BELARUSIAN STATE UNIVERSITY

Establishment of Education
«International Sakharov Environmental Institute»

ACTUAL ENVIRONMENTAL PROBLEMS

Proceedings of the XI International
Scientific Conference of young scientists,
graduates, master and PhD students

December 2–3, 2021
Minsk, Republic of Belarus

Minsk, 2021

UDC 504.75
A19

The conference proceedings include the theses submitted at the XIth International scientific conference of young scientists, PhD students, Master`s degree students, and students «Actual environmental problems» in English, which was held in December 2–3, 2021 at the International Sakharov Environmental Institute of Belarusian State University.

The proceedings are reffered to a wide range of expert, lecturers of higner and secondary educational establishments, PhD students, Master`s degree students and students.

The conference proceedings are published with the financial and information support
of the Ministry of Education of the Republic of Belarus
and with the financial support of the UNESCO National Project
«School-laboratory for pupils is the instrument for implementing the agenda 2030 in the Republic of Belarus»

ISBN

SECTION 1

SOCIO-ECOLOGICAL, ETHICAL AND PEDAGOGICAL PROBLEMS OF OUR TIME

THE IMPACT OF PSYCHOLOGY AND BIOLOGY ON THE IDENTITY CRISIS OF ADOLESCENCE

E. Akshevskaya, A. Kozorez, I. Olevskпaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
ewa.akshewska@gmail.com

The article discusses the problem of identity in adolescence, and also proposes a way for overcoming the crisis from a psychological and biological point of view.

Key words: biology lessons, psychology, identity crisis, psychological tests

Identity crisis is an urgent problem of high school students [2]. The concept of "identity" is widely demanded in various humanities, such as philosophy, sociology, psychology, cultural and social anthropology, cultural studies, ethology, in gender and political sciences [3]. Many of these disciplines are also found in school biology.

In the modern world, there are more than 400 thousand specialties. In connection with such a huge choice, most people experience an identity crisis, i.e. adolescents don't know in which sphere of life one can reveal and apply themselves.

Within the framework of this research, we carry out the practical part which can avoid an identity crisis at school age and help a person find his or her reference point for the future based on biology lessons [1]. Since a person is a biological object, and the modern world is a human environment, the methodology that will be proposed later can help adolescents learn to navigate in this environment. This is very important, since modern education is not able to fully prepare a person for life, and increasingly, schoolchildren are faced with the problem of inability to choose their future.

Research involves the following stages:

1. Testing adolescents for the type of temperament, as well as identifying objects to which there are special inclinations.
2. Data collection and information processing.
3. Distribution of adolescents into groups, in accordance with the prevailing type of temperament.
4. Familiarization of groups with the most suitable professions for each of them, both in theory and in practice.

It is important to mention the existence of the possibility of acquaintance with other areas of activity that were not included in the list for the selected characteristics.

This methodology is most rationally applied to students in grades 8-9-th, since this is the most suitable period for personal self-identification.

Psychological and biological aspects of this research consist in more detailed informing of adolescents with the most suitable professions based on endogenous factors such as gender, age, race, heredity, constitutions, ethnic characteristics, ecological portrait and psychological picture.

Thus, results of practical research can be included in the educational process of biology teachers, as well as in psychological work with schoolchildren outside of educational time.

BIBLIOGRAPHY

1. *Крутько И. С.* Психотехнологии в работе с молодежью: учебное пособие / И. С. Крутько; научный редактор А. В. Пономарев; Министерство образования и науки Российской Федерации, Уральский федеральный университет имени первого Президента России Б.Н. Ельцина. — Екатеринбург: Издательство Уральского университета, 2017. – 188 с. – ISBN 978-5-7996-2188-9.

2. *Курочкина, И. А.* Проблема гендерной идентичности: учеб. Пособие / И. А. Курочкина, О. Н. Шахматова – Екатеринбург: Изд-во Рос. гос. проф.-пед. ун-та, 2014. – 243 с.

3. Патырбаева, К. В. Идентичность: социально-психологические и социально-философские аспекты / К. В. Патырбаева, В. В. Козлов, Е. Ю. Мазур, Г. М. Конобеев, Д. В. Мазур, К. Д. Марицас, М. И. Патырбаева – Пермь: ООО Учебный центр «Информатика», 2012. – 251 с.

POSTHUMANISM: ALTERNATIVE REALITIES AND ARTIFICIAL INTELLIGENCE IN GREG EGAN'S SCIENCE FICTION

I. Boyarkina

University of Rome
Rome, Italy
estel20@mail.ru

The paper focuses on science fiction novels *Permutation City and Quarantine* by Greg Egan and analyses his ideas on how life-altering technologies and life-simulating sciences are transforming human life, our consciousness, our understanding of such concepts as human/non/-human, ecology, the world around us. The paper studies the way Egan explores the themes of posthumanism, simulated realities, digital immortality through the prism of various ethical, social, philosophical, ecological and other problems that these concepts inevitably arise. The rich scientific background of these hard sf novels is also analysed.

Keywords: Permutation City, Quarantine, computer sciences, simulated reality, ecology, quantum mechanics, brain scan, neuroimaging, Alife, AI, climate change, digital technologies, biology, digital immortality.

Greg Egan (BS in Maths) is an Australian hard science fiction writer who explores the themes of posthumanism, simulated reality, Artificial Intelligence, the nature of consciousness, the interaction of human/non human and many others. Egan's works demonstrate author's scientific background in natural sciences, ranging from mathematics, quantum theory, computer science to genetics, ecology, biology, etc.; Egan's imaginary worlds employ various novums that often lie on the intersections of these sciences. In his sf works, Egan speculates about the impact of new scientific discoveries and new technologies as an effective way to develop critical thinking on the way Artificial Intelligence affects our society and our humanity (Burnham, 2014). The authour also reflects on how life-altering technologies and life-simulating sciences are transforming human life, consciousness, ecology, the world around us.

In *Permutation City*, Greg Egan raises the issues of digital immortality as a way to overcome the limitations of a physical human body, as well as explores the category of human /non human as applied to the concept of a digital consciousness versus human consciousness and identity. Various protagonists of the novel express different opinions about complete human brain scan and digitalization of the data that enables creation of a Copy which is placed into a simulated world. Some consider it to be the only possibility to avoid death and complete annihilation, while others hold that the digitalization of their brain scan alters completely their consciousness and identity; for this reason they refuse brain scan and simulated reality, (f.ex. Francesca). Such protagonists clearly understand the difference between real world, human consciousness/identity as opposed to simulated reality. In P*ermutation City* Egan raises not only philosophical issues related to simulated realities and digital Copies but a wide range of issues related to social justice, equality, ecology, etc. Since Copy creation and reality simulation is very expensive, not everyone can effort it, hence, computer simulation causes inequality and may provoke social disorders. Computer simulation has negative impact on ecology because it requires electricity, vast computing resources that are needed for other purposes (in the novel, for fatal tornado forecasts).

Some of the possibilities explored in the novel are: creation of multiple simulated realities and multiple copies of the same human being, as well as creation of digital worlds that allow natural evolution of life. For example, Maria is trying to simulate a whole planet where some artificial life is possible. The program she employed (Autoverse) reminds us of the game «Life»: «The *Game of Life* (GoL) is a solitaire game invented by John Conway and introduced to the world by Martin Gardner (1970) in *Scientific American*. It is played on a potentially infinite, two-dimensional grid of square cells. Each cell is either *dead* (state 0) or *alive* (state 1). The state of a cell changes with time, based on the states of its eight nearest neighbors.» [4].

Egan's numerous digital worlds are populated with digital copies that suffer from various computing technical problems and limitations, including inconveniences of communication with the real world and real people. All these limitations force digital copies to consider their life choices from different points of view and to look for alternatives.

In *Permutation City*, the idea of creating various digital realities and copies inhabiting them that are only slightly different from each other is in a way similar to the idea of multiple worlds that Egan tried to employ in his Quarantine that employs a free interpretation of the consequences of the Copenhagen Interpretation of Quantum mechanics [3]. For more differences between CI and MWI of Quantum mechanics in sf see, for example, [5].

SCHOOL ENVIRONMENTAL EDUCATION IS THA BASIS OF ENVIRONMENTAL EDUCATION

G. Bunel, O. Davydova-Loiko

Gerebkovichy School

Lyahovichy region, v.Gerebkovichy, Republic of Belarus

Olga-autotaktika@mail.ru

Based on the fact that the interaction of relations "man-nature" in the modern world is constantly gaining momentum, undoubtedly relevant are new developments and the introduction of environmental aspects in almost all spheres of human activity. In this regard, the structures of the education system rightfully occupy an important place. Research in the field of environmental education is becoming increasingly important.

Keywords: school, ecological education, ecological monitoring

Environmental education is the direct assimilation of the entire complex of eco-knowledge, including the process of training environmental specialists. At the same time, the term "greening the education system" characterizes the level of penetration of ideas, concepts, principles, approaches of environmental science into other disciplines, as well as the training of environmentally competent specialists of the widest profile: engineers, doctors, economists, sociologists, etc.

Of course, the school is the basis and foundation in preparing young people for an independent life, for a conscious choice of their future specialty. Along with the family, the school forms the basis of the worldview. Considering all stages of the educational process, it is the school years that make up the majority of the education. That is why it is important at this stage to convey the correct and necessary information to the students, to suggest in which key it is possible and necessary to move. Thus, environmental education within the school curriculum is a springboard for the formation of environmentally literate and responsible people.

However, it should be noted that environmental education is not a separate subject. There are three main approaches to integrating environmental considerations into school education. The 1977 declaration of the UNESCO Intergovernmental Conference on the Environment highlighted the following possible solutions:

– inclusion in each studied subject of the necessary aspect of the environmental problem;

– work in interdisciplinary teams;

– the study of specific problems that can be observed by students and teachers.

As can be seen from the above, the recommendations of 50 years ago have not lost their relevance today.

Taking into account the above, on the basis of the secondary Zherebkovichi school in the period from 2012–2014, environmental education and education is being actively introduced not only for schoolchildren, but also for the teaching staff. So, educational research works are actively used in teaching. Among the topics under consideration, the following are noted:

– species diversity of flora and fauna in the vicinity of the Lyakhovichi region and the village of Zherebkovichi;

– environmental monitoring. This topic is the most relevant and is most often used in the selection of educational and research works.

– environmental law;

– environmental protection;

– environmental education, etc.

The foundations of research activities are mainly laid in the lessons. To do this, it is necessary to systematically provide the opportunity for students to participate in such work in the classroom, to teach all the necessary techniques for conducting independent research. Research continues in the summer: they collect herbarium material, take photographs, carry out the necessary measurements according to a plan, which includes the processing and systematization of materials, formulating conclusions, designing work and preparing visual material, speaking at a conference. On the basis of generalized and systematized knowledge, information is analyzed and the results are discussed, where common features are highlighted, patterns are formed, solutions to the problem are given, and conclusions are formulated.

Among the participants in the work are children of grades 8–11. The main share of prize-winners-students, starting from 2014, falls on 10 classes.

Every year, educational and research works are presented at district, regional and republican competitions.

It should be noted that the guys independently choose topics, study the relevance of the chosen topic, its problems. When carrying out work, they cooperate with the Lyakhovichi forestry enterprise, namely, for more than 6 years, the institution has been helping students in providing research objects, and also pointing out important research topics. Pupils also cooperate with the sanitary and hygienic service of Lyakhovichi, the enterprise JSC "Zherebkovichi".

It should be noted that in 2018, according to the results of research work at the Republican competition with the topic "Obtaining two harvests of early varieties of potatoes as one of the economically profitable ways of growing it", a student of grade 10 D. Kolyada, and in 2019 A. Rusakevich, student of grade 10 with the theme “Obtaining three harvests of early varieties of potatoes with different tastes” became scholars of the special fund of the President of the Republic of Belarus for social support of gifted pupils and students.

The important thing in this approach is that it is necessary to prepare students for the fact that knowledge not only needs to be assimilated, but also multiplied, creatively processed and used in practice. Also, one should not impose this technique, but interest the student, show importance, instill interest and even curiosity in this matter, love for nature and one's own environment.

Educational and research work with students is a big and painstaking joint creative work. Success plays an important role in working with children in this direction and not only. And the success of a child largely depends on the success of the teacher. Therefore, it is important for a teacher to keep up with the times, show non-standard approaches in teaching, constantly improve their level, qualifications, and even try to understand young people and their hobbies as much as possible.

The most important thing is to identify the student's interest, the desire to seek and learn new things, and to support his aspiration.

Extracurricular forms of work, where the child has the opportunity to express himself in full force, make it possible to reveal his talents, develop the ability to cognize, logical thinking. Various types of extracurricular work are aimed at developing the student's creative abilities, make it possible to emotionally express their feelings, see the beautiful, develop visual skills, and also contributes to the formation of a close-knit children's team.

In addition to the ecological educational process, cultural events are held with students on the topic of environmental protection, these are actions for the collection of waste paper, cleaning up territories, collecting garbage, namely separate collection, hiking with an ecological bias, ecological quests, ecological competitions such as "Kvitney, my forest", "Lesomania". Trainings are conducted in both Russian and Belarusian. Sometimes the entire stake is involved, from grades 1 to 11. The ecological ideas of the children themselves and their parents are also encouraged.

However, it should be noted that along with the positive aspects in the environmental education of schoolchildren, there are those that hinder this process. In most cases, there is an economic deterrent because many things are not feasible due to insufficient funding. The next point is that the formation of a respectful attitude to nature and "greening" lie not only through legal support, but primarily in the awakening of a holistic perception of the surrounding nature. It often turns out that the "fashion for ecology" is created by individuals, or groups of people, public or commercial organizations. Also, as part of the implementation of the sustainable development program, not everything is done in a practical way. Moreover, some aspects of this approach require a lot of work with documentation, preparation of reports, etc., which introduces a large time-consuming part. It should be added that in the school curriculum, the environmental component is not particularly reflected in most subjects, moreover, issues in relation to life, in everyday life, are not considered.

Summing up, I would like to note that environmental education implies a continuous process of training, upbringing and personal development, aimed at the formation of knowledge and skills, as well as value orientations, behavior and activities. It is very important to lay in the subconsciousness of children and adolescents a reverent attitude to the environment, nature at the initial stages of their development, to consider nature as an independent unit, and not as an object of obtaining "benefits".

When teaching children, it is necessary to give scope for personal development. The teacher must organize the conditions for the development of the personality of each student. Only in an atmosphere of joyful and benevolent communication can a student manifest himself as a person and develop while improving. It is with this formation and personal growth that it is possible to establish a balance between the relationship "man-nature".

PROBLEMS OF INTRODUCTION OF CIRCULAR ECONOMY IN BELARUS

L. Chayka, L. Kuzina

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
lizzachayka@yandex.by

This article discusses the concept of a circular economy, its concept, key elements, describes the initiatives of developed countries to introduce a circular economy. An idea is given about the possibilities of growth and development of the circular economy in Belarus.

Key words: circular economy, concept, resources

The limited availability or scarcity of many natural resources for economic activity in the world, their irrational use for a long time led to the need to restructure the existing economic model. Modern economic trends optimize production and prevent resource depletion: conscious consumption and circular economy [1].

There are many concepts of circular economy. Some researchers, considering this concept, focus on three key elements: closed cycles; renewable energy; system thinking [2].

1. Closed cycles. In a closed-loop economy, material cycles are closed following the example of an ecosystem. There is no waste, toxic substances are removed, and residual flows are divided into a biological and technical cycle. Manufacturers accept their products after use and repair them for a new service life. According to experts, the use of closed cycles will lead to savings of up to 380 billion dollars, the use of recyclables will save greenhouse gas emissions by up to 90 %, and also reduce waste generation by up to 80 % [2].

2. Renewable energy. Just as with raw materials and products, in a circular economy, energy should be used as efficiently as possible at the expense of renewable energy sources [2].

3. System thinking. A circular economy requires not only closed material cycles and renewable energy sources, but also systemic thinking. Each economic entity is connected with other entities. Together, this forms a network in which the actions of one player affect other players [2].

The transition to closed-loop methods is becoming global in nature, as the advantages of implementing this concept are becoming more and more obvious. According to experts, the circular economy can annually provide an increase in the income of the world economy over $1 trillion [2].

Thus, Germany, having a powerful industrial economy, formed the basis of a circular economy through material flows and the availability of materials, and the Netherlands - on innovations in materials and business models. Finland is the first country in the world to develop a national roadmap for the transition to a circular economy. Japan has moved to a highly efficient circular economy and currently Japanese recycling rates are extraordinary: the country recycles 98 % of its metals [2].

The introduction of a circular economy in Belarus is one of the priorities within the framework of the concept of the National Strategy for Sustainable Development for the period up to 2035. But in Belarus there are many different barriers and obstacles that need to be overcome to facilitate a large-scale transition from a linear model of the economy to a circular one [1].

In our opinion, it is advisable to pay more attention to concrete actions to implement the circular economy in the development strategies of Belarus. For example, to finance innovative business projects, to encourage the development of circular production through the introduction of circular procurement systems [1].

BIBLIOGRAPHY

1. Circular economy: conceptual approaches and tools for their implementation. A monograph for specialists of public administration, business and the interested public / N. Batova [et al.] ; edited by S. Dorozhko, A. Shushkevich ; Internationales Bildungs- und Begegnungswerk (IBB) Dortmund GG GmbH. – Minsk : Medisont, 2020. – 212 p. : ill. ISBN 978-985-7261-22-2.

2. *Socheeva, V. E.* The circular model of the economy as a new approach to the problem of sustainable development / V. E. Socheeva // Economics and Business: theory and practice. – 2018. – No. 7. – pp. 122–125.

THE IMPACT OF FOOD WASTE ON THE ENVIRONMENT

D. Chкurakova, L. Kuzina

Belarusian State University, ISEU BSU
Minsk, Republic of Belarus
churakova2112@gmail.com

Resume: this article provides data on food losses at the stages of production, trade and consumption. Food waste negatively affects the climatic conditions of our planet. The article indicates the reasons leading to the growth of food waste, suggests methods to improve the situation with food losses and waste.

Key words: waste, environment, food, losses.

Every year, a third of all food produced in the world ends up in losses or waste. In developing countries, a considerable proportion of food (40 %) is lost at the stage of harvesting or processing. This is called food losses. In developed countries, the same percentage (40 %) is lost at the stage of consumption or retail sale, when food products that are not bought in stores or not eaten at home, in restaurants or cafes go to waste. This is called food waste. Today, the average European throws about 250 kilograms of household waste into the trash, half of them

food waste. According to the UN World Production Program, every year 1.3 billion tons of products produced in the world are sent to landfills, so many could wrap the Earth 7 times. At the same time, according to data for 2019, 690 million people were malnourished, and 3 billion could not afford a healthy diet. human [2]. Food waste is the cause of all kinds of environmental impacts of food production. According to the Food and Agriculture Organization (FAO), food waste accounts for 8 % of global greenhouse gas emissions in the world. FAO concludes that almost 30 % of all available agricultural land in the world – 1.4 billion hectares – is used for the production of uneaten food. Reducing food waste at the retail, catering and household levels can bring huge benefits to people and the planet. Today there are many opportunities to improve the situation with food losses and waste, which remained mostly unused and underused. For example, American scientists have developed a technology that allows you to get heat from cheese production waste, they are processed to produce methane. There are many cheese factories located in Wisconsin. As a result of washing the factory equipment, whey and regular milk waste is regularly generated here. The use of 900 thousand liters of cheese production waste, which the processing enterprise receives from local factories, made it possible to synthesize so much methane that it was enough to heat three thousand private homes. And the remaining waste can be dried and further used for the production of fertilizers. In addition, culinary fat has also been used, which is formed daily after draining the oil from the fryers of fast food restaurants. Scientists from Washington State University have developed a technology that can turn it into asphalt [1]. As noted above, the problem of food waste entails not only the waste of resources - land, water, energy, labor and finance, but also stimulates the emission of greenhouse gases and global climate change. Scientists are sure that if everyone pays attention to this problem, then it will become much easier to solve it on a global scale. For example, we have acquired habits that damage the environment and create an additional burden on natural resources. Here are a few simple things you can do right now to become a zero hunger hero and turn thrift into a way of life [3].You need to start small – reduce portions at home or in a restaurant with friends; do not leave anything on the plate; buy only what you need; buy "ugly" or irregularly shaped fruits and vegetables: they are just as delicious, just look a little different; give the surplus to those in need; shares products with others, etc.

BIBLIOGRAPHY

1. Decree of the President of the Republic of Belarus No. 313 dated July 11, 2012 "On some issues of consumer waste management".

2. *Efimova, E. V.* No food waste / E. V. Efimova // Solid household waste. – 2017. – No. 3. – p. 61.

3. Resolution of the Council of Ministers of the Republic of Belarus of July 28, 2017 on the approval of the "National Strategy for the Management of Solid Municipal Waste and Secondary Material Resources in the Republic of Belarus for the period up to 2035".

IFFERENCES IN THE VERBAL DEFINITION OF THE CHARACTERISTICS OF THE ECOLOGICAL QUALITY OF PRODUCTS IN SOME LANGUAGES AS A BASIS FOR THE UNIFICATION OF THEIR ENVIRONMENTAL LABELING

V. Gudovich[1], A. Fralou[2]

[1]*Minsk State Linguistic University*

[2]*University of civil protection ministry for emergency situations of Republic Belarus, Minsk, Republic of Belarus*

valeriagudovich@list.ru

The differences found in modern languages in the expression of the characteristic of such environmental characteristic of products as the absence of potentially hazardous chemicals in them make it expedient to unify their environmental labeling in a wide international practice.

K*eywords*: ecology, chemicals, environmentally friendly product, environmental labeling.

Currently, in various countries, but primarily in industrialized countries, consumers are increasingly interested in such environmental quality of food products as the absence of chemical ingredients in them that may not be safe for health. Prevention of food contamination with potentially dangerous chemicals is provided by so-called environmentally friendly technologies that exclude or minimize the use of chemicals for agricultural production. Practice shows that such technologies are able to cause a higher production cost and, accordingly, the price of the product. Nevertheless, many consumers today are ready to give preference to such products and, if possible, purchase them. However, it is found that in different languages there are differences in the expression of such an ecological quality of the product as obtaining it using the so-called environmentally friendly technology.

And this can create difficulties in choosing such a product for a person who finds himself in another country and is in an unusual language environment for him.

So, in our country, both in Belarusian and in Russian, as well as in Ukrainian, people are accustomed to the verbal meaning of this product literally as "environmentally pure". Which in meaning implies that there are no substances in the product that are dangerous to both humans and the environment. Similarly, such a product is defined in French – "produits ecologiquement purs". However, in Germany and other German-speaking countries, a different construction is used to formulate the same term. In German, such a product is called "umweltfreundliches Produkt". Which in Belarusian and Russian literally means a product friendly to the environment. A similar verbal meaning is also used in English: "environmentally friendly product". Meanwhile, in Italian, the adjective "biologica" is used. So, Italians call it "biological product".

From the examples given, it follows that, once in another country, a person, due to differences in the language constructs, may have difficulty in understanding the information about the environmental quality of the product being selected and purchased, not fully understanding the meaning of the labels on its packaging or in the store.

Unification in different languages with their historically established traditions of the product designation produced by clean technology without the use of chemicals seems to be hardly possible. Therefore, in our opinion, in this situation it would be useful and expedient to solve the problem of unification in the broad international practice of ecolabelling of products. By introducing for the designation of a product produced by clean technology without the use of chemicals a single common label for a variety of countries and, therefore, everywhere recognizable. Just as it has been done so far in the practice of the Scandinavian countries and the European Union.

ROLE OF AN ACTIVE LIFESTYLE ON HUMAN PHYSICAL HEALTH

O. Hadasevic

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
hdsoleg84@mail.ru

In our society, most of the work is done sitting, even in their free time, most people practically do not exercise. In the household, many daily activities are no longer related to physical activity. However, sufficient exercise is important in the long term to maintain the performance and quality of life of everyone.

Keywords: physical culture, health, mobility.

Various aspects of physical activity can be defined according to the following definitions: Physical activity includes any movement produced by skeletal muscle that causes a significant increase in energy consumption. Exercise is activities that are planned, structured, and regularly repeated to improve or maintain fitness. Physical fitness is determined by certain characteristics of a person that are associated with the ability to perform physical activity. It is influenced by the type and degree of physical activity, as well as genetic factors, lifestyle and current health status.

An active lifestyle reduces the risk of many diseases and promotes their treatment, including cardiovascular disease, type II diabetes and colon cancer [1]. Fitness helps reduce the risk of obesity, osteoporosis, and back problems. German studies have also shown that adequate physical activity is associated with a higher life expectancy [2].

Children and adolescents have a natural urge to move. This high level of physical activity, which is often expressed in a playful way, is also necessary, for example, to explore the environment, learn motor skills and test one's own physical abilities in social exchange with other peers.

It is especially important in old age to stay active. Physical activity continues to have a positive effect on health, even if up to now there has been a predominantly sedentary lifestyle. For this reason, motivating the population to be more physically active is of great importance in health prevention. Mobility is an important prerequisite for health and well-being in old age. Skeletal muscle weakening and loss of functionality are not an inevitable consequence of aging, but rather are caused by decreased physical activity. Endurance training in the elderly, aimed at maintaining adequate muscle mass, is of great importance for the maximum possible functional independence of the elderly [3].

All adults are advised to be physically active for at least half an hour, preferably all days of the week, from moderate to intense. This time can be divided into several stages of at least 10 minutes. People who have previously been mostly sedentary should discuss increased activity with their doctor beforehand. Children and adolescents should be more active (at least one hour a day). For people who already meet these minimum guidelines, additional exercise or exercise will bring health, performance, and well-being benefits.

BIBLIOGRAPHY

1. *Thomas, J.* Genes, Environment, and Personality / J. Thomas // Science 1994. Vol. 264. P. 1700–1701.

2. *Temme, E. H.* Comparison of the effects of diets enriched in lauric, palmitic, or oleic acids on serum lipids and lipoproteins in healthy women and men./ E. H. Temme [et. al.] // Am J Clin Nutr. 1996. Vol. 63 No. 6. P. 897–903.

3. *Paffenbarger, R. S.* The association of changes in physical-activity level and other lifestyle characteristics with mortality among men / R. S. Paffenbarger [et. al.] // N Engl J Med. 1993 P. 538–545.

INFLUENCE OF STRESS ON MENTAL AND PHYSICAL HEALTH OF THE HUMAN

I. Olevskaya, R. Kazakov

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
roman.kazakov.02@bk.ru

In general, stress can have both positive and negative effects. The beneficial effects of stress include maintaining cell homeostasis, which leads to long-term survival. However, in many cases, the harmful effects of stress receive more attention from a person due to their role in various pathological conditions and diseases. Various factors are important, such as hormones, neuroendocrine mediators, peptides and neurotransmitters involved in the body's response to stress.

Keywords: stress, etiology of stress, consequences of stress.

Many disorders arise from stress, especially if it is severe and prolonged. The medical community should become more aware of the significant role that stress can play in various diseases and then treat the patient appropriately, using both pharmacological (medications / nutraceuticals) and non-pharmacological (lifestyle changes, daily exercise, healthy eating, stress reduction programs) therapeutic interventions. It is important that everyone has a different response to stress, so a particular treatment strategy or intervention that is appropriate for one patient may not be appropriate or may be optimal for another patient.

The biological approach to explaining stress responses considers stress from a biological point of view – stress responses that occur in the body are supposed to provide the optimum energy for the immediate mobilization of all systems in an environment of increased danger. Regardless of whether it is short-term or long-term, stress promotes hormonal and autonomic adaptation to the corresponding state [1].

Stress can develop due to an imbalance between environmental demands and personal resources, such as capabilities, skills, or coping strategies. Psychological stimuli set in motion the biochemical processes in the brain – for example, due to the fear of not being able to do something or not having the resources to cope with a situation. Influencing factors have no external influence on a person, but arise primarily from the person himself – through his thoughts [2].

In the case of stressful reactions, which often require the body to be alert and ready to flee, activation of the sympathetic nervous system stimulates the adrenal glands and the adrenal medulla, which triggers the release of the hormones cortisol, adrenaline and norepinephrine. These hormones are also called stress hormones. The release of stress hormones triggers remarkable reactions in humans, such as increased breathing or dilated pupils. However, during this time, other body systems are suppressed or less activated, such as digestion. The sympathetic nervous system causes an increased desire to work and the ability to concentrate in case of short-term stress reactions, the parasympathetic nervous system, on the contrary, achieves recovery and regeneration of the body. If it is no longer short-term stress, but constant stress, psychosomatic reactions can be the result of constant sympathetic activation, including digestive problems, cardiovascular disorders, migraines, chronic fatigue, or lethargy [3].

In the long term perspective, moderate short-term stress can improve a person's cognitive abilities, but chronic stress can lead to serious consequences, both on the part of physical and mental health.

BIBLIOGRAPHY

1. *Wood, G. E.* The contribution of adrenal and reproductive hormones to the opposing effects of stress on trace conditioning in males versus females / G.E. Wood // Behav. Neurosci. 2001. P. 175–187.

2. *Griffiths, B. B.* Neuroepigenetics of stress / B.B. Griffiths // Neuroscience 2014. P. 420–435.

3. *McEwen, B. S.* Physiology and neurobiology of stress and adaptation: central role of the brain / B. S. McEwen // Physiol. Rev. 2007. P. 873–904.

TECHNOLOGY OF MANUFACTURING ORGANIC CARDS IN SECONDARY EDUCATIONAL INSTITUTION

N. Kirchuk

Grodno Secondary school No. 7
Grodno, Republic of Belarus
zhilkoana@mail.ru

The article examines the practical use of recycled paper by school children in extracurricular activities to raise awareness of the problem of deforestation. The step-by-step description of making a creative and useful greeting with your own hands helps to reveal the importance of recycled paper in educational institutions.

Keywords: pulp, organic paper, making useful gifts.

We have been used to using paper since childhood: drawing in sketchbooks in kindergarten, writing in notebooks at school, signing holiday greeting cards, reading books, collecting receipts from shops. Products of the paper industry reach landfill, emitting greenhouse gas - methane, which is 25 times stronger than carbon dioxide. It is known that 60 kg of paper, collected as waste paper, allows saving more than one tree. Using waste paper to make beautiful and useful items not only preserves natural resources, but also improves the environment.

The relative simplicity of producing paper process from waste paper (soaked waste paper is crushed through a sieve, shredding it and removing insoluble particles, then the liquid is removed and dried) allows the following six-step experiment to be carried out using water, two containers of different volumes, a mesh, towels, a blender and a press [1]. Old newspapers and notebooks, previously cut into pieces of approximately 2×2 cm, were placed in a small bucket and poured overnight with water. After 12 hours, the resulting pulp was ground with a blender and poured into a large bucket, where the solution was brought to a liquid consistency by adding water. After stirring the pulp, a mesh was lowered into the bucket. After 2 minutes, the mesh was pulled out and placed on a towel and carefully covered with another towel. Then the towel was removed and the paper was carefully smoothed out. We took the seeds of the plants (Aster Annuals, Petunia Ampelas, Sweet Pepper, Cucumber Finger, Tomato Ruby Slices) and sprinkled them on top of the damp paper. Then the sheet of paper was laid on another towel, covering it again with a towel and leaving it to dry for 8–10 hours for final drying. In order to make the paper flat, a stack of books was placed on top. The resulting paper was used to make greeting cards. Some of the paper was torn into pieces, planted in the ground and watered for a few days, after which the seeds sprouted into the first sprouts. The rest of the paper was sprayed with water from a sprayer and the seeds sprouted right onto it.

Fig. 1 – Stages of the organic greeting card experience

On the basis of the work done, it can be stated that handmade paper from recycled materials is not only absolutely exclusive, cost-effective and able to "come to life" in flower pots, bringing positive emotions after the basic application, but also draws attention to the problem of deforestation.

BIBLIOGRAPHY

1. Paper from recovered paper. [Electronic resource]. – 2021. – Access mode: https://globallab.org/en/project/cover/bumaga_iz_makulatury.ru.html#.YFD8UdpxeUl. – Date of access: 10.03.2021.

ESG PRINCIPLES AS THE MAIN COMPONENT OF THE STRATEGY OF A MODERN COMPANY

M. Kirikovich, O. Moyseenok

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
oksana.moyseenok@inbox.ru

Active development of a new investment direction, concern for the environment, health, moral development of society, formation of responsible business.

Keywords: ESG principles, investing, ESG funds.

The ESG principles were first formulated by former UN Secretary General Kofi Annan. He invited the heads of major global companies to include them in their strategies, primarily to combat climate change.

ESG is a set of rules and approaches that authorities and businessmen should take into account when developing development strategies, working through environmental protection issues, relations with employees, customers and society, and corporate governance standards.

There is a steady growth trend of responsible investment in the world. Investors want to support companies that not only think about profit at any cost, but also care about the environment and their employees, are intolerant of corruption, racial and gender discrimination.

Experts say that the greatest interest in ESG investments is shown by people who were born at the end of the XX century. Representatives of this generation believe that such an approach will help them fight climate change on the planet, social inequality in society, infringement of rights and freedoms.

Changes in the environment, the situation with COVID-19, the desire for responsible management and doing business taking into account environmental and social consequences will change the management of companies and form an infusion of investments into the green economy. In the near future, global funds will stop directing cash flows to companies that ignore the principles of sustainable development. The share of investors interested in ensuring that their investments meet the ESG criteria is significantly increasing (Table 1). Thus, they have an impact on the quotes of companies.

Table 1

Survey of investors divided by asset size

The size of assets	Are aware of the possibilities of ESG-investing	Are inclined to invest in an ESG-fund, if they meet one
100 000–150 000 US dollars	41 %	43 %
150 000–250 000 US dollars	43 %	40 %
250 000–500 000 US dollars	31 %	41 %
500 000–1 000 000 US dollars	34 %	37 %
More than 1 000 000 US dollars	42 %	29 %

Note. Source – [https://advisor.visualcapitalist.com/the-rise-of-the-values-driven-investor/].

One of the easiest ways to invest in ESG companies is to use ESG funds. These are funds that invest in organizations with high ESG scores. The main investments are made in businesses from different spheres. According to Morningstar, a record 23 new ESG funds were launched in the first half of 2020. As many more are preparing for the opening. Bloomberg calculated that in 2020, investments in ESG funds have already exceeded the volumes of 2019 by 3 times. Then the process will only accelerate. European and American countries are introducing measures that will limit the inflow of investments into "dirty" enterprises. For example, according to the Paris Agreement, by 2030, European countries should reduce greenhouse gas emissions by 50 % from 1990 levels. In 2023, the EU introduces a carbon tax on imported goods. This will accelerate the transition to less harmful technologies. The global stock market is reacting to a new vector in investing by increasing the prices of shares of ESG companies and creating new exchange-traded funds [1].

BPS-Sberbank will become one of the first companies in Belarus to fully adopt the principles of ESG - sustainable development with care for nature. The bank is already cutting paper costs, planting trees. The bank's management says that in the future their loans and purchases will become "green".

For sustainable development, it is important that people consume products and services in a conscious, rational way. To do this, highly efficient, productive products that meet the interests of customers should be used,

they should be created with the help of environmentally friendly technologies. It is necessary to combine efforts both within the industry and with other industries.

BIBLIOGRAPHY

1. Что такое ESG – инвестирование [Электронный ресурс]. – https://life.akbars.ru/pf/ESG-principy-v-investirovanii. – Дата доступа – 01.10.2021.

ENVIRONMENTAL IDEAS OF THE PHILOSOPHY OF TAOISM

D. Kolesnikovich, N. Lepskaya

Belarusian State University, ISEI BSU
Minsk, Belarus
dkolesnikovich00@bk.ru

In this work an attempt is made to take as a model of inexhaustible nature management the principles of harmonizing the interaction of man and nature, set forth in the philosophical teaching of Taoism.

Key words: Tao Te Ching, Taoism, «Wu-wei» principle, ecology, nature, nature management.

Taoism is a philosophical and religious teaching of Ancient China. The worship of natural phenomena was widespread in the culture of ancient China. Man (microcosm) was perceived as a part of nature (macrocosm), and the whole life of society – rituals, traditions, medicine – was built on this conviction. According to Taoist beliefs, harmony in the world is associated with the law of Tao. This law maintains the correct order in the world.

The path of Tao is inherent in the power of "Te" – literally "virtue" or "morality." A virtue given from above, a tremendous spiritual power that Heaven endowed the ruler of China with and which he could pass on to his subjects. Through the power of "Wu-wei", Tao manifests itself in every person. "Wu-wei" should not be interpreted as an effort, but on the contrary, as a desire to avoid any effort. "Wu-wei" – means the denial of purposeful activity that runs counter to the natural order. The basis of a wrong action, as the Tao de Ching says, is always a selfish motive arising from the person's self. Any action that contradicts Tao means a waste of energy and leads to destruction and death.

The belief that the most important thing in life should be the harmonious relationship of things led to the fact that the goal of their philosophy and religion was defined by the Taoists as maintaining the natural rhythm of life and striving for harmony in all relationships.

Taoists believed that life should be built according to the principles of conformity to nature, reasonable consumption, and justice. The philosophy of Taoism teaches people to perceive themselves as part of nature, because the Earth with its ecosystem existed long before the appearance of man and may well exist without us. Man – on the contrary: without an ecosystem, nature will not preserve itself as a species.

BIBLIOGRAPHY

1. *Tao de Ching.* The book of the path and dignity. Edited by L. N. Tolstoy. –http://taopooh.narod.ru/3/transl.htm

2. *Kozlov V. V.* Taoism about human nature. Article: http://psyera.ru/daosizm-o-prirode-cheloveka-73.htm

3. *Moiseev N. I.* Science and life, ecology in the modern world. Article: http://www.nkj.ru/archive/articles/10376/

CONSUMING SOCIETY

A. Korotkevich, A. Budko

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
aivakina7070@mail.ru, budko.anzhelika@gmail.com

The article analyzes the concept of a consuming society and describes the behavior of modern consumers and consumer trends.

Keywords: consumer, consumer trends, consuming society.

It would seem that people have always bought and sold, owned something, spent money, and had a desire to live in wealth and luxury. Man has always consumed, because consumption is necessary for everyone to maintain

life. However, the previous epochs are not associated with the concept of “consumption”, they do not put consumption at the forefront when understanding these epochs.

The essence of consumption lies not in the ability to purchase the advertised product, but in the desire to do so. The consumer society is a set of relations in which the symbolism of material objects, acting as the meaning of life, dominates, which attracts consumers to acquire things and thereby endow themselves with a certain status.

To understand what the next generations of society will have to live with, let's consider the key aspects and features of the behavior of the modern consumer according to the results of a sociological survey.

178 respondents took part in the study. We found out that the majority of respondents (81 %) agree that modern society is a consumer society. A small part of the respondents rather disagree and completely disagree with the fact that modern society can be called consumer.

When studying consumer behavior, it is important to find out what primarily affects the purchase of a particular product. Among the main factors that respondents are guided by when buying a product were "price" – 60 % and "quality" – 42 %. No less significant when purchasing a product are "individual taste preferences". The prestige of the manufacturer was noted by 2% of respondents. The design and packaging turned out to be the least significant when choosing a product. The influence of the brand on the purchase decision plays a significant role in the study of consumer behavior. It was found that when purchasing a product, most of the respondents (58 %) pay attention to the brand only sometimes, depending on the product.

As for public opinion, when purchasing goods and services, the majority of respondents (46 %) sometimes wonder what others will say. For 34 % of respondents, the opinion of society is not important. The largest percentage of survey participants (20 %) say that public opinion plays a major role for them when purchasing a product.

One of the characteristics of modern society is the assignment of symbols to things that make people "special" and distinguish them from the crowd. It turned out that the majority of respondents (65 %) do not want to buy an expensive thing, the presence of which will make them "unique". Another part of respondents – 29 % say that they can buy such things to emphasize their "uniqueness".

Advertising plays a certain role in the process of selling and purchasing goods. The majority of respondents note that they rather do not feel the influence of advertising. For 44% of respondents, advertising has absolutely no influence on anyone. Sometimes they buy products whose advertising turned out to be interesting for 20 % of respondents.

The trend of environmental friendliness cannot but please. The formation of a society and economy developing in the direction of lean production and attitude to the environment is very slow. 47 % of consumers say they want to buy "green" products, but only 6 % actually buy them. At the same time, 68 % of consumers think that eco-friendly products are too expensive.

Thus, modern society does not strive for moderate and reasonable consumption, society is aimed at satisfying desires. Today there is no consumer culture yet, it is only in the future. The task of the society is to instill in modern youth a culture of consumption and the principles of eco-friendly consumption.

THE PROBLEM OF EXPIRED DRUGS

Y. Kuratnik, L. Kuzina

Belarusian State University, ISEU BSU,
Minsk, Republic of Belarus
yanysianochka@gmail.com

This article discusses the problem of expired medicines, describes how each person can help the state in reducing them. The ways of disposing of medicines in Belarus and abroad are analyzed.

Keywords: expired medicines, recycling, ecology.

The issue of disposal of expired medicines and other medical products is extremely relevant. All expired medicines are potentially dangerous for people and the environment and require special disposal. According to the Center for Environmental Solutions, almost 97 % of Belarusians have medicines. People have to throw expired medicines in the trash, in a landfill or in the toilet drain. First, the drugs end up in the sewers, then in groundwater and reservoirs, and from there they enter the water supply. The problem of recycling is facing all medical institutions, pharmacies and the population. In this article we will look at how this problem should be solved by each of us. Almost half of those who have them store tablets in an amount of more than 10 packages, 82.9 % have ointments in tubes, 74.1% have liquid medicines in vials, 50 % of the population have packages of herbal preparations. Drug residues are found in the environment all over the world, because modern purification

systems are not able to capture drug molecules. This means that they can even end up in drinking water. It is known that hormonal drugs can cause reproductive problems, antibiotics can lead to resistance of microorganisms, and a person will subsequently not be able to be treated for serious diseases.

What should I do? About once every six months, it is necessary to arrange an audit in home first-aid kits, cleaning them not only from expired medicines, but also from those medicines whose appearance does not inspire confidence. Also try to buy exactly as many medical products as you need for recovery [1].

And what do they do with expired medicines in other countries? In Russia, for medicines with expired shelf life, the legislation only provides for the requirement to store them separately from other drugs, as well as a ban on sale. Special companies are engaged in the disposal of medicines today. Incineration, discharge into industrial sewers or burial at sanitary landfills can be used. According to environmentalists, all these methods are environmentally unsafe [2]. In Germany, there are several ways to dispose of unnecessary medicines: use a special black dumpster in which residual waste is collected; create special reception points, etc. Pharmaceutical companies in the United States are strictly prohibited from throwing out expired medicines along with other garbage. Tablets, pills, capsules, medicines and other expired medical products are sent to special liquidation plants or destroyed in huge furnaces [3]. In our opinion, there is only one way out of the dangerous situation: it is necessary to create an organized system for collecting waste medicines from the population. There are already some progress in this issue in the republic. So in 2021, at the 40th clinical polyclinic in Minsk, on the initiative of the Center for Environmental Solutions, together with the Health Committee of the Minsk City Executive Committee and with the support of the Clean Baltic coalition, a container was installed to collect spoiled medicines from the population. Apparently, it is necessary to use this experience and install containers in all polyclinics of the republic. In our opinion, this will be the first step to solve this problem.

BIBLIOGRAPHY

1. Information portal [Electronic resource] /BELTA. – Access mode: https://www.belta.by/society/view/ekologi-obespokoeny-v-domashnih-aptechkah-belorusov-izlishek-lekarstv-326825-2018/

2. Malina G. [Electronic resource] / Ecoinstruction: What to do with unnecessary and expired medicines. – Access mode: https://recyclemag.ru/article/ekoinstruktsiya-delat-nenuzhnimi-prosrochennimi-lekarstvami/

3. Online edition [Electronic resource] / Expired medicines in Germany: how to properly dispose of. – Access mode: https://aussiedlerbote.de/2019/09/prosrochennye-lekarstva-v-germanii-kak-pravilno-utilizirovat/

BRAIN CAPACITY OF YOUNG BASKETBALL PLAYERS IN TRAINING AND COMPETITIVE ACTIVITIES

M. O. Lashchevskaya, N. A. Buzlyakov, I. Z. Olevskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
mlashchevskaya@gmail.com

This article presents research material obtained in the course of psychophysical testing, the purpose of which was to analyze the level of brain bandwidth of young basketball players in training and competitive activities. The analysis of the dynamics of the studied indicators among female basketball players during the game process provides objective information about the adaptation processes occurring in the body of female athletes when solving technical and tactical actions, against the background of increasing fatigue from psychological and physical stress.

Keywords: brain capacity, psychophysical testing, Landolt test, adaptation to competitive activity, different game roles, age differences.

In playing sports, the processes of perception and processing of information are of great importance. The success of an athlete's actions is determined not only by the quality of the work of his cardiorespiratory and muscular systems, but also by the speed of the course of nervous processes. The efficiency of these processes depends on the brain's bandwidth, which is estimated by the amount of processed information per unit of time (bit / s).

There are significant differences in brain carrying capacity among qualified athletes involved in a variety of sports. For example, the brain bandwidth of basketball players is 1.66-2.14 bps, while that of handball players is 2.33–3.01 bps. The capacity metric is used to determine fitness for specific sports.

Basketball players of the Republic of Belarus from 14 to 20 years old took part in the psychophysiological testing. They are members of youth national teams, qualifications from 1 adult to masters of sports of the Republic of Belarus. To assess the brain capacity, we used a proofreading test "Landolt's rings". Before the start of test-

ing, the athletes were given blanks with rings. The task is to look through the form with maximum speed and cross out the rings in it with a certain break position. The form lies in front of the examinee on the side on which the test line is located below. The letterhead contains a set of rings with a break in one of eight directions: at 13, 15, 17, 18, 19, 21, 23 and 24 hours, if you focus on the dial of the clock. The task of the basketball players was to look through the lines from left to right and cross out the rings with a certain gap as quickly as possible within a certain time. In this case, they completed the task for three minutes. After the lapse of time, the subject put a vertical line, where he finished viewing the rings. Forms with test results were processed using special Keys, which are combined with the forms using markers, marked on the form not crossed out (omitted) and incorrectly crossed out rings. Then she calculated and entered certain indicators into the fixation form.

Thus, it can be argued that in the period from 14 to 20 years, the level of brain capacity depends mainly on the age of young basketball players. The difference in the role of sportswomen is not decisive in basketball for the level of information processing speed. Revealed the dependence of the level of brain bandwidth depending on the type of activity. The game mode presupposes a high concentration of psychophysiological abilities for the effective implementation of technical and tactical actions during competitive activity.

BIBLIOGRAPHY

1. *Солодков А. С., Сологуб Е. Б.* Физиология человека. Общая. Спортивная. Возрастная./ 2-е изд. – М.: 2005. – 528 с.

2. *Brisswalter J., Collardeau M., Rene A.* Effects of acute physical exercise characteristics on cognitive performance // Sports Med.- 2002. –Vol. 32, (9). –P. 555-566.

3. *Grego F., Vallier J. M., Collardeau M., Rousseu C., Cremieux J., Brisswalter J.* Influence of exercise duration status on cognitive function during prolonged cycling exercise// Int. J, Sports Med, – 2005. – Vol. 26 (1). – P. 27–33.

4. *Drid P., Majstorovic N., Drapsin M.* The effects of different exercise workloads on visual perception skills in elite Serbian female judokas // Kinesiology. – 2010. – Vol. 42,(2). – P. 201–207.

PSYCHOPHYSIOLOGICAL STATE OF HEALTH OF THE RESIDENTS OF MODERN MEGAPOLISES IN THE CONDITIONS OF URBANIZATION

V. Luchina, V. Sivukha

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
sivuxa.2001@mail.com

Urbanization is a historical process of increasing the number of cities and concentrating in them the political, economic and cultural life of states. Typical environmental problems for megacities are: the impact of a polluted and altered environment, a large population, water and air pollution, electromagnetic radiation, high noise levels and a large amount of waste.

Keywords: urbanization, ecological problems of megacities, urban stress, environment, "radiation fear", "green zone", sustainable development.

Air pollution in large cities adversely affects human health, causing respiratory diseases, changes in lung function, as well as leading to lung cancer, cardiovascular disease and exacerbation of asthma.

Pollution and clogging of water bodies is the result of insufficiently treated wastewater from various enterprises. According to the WHO, water contains 13 thousand potentially toxic elements: lead, mercury, cadmium, zinc, nickel and chromium can cause hypertension, atherosclerosis, polyneuritis, loss of visual acuity, and bone marrow damage. The radioactive elements cesium, uranium, plutonium, strontium cause cancer, weakened immunity, genetic changes, and many others.

Air transport, road transport, industrial plants and rail transport are the main sources of noise in large cities. Industrial plants generate significant noise and acoustic disturbance. With prolonged exposure to noise on the human body, the blood sugar content decreases to the lower level of the norm, which causes an increase in the concentration of adrenaline in the blood and leads to a sharp hypoglycemia. Reduces some indicators of human immunity and noise, sometimes recorded on urban highways.

People living in the city are constantly accompanied by stress (the so-called urban stress). Prolonged stress leads to dysfunctions of the body, diseases of the cardiovascular system, gastrointestinal tract. Stress can serve as the pathogenetic basis of cardiovascular, neurotic, endocrine diseases.

The most important example of the adverse impact of urbanization is radioactive contamination: accidents at nuclear power plants and other man-made disasters of the 20th century, accompanied by radioactive contamination, caused significant psychological and medical consequences for the population. After the Chernobyl tragedy, "radiation fear" is the cause of psychoemotional stress in many people who are characterized by weak emotional stress resistance [1].

The urbanized space of modern megalopolises has a rather strong influence on the psyche and mood of a person. Color solutions, building density, its uniformity, the height of buildings can both cause discomfort in people, lead to stress or depression, and vice versa, improve a person's mood, performance and level of well-being. [2].

It is important to take this into account in the design of buildings and use natural, non-odd colors and their combinations. Moreover, green spaces, flower beds, art objects, sculptures have a beneficial effect on creating a comfortable atmosphere for a tense human psyche [3].

Many megacities developed spontaneously, while often not taking into account the biological needs and psychological characteristics of the individual. A modern big city with its numerous monotonous buildings, transport arteries and continuous noise suppresses the biological nature of a person, eliminates the necessary physical activity, and depresses the psyche.

Today in many developed countries the problems of urbanization are being solved by creating "green zones". A green zone is a naturally natural strip that fits quite tightly around a city or urban area, where the layout must be permanent, or at least very difficult to change. For example, in the Republic of South Korea, green areas are designed as buffers to protect open space, wildlife, ecosystems and for more compact development of cities and their districts [4].

The increase in the number of megacities, the emergence of agglomerations - all this is an inevitable process of urbanization. Urbanization has an ambiguous effect on the human society, therefore, the person and the environment should be considered as a whole. For a large city, the characteristic environmental problems are: a large number of inhabitants, pollution of water and atmospheric air, electromagnetic radiation, high noise levels, and a large amount of waste. A comprehensive solution to the problems of urbanization at the state level, the adoption of measures of a social, environmental, medical, technical, legal and economic nature will allow modern states to follow the postulates of the UN Sustainable Development Concept.

BIBLIOGRAPHY

1. Молодая наука – 2013: материалы IV Открытой междунар. Молодеж. науч.-практ. конф. Туапсе, 2013/ ФГБОУ ВПО фил. Рос. гос. гидрометеорол. ун-та; редкол.: М.С. Аракелова [и др.]. – Туапсе: ФГБОУ ВПО ФГГМУ, 2013. – 312 с.

2. Конкурентоспособность территорий: материалы XXВсерос. Эконом. Форума молодых ученых и студентов Екатеринбург, 27-28 апреля 2017 г. / Уральск.гос.эконом.ун-т; редкол.: Я.П. Силин [и др.]. – Екатеринбург: УГЭУ, 2017. – 254 с.

3. Тенденции и перспективы развития науки XXI века: сб. ст./ Междунар. центр инновац. Исслед. «Омега Сайнс»; под ред..: А.А. Сукиасяна. – Екатеринбург: РИО МЦИИ «Омега Сайнс», 2015. – 263 с.

4. Actual environmental problems: proceedings of the VII International Scientific Conference of young scientists, graduates, master and PhD students, Minsk, 23-24 Nov. 2017/ ISEI BSU; ed.: S.A. Maskevich [at al.]. – Minsk: ISEI BSU, 2017. – 221 p.

THE MAIN PROBLEMS OF INVASIVE ANIMAL SPECIES IN BELARUS

E. Makarevich, I. Khandohiy

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
lena.makarevich1@gmail.com

Currently, invasive animal species represent the main threat to the conservation of biological diversity in the Republic of Belarus.

Keywords: invasions, alien species, Black Book.

The problem of the penetration of alien species has a number of negative consequences of an ecological, economic and social nature. The recognition by the public and organizations of various ranks of the importance of the problem associated with the penetration of alien animal species into new territories and their impact on ecosystems has led to more and more attention being paid to this issue.

The penetration of alien species into the territory of the Republic of Belarus is facilitated by anthropogenic transformation of territories and global climate change.

The main ways of foreign animal species entering the territory of our republic are: natural expansion from neighboring countries, transport links of various kinds, trade, unintentional and deliberate introduction, and even irresponsible attitude to the maintenance of pets - release into the natural habitat of the inhabitants of aquariums and terrariums

Biological invasions have a significant impact on natural ecosystems, affecting various aspects of biology as a science: biology and ecology of species, adaptation and evolution of species in new conditions, ways of penetration and distribution, assessment of harm, etc.

Invasive species act as vectors of genetic material transfer and are objects of interspecific hybridization. Which can lead to the emergence of new species, both positively and negatively affecting natural ecosystems.

They are also carriers of pathogens of plant, animal and human diseases. As a result, the possible appearance of new parasitic and infectious diseases [2].

In addition to the fact that invasive animal species make their own adjustments to natural ecosystems, they also cause various types of damage, leading to a decrease in the yield of final products of cultivated and economically significant plants.

The economic losses inflicted annually by alien representatives of arthropods are estimated at colossal amounts: for example, in 2001 for Australia they amounted to 0.94, for Great Britain – 0.96, South Africa – 1, Brazil – 8.5, India – 16.8 and the USA – 18 billion US dollars [3].

Today in Belarus there is a certain list of alien species that have already penetrated into the natural ecosystems of our republic, and the "Black Book of Invasive Animal Species of Belarus" has also been published. Unlike the well-known Red Book, it contains information about aggressive invasive species, the spread of which in our territory violates the ecological balance of entire regions, and therefore is extremely undesirable.

For the Republic of Belarus, the growth in the number of alien species is exponential. This means that the number of invasions is constantly increasing. More recently, a new species of mammals, the golden jackal, was recorded on the territory of the country and included in the list of invasive [1].

Thus, in Belarus, the problem of alien invasive species does not remain without attention, research is constantly being conducted in this area, regulatory documents are being issued, the risks of bioinvasions are being studied, measures are being taken to minimize or eliminate the consequences of invasive processes, as well as preventive measures are being carried out in this area.

BIBLIOGRAPHY

1. Золотистый шакал – новый вид в официальном списке млекопитающих Беларуси [Электронный ресурс]. Режим доступа : https://www.ganc-chas.by/by/page/society/12733/. Дата доступа : 01.12.2018.

2. *Слынько, Ю. В*. Генетические последствия биологических инвазий / Ю. В. Слынько // In : Alienspecies in Holarctic. Borok, 2005. 329 с.

3. *Уильямсон, М.* Различный успех захватчиков / М. Уильямсон, А. Фиттер. М. : Иностранной литературы, 1996. С. 1661–1666.

FACTORS OF TOURISM DEVELOPMENT – DIVERSITY AND CLASSIFICATION

A. Makavitski

Belarusian State University, Faculty of Geography and Geoinformatics,
Minsk, Republic of Belarus
alexmakovitcky@gmail.com

The article describes the grouping of factors affecting tourism development. The author pays attention to a description of the political, legal and security tourism development factors. The author points out the need to consider factors in contexts of individual tourist spaces and processes.

Keywords: geography of tourism, factors of tourism development, variety of factors, analysis, structuring.

Tourism, as a complex phenomenon, is influenced by a wide range of variables. All factors affecting global tourism as a whole have an impact on its constituent national parts. All elements of tourism development can be divided into two groups: external (exogenous) and internal (endogenous). External factors are determined by the influence of objective reality that has no direct connection with the functioning of the tourism industry. External factors include political and legal, security elements, economic, ethnocultural, socio-demographic, infrastructural, etc. Endogenous factors are directly determined by the characteristics of tourism as an economic and social pro-

cess of production, distribution and consumption of resources. Among the internal factors, the following are particularly distinguished: improvement of the tourist product, processes and systems of distribution of services, etc.

The political and legal factor is determined by what political and legal features the state has in the issue of tourism, how it uses its tourism resources at the level of state decision-making systems [1–3]. If the country is interested in the tourism development of its territory, this is reflected not only in internal legal documents but also in its activities to create attractive conditions for the arrival of tourists. The effect of these factors is manifested in the adoption of government acts aimed at the activation of tourism development, the development of economic measures to support and form the necessary infrastructure – the construction of new accommodation, as well as the expansion and modernization of existing ones, etc. The political and legal factors reflect how countries regulate the reception of international tourists and the peculiarities of departures. It manifested in the introduction of restrictions on border crossings with individuals or all surrounding states.

We will also highlight the factor of protection of tourists since safety is the main requirement, on which the possibility of a trip largely depends [1]. Security issues occupied an increasingly important place with the development of tourism. In addition, the COVID-19 pandemic changes the lives of the entire population of the planet, most acutely raising the question of the value of human life and the need to preserve it [4]. Travelers need to have guarantees. They should be provided by their host country in the form of appropriate measures to ensure the protection of life or property, health, finances. It can be assumed that future changes in the global situation regarding that tourist protection will lead to the fact that, along with the mandatory verification of travelers' property when they cross borders, the analysis of people's health status by any parameter will also become as permanent. Important to note that the lack of medical protection for travelers is very significant. It leads to a reduction in the percentage of their departure outside their countries of origin. An example it's the development of tourism in the world with extreme insecurity of tourists in the conditions of the COVID-19 pandemic noted earlier. According to the World Tourism Organization, the international tours worldwide decreased by 22 % in the first quarter of 2020 [5]. In total, in the first ten months of 2020, the number of international arrivals decreased by 72 %. In the conditions of the COVID–19 pandemic, the opportunities for citizens of most countries of the world to travel abroad, including for tourism purposes, were partially limited.

Summing up, we note that the factors influencing the development of tourism are very diverse, due to the peculiarities of tourism as a type of economic and social activity, which both actively interacts with the objects of the surrounding reality and is continuously internally transformed under the influence of market changes and external conditions. The impact of each factor should be carried out in the context of the studied tourist processes or spaces.

BIBLIOGRAPHY

1. *Hall C. M.* Tourism: Rethinking the Social Science of Mobility / C.M. Hall. Harlow: Prentice-Hall, 2005. – P. 164–202.

2. *Решетников Д. Г.* География туризма Беларуси / Д.Г. Решетников. Минск: БГУ, 2012. – 303 с.

3. *Goeldner C. R.* Tourism: principles, practices, philosophies. 11 ed / C.R. Goeldner, J.R. Brent Ritchie. Hoboken: John Wiley & Sons, Inc. 2009. – 657 p.

4. Общество в свете пандемии: Екатерина Шульман: [Электронный ресурс] / ЮНЕСКО. – Режим доступа: https://ru.unesco.org/courier/2020-3/obshchestvo-v-svete-pandemii. – Дата доступа: 06.10.2021.

5. International Tourist Numbers Could Fall 60–80 % [El. res.] / UNWTO. – Access mode: https://www.unwto.org/news/covid-19-international-tourist-numbers-could-fall-60-80-in-2020. – Access date: 06.10.2021.

DEVIANT BEHAVIOR IN ADOLESCENTS

A. Melnichonok, S. Pekarskaya, I. Olevskaya

Belarusian State University, ISEI BSU

Minsk, Belarus

spar7row@gmail.com

Today, the deviant behavior of adolescents is an urgent problem for society, which requires detailed consideration and study.

Keywords: deviant behavior, adolescents, society, addiction.

Adolescence is considered a major period for the formation and consolidation of social and emotional habits that are essential for mental well-being. There are a number of features that lead to deviations from the normal mental development of adolescents.

Taking into account the fact that deviant behavior has a complex character, this work is being built in order to find out the causes of deviation, prevent manifestations and their outcomes both in our country and around the world. As part of the research, a large amount of literature was studied by both foreign and domestic sociologists, psychologists and philosophers.

Based on this, deviation is a negative behavior in a critical period of the development of our society, which is characterized by deviations that do not correspond to social norms and standards. The main forms of manifestation are: various kinds of addiction (alcohol, drugs, gambling, tobacco smoking, etc.), suicide, crime, aggressive behavior, prostitution, negative attitude to the learning process, family conflicts [1].

Adolescents aged 14 to 15 years participated in the study to determine the exact causes and consequences of deviant behavior. Data collection to confirm the abovementioned deviations was carried out using the survey method. This questionnaire contains only accessible and open-ended questions that made it possible to collect the most honest and qualitative indicators [2]. The survey was conducted voluntarily and teenagers had the opportunity not to answer uncomfortable questions, in their opinion.

The results of this event were as follows:

– alcoholism: 46 % were exposed to frequent alcohol consumption. 13 % claim to have consumed only as entertainment, and only 41 % have never consumed alcohol.

– use of prohibited substances: negative response from all survey participants.

– gaming addiction: following the analysis, 68 % claim that they like to spend time playing games without any addiction.

– smoking: a positive answer to the question "did they smoke?" it gave 24 % of respondents. Most consider smoking to be a habit harmful to their health.

– suicide: 39 % said that this thought came to mind, 7 % were subject to suicide attempts, 54 % didn't even think about this act.

After analyzing the results of the study, it is clear that the use of alcoholic beverages and tobacco products are two issues that are very important to consider. It is necessary to protect teenagers from this for themselves and for society.

The manifestation of typical characteristics of deviant behavior of adolescents is an unhealthy addiction. Prevention of deviation among adolescents should be carried out both by parents and by professionals working in this field. Effective prevention of the development of this manifestation in the younger generation can be carried out on the basis of the work of scientific organizations to form a conscious and independent opportunity for adolescents to choose their life development and actively reject those manifestations of behavior that cause inevitable confrontation between the individual and society [3]. Conditions that negatively affect minors should be eliminated.

BIBLIOGRAPHY

1. *Гилинский, Я. И.* Девиантология. – 2-е изд. испр. и доп.: учебник для вузов / Я. И. Глинский. – СПб: Издательство Р. Асланова «Юридический центр Пресс», 2007. – 528 с.

2. *Майсак, Н. В.* Проблема систематизации девиантного поведения / Н. В. Майсак // Астраханский медицинский журнал. – 2011. – № 2.

3. *Тарханова, И.* Девиантное поведение: профилактика, коррекция, реабилитация: учебное пособие / И. Тарханова. – М: Владос, 2010.

THE PSYCHOLOGY OF STRESS

D. Mozheiko, D. Zhukouskaya, I. Olevskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
dasha.mozheyko@mail.ru

Stress in the psychological sense of health is the physical and psychological response of a person to a situation that is perceived as impossible to overcome. The stress response can be triggered by many factors, such as time pressure, social conflicts, a disrupted work climate, inappropriate leadership behavior, and personal or family problems. The causes of stress can be reduced through well-structured and sustainable stress management.

Keywords: stress, etiology of stress, consequences of stress.

Stress is defined as a state of imbalance between environmental requirements and individual performance requirements, goals and human needs. The person falls into a state of anxiety. These triggers are called stressors.

Stressors induce a readiness response in the body, which leads to the experience of stress and, thanks to certain coping patterns, causes the fine tuning or regulation of the nervous system, corresponding to the tasks set.

Each stressor first triggers the general supply of additional energy to the body to cope with the extreme demand. The heart beats faster, blood pressure rises, and all muscles tense to develop maximum strength. Cellular fuel and hormones are released. Attention is focused on the stressor, and memory is looking for appropriate behaviors to solve a new problem. If too little energy were provided to meet the need, the body would have to use emergency reserves, which increases the load on the musculoskeletal organs. However, if excess energy is released, it must be expended in organs that are not involved in the task. Usually, only after the end of a stressful situation, a person notices a lack of energy as depletion or an excess of energy as a continuing internal overexcitation. Therefore, stress is often experienced as an excess of energy [1].

Stress is usually only a short-term condition and therefore not harmful. When the danger or stressful situation disappears, the body's stress responses also diminish. However, this becomes dangerous when a short-term feeling of stress develops into constant stress.

Many people suffer from chronic stress. A typical side effect of constant stress is the feeling that we are no longer in control of our lives. Constant stress paralyzes us, and the less work we do, the harder it is for us to truly relax and unwind. We force ourselves to work harder and harder and find no rest. This is a typical stress spiral where stress creates more stress [2].

Stress has consequences. The physical and emotional symptoms of stress do not go away right away, and it takes time for the person to regain their normal balance. After periods of intense stress, this can take several weeks. If the recovery phase is no longer enough, then even ordinary daily activities become a stress factor [3].

BIBLIOGRAPHY

1. *Kimberly V.* Oxington. Psychology of Stress / // Nova Publishers. 2005. P. 203–209.

2. *Page, M.W.* The Impact of the Human Stress Response: The Biologic Origins of Human Stress / M. W. Page //Paperback. 2016. P. 1883–187.

3. *Çakmur, H.* Effects of Stress on Human Health / H. Çakmur // Intechopen. 2020. P. 53–67.

ECONOMIC ASPECTS OF THE IMPLEMENTATION OF ORGANIC AGRICULTURE IN THE REPUBLIC OF BELARUS

A. Nazarovich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
miss.nazarovich@mail.ru

A brief overview of global organic agriculture statistics, drawing attention to the situation in the Republic of Belarus, the obstacles to mass production of organic products in Belarus on the domestic and foreign markets and the ways to solve problems.

Keywords: agriculture, organic products.

Currently, the popularity of organic agriculture is growing in the world. Such "clean" agricultural production implies the rejection of the use of mineral fertilizers and chemical plant protection products, combining the traditions of the past with the latest achievements of science. However, having a number of advantages that favorably affect the environment, it is not yet relevant for large-scale food production because at this stage organic agriculture is not effective enough.

The share of agricultural lands used for organic farming is 0.7 % of the total area of agricultural land in the world. This indicator varies in different countries in Europe.

For example, in Italy, Finland, Sweden and Switzerland, these types of territories occupy from 4.1 to 6.7 % of agricultural land, and in the United States – 0.5 %. At the same time, the share of bio-organic food products on the world market is about 3 % [1].

In the Republic of Belarus, the share of land areas for organic agriculture is only 0.02%, which is significantly lower than in the world on the average (1.5 %), i.e. at this stage of the agricultural sector development, this practice is just emerging. However, according to FiBL (Research Institute of Organic Agriculture) in 2018, the Republic of Belarus entered the top 10 European countries according to the growth rate of acreage for organic agriculture. In November 2019, the Law “On the Production and Circulation of Organic Products" of November 9,

2018 No. 144-3 came into force. Today, about 27 business entities are engaged in the production of organic products in Belarus, including peasant farms, personal subsidiary farms, agricultural and other entities of the Brest, Vitebsk, Grodno, Minsk and Mogilev regions, and the country also has about 1,600 hectares of agricultural land for the production of organic products. Despite this, in 2020 Belarus was in last place among the EAEU (Eurasian Economic Union) countries in terms of the number of both producers and processors of organic products [2], [3].

According to experts, there are serious obstacles to the development of organic agriculture in Belarus, namely: low natural fertility of sod-podzolic soils, which makes it almost impossible to obtain sustainable crops without the use of mineral fertilizers; large amounts of necessary financial investments; underdeveloped market of organic products; underdeveloped practice of fixing prices for agricultural products; lack of cooperation between farmers; difficulties in entering the international market; lack of a developed discussion platform between producers, science and business representatives; lack of a permanent general education program and information base.

In our opinion, the current situation in Belarus regarding organic agriculture is not a problem but an opportunity that requires in-depth analysis of data and identification of reasons that hinder (or contribute to) the implementation of specific projects in this area.

BIBLIOGRAPHY

1. *Поречина Н. И.* Органическое сельское хозяйство Беларуси: перспективы развития / Поперечина Н. И. // Материалы междунар. науч.-практ. конф. Мн. : Донарит, 2012. – 104 с.

2. Информация о развитии органического сельского хозяйства в Республике Беларусь. Available at: https://mshp.gov.by/documents/orgproizvodstvo/fbb17ace39788c02.html (accessed 21.09.2021).

3. Органическое сельское хозяйство в Республике Беларусь: текущее состояние и перспективы. Available at: https://investinbelarus.by/upload/medialibrary/165/organicheskoe-selskoe-khozyaystvo-1_compressed-_4_.pdf (accessed 24.09.2021).

INSTRUCTIONAL DESIGN: THE ESSENCE OF THE ISSUE

A. Osinovskaya

Shirokov's Institute of Contemporary Knowledge, IoCK
Minsk, Republic of Belarus
anzhelikachan@gmail.com

In this article, the author defines the essence and actualizes the concept of instructional design. The author defines the reasons for the occurence of instructional design. The necessity of developing high-quality educational material and creating a psychologically comfortable educational environment is emphasized.

Keywords: instructional design, education, knowledge, content, student, learning, teaching, process.

Today there is still no unambiguous and generally accepted interpretation of the concept of «instructional design». Instructional design can be viewed by specialists as a scientific discipline, a field of science and as a process [1]. In the age of information technology, education should be as accessible as possible for any student. Instructional design helps to systematize teaching methods and systems in order to develop quality educational content. It is important that the learning process is not a mechanical transfer of knowledge from teacher to student, but their interaction. Instructional design allows you to create a psychologically comfortable educational environment, taking into account the individual characteristics of students.

Instructional design first emerged during the Second world war. At that time, the main goal was to quickly and efficiently prepare soldiers for a multitude of tasks [2].

In the future, the need for the formation of quality knowledge increased. It became obvious that the traditional education system is not very effective, since it does not take into account the individual characteristics of students and in many cases leads to a waste of time and resources, expressed in a low level of student achievement in educational institutions.

In the last century, nine principles of instructional design were defined and expounded by Robert Gagne [2]. Gagne's learning theory states that in order for a student to master a complex skill, he must be able to complete all of its elementary skills. Gagne's approach has been applied in education all over the world. Today there are more than a dozen popular and proven instructional design models. Instructional design helps to understand what processes underlie successful learning. First of all, you need to clearly define the goal. In the learning process, modern methods and approaches should be used in order to attract the attention of students and motivate them to learn. The main

goal of the education is the ability to apply the acquired knowledge in practice. If we consider instructional design as a process, then its essence lies in the development and realization of the most effective forms and methods of teaching to achieve this goal. The process of developing educational materials consists of 5 stages: analysis, design, development, application and evaluation. Nowadays, instructional design is actively used in the creation of textbooks and the development of distance and online learning; it is used by modern services and educational platforms. It is important to take into consideration that instructional design considers precisely the content part of learning and does not include additions to the main material, such as graphics, animation, and others.

Thus, instructional design is relevant in our time, as it allows us to develop the most effective forms and methods of teaching and makes education more accessible. Instructional design is versatile, as it is used not only in educational institutions, but also in business to educate and improve the classification of company employees. The essence of instructional design lies in the development of high-quality educational material and the creation and maintenance of an environment in which psychologically comfortable and pedagogically justified development of students is ensured, based on their individual differences. Traditional teaching methods allow solving relatively simple problems, while instructional design requires an analysis of the subjects of education for successful and effective teaching.

BIBLIOGRAPHY

1. Педагогический дизайн и проектирование: принципы, задачи, модели [Электронный ресурс]. – Режим доступа: https://etutorium.ru/blog/pedagogicheskij-dizajn-proektirovanie. – Дата доступа: 07.10.2021.

2. Осмысление понятия «Педагогический дизайн» через историю его развития [Электронный ресурс]. – Режим доступа: https://pandia.ru/text/77/283/90820.php. – Дата доступа: 07.10.2021.

DEVELOPMENT OF A BICYCLE ROUTE PROJECT IN BARANOVICH DISTRICT AS A WAY TO IMPROVE TOURISTIC AND RECREATION POTENTIAL

A. E. Rasskazova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus

The paper examines the recreational and tourist potential of the Baranovichi region and the way to improve it on the example of a bicycle route. The object of the research is the recreational and tourist potential of the Baranovichi region. The purpose of the work is to assess the recreational and tourist potential of the Baranovichi region and to propose options for optimizing the area for ecological tourism, in particular, the development of an ecological and educational cycling route.

Key words: ecological tourism, recreation, cycling route.

The Baranovichi district is located in the northeast of the Brest region and its area is more than 2.2 thousand km2. The population of the district is 30 703 people. On the territory of the city of Baranovichi there are about 28 large enterprises of the main industry, most of which are sources of harmful emissions. In this regard, most enterprises provide additional days off to compensate for the harmful effects of working conditions on the human body.

During the research of the district, it was found that there are no ecological tourism facilities on its territory that would be popular with the city residents, including employees of enterprises with harmful working conditions. Those few ecological tourism objects that are present in the territory of the district are not landscaped and are not popularized among the residents of the city as potential places for spending leisure time in order to improve their health and recreation. There are objects of a different kind that are not related to ecological tourism, such as the Myshanka River, which are very popular among city residents due to their ignorance of other leisure options. That is why it became necessary to improve the tourist and recreational state of the region by introducing new facilities [1].

To solve the set task of improving the attractiveness and organization of recreation sites, an attempt was made to create an ecological educational cycling route. The route will go through the city of Baranovichi to Lake Gat. A total of 9 stops are planned along the route near such objects as the Church of St. Siegmund, St. Alexander Nevsky, Seventh Day Adventist Church, Polessky Railway Station, Railway Museum, St. Myrrh-Bearing Women, Church of St. John Paul which are located in the city of Baranovichi, as well as the Kotlubaev Estate in the village of Yastrembel and the Chapel, established in the 1930s. in memory of the victory of the rebels over the tsarist troops during the uprising of 1863–1864. in the village of Milovidy [2].

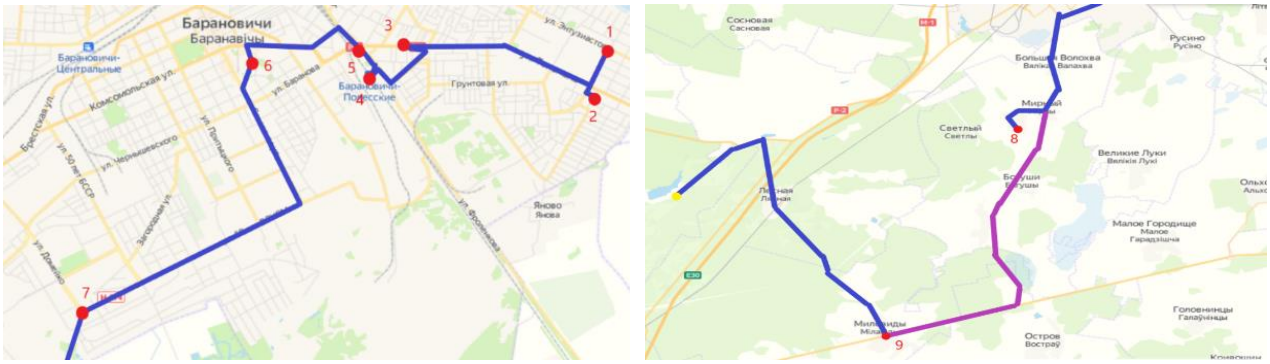


Fig. 1 – Schematic map of the cycling route

The developed project of the bicycle route will make it possible to better acquaint the residents of the Baranovichi district with the beauties of their native land and improve their health by cycling, which not only helps to increase muscle tone, but also improves the psychological state and helps to reduce stress after working days. In addition, this route will increase the attractiveness of the region both for neighboring regions and for all the rest of the territory of Belarus.

BIBLIOGRAPHY

1. About the area. [Electronic source] / Baranovichi regional executive committee. – Access mode: http://baranovichi.brest–region.gov.by/index.php?option=com_content&view=article&id=64% 3A2010–05–07–11–23–29 & catid = 57% 3Aarea & Itemid = 117 & lang = ru. – Access date: 10/01/2021;

2. Attractions [Electronic source] / Baranovichi region – Attractions. – Access mode: https://radzima.org/ru/rayon/baranovichskiy.html. – Access date: 10/01/2021.

INFLUENCE OF HYPOTHYROIDISM ON HUMAN MENTAL HEALTH

D. Sikita, A. Derachits, I. Olevskaya

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
ito.nimeriya2017@yandex.ru
derachits.alena@mail.ru

The influence of thyroid pathology in patients on their mental state has been studied. It was found that hypothyroidism affects from 9 to 56% of people referred to a psychologist or psychiatrist with a diagnosis of depression.

Keywords: hypothyroidism, thyroid gland, emotions, depression.

The urgency of the problem is connected with the increase in number of patients with thyroid gland diseases because of negative influence of psychosocial, ecological and biological factors.

Pathology of thyroid gland function is accompanied by psycho-emotional disturbances of varying degrees of severity, which is associated with changes in hormonal status. The brain is the most sensitive to the deficiency of thyroid hormones. A correlation has been established between a decrease in the level of optimism, cheerfulness and mental activity due to thyroid hormone deficiency [1].

In this connection there are functional changes in the central and peripheral nervous system. It has been revealed that hypothyroidism has the most significant effect on the psychological status of patients. At subclinical hypothyroidism the emotional sphere suffers. Depressed mood, inexplicable melancholy, severe depression, with panic attacks and low efficiency of antidepressants used, being a distinctive feature, are noted. In manifest hypothyroidism, neuropsychiatric disorders are most pronounced in elderly patients. Hypothyroid encephalopathy, which is observed in the elderly, is characterized by general retardation, dizziness, decreased social adaptation, significant impairment of the intellect. At the same time, problems with the analysis of occurring events are noted. In patients with hypothyroidism against the background of autoimmune thyroiditis the predominance of psychoemotional disorders is noted [4].

In hypothyroidism, children are noted to be withdrawn, prone to loneliness, introversion, aloofness from the environment. They have increased fatigue and sleep disorders. When analyzing psychological indicators in children suffering from hypothyroidism, using the projective technique "Children's Drawing", the following changes were revealed: depression, asthenia, personal anxiety, aggression [3].

Thus, hypothyroidism has a significant negative impact on human mental health at all stages of life, from mild disorders to severe mental disorders.

BIBLIOGRAPHY

1. *Joffe, R. T.* Subclinical hypothyroidism, mood, and cognition in older adults: a review / R. T. Joffe, E. N.Pearce, J. V.Hennessey [et al.] // International J. of Geriatric Psychiatry. 2013. V. 28. № 4. P. 111–118.

2. *Radhakrishnan, R.* Thyroid dysfunction in major psychiatric disorders in a hospital based sample / R. Radhakrishnan, S. Calvin, J. K. Singh [et al.] // The Indian J. of Medical Research. 2013. V. 138. № 6. P. 888–893.

3. *Гусарук, Л. Р.* Особенности психоэмоционального статуса детей с врожденным гипотиреозом в зависимости от уровня интеллектуального развития. / Л. Р. Гусарук, В. И. Голубцов // Кубан. науч. мед. вестн. 2009. № 9. С. 23–26.

4. *Мадиярова, М. Ш*. Особенности клинической картины, показателей качества жизни и когнитивных функций у пациентов с гипотиреозом разной этиологии / М. Ш. Мадияроа, Т. Б. Моргунова, В. В. Фадеев [и др.] // Клиническая и экспериментальная тиреоидология. 2014. Т. 10. № 1. С.44–54.

PSYCHOLOGICAL FEATURES OF PANIC DISORDER.

L. A. Sultanova , I. Z. Olevskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
sultanovalola26@gmail.com

The impact of panic disorder on the mental state of patients has been studied. It was found that panic disorder affects about 10 % of people referred to various kinds of specialists, but never to a psychologist or psychotherapist [2].

Keywords: panic attack, panic disorder, anxiety, depression.

The relevance of this issue is related to the increase in the number of patients with panic disorder due to the negative impact of psychosocial, environmental and biological factors.

Panic disorder can be an illness in its own right, or it can be part of a pathology. Panic attacks can occur not only in patients with mental illness, but also in a range of other non-psychiatric illnesses (rheumatic diseases, endocrine and cardiovascular pathologies) [3].

Panic disorder is recurrent panic attacks, usually accompanied by anticipatory anxiety about future attacks or changes in behaviour to avoid situations that predispose to panic attacks. The diagnosis is clinical. Isolated panic attacks may not require treatment. Panic disorder is treated with medication and/or psychotherapy (e.g., exposure or cognitive behavioural therapy). Panic disorder affects 2–3 % of the population within 12 months. Panic disorder usually appears in late adolescence or young adulthood and affects women about twice as often as men [1].

Suddenly occurring, uncontrollable attacks of irrational fear are called panic attacks (PA). They are accompanied by violent reactions from the nervous system and various somatic complaints [1].

Panic attacks are common, affecting up to 11 % of the population within 1 year. Most patients recover without treatment; a small number develop panic disorder [1].

Individual selection of pharmacological drugs, the use of low doses in combination with psychotherapy and social adaptation can now successfully cope with panic disorder [2].

Thus, panic disorder has a significant negative impact on a person's mental health at all stages of life, confirming the appearance of clinical syndromes ranging from mild impairment to severe mental disorders.

BIBLIOGRAPHY

1. *Barnhill J.W.* Attaque de panique et trouble panique / LE MANUEL MSD. 2020.

2. *Дюкова, Г. М.* (2007). Панические расстройства. Нервные болезни, (3), 3–7.

3. *Липовая О.А., Соколовский Г.В.* Психологические особенности панических атак // Вестник Таганрогского института имени А.П. Чехова. 2017. №1. URL: https://cyberleninka.ru/article/n/psihologicheskie-osobennosti-panicheskih-atak

THE PROBLEM OF INFLATED EXPECTATIONS

V. Timchenko, M. Yakauleva

Belarusian State University, ISEI BSU
Minsk, the Republic of Belarus
violettapolyanskaya@gmail.com

This article analyses the problem of inflated expectations and its influence on the formation of the child's psyche.

Keywords: expectations, syndrome, self-esteem, formation.

In today's world, the problem of inflated expectations is widespread. Each individual has certain expectations from a young age. Parents expect success and achievements from children, children expect understanding and favor from teachers and classmates, teenagers expect financial independence, and adults expect success in a career and having an ideal marriage.

According to psychologists, expectations are built on the basis of life experience, which is formed throughout life. Under the influence of positive and negative experiences, a person forms positive and negative expectations from life in general and from other people.

In addition, due to the fact that a person is a social being and lives in society, expectations, dreams and desires are formed under the influence of many factors. There is an active propaganda of external success, a better life, improved goods and services in the media. People constantly compare themselves with others, with the ideal world that is demonstrated on social networks, and begin to create their own world of desires, while doing nothing to fulfill them.

The most favorable period for the formation and formation of social expectations is primary school age. It is during this period that children especially suffer from the syndrome of high expectations on the part of parents, teachers or peers.

The syndrome of inflated expectations is a common deviation of a psychological nature, which is expressed in the presentation of unrealistic demands and expectations from oneself and others. A person suffering from this syndrome feels unhappy most of his life, believes that he has not been appreciated and deserves a better life, better conditions, etc. This problem affects all spheres of life and is accompanied by constant irritability and nervousness. The conflict between the fictional world and reality generates anxiety and anxiety. In addition, the constant failure to achieve the desired significantly reduces a person's self-esteem. Although this disorder occurs both in people with low and in people with high self-esteem. Such people are not able to soberly assess their advantages and disadvantages.

An important role in the development of this syndrome is played by the family climate and the presence of psychological trauma in childhood. The connection between what an individual lacked in childhood and what he expects to receive in the future is revealed. So children whose parents demanded great achievements and successes from them often become perfectionists with an obsession with "becoming the best in everything." Then, making the same high demands on colleagues, spouse and their own children, they face misunderstanding, irritability and often initiate conflicts in the work process and family. All this leaves its mark on their children, forming a vicious circle of inflated expectations and demands. Eventually, in the absence of work with this problem, such people come to depression and inner loneliness.

In this way, when this problem is detected, it is impossible to turn a blind eye to it. It is necessary to learn to soberly evaluate yourself, set feasible goals for yourself and move towards achieving them. Since inflated expectations only lead to disappointment and unhappiness. In addition, it is not necessary to improve other people, it is important to start with yourself, learn to be grateful for what you have, and happy regardless of circumstances.

BIBLIOGRAPHY

1. *Бузиашвили, Ю.* Мы слишком многого ожидаем от жизни? / Ю. В. Бузиашвили // Российская академия наук. 2016. № 6907. С. 37

2. *Демянчук, И.* Проблемы психологии: как избавиться от завышенных ожиданий / И. А. Демянчук // Про здоровье. 2016. № 2. С. 23

3. *Ситник, Л.* Ожидания и реальность: откуда берутся разочарования / Л.Е. Ситник // Номер один. 2020. № 26. С. 23–29.

PROBLEMS OF ECOLOGICAL CONSCIOUSNESS AND BEHAVIOR OF STUDENTS

A. Vabishchevich, T. Kapustina

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
Vabishevich2002@mail.ru

The article deals with the problem of environmental conservation. The results of a survey of students of the ISEI BSU aimed at identifying the level of their ecological consciousness and understanding of environmental issues are presented.

Keywords: ecology, environmental protection, environmental responsibility, environmental consciousness.

According to the statistics of the National Statistical Committee of the Republic of Belarus, more than 60 million tons of waste from various industries and about 5 million tons of solid municipal waste were generated in 2020 [1]. Nature protection, rational use of raw materials and material and technical resources is a big and responsible task, which is the most important condition for the survival and progress of humanity.

Various environmental exhibitions, thematic sections, as well as republican, city and district actions, environmental contests are regularly held in Belarus, where the main topics are: environmental conservation, achievements and prospects for the development of ecology and environmental safety issues.

Holding such events contributes to the involvement of the younger generation and the adult population in the processes of nature protection and makes a significant contribution to the formation of ecological culture.

A survey was conducted to identify the level of concern about the state of the environment among the 2nd and 3rd year students of the Faculty of Environmental Medicine of ISEI BSU. According to the survey results, more than 90 % of students are interested in the environmental conditions of their place of residence, but 24 % claim that information is unavailable. About 50 % think that humanity is facing an environmental disaster in the next 30 years, and among the most pressing environmental problems are pollution of water, air, accumulation of industrial and household waste, climate change. The analysis also showed that 63 % of respondents know about the location of recycling collection points, but only 41.3 % have applied there at least once.

According to respondents, the following measures should be taken to improve the environmental situation: separate garbage collection (74 % think so), reuse of resources (67 %), engagement in environmental activities (54 %), economizing water and electricity (55 %). At the same time, when asked what measures the respondents themselves and their family members take to save the environment, the following results were achieved: about 65 % are engaged in separate waste collection, 41 % reuse resources, about 50% economize water and electricity, and only about 20 % attend environmental events. 61 % of the survey participants believe that their personal contribution is important in changing the environmental situation for the better, the rest also note the value of their contribution, but only if the overwhelming majority of the world's population participates in solving environmental issues.

When conducting environmental education events, it is important to get across that everyone is able to contribute to improving the environmental situation. To do this, you need quite a few simple actions:

– refuse plastic bags and use reusable fabric bags instead, which serve for a long time and are easily recyclable;
– use water sparingly while brushing your teeth and washing dishes;
– use both sides of the paper when printing documents;
– walk more often, ride a bicycle or use electric modes of transport (scooter, electric bus);
– use energy-saving light bulbs;
– follow the rules of separate waste collection.

BIBLIOGRAPHY

1. National Legal Internet Portal of the Republic of Belarus [Electronic resource]. – Access mode: http://www.pravo.by . – Access date: 07.10.2021.

ENVIRONMENTAL EDUCATION OF SCHOOLCHILDREN WITHIN THE FRAMEWORK OF THE ACADEMIC SUBJECT "MAN AND THE WORLD"

S. Vergeichik, E. Zhuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
svetlana.vergeichik@gmail.com

The formation of environmental competencies of younger schoolchildren is a necessary component in mastering knowledge and skills within the framework of the educational subject "Man and the world". Diagnostic methods (conversation and pedagogical observation) are the most objective for determining the initial level of knowledge in children of primary school age.

Key words: environmental education, educational subject "Man and the world", sustainable development.

Environmental education and upbringing is an important component of comprehensive personal development. A special role for students at the initial stage of education is played by the educational subject "Man and the world", which is aimed at developing existing knowledge about nature, consolidating environmental rules for building the world.

The main object of students ' knowledge in the lessons "Man and the world" is natural nature, which allows us to successfully solve the problems of forming an ecological culture. The purpose of the educational subject "Man and the world" is to form the foundations of a scientific worldview, ecological and spiritual and moral culture, knowledge about nature, society and man, necessary for versatile interaction with the surrounding world [1]. The development of environmental knowledge in children of primary school age is realized with the help of tasks, which should be given an environmental orientation accordingly. The tasks used in the lessons should determine not only the relationship of organisms with the environment, but also the value normative and practical aspects of human relations to the natural environment.

The assessment of the formation of environmental competencies was carried out by us among students of the 2nd "A" class on the basis of the state educational institution "Secondary School № 3 in Khoiniki".

To diagnose the environmental competence of younger schoolchildren, methods were used - conversation and pedagogical observation. The assessment of the level of environmental competence (high, medium, low) of primary school students was carried out by analyzing the tasks performed. We have developed a didactic material for performing tasks, which includes a task for recognizing animals, a task for recognizing plants and a task for attitude to the natural world.

The task – Recognizing animals-showed that younger schoolchildren do not show and do not express their attitude to animals (birds), they find it difficult to name the characteristic features of representatives of the animal world. The ratio of responses by competence levels is almost the same (33.3 %).

The task – Recognition of plants showed that students mostly correctly identify groups of proposed plants. They tell you how to properly care for indoor plants. The majority of students (67 %) completed the task at the intermediate level.

The task – Attitude to the natural world showed that most of the students answer the questions posed, basically they know how to take care of pets and the inhabitants of a corner of nature. Some of the students do not understand the relationship between human activity and the life of animals, birds and plants. 46.6 % of students are in the group with an average level of competence.

A high level of respect for the natural environment was noted in 33 % of children, an average level – 53 %, a low level in 13% of children, which indicates the effectiveness of purposeful work on the formation of environmental competencies.

The selected diagnostic methods (conversation and pedagogical observation) are the most objective for determining the initial level of environmental knowledge in primary school children.

BIBLIOGRAPHY

1. Учебная программа по учебному предмету «Человек и мир» для I класса учреждений общего среднего образования с русским языком обучения и воспитания. – 2017. – 68 с.

EXPERIENCE IN ORGANIZING DISTANCE LEARNING STUDENTS

A. Yatskovskaya, D. Churakova, T. Kapustina E. Zhuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
yatskovskaya26@gmail.com
churacova2112@gmail.com

The organization of distance learning (DL) for distance learning students is in modern conditions a necessary component in mastering the knowledge and skills of future specialists. The experience of organizing DL and the assessment of DL by part-time students of the first year is presented.

Key words: distance learning, part-time education, active forms, essays.

Modern trends in education lead to the need to use distance learning (DL) in the educational process. The correspondence form of training most urgently needs methodological recommendations for organizing the assimilation of material by correspondence students.

The target group for the research was selected first-year students of the specialty "Medical Ecology" of the Moscow State Power Engineering Institute. HELL. ISEI BSU (84 students). The discipline "Introduction to the specialty" includes lectures, practical exercises and credit. When organizing DL it is necessary, for the effectiveness of training, to change the format of conducting classes. Lectures included joint viewing of presentations, chat was used to discuss issues, it was obligatory to complete an assignment to assimilate the material of the lecture. Practical exercises were conducted with a discussion of the progress of work, consultations on controversial issues and an indication of the time of defense of the work performed.

The introduction of independent work in the educational process of DL is one of the most effective ways to increase the effectiveness of education. The organization of independent work within the framework of DOs entails additional requirements: the timeliness of the provision of information, the efficiency of assessment of tasks, the development of a control and diagnostic module.

We, within the framework of the organization of independent work, have applied the essay method on the topic "Distance education and I". The main tasks of the analysis of the essay: to determine, based on the individual reasoning of students, the attitude to this form of organization of training, analysis of the advantages and disadvantages.

The analysis of the essay showed that the attitude of first-year students (84 students) to DL can be divided into groups: positive attitude (69.1 %), negative (8.3 %), indifferent (22.6 %). The attitude towards DL was described by indicating the advantages and disadvantages of DL from the perspective of a correspondence student.

On the whole, there were more advantages of DL was, almost twice. The main advantages of DL are indicated in the essay by students: time saving (43 people) 19.1 %, comfortable conditions (time, place, environment) (42 people) 18.7 %, money saving (32 people) 14.2 %. Of the described shortcomings, the following were indicated: lack of personal communication with teachers and fellow students (37 people) 25.7 %, the format of conducting practical classes without personal communication (32 people) 22.2 %, problems with the Internet (24 people) 16.7 %

The organization of DL presupposes the development and application of active forms of education. It makes it possible to stimulate the independent work of students, to develop the skills of information analysis, experience in systematizing the material being studied.

"GREEN ECONOMY" IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

A. Yatskovskaya, L. Kuzina

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
yatskovskaya26@gmail.com

This article examines the differences between the “green economy” of Europe and Belarus. An idea of the possibilities of its further growth and development based on the use of the experience of developed countries is given.

Key words: “green economy”, sustainable development, concept.

Today the concept of “green economy” is becoming a global trend, a new global model of sustainable development. The interest in the concept of “green economy” is caused by the numerous crises that the world has faced in recent years, primarily climate, environmental, food, financial and economic. This necessitated the search for other ways of development. Many countries have chosen the green course instead of the brown economy, as it ensures the successful economic and environmental development of the country. The Scandinavian countries are examples of such successful development. Everyone knows that Sweden, Denmark, Norway, Finland and Iceland have a very high standard of living, and ecology is one of the main tasks. Most of the population of these countries considers environmental problems to be the most important social problems. [2]

In Belarus, much attention is paid to industry and management, which are the backbone of the economy, but at the same time leave a significant ecological footprint. According to international estimates, the ecological efficiency index of Belarus for 2016 is 82.3 % (the republic ranks 35th out of 180 countries). Thus, improving the environment and sustainable management of natural resources are top priorities for national policy. The commitment of the Republic of Belarus to the principles of a green economy is spelled out in national policy documents, including the National Strategy for Sustainable Development until 2030. Taking into account national characteristics, the state has chosen a green economy as a strategic priority. A National Action Plan has been developed for the implementation of the principles of a green economy in the sectors of the national economy of the Republic of Belarus until 2020. The result of the effective implementation of the National Plan will be a phased transformation of the national economy based on the implementation of the principles of a green economy and the achievement of sustainable development goals. [1]

The following directions of the green economy development are highlighted as the main ones: development of electric transport (infrastructure) and urban mobility; implementation of the concept of “smart cities”; development of construction of energy efficient residential buildings and improvement of energy efficiency of the housing stock; reducing the energy intensity of GDP, increasing energy efficiency; increasing the potential for using renewable energy sources; creating conditions for the production of organic products; development of ecological tourism. [3]

We believe that for the speedy implementation of the National Plan, it is necessary to conduct training seminars on the green economy for specialists of local executive and administrative bodies, to include a training course on the “green” economy in the training programs for specialists, as well as in the advanced training programs for specialists in technical and economic specialties. Participate in actions dedicated to the “green economy” and develop plans to improve the ecological state of the country.

BIBLIOGRAPHY

1. National action plan for the implementation of the principles of a green economy in the sectors of the national economy of the Republic of Belarus until 2020, approved by the Resolution of the Council of Ministers of the Republic of Belarus dated December 21, 2016. No. 1061.

2. *Gusev A. A.* Transition to the policy of "green" economic growth // Economic science of modern Russia. 2016. No. 2 p. 27–35

3. *Kuzina L. V.* "Green economy" as an alternative to the existing market economy. Lesnoy Vestnik of Moscow State Forest University No. 4, 2015, pp. 37–41.

SECTION 2

MEDICAL ECOLOGY

THE EFFECT OF SOME MONOSACCHARIDES ON INSULIN FIBRILLATION

V. Abakumets, R. Baranovskiy, N. Bogdanova, K. Bulanova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
abakumecvika99@gmail.com

Violation of protein folding leads to the development of a number of systemic and neurodegenerative diseases – proteinopathies, when proteins become inactive, toxic, prone to aggregation and deposition in various organs and tissues. Type 2 diabetes mellitus belongs to the group of these diseases. Insulin fibrils were detected at the sites of repeated injections in patients with diabetes. There is a hypothesis that the primary cytotoxic agents in the development of proteinopathies are protein oligomers prone to aggregation, which allows for in vitro studies of fibrillation.

Keywords: insulin, fibrillation, protein.

The formation of insulin fibrils is a process by which partially deployed insulin molecules interact with each other to form linear aggregates [1]. It is believed that the fibrillation of insulin occurs through the mechanism of nucleation and is enhanced by conditions conducive to protein denaturation [2]. This paper presents an analysis of data on the effect of different concentrations of glucose and fructose on insulin fibrillation in different time periods. The intensity of fibrillation processes was assessed using theoflavine T.

1. After adding various concentrations of glucose to the insulin solution (from 10-6M to 10-3M), it was found that its low concentrations (10-6-10-5M) in the first minutes have little effect on the fibrillation of hormone molecules, and only concentrations from 10-4M to 10-3M are able to initiate this process. The aggregation of insulin molecules stimulated by glucose is reversible: the most pronounced effects of glucose appear in the first minutes, and in later hours (12 hours) there is a decrease in effects by about 2 times, and by 24 hours they again show the least effect.

2. After the introduction of fructose into the insulin incubation medium, a slight increase in the intensity of thioflavin fluorescence is observed in the first minutes, corresponding to the indicators characteristic of the lowest glucose concentrations (10-6M). However, by 12 o'clock, fibrillation is stimulated, the intensity of which is proportional to the values of fructose concentration, but by 24 o'clock a gradual decrease in thioflavin fluorescence also indicates the reversibility of the process of insulin fibrillation.

Summing up, we can say that a significant accumulation of glucose in the blood is able to initiate the initial, reversible processes of formation of insulin aggregation nuclei. Fructose is a weak initiator of fibrillation, however, the manifestation of its maximum activity in antiphase with the effects of glucose indicates its possible involvement in the initiation of the initial stages of aggregation. Also, the elevated blood sugar level observed in diabetes mellitus is able to initiate the process of fibrillation of insulin molecules, most likely due to non-enzymatic glycation of this protein [3]. It is known that during protein glycation, aldehyde or keto groups of reducing sugars reversibly react with free amino groups of the protein to form Schiff bases exclusively at the initial stage by triggering nucleation mechanisms. The reversibility of insulin fibrillation caused by both glucose and fructose indicates their involvement in the initial stages of the formation of aggregation nuclei. The persistent presence in the blood of an excessive amount of glucose, reactive oxygen species formed in the Schiff reaction, can then lead to irreversible rearrangements and the formation of glycation end products [4].

BIBLIOGRAPHY

1. Toward understanding insulin fibrillation / J Brange [ed al.] // journal – 1997 – № 86 – p. 17–25.

2. Amyloid. A protein related to the subunit structure of human amyloid fibrils/ Benditt, E.P. [ed al.] // journal Proc. Natl. Acad. Sci. USA – 1966 - №55 – p.308-316.

3. Исследование процесса амилоидообразования aβ пептида/ Галзитская О. В. [и др.] // сб. научн. ст. / Институт белка РАН, Пущино, Московская область. – Москва, 2018. – с.133–172.

4. Insulin glycation coupled with liposomal lipid peroxidation and microglial cell death/ Manijheh Sabokdast [ed al.]// journal – 2015 – № 5 – p. 33114–33122.

THE RARE MUTANTS OF BARLEY PRODUCED IN CONDITIONS OF MOUNTAINS

I. Abdulov, I. Amanturtiev

National University of Uzbekistan named after Mirzo Ulugbek
Tashkent, Republic of Uzbekistan
ildar2525a@yandex.com

Chemical mutagens in genetics and plant breeding are of great theoretical and practical importance.

Keywords: mutagens, genetic, plants.

The use of chemical mutagens in genetics and plant breeding is of great theoretical and practical importance. By the method of experimental mutagenesis, an interesting form is obtained that is of interest in the breeding of cultivated plants [1, 2]. As a result of long-term works on experimental mutagenesis in conditions of the Western and East Pamir mutants of barley (*H.vulgare* L.) representing selection, genetic and evolutionary interest have been produced. Mutants are basically received on barley of Jau-kobutak (*var.himalaense*), Jau-safedak (*var.coeleste*).

Jau-kobutak, Jau-safedak is a grade of national selection and is sowed on the Western Pamir (Badakshan) at heights up to 3200 m above sea level. Plants of the given cultivar have the following characteristics: a stalk length is 50–60 cm, an ear length is 8-10 cm, ear density is 11–12, 1000 grains weight is 45–50 g. The grain form is oblong.

Under the effect of dietilsulfat at a concentration of 0.1 % in the Western Pamirs 2600 m above the sea level Wahan-1 mutant on a short and erect 25–30 cm stem was developed, its ear length is 4–5cm, ear density is 23–24, 1000-grain weight is 33-36 g. It is interesting, that this mutant grains have a rounded shape.

In the conditions of East Pamir at a height of 3860 m under a similar effect of mutagene NMU the rare mutant with the ligule absence of lamina is produced. The genetic analysis has shown, that the given character is recessive. Plants of nonligular mutant have length of a stalk 50–55 cm, length of an ear 7–9 cm, density of an ear 11–12 and weight of 1000 grains 45-48 g.

As a result of Wahan-1 и nonligular mutants hybridization (breeding) the wide range of variability is received. In particular, among others, nonligular round-grained plants are developed. These plants have a stalk of 50–55 cm, an ear of 5–7 cm, their ear density is 18–19 and 1000-grain weight is 40–42 g. The produced forms without doubt are interesting for selection.

As well other mutants were produced, such as dwarfs, large-grained, early ripening, which are important for selection and also mutants of genetic-evoluti-onary interest, such as two-row, rye ear type, etc.

Thus, a combination method of experimental mutagenesis and hybridization has not only contributed to a breeding of useful and genetically interesting mutants, but has also identified new botanical forms of barley-nonligular plants with rounded grains.

BIBLIOGRAPHY

1. *Sanamyan M. F.* Sitogenetika mutasiy, translokasiy, monosomii I mejvidovoy gibridizasii u xlopchatnika // Monography. Publishing by Universitet. Tashkent, 2020. – 384 pp.

2. *Ivan Obare.* Effects of Induced Mutagenesis on Agronomic Traits in Barley (*Hordeum vulgare* L) // American Journal of Experimental Agriculture 4(12):1536-1543. DOI:10.9734/AJEA/2014/11158.

THE EFFECT OF ANTIMICROBIAL THERAPY OF ORAL MUCOSA IN NORMAL AND PATHOLOGICAL CONDITION

Abdulrazzak Mohammad Sabah Abdulrazzak, N. Ikonnikova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
mohmmedaldraje4@gmail.com
sofnat@mail.ru

The microbiocenosis of the oral cavity provides non-specific resistance of the body and plays a role in the development of certain dental diseases. Bacterial microflora of dental plaque is the main factor that causes the development of caries, periodontal lesions in gingivitis and periodontitis. In the oral cavity of a healthy person,

was mainly represented by coccal flora: staphylococci, streptococci. The number of opportunistic microorganisms *Enterococcus faecium* and *Streptococcus parvulus* increased in older people.

Keywords: microflora, oral cavity, gingivitis, periodontitis, sensitivity/resistance, antibiotics.

The purpose of the thesis is to study the microflora of the human oral cavity, its participation in the formation of the body's immune system reactivity and to evaluate the effect of antimicrobial therapy agents on its main representatives in vitro.

65 people were examined in different age categories (from 18 to 50 years old), among them: students, teachers, laboratory assistants, employees of the International Sakharov Environmental Institute of Belarusian State University, as well as the patients of the Slutsk district hospital, who gave written informed consent to the collection of biological material.

The detected decrease in the content of sIgA in saliva in the examined patients with periodontal diseases and diseases is evidence of a weakening of the local protection of the mucous membranes, leading to an increase in the probability of the occurrence of the carious process and deterioration of the periodontal condition. The reduced content of sIgA leads to the creation of conditions in the oral cavity that predispose to a decrease in the resistance of the tooth tissue to adhesion by caries-causing microorganisms compared to the group of healthy individuals.

The microflora of the oral cavity in the comparison groups was mainly represented by coccal flora: staphylococci, streptococci. *Enterobacteria, Veillonella,* bacteroides, actinomycetes, *Neisseria,* etc. were found. Representatives of the genus streptococci were most often sown – 57 % of all microorganisms sown in this biotope. Representatives of the genus Staphylococcus occupied 22 %, the share of enterobacteria accounted for up to 15 %, about 4 % and 2 % of *Neisseria*. In the representatives of the older group 2, there was a decrease in colonization of the cavity by representatives of the normal microflora *Neisseria lactamica, Clostridium sphenoides, Clostridium ramosum,* as well as an increase in the frequency of opportunistic microorganisms *Enterococcus faecium* and *Streptococcus parvulus.*

To determine the sensitivity/resistance of microorganisms – the main representatives of the oral microflora to antimicrobial drugs widely used in modern therapeutic practice (antibiotics) in vitro. All the bacteria isolated from the oral cavity showed resistance to the action of Amoxicillin. Bacteria of the genera *Lactobacillus, Staphylococcus, Bifidobacterium, Escherichia, Sarcina* showed resistance to Carbenicillin. All bacteria were sensitive to Streptomycin, Doxycycline, and Tetracycline.

The most effective measures to contain the spread of antibiotic resistance should be aimed at microbial populations in general. Currently, as a result of the selective pressure of antibiotics used in medical practice, the spread of antibiotic resistance has become global.

BIBLIOGRAPHY

1. *Aps, J. K.* Review: the physiology of saliva and transfer of drugs into saliva / J. K. Aps, L. C. Martens // Forensic. Sci. Int. – 2005. – V. 150. – P. 119–131.

2. *Kinane, D.* Periodontal diseases and health: consensus report of the sixth european workshop on periodontology / D. Kinane, P. Bouchard // J. Clin. Periodontol. – 2008. – V. 35. – P. 333–337.

THE ANALYSIS OF THE POSSIBILITIES OF ACCUMULATION OF ALUMINUM IONS BY ERYTHROCYTES AND LYMPHOCYTES OF HUMAN PERIPHERAL BLOOD

P. Adashova[1], **A. Skorobohatova**[2], **E. Slobozhanina**[2], **E. Smirnova**[1]

[1]*Belarusian State University, ISEI BSU,*

[2]*Institute of Biophysics and Cell Engineering of the National Academy of Sciences of Belarus*

Minsk, Republic of Belarus

adashova.01@gmail.com

The aim of this study is to assess the ability of human erythrocytes and lymphocytes of peripheral blood to accumulate aluminum ions in vitro, as well as to assess the elemental profile of these cells after exposure to aluminum ions at various concentrations.

Keywords: aluminum, elemental analysis, toxicity, erythrocytes, lymphocytes.

The balance of elements in the body is one of the main characteristics that determine its normal vital activity. The complex impact of environmental factors (natural-geographical, technogenic, social, lifestyle (bad habits, nutrition)) significantly affect the content of chemical elements in the human body. Taking into account the deterio-

rating environmental situation every year, it is of interest to identify the toxic effects of a number of chemical elements thatenter the human body and can accumulate in it. One of these microelements is aluminium, the excess intake of which is possible with contaminated drinking water, using aluminium dishes, certain cosmetics (antiperspirants, lipstick), whitening toothpastes, and through the lungs with high levels of air pollution. [1–2]. Despite the low ability of aluminium to enter the human boy through the skin and respiratory tract, its accumulation has a toxic effect [3].

The aim of this study was to determine the ability of crythrocytes and lymphocytes of human peripheral blood to accumulate aluminium ions in vitro. The material was samples of peripheral blood donors from the State Institution "Republican Scientific and Practical Center for Transfusiology and Medical Biotechnologies" Ministry of Health of the Republic of Belarus (expedition department). Treatment of erythrocytes and lymphocytes with alumin- ium chloride was carried out with incubation in PBS buffer containing various concentrations of aluminium ions (2.7 - 27 mg/l) for 3 h at 37 °C. The analysis of the elemental composition of erythrocytes and lymphocytes was carried out with the method of inductively coupled plasma atomic emission spectroscopy on an ICPE-9000 device (Shimadzu, Japan). The experimental results were analysed by the method of variation statistics using the parametric ANOVA test. The p-values <0.05 were considered statistically significant.

It was found that erythrocytes and lymphocytes accumulate aluminium ions in a dose-dependent manner as a result of the study; nevertheless, there were differences in their storage capacity, which causes different degrees of negative biological effects on these cells. With an increase in the content of aluminium ions in erythrocytes, a statistically significant decrease in the content of lithium ions (from 6.03±0.77 mg/l to 5.12±0.79 mg/l) and boron (from 1.09±0.34 mg/l to 0.69±0.28 mg/l) and an increase in the content of zinc ions (from 3.98±1.93 mg/l to 8.86±4.75 mg/l). There was also a tendency to change the content ofions of macroelements as calcium, sodium, potassium and iron. It is likely that such an imbalance in the micro- and macroelement composition in erythrocytes, caused by the accumulation of high concentrations of aluminium ions, can serve as one of the mechanisms for the development of the toxic effect of aluminium. The accumulating capacity of lymphocytes was significantly lower. With an increase in the content of aluminium ions in the cells, a tendency towards a change in the content of sodium was observed, but no other significant changes in the content of essential elements were found. It can be assumed that lymphocytes are more resistant to the toxic effect of aluminium, or during the allotted incubation time, they are not able to accumulate a sufficient amount of aluminium ions to observe the physiological effect.

To obtain more reliable results on changes in the balance of macronutrients in erythrocytes and lymphocytes, it is planned to continue research by increasing the exposure time and expanding the samples.

BIBLIOGRAPHY

1. *Russ, T. C.* Aluminium and fluoride in drinking water in relation to later dementia risk / T. C. Russ [et al.] / Br J Psychiatry. 2020, V. 216. № 1. P. 29–34.

2. *Tietz, T.* Aggregated aluminium exposure: risk assessment for the general population / T. Tietz// Arch Toxicol. 2019. V. 93, № 12. P. 3503–3521.

3. *Нечипуренко, Н. И.* Роль макро- и микроэлементов в патогенезе ишемии головного мозга / Н. И. Нечипуренко, И. Д. Пашковская, Т.А. Прокопенко // Медицинские новости. 2019. Т. 1. С. 32–37.

EFFECT OF HELMAR 1 POLYPHENOL EXTRACT ON GLUTATHIONE PEROXIDASE ENZYME ACTIVITY IN RAT LIVER MITOCHONDRIA IN TOXIC HEPATITIS

S. Ahmedova, M. Asrarov, S. Mirzakulov, M. Pozilov

National University of Uzbekistan named after Mirzo Ulugbek,
Uzbekistan, Tashkent
saidaxon.axmedova@gmail.com

In this study, the inhibitory effect of helmar-1 polyphenol extract isolated from the plant *Helichrysum maracandicum* on the activity of the antioxidant enzyme glutathione peroxidase in conditions of toxic hepatitis was determined.

Keywords: carbon tetrachloride, glutathione peroxidase, *helichrysum maracandicum*, mitochondria, toxic hepatitis.

Stabilizing the balance between the formation of reactive forms of oxygen (ROS) and protection from oxidants is a crucial factor in the prevention of pathologies. One of these factors is the antioxidant system, which inhibits oxidation processes by neutralizing free radicals [1]. In normal and toxic hepatitis, rats were isolated by

differential centrifugation of liver mitochondria [2]. The previously established linear correlation relationship between the intensity of LPO processes induced by the Fe^{2+}/citrate (and Fe^{2+}/ascorbate system and the rate of high-amplitude swelling of mitochondria) makes it possible to judge the state of LPO reactions by the swelling intensity and use this model as a test system for studying the antioxidant properties of various biologically active substances [3]. Glutathione peroxidase (GP) enzyme activity was detected in rat liver mitochondria, in which mitochondria were centrifuged with 3.8 % sodium citrate solution in a 10: 1 ratio for 3000 rpm for 15 minutes. The GP activity in the reaction medium contained 2 ml of phosphate buffer (0.05 M rN 8.0), 0.2 ml of 1 mM EDTA, 0.5 ml of 7.5 mM oxidized glutathione, 0.2 ml of hemolysate, 0.1 ml of 1, 2 mM NADF.N was measured at a wavelength of 340 nm for 10 min at 37 oC due to a decrease in NADF.N [4].

According to the results, the glutathione peroxidase activity in the liver mitochondria of healthy group I rats was 80.11 ± 1.75 mM/min mg of protein. Liver mitochondrial glutathione peroxidase enzyme activity in group II rats with toxic hepatitis was found to be 60.88 ± 1.40 mM /min mg, a decrease of 24.0 ± 2.1% compared to the control group. When pharmacotherapy of animals with toxic hepatitis caused by group III helmar-1 polyphenol extract, respectively, their liver mitochondrial glutathione peroxidase enzyme activity was 75.98 ± 3.56 mM / min mg protein. This indicates that glutathione peroxidase activity was restored to 22.3 ± 1.20 % and 24.8 ± 1.17 % compared to group II.

Thus, in toxic hepatitis caused by CCl_4, it was found that helmar-1 polyphenol extract effectively restores the enzyme activity by influencing the mitochondrial glutathione peroxidase activity of the liver.

BIBLIOGRAPHY

1. *Корда, М. М.* Антиоксидантный статус организма при остром токсическом поражении печени и его коррекция энтеросорбцией и антиоксидантами: Автореф. дисс. …канд. мед. наук. Львов, 1991;19.

2. *Schneider W.C.* Cytochemical studies of mammalion tissues: the isolation of cell components by differential centrifugation // Cancer. Res. – 1951. – V. 11 (1). – P. 1–22.

3. *Almeida, A.M.* Mitochondrial DNA damage associated with lipid peroxidation of the mitochondrial membrane induced by Fe2+-citrate // *An. Acad. Bras. Cienc.* – 2006. – 78. – P. 505–514.

4. *Власова, С. Н.* Активность глутатионзависимых эритроцитов при хронических заболеваниях / С. Н. Власова, Е. И. Шабунина // Москва. – *Медицина.* – 1990. – С. 19–21.

IMPORTANCE OF MEDICAL ECOLOGY IN THE RECOVERY PERIOD FROM COVID-19

G. Akhmedova, B. Zaripov, B. Kakhorov

National University of Uzbekistan named after Mirzo Ulugbek.
Tashkent, Republic of Uzbekistan
gulsara.akhmedova@inbox.ru

This article identifies the physiometric parameters to be studied by analyzing scientific data on the human renin-angiotensin system during the SARS-CoV-2 pandemic. The physiological activity of the human body during a pandemic (PAHB) was divided into 3 periods: the first - PAHB before the disease, the second - PAHB during the COVID-19 disease, and the third - PAHB after the disease (post-COVID-19). Since the central system in the disease caused by the SARS-CoV-2 virus is the renin-angiotensin system, the PAHB in period 3 was analyzed around the renin-angiotensin system.

*Keywords***:** COVID-19, medical ecology, recovery period, prevention, virus SARS-CoV-2, post-COVID-19, renin-angiotensin, body mass index (BMI).

Coronavirus disease is classified in the field of medical ecology in two ways: the first is the classification of the pathogen as an external adverse effect, specific features, the second is by identifying favorable environmental conditions to prevent the disease and achieve an easy recovery. Since COVID-19 is a new disease in human history, it is extremely important to study it from the perspective of the medical environment, otherwise people will develop complications and additional chronic diseases due to regular exposure to adverse environmental factors along with the pandemic. Our opinion also testifies to the increase in the number of postcoid syndrome, hyperglycemia, diabetes, obesity, high blood pressure after COVID-19 during a pandemic.

Hyperactivation of the angiotensin system (RAC) of the leads to the disruption of homeostatic reactions in the body, as well as to certain diseases, such as cardiovascular disease, diabetes, obesity and metabolic syndrome. [1]. The angiotensin converter II enzyme (ACE2), an important component of RAC, plays a critical role in the pathogenesis of COVID-19 [2]. ACE2 is a functional SARS-CoV-2 receptor that allows the virus to enter human

cells. [3, 4]. Given that being overweight increases the development of chronic disease, obesity may also be an independent risk factor for COVID-19. [5].

An analysis of the above articles, as well as a recent survey [6], made it possible to determine the functional relationship between body mass index and blood sugar levels with the following scientific hypothesis: with an increase in body mass index in post-COVID-19 PAHB, the amount of sugar in the blood increases in direct proportion.

The objects of the research were people who recovered from COVID-19 with their voluntary consent and anonymously (n=52). Patients with a history of diabetes mellitus were excluded to obtain accurate blood sugar measurements. Body mass index BMI ($I = m / h^2$) kg / m2 was calculated based on height and body weight. The grouping of BMI scores was based on the classification standards adopted by the World Health Organization. Blood sugar was measured using a glucometer (BG-202 Medico, Hangzhou Sejoy Electonic, China).

The study participants were divided into 6 groups according to the standard TMI classification adopted by the World Health Organization. I group 16> кг/м^2 n=5, II group 16-18,5 кг/м^2 n=8, III group 18,5 – 25 кг/м^2 n=12, IV group 25-30 кг/м^2 n=10, V group 30-35 кг/м^2 n=10, VI group 40< кг/м^2 n=7.

Table

Resualts of analysis

Group (n)	1 (5)	2 (8)	3 (12)	4 (10)	5 (10)	6 (7)
BMI kg / m^2	15,50±0,64	18,08±0,43	23,20±1,11	26,09±0,92	33,64±0,97	40,69±0,71
Fisher's criteria p	0,006**	0,06	0,003**	0,01*	0,01*	0,005**
Blood sugar (*mmol / L)*	5,16±0,52	5,88±0,73	6,06±0,56	5,65±0,63	7,04±0,62	7,50±0,45
Fisher's criteria p	0,04*	0,002**	0,03*	0,0001***	0,006**	0,001***
Pearson's correlation coefficient (r)	-0,88	0,64	0,78	-0,05	0,91	0,89

* – P<0,05; ** – P<0,01; *** – P<0,001.

According to Pearson's correlation coefficients, obtained from the correlation between body mass index and blood sugar, an inverse relationship was observed in the first (BMI 15.5 kg / m^2) and fourth (BMI 26.09 kg / m^2) groups**.** In addition, in the second (BMI 18.08 kg / m^2) and third (BMI 23.20 kg / m^2) groups, the sugar content was 5.88 mmol / L and 6.06 mmol / L, respectively, with the following $r_2 = 0,64$, $r_3 = 0.78$, $\pm 0.5 < r < \pm 0.8$, so it was found that there was a moderate functional association in groups 2-3. Hypothesis: post-COVID-19 – Pearson's correlation coefficients ($\pm 0.8 < r < \pm 1$ strong correlation) to the assumption that the amount of blood sugar in postoperative PAHB increases in direct proportion to the increase in body mass index, this was proven in the fifth r_5=0,91 (BMI 33.34 kg/m^2) and sixth r6 = 0,89 (BMI 40.69 kg / m^2) groups. Regular exercise, strengthening the immune system, proper nutrition, exercise, and an active lifestyle can lead to complete recovery. These data play a role in the restoration of PAHB.

BIBLIOGRAPHY

1. *Шестакова М. В.* Активность ренин-ангиотензиновой системы (РАС) жировой ткани: метаболические эффекты блокады РАС //Ожирение и метаболизм. – 2011. – № 1.

2. *Bourgonje A. R. et al.* Angiotensin-converting enzyme 2 (ACE2), SARS-CoV-2 and the pathophysiology of coronavirus disease 2019 (COVID-19) // The Journal of pathology. – 2020. – Т. 251. – № 3. – С. 228–248.

3. *Hamming I. et al*. Tissue distribution of ACE2 protein, the functional receptor for SARS coronavirus. A first step in understanding SARS pathogenesis //The Journal of Pathology: A Journal of the Pathological Society of Great Britain and Ireland. – 2004. – Т. 203. – №. 2. – С. 631–637.

4. *Hoffmann M. et al.* SARS-CoV-2 cell entry depends on ACE2 and TMPRSS2 and is blocked by a clinically proven protease inhibitor // Cell. – 2020. – Т. 181. – № 2. – С. 271–280. e8.

5. *Ryan D. H., Ravussin E., Heymsfield S.* COVID 19 and the patient with obesity–the editors speak out // Obesity (Silver Spring, Md.). – 2020.

6. *Zaripov B, Allamuratov M., Akhmedova G., et al.* Rehabilitation factors of post-COVID-19 in the population of Uzbekistan // Annals of the Romanian Society for Cell Biology. – 2021. – С. 5684–5690.

INTERACTION BETWEEN NANOTUBE (8,10) AND RESVERATROL

A. Augustinovich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
avgnastya@mail.ru

Resveratrol is a plant-derived compound with antioxidant properties. A model of the interaction between a nanotube (8,10) and a resveratrol molecule has been studied. The total interaction energy of these molecules is found. The band gap of resveratrol was calculated by the molecular mechanics method Mm +, and the complex was found to be the thermodynamically most stable complex

Keywords: nanotube, resveratrol, total energy.

Carbon nanotubes are a wide class of various cylindrical nanoparticles that are formed by ordered carbon atoms and have an internal cavity along the axis. Carbon atoms form networks of hexagons in the walls of nanotubes. In carbon nanotubes, unlike another form of carbon, graphite, these nets are rolled up into cylinders, rolls, or cones.

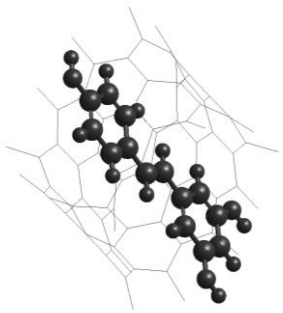
Resveratrol is a plant-derived compound with antioxidant properties. The highest concentration of this substance is found in natural products such as peanuts, grapes, certain types of berries, as well as in red wine. The peculiarity of this substance to increase life expectancy has become the main topic of discussion, as well as the main area of research. According to some experts, resveratrol is able to activate certain genes in the human body that slow down the aging process.

A model of the interaction between a nanotube and a resveratrol molecule has been studied.

The calculated energy of each component of the complex, the energy of resveratrol is -2.7045 kcal / mol. Negative energy indicates that the resveratrol molecule is thermodynamically stable and exists in nature. The energy of the nanotube (8.10) is 126.752179 kcal / mol (table 1).

Table 1

Properties of the complex and components of this comp

Structure of the complex	$E_{LOMO\ REC}$ eV	$E_{HOMO\ REC}$ eV	E_g eV	$E_{NANOTUBE}$ kcal/mol	E_{REC} kcal/mol	$E_{complex}$ kcal/mol
	-4,132	-11,580	15,712	126,752179	-2,7045	105,232157

The total energy of the complex is 105.232157 kcal / mol (table 1). This indicator is less than the energy of the nanotube, which indicates the thermodynamic stability of the complex.

BIBLIOGRAPHY

1. *Shahab, S.* A DFT study of Se-decorated B12N12 nanocluster as a possible drug delivery system for ciclopirox / S. Shahab, S. Kaviani, M. Sheikhi, V. Potkin H. Zhou // Comp. and Theor. Chem. 2021 B. 1201. № 65. P. 113246.

2. *Shahab, S.* quantum chemical analysis of the sorption interaction between psoralene and carbon dioxide (II) // sakharov readings 2021 B. 1. P. 358–360.

DETERMINATION OF THE CONTENT OF ZINC IONS IN THE BLOOD IN PREECLAMPSIA

R. Baranovsky, A. Zhiv, K. Bulanova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
baranovskii.return@gmail.com

It was found that during normal pregnancy, the concentration of zinc in the blood is 22.07 ± 1.78 microns. Three times lower concentrations of zinc are found in the blood plasma of pregnant women at risk of developing preeclampsia. With preeclampsia of moderate severity, the concentration of trace elements normalizes, probably due to the influx of ions from depositing structures, cells of a number of organs. In pregnant women with severe preeclampsia, there is again a sharp decrease in the content of this micronutrient in the blood.

Keywords: Preeclampsia, zinc.

Preeclampsia is a pregnancy-specific syndrome that usually occurs after 20 weeks. There are different theories of the pathogenesis of preeclampsia. One focuses on implantation problems; the other focuses on endothelial dysfunction and systemic inflammatory response.

Zinc is one of the most important elements of the human body and is vital for all forms of life [1]. According to WHO estimates, up to 80 % of pregnant women do not receive enough zinc [2].

Zinc deficiency in the mother forms a double risk of deterioration of the fetus and the health of the newborn. On the one hand, it leads to a violation of the course of pregnancy in a woman, on the other hand, it contributes to the development of a deficient condition in the fetus, followed by a violation of the formation and functioning of the main physiological systems of the body [3].

The study showed that the concentration of zinc in normal pregnancy is 22.07 ± 1.78 microns, which is the upper limit of the norm for adults.

There was also a threefold decrease in the concentration of zinc in blood plasma in pregnant women at risk of developing preeclampsia compared with normal pregnancy, which indicates a clear deficiency in the body of women. In preeclampsia of moderate severity, the concentration of trace element was normalized to 24.10 ± 3.71 microns, due to the body's ability to mobilize available zinc resources.

In pregnant women with severe preeclampsia, there is again a sharp decrease in the content of this micronutrient in the body to 12.04 ± 0.67 microns relative to the control group, which also indicates a lack of it in the body of women, probably due to the exhaustion of reserves available in the body.

The revealed threefold decrease in the content of zinc ions in the blood plasma, found in the group of pregnant women at risk of developing preeclampsia, can serve as an early marker for the diagnosis of this complication of pregnancy.

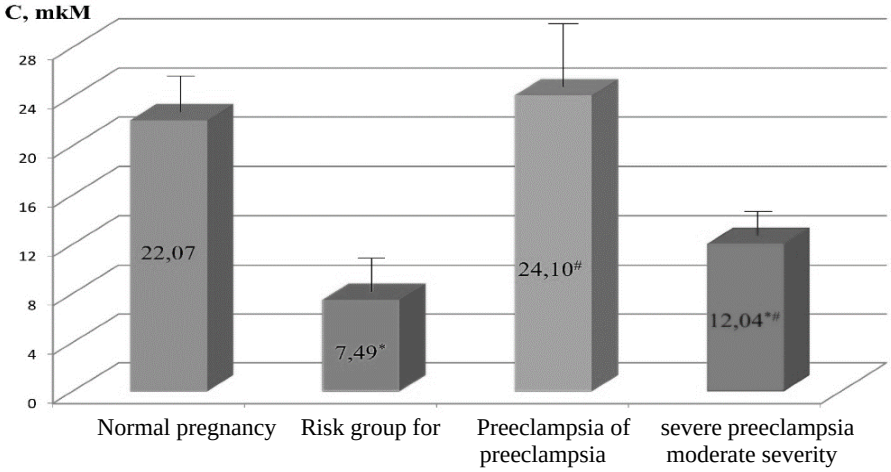


Fig. 1 – Zinc content in the blood plasma of women with normal pregnancy and preeclampsia of varying severity

BIBLIOGRAPHY

1. *Оберлис, Д.* Биологическая роль макро- и микроэлементов у человека и животных / Д.Оберлис, Б.Харланд, А.Скальный // Наука, 2008. – С. 544.

2. *Олина А. А.* Значение дефицита цинка в формировании нарушений репродуктивного здоровья (обзор литературы) / А. А. Олина, Г. К. Садыкова. // Пермский медицинский журнал. – 2015. – Т. 32 – № 5. – с. 138–143.

3. *Щеплягина, Л. А.* Дефицит цинка и его влияние на здоровье матери и ребенка. Возможности коррекции / Л.А.Щеплягина, Т.И.Легонькова // Научный центр здоровья детей РАМН, 2004. – С. 30.

ANALYSIS OF LONG-TERM DYNAMICS OF CAUSES OF MORTALITY OF THE POPULATION OF THE REPUBLIC OF BELARUS

A. Bobrova, N. Porada

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
bobrowa.nastyuha0@icloud.com

Mortality rates characterize the health status of the population. Since the end of the twentieth century, the demographic problems of the Republic of Belarus began to pose a potential threat to the national security of the country, when the population began to decrease due to the excess of the number of deaths over the number of births. The analysis of the causes of mortality makes it possible to identify the most severe forms of diseases that play a significant role in the structure of mortality of the population, and thus allows us to determine a system of measures aimed at reducing morbidity and mortality of the population, improving the quality of life [1]. The indicators and main trends of mortality of the population of the Republic of Belarus in the period from 2010 to 2019 are analyzed.

Keywords: Mortality, structure, causes of mortality, long-term dynamics, trend.

The decline in the population in the Republic of Belarus is primarily due to the excess of mortality over fertility.

The purpose of the work was to conduct a retrospective analysis with the determination of the trend in the dynamics of [2] mortality of the population of the Republic of Belarus, to study the structure of mortality by causes, to identify age characteristics in the period from 2010 to 2019.

In the long-term dynamics of mortality of the population of the Republic of Belarus in 2010–2019, a steady downward trend was revealed (R2= 0.74). The mortality rate of the population of the Republic of Belarus in 2019 decreased by 1.4 times compared to 2010. The main causes of mortality were diseases of the circulatory system (58.9 % in 2019), neoplasms (16.0 % in 2019). The third place belonged to external influences (6.5 % in 2019). The proportion of old age as a cause of mortality in 2019 decreased by 2.5 times compared to 2010 and amounted to 4.1%.

Structural analysis of mortality by sex revealed an increase in the proportion of mortality in women and its predominance over mortality in men. In 2018, the ratio was 50.16 to 49.84 %. There have been changes in the structure of mortality in the context of rural and urban populations. The share of deaths among the rural population decreased from 40.54 % to 37.09 %.

In the dynamics of mortality from diseases of the circulatory system and neoplasms, the marked decrease in indicators in the period from 2010 to 2014 was replaced in subsequent years by a steady increase in mortality from these causes (69.4 % of LLC and 18.7 % of LLC in 2015, respectively, 74.9 % of LLC and 20.4 % of LLC in 2019). The average annual rate of mortality from diseases of the circulatory system was 71.9 deaths per 100,000 population, from neoplasms - 19.2% of LLC. A steady downward trend (R2=0.89) was also revealed in the dynamics of mortality from external causes. By 2019. the indicator decreased by 1.8 times compared to the level of 2010. The average annual rate of deaths of the population from external causes was 10.5 ‰.

There was a decrease in mortality from infectious and parasitic diseases by 5.8 times compared to the level of 2010, from old age - by 2.3 times. The direction of the trend in the dynamics of mortality from diseases of the digestive system and respiratory organs was unclear. The mortality of the population from diseases of the nervous system by 2019 increased by 5 times compared to the level of 2010 (R2 =0.93).

The highest mortality rates were found in people older than working age. The main causes of death in 2010–2019 in the ranking order were diseases of the circulatory system (62.7 %), neoplasms (13.9 %) and old age (10.4 %). In people of working age: diseases of the circulatory system (35.2 %), injuries (27.3 %), neoplasms (19.7 %) and diseases of the digestive system (7.1 %).

In children, the causes of death were accidents, injuries and poisoning (29.0 %), certain conditions occurring in the perinatal period (21.2 %), congenital malformations (15.1 %). There is a decrease in child mortality. The

proportion of deaths of children under the age of 5 in 2012–2018 decreased from 0.40 to 0.28%, from 5 to 9 years – from 0.06 to 0.04 %.

BIBLIOGRAPHY

1. Демография и статистика населения: учебник для академического бакалавриата / под ред. И. И. Елисеевой, М. А. Клупта. – 3-е изд., перераб. и доп. – М. : Издательство Юрайт, 2016. – 405 с.

2. *Кучеренко, В.З.* Применение методов статистического анализа для изучения общественного здоровья и здравоохранения: Учебное пособие / корр. РАМН, проф. В.З. Кучеренко. – Москва: ИНФРА-М, 2006. − 30 с.

INFLUENCE OF BONE MARROW – DERIVED MULTIPOTENT MESENCHYMAL STROMAL CELLS ON THE PROLIFERATIVE POTENTIAL OF LEUKEMIA K562 CELL LINE

V. Bondarenko, M. Yurkevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
ocdx02@gmail.com

Multipotent mesenchymal stromal cells (MMSCs) have tremendous therapeutic potential for the treatment of various human diseases, including cancer. The tumor properties of MMSCs can be used to target cancer cells. Although the effect of MMSCs on tumor progression remains unexplored. It has been established that cultivation of bone marrow-derived MMSCs with the K562 cell line in a ratio of 1:10, respectively, supress the growth and proliferation of cancer cells.

Keywords: multipotent mesenchymal stromal cells, bone marrow, K562 cell line, cancer, co-cultivation.

Cancer development is a multi-stage process, including genetic transformation of cells, their uncontrolled proliferation and growth. The most significant risk of developing cancer is associated with lifestyle factors and exposure to certain chemicals

Multipotent mesenchymal stromal cells (MMSCs) found in adult tissues function as progenitor cells that can differentiate into various mesenchymal cell lineages and exhibit immunoregulatory properties[1]. Over the past two decades, MMSCs have been viewed as promising candidates for cell therapy of various diseases including autoimmune pathologies, inflammatory processes, neurological disorders, etc. MSCs can interact with tumor cells using various mechanisms: directly or indirectly through humoral factors; due to the processes of angiogenesis in the tumor, as well as modifying the tumor microenvironment [2].

The aim of this work was to assess the effect of MMSCs on the proliferation of K562 tumor line cells during their co-cultivation.

Matherials and methods. MMSCs were isolated from bone marrow by density gradient centrifugation (Histopaque-1077, «Sigma», Germany). Bone marrow-derived MMSCs were seeded into a well of a 24-well plate at a concentration of $1x10^4/cm^2$. K562 cells were added to daily MMSC cultures in the ratio of MMSC: K562 cells – 1:10. Cultivation was carried out in complete RPMI medium «Gibco», USA) with 2mM L-glutamine, 10 % fetal bovine serum («Capricorn Scientific», Germany), 100 U/ml benzylpenicillin sodium, 100 U/ml streptomycin sulfate, 100 U/ml neomycin sulfate («Lonza», USA) at 37°C and 5% CO_2. The medium was changed every 2–3 days. The proliferative activity of K562 cells was assessed on the 5th day of cultivation. The number (NDC) and time (TDC) of cell population doubling were calculated using the following formulas:

$$NDC = \log10 (n / N) * 3.33,$$

$$TDC = \text{time of culture growth (days)} / TDC,$$

where n is the number of cells after cultivation; N is the number of cells for seeding.

Data are presented as median (25 % ÷ 75 % percentiles). Differences were considered statistically significant at p-level less than 0,05 (5 %).

Results. Isolated MMSCs had a fibroblastic-like morphology with adherent property to the culture plate. Cell viability assessed by trypan blue exclusion was more than 95 %. Number of cell population doubling in K562 monoculture on the 5th day of cultivation was 6,1 (5,7÷6,9) and decreased during co-cultivation with MSCs in the ratio of MMSCs: K562 cells – 1:10 (4,3 (4,0÷4,5), p=0,02, Wilcoxon T test). Accordingly, in the presence of MMSC, a statistically significant increase in the doubling time of populations was observed. TDC in K562 mon-

oculture and co-culture K562 with MMSC were 1,1 (0,8÷1,7) days and 2,3 (2,0÷2,9), respectively, p=0,01, Wilcoxon T test.

Conclusion. Cultivation of bone marrow-derived MMSCs with the K562 cell line in a ratio of 1:10, respectively, led to suppression of the growth and proliferation of cancer cells, which was confirmed by a statistically significant decrease in number of K562 doubling and increased of time of these cells doubling in co-cultures with MMSCs in comparison with monocultures.

BIBLIOGRAPHY

1. *Rastegar, F.* Mesenchymal stem cells: Molecular characteristics and clinical applications / D. Shenaq, J. Huang et al. // World J. Stem Cells. – 2010. – P. 7–60.

2. *Saka, Y.* Adipose-derived stromal cells cultured in a low-serum medium, but not bone marrow-derived stromal cells, impede xenoantibody production/ K. Furuhashi, T. Katsuno et al// Xenotransplantation. – 2011.– P. 196–208.

RETROSPECTIVE ANALYSIS OF THE INCIDENCE OF CIRCULATORY SYSTEM DISEASES OF ADULT POPULATION OF CHASHNIKI REGION IN 2015–2019

E. Bulyno, A. Sysa

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
bulyno.elena@gmail.com

The paper provides a retrospective analysis of the incidence of diseases of the circulatory system in the adult population of the Chashniki district; analyzed the structure, dynamics of the general and primary morbidity of the cardiovascular system for the period 2015–2019.

Keywords: diseases of the circulatory system, ischemic disease, arterial hypertension, cerebrovascular disease, morbidity.

A retrospective analysis of the morbidity structure of diseases of the circulatory system in the adult population of the Chashniki region revealed three main diseases that have the largest proportion among the rest. These diseases include ischemic heart disease, arterial hypertension, and cerebrovascular disease.

A retrospective analysis of the structure of general and primary morbidity was carried out.

At the beginning of the study period in 2015, arterial hypertension (52 %) had the largest share in the overall morbidity structure; at the end of the study period (2019), arterial hypertension remained the leader in the morbidity structure (49 %) in comparison with other cardiovascular diseases. systems. Ischemic heart disease is in second place with a specific gravity of 26 % in 2015 and a specific gravity of 31% in 2019. Cerebrovascular diseases rank third with a specific weight of 16 % at the beginning of the study period (2015) and with a specific weight of 15 % at the end of the study period (2017).

When analyzing the primary incidence of diseases of the circulatory system at the beginning of the study period (2015), it was revealed that the largest specific weight is ischemic heart disease (38 %), by the end of the study period, the rate of which increased significantly (62 %).

Analysis of the dynamics of the general and primary morbidity of the adult population of the Chashniki district with diseases of the circulatory system for the period under study (2015–2019) revealed a trend towards a pronounced increase in the incidence of coronary heart disease, and we can also note an increase in the overall incidence of arterial hypertension. Analysis of the dynamics of and primary incidence of cerebrovascular diseases and the analysis of the dynamics of the primary incidence of arterial hypertension did not reveal a pronounced trend towards an increase / decrease in the incidence.

Diseases of the cardiovascular system are very common among people of working age, thereby causing significant economic damage. The increase in the number of diseases of the circulatory system determines the relevance of the medical.

To prevent an increase in the incidence of diseases of the circulatory system, it is necessary to improve and introduce for the detection and diagnosis of diseases, to increase the effectiveness of treatment and a set of preventive measures.

BIBLIOGRAPHY

1. *Бегун, Д. Н.* Болезни системы кровообращения как медико-социальная проблема/ Д. Н. Бегун, Т. А. Морозова, А. В. Сурикова // Молодой ученый. – 2019. – № 8. – С. 25–28.

2. *Исаков, Е. Б.* Эпидемиология сердечно-сосудистых заболеваний/ Е. Б. Искаков // Медицина и экология. – 2017. – № 2. – С. 15–16.

ASSESSMENT OF THE EFFECT OF CO_2 ON THE LEVEL OF SORPTION OF FURANOCOUMARINS

V. Cheplya, S. Shahab

Belarusian State University, ISEI BSU,
Belarusian State University,
Minsk, Republic of Belarus

The problem of ambient air pollution is one of the priority problems of modern science, and the search for innovative ways to clean it is one of its main directions. The use of computer chemistry methods to study the physico-chemical, adsorption properties of molecules, in comparison with experimental studies, significantly accelerates the obtaining of theoretical results.

Keywords: air pollution, density functional theory, furano-coumarins, adsorption.

In this paper, a complete optimization of molecules was performed and the most stable conformers of furanocoumarin derivatives were determined, as well as the electronic properties of the complex with carbon dioxide were calculated, their physicochemical and electrical properties were studied.

The estimated quantum-chemical modeling of the angelicin and CO_2 complex was performed by the semi-empirical PM6 method. According to the calculated energy values, the most stable complex was selected [1].

A complete quantum chemical simulation of the angelicin and CO_2 complex was carried out using the wB97XD/6-31G* method.

Table 1

Thermochemical parameters of angelicin and angelicin complexes with CO and CO2 calculated using the wB97XD/6-31G* method

Compound	E+G (ccal/mol)	E+H (ccal/mol)	E+T (ccal/mol)	S (ccal/mol *K)
Angelicin	-406 703.108	-406 674.682	-406 681.127	95.345
Angelicin /CO	-477 781.937	-477 749.243	-477 749.835	109.658
Angelicin/CO_2	-525 001.921	-524 965.399	-524 965.991	122.498

Thermochemical parameters are given, such as the sum of electron and thermal energies (E+T), the sum of electron and thermal enthalpy (E+H), the sum of electron and thermal free energies (E+G) and entropy (S) of optimized compounds and complex [1,3].

The data in Table 1 indicate that when the angelicin molecule is in an unbound state, the values of E+G, E+H and E+T are greater than in the bound state. The decrease in the energy value reflects a decrease in the reactivity and an increase in the stability of the angelicin molecule in the presence of CO_2.

Electronic spectra for the angelecin complex/CO_2 are calculated for 20 single-electron excitations in the region of 148.13 - 362.08 nm and 152.34 - 359.61 nm, respectively [2].

It was revealed that the electronic properties of angelicin are sensitive to CO_2 adsorption. The charge of the atoms of the compounds under study undergoes a change in the non-binding interaction with CO_2. It was found that the λ_{max} of angelicin does not change significantly with unrelated interaction and CO_2.

BIBLIOGRAPHY

1. *Bagayoko D.* Understanding the Relativistic Generalization of Density Functional Theory (DFT) and Completing It in Practice / D. Bagayoko // Journal of Modern Physics. – Vol.7 No.9. – May 26, 2016. – P. 4236.

2. *Changqing, Y.* A Generation Method of Dithering Signal Based on DFT / Y. Changqing, X. Xingzhong // Int'l J. of Communications, Network and System Sciences. – Vol.10 No.8.: B, August 14. – 2017. – p. 245–271.

3. *Cheplya, V.* Theoretical model of physisorption effect of CO on coniine and furanocoumarins for air purification / V. Cheplya, S. Shahab, M. Murashko // IX International Scientific Conference for Young Scientists, Graduates, Master and PhD Students “Actual Environmental Problems”.: International Sakharov Environmental Institute of Belarusian State University. – 21–22th of November, 2019. – p. 324–325.

CREATION OF A GENETIC CONSTRUCT CARRYING THE DNA POLYMERASE GENE OF THE BACTERIOPHAGE *PHI29*

V. Chichina, A. Bulatovsky

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
chichina.v@yandex.by

The aim of this work is to obtain a construct containing the *phi29* DNA polymerase gene, which will be introduced into *E. coli* cells in the future.

Keywords: DNA, *phi29* polymerase, replication.

Bacteriophage *phi29* DNA polymerase has a high precision and an outstanding processive DNA synthesis ability, coupled with an inherent strand displacement capacity. Intrinsic properties with *phi29* DNA polymerase make this polymerase particularly distinctive and significant [1]. This polymerase has the highest processivity of DNA synthesis among DNA polymerases with the fastest rate of DNA synthesis without any accessory protein [2]. In addition, *phi29* DNA polymerase has high 3′ to 5′ exonuclease activity, which is involved in its high replication accuracy during DNA synthesis [3].

Phi29 DNA polymerase has helicase-like activity coupled with DNA synthesis, which is called strand displacement activity. *Phi29* DNA polymerase promotes DNA synthesis while displacing downstream non-template DNA from a template [4]. Polymerase catalyzes two different synthetic reactions: polymerization reaction and *phi29* terminal protein (TP) deoxynucleotidylation that enables start of DNA replication.

Phi29 is a bacteriophage of *Bacillus subtilis* with a sequenced, linear, DNA genome. Each 5' end is covalently linked to a terminal protein, which is important in the replication process. A symmetrical mode of replication has been used, whereby protein-primed initiation occurs non-simultaneously from either end of the chromosome; this includes two replication origins and two distinct polymerase monomers [5].

Genomic *phi29* DNA was isolated from *phi29* bacteriophage using a commercial QIAamp DNA Mini Kit. Then the target DNA fragments were amplified by PCR using *phi29* polymerase gene, plasmids and synthetic primers as a template. DNA electrophoresis was carried out in agarose gel with a concentration of 1% in a TAE buffer at a voltage of 3-4 V / cm. The next step was the combination of the *phi29* polymerase gene and the linearized pET42a (+) vector by prolonged overlapping PCR.

At the moment, a construct containing the *phi29* DNA polymerase gene has been obtained, which will be transferred to *E. coli* cells to create a recombinant strain in the future. It is also planned to develop and purify bacteriophage *phi29* DNA polymerase. DNA polymerase is planned to be used for *in vitro* production of DNA containing immunostimulatory CpG motifs.

Phi29 DNA polymerase is considered invaluable for many molecular methods. This polymerase is used in DNA amplification due to its ability to generate large amounts of DNA from even a very small sample with fewer errors than other polymerases.

BIBLIOGRAPHY

1. The bacteriophage phi29 DNA polymerase / M. Salas [et al.] // IUBMB Life. – 2008. – Vol. 60, N 1. – P. 82–85.

2. Highly efficient DNA synthesis by the phage phi 29 DNA polymerase. Symmetrical mode of DNA replication / L. Blanco [et al.] // J. Biol. Chem. – 1989. – Vol. 264, N 15. – P. 8935–8940.

3. 3′→5′ exonuclease active site of phi 29 DNA polymerase. Evidence favoring a metal ion-assisted reaction mechanism / J. A. Esteban [et al.] // J. Biol. Chem. – 1994. – Vol. 269, N 50. – P. 31946–31954.

4. Mutation detection and single-molecule counting using isothermal rolling-circle amplification / P. M. Lizardi [et al.] // Nat. Genet. – 1998. – Vol. 19, N 3. – P. 225–232.

5. *Blanco, L.* Relating structure to function in φ29 DNA polymerase / L. Blanco, M. Salas // J. Biol. Chem. – 1996. – Vol. 271, N 15. – P. 8509–8512.

MODERNIZATION OF THE EQUIPMENT OF THE RADIOLOGICAL DEPARTMENT OF THE STATE INSTITUTION «N. N. ALEXANDROV NATIONAL CANCER CENTRE OF BELARUS»

I. Chirkova, T. Chikova

N. N. Alexandrov National Cancer Centre of Belarus
Minsk, Republic of Belarus
irinagutkovskaya@gmail.com

The relevance, sequence and content of measures to replace the expired resource of medical linear electron accelerators with new linear accelerators in the leading oncological center of the Republic of Belarus are considered.

Keywords: oncology, malignant tumor, radiation therapy, linear electron acceleratorю, equipment modernization.

In 2019 the Commission of the International Atomic Energy Agency (IAEA) carried out an audit in the State institution «N. N. Alexandrov National Cancer Centre of Belarus». She recommended updating the fleet of radiation therapy devices [1].

At the Healthcare Institution State institution «N. N. Alexandrov National Cancer Centre of Belarus» in 2005, a linear electron accelerator «Clinac 2100» was installed and put into operation. In 2008, the «Tilogy» linear electron accelerator was installed and put into operation [2]. Currently, a procedure is being launched to replace these out-of-date linear accelerators and electrons with new ones.

To carry out the equipment modernization procedure, a number of measures are required. The sequence and content of these activities is due to the requirements of regulatory documents to ensure procedures for the treatment of patients and radiation safety of personnel, patients and the surrounding population [3].

1. Study of the world experience in the decommissioning of linear accelerators, as well as the experience in the decommissioning of linear accelerators located in oncological dispensaries of the Republic of Belarus. Compilation of a list of documents required for the decommissioning of the linear accelerator

2. Development and creation of a unified base of spare elements of a linear accelerator, subject to decommissioning, which can be used as spare parts on operating linear accelerators at the State institution «N. N. Alexandrov National Cancer Centre of Belarus», or on linear accelerators in other oncological dispensaries of the Republic of Belarus.

3. Development of an action plan for the decommissioning of the linear accelerator and subsequent dismantling.

4. Preparation of regulatory documents for the installation and commissioning of a new linear accelerator at the State institution «N. N. Alexandrov National Cancer Centre of Belarus».

5. Study of the reconstruction plan for the premises where the new accelerator will be located in the State institution «N. N. Alexandrov National Cancer Centre of Belarus».

6. Development and approval, as a document for internal use, of an action plan for the commissioning of a new linear accelerator at the State institution «N. N. Alexandrov National Cancer Centre of Belarus»

The developed and approved documents for the modernization of the equipment of the radiological department will be universal in nature. They will be used in the State institution «N. N. Alexandrov National Cancer Centre of Belarus». In addition, they will be in demand in other medical institutions of the oncological profile, where it is planned to install new linear electron accelerators and replace the linear electron accelerators that have worked out their resource with new ones.

BIBLIOGRAPHY

1. Лечение рака: лучевая терапия: Официальный сайт МАГАТЭ [Электронный ресурс]. – Режим доступа: https://www.iaea.org/ru/temy/lechenie-raka-luchevaya-terapiya – Дата доступа: 21.09.2021.

2. Официальный сайт Учреждения здравоохранения «Республиканский научно-практический центр онкологии и медицинской радиологии им. Н. Н. Александрова». [Электронный ресурс]. – Режим доступа: https://omr.by/o-nas/otdeleniya/vse-otdelenya/laboratoriya-luchevoj-terapii – Дата доступа: 21.09.2021.

3. Официальный сайт компании Varian. [Электронный ресурс]. – Режим доступа: https://www.varian.com/products/radiotherapy/treatment-delivery/truebeam – Дата доступа: 21.09.2021.

MODERN HIGH-TECH EQUIPMENT OF THE RADIOLOGY DEPARTMENT OF THE STATE INSTITUTION «N. N. ALEXANDROV NATIONAL CANCER CENTRE OF BELARUS»

I. Chirkova, T. Chikova

N. N. Alexandrov National Cancer Centre of Belarus
Minsk, Republic of Belarus
irinagutkovskaya@gmail.com

The quality of treatment for cancer patients largely depends on the availability of the necessary high-tech equipment in a specialized medical center. The modern radiotherapy equipment of the radiological department of the leading oncological center of the Republic of Belarus has been analyzed.

Keywords: oncology, medical radiology, radiation therapy, radiology department, radiotherapy equipment.

Radiation therapy is a method of treating malignant neoplasms by destroying and destroying a tumor using various forms of ionizing radiation, such as gamma rays, X-rays, particles, in combination with surgery or chemotherapy. The success of the treatment of cancer patients is determined by the level of technology and equipment used in a medical institution.

Equipping the radiological department of the leading oncological center of the Republic of Belarus State institution «N. N. Alexandrov National Cancer Centre of Belarus» meets high international requirements. This allows us to provide high-quality high-tech medical care to cancer patients in our country, as well as in neighboring countries.

The initial stage of radiation therapy – pre-radiation preparation – is carried out on a computer tomograph. At the State institution «N. N. Alexandrov National Cancer Centre of Belarus», a Spiral topometric computer X-ray tomograph «LightSpeed RT» was installed for topometric preparation of patients for irradiation with the ability to transfer data in DICOM 3 / DICOM RT format over a computer network.

The planning stage of treatment plans takes place on the Computer System for Optimal Three-Dimensional Treatment Planning «ECLIPSE 3D», where the patient's plan is calculated according to the method of conformal irradiation, IMRT and IMAT planning.

At the next stage of pre-radiation preparation, the patient enters the X-ray simulator Varian «ACUITY EX» with a tomographic attachment «Cone-Beam CT» to check the selected optimal irradiation plans and mark the irradiation fields.

The implementation of the irradiation plans is carried out using radiation therapy devices. At present, at the State institution «N. N. Alexandrov National Cancer Centre of Belarus» the following installations function:

1. Linear electron accelerators «Trilogy». The Trilogy linear accelerator provides a choice of radiation methods from a wide range of radiation therapy methods, including three-dimensional conformal therapy using MLC (3DCRT), dynamic intensity-modulated radiation therapy (IMRT), radiation therapy with dynamic volumetric intensity modulation (VMAT), image guided therapy (IGRT), and stereotaxic radiation therapy (SRT).

2. Linear accelerator «Unique». The main advantages of the Unique accelerator are low cost, simplicity of design and use. Linear accelerator «Unique» manufactured by «Varian» is intended for radiation therapy with low-energy beams and allows the use of irradiation modes: a) conformal irradiation using a multi-leaf collimator (3DCRT); b) irradiation using a dynamic wedge with advanced capabilities; c) dynamic intensity modulated radiation therapy (IMRT); d) radiation therapy with dynamic intensity modulation by the volume of the target (VMAT); e) irradiation of the whole body; f) image guided radiation therapy (IGRT).

3. Linear accelerator «TrueBeam», which is one of the most modern accelerators installed in the State institution «N. N. Alexandrov National Cancer Centre of Belarus» by «Varian». Its advantages over other linear accelerators are that a) the linear accelerator provides various methods of treatment, among them the most modern ones, such as «HyperArc» and «RapidArc», for treating a wide range of cancer cases, b) the patented «Maestro» synchronous control system ensures uninterrupted operation of the system, c) the ability to obtain breath-synchronized radiographs, trigger imaging, d) built-in patient safety functions that allow doctors to confidently cope with the complexities of cancer treatment, e) submillimeter accuracy ensures consistency of dose delivery to organs or tissues of the human body.

Dosimetric support and technical quality control of radiation therapy in the State institution «N. N. Alexandrov National Cancer Centre of Belarus» is carried out at the most modern level in compliance with all international standards, which is confirmed by repeated inspections of experts from the International Atomic Energy Agency (IAEA).

CHANGES IN THE CONTENT OF LPO PRODUCTS IN A RAT LIVER MITOCHONDRIA OF THE "RAPID AGING" MODEL AND THE EFFECT OF SUPROMOLECULAR COMPOUNDS ON THEM

S. Dalimova, Sh. Kuziev, G. Umarova, G. Mukhammadjanova, M. Yunusova, N. Khamdamova, S. Khamroev, M. Mustafakulov, D. Azimova

National University of Uzbekistan named after Mirzo Ulugbek, Department of Biochemistry
Tashkent, Republic of Uzbekistan
kuziev.sherali@gmail.com

Keywords: radiation, environmental stress, antioxidants.

It is known from the literature that radiation causes strong changes in chromatin and other cellular components which are similar to the process of rapid aging in the body, so the model of "rapid aging" in experimental animals under the influence of radiation is widely used by researchers in scientific experiments.

The aim of our work was to study the influence of the amount of lipid peroxidation products in the liver mitochondria - malon dialdehyde (MDA) and diene and triene conjugates (DC, TC) in the blood of "rapid aging" model rats based on polyphenol-quercetin (QUE) based on natural compounds and a new supramolecular complex (ratio 4: 1) in a monoammonium salt of glycyrrhizinic acid (MASGA). In our study, we used 6-month-old white, non-pedigree rats (control group). To create the “rapid aging” model, 6-month-old rats were irradiated with X-rays at a dose of 2 gr once in a RUM-17 device. 6 days after irradiation, the animals were injected with a complex dose of MASGK : QUE 0.5 mg / 100 g by weight for 7 days. The amount of LPO products was determined in the liver mitochondria of control and irradiated rats.

Based on the experiments, the following results were obtained: a sharp acceleration of the process of LPO in the mitochondria and blood of irradiated animals was observed: MDA increased by 180, DC and TC by 205 and 188%. The transfer of the MASGA : QUE complex to the model animals led to the recovery of the studied indicators. Under the influence of the supramolecular complex, the amount of MDA in mitochondria decreased by 120, the amount of DC and TC by 167 and 134 %.

The obtained results allow to conclude that the new supramolecular complex can be used as a compound with strong antioxidant activity when studying the effects on processes occurring in mitochondria during subsequent stressful environmental situations.

BIBLIOGRAPHY

1. *S. Dalimova, SH. Kuziev, G. Umarova, G. Mukhammadjonova, M. Yunusova, N. Khamdamova and F. Eshboev.* Influence of the supramolecular complex of glycyrrhizic acid with quercetin on age-related functional changes in rat brain mitochondria // Plant Cell Biotechnology and Molecular Biology 21(45&46):63–73; 2020.

2. *М. Юнусова и др.* Изучение влияния супрамолекулярных комплексов на процессы перикисного окисления липидов и активность митохондриальных ферментов клеток сердечной мышцы при экспериментальном миокардите // DOI – 10.32743/UniChem.2021.88.10.12343 С. 38–44.

3. *A. Y. Baev, P. R. Angelova, A. Y. Abramov*. Inorganic polyphosphate is produced and hydrolyzed in F_0F_1-ATP synthase of mammalian mitochondria. Biochem J. 2020;477(8):1515.

STUDY OF CARDIOPROTECTIVE PROPERTIES SUPRAMOLECULAR COMPOUNDS WITH GLYCIRRIZIC ACID

S. Dalimova, M. Yunusova, G. Umarova, Sh. Kuziyev, G. Mukhamadjonova, N. Khamdamova, S. Khamroyev, M. Mukhamedova, M. Dadakhonova

National University of Uzbekistan named after Mirzo Ulugbek, Department of Biochemistry
Tashkent, Republic of Uzbekistan
muslima8390@gmail.com

The effect of the glycyrrhizic acid and aspirin (GLAS) supramolecular complex, consisting of acetylsalicylic and glycyrrhizic acids, on the process of lipid peroxidation in heart muscle cells and platelets on an experimental myocarditis model was studied. GLAS was found to have greater antioxidant activity compared with the aspirin comparison drug. When studying the effect of GLAS on the functional activity of platelets, it was found that this drug, in comparison with aspirin, has a pronounced decrease in platelet aggregation and adhesion processes, without affecting the number of the latter.

Keywords: acetylsalicylic and glycyrrhizic acids, heart, experimental myocarditis.

Cardiovascular disease (CVD) is the leading cause of death worldwide. Mitochondrial dysfunction plays a crucial role in the pathogenesis of cardiovascular disease. Cardiovascular disease is associated with altered mitochondrial biogenesis and clearance. The universal mechanism of cell adaptation to changing conditions of existence is the restructuring of metabolism and energy. At the present stage of the development of pharmacology, a whole arsenal of cardioprotectors has been developed and tested, with a wide spectrum of action, promoting the synthesis and mobilization of energy and plastic resources, optimizing the activity of physiological systems, accelerating recovery processes, including in the heart muscle.

At present, advances in the development of new drugs are associated not only with the synthesis of new chemical compounds, but also, to a large extent, with the improvement of the properties of existing drugs, including by creating new dosage forms with targeted delivery to the target organ. As a complexing agent, glycoside glycyrrhizic acid (GA), obtained from licorice root, is often used. It is known that complexation makes it possible to prolong the effect of the active substance by increasing the affinity for the receptor. Complexes of this glycoside with various NSAIDs, prostaglandins, antiarrhythmic agents and other psychotropic agents, antitumor agents have been studied.

However, the effect of complexation with drugs that affect the cardiovascular system is not well understood. At the Institute of Bioorganic Chemistry, ASRUz, a new non-steroidal anti-inflammatory drug GLAS was created, which is a supramolecular complex of glycyrrhizic acid with acetylsalicylic acid. It was found that this drug in small doses has a pronounced antiaggregatory activity. The aim of our study was to study the effect of different doses of GLAS on the functional state and the process of lipid peroxidation (LPO) of mitochondria of cardiomyocytes in intact rats and rats with experimental myocarditis. It was found that in the mitochondria of model rats, more than a twofold increase in the lipid peroxidation product, malondialdehyde (MDA), is observed as compared to the control. As a result, there is a decrease in respiration and the process of oxidative phosphorylation of mitochondria in myocarditis animals. The introduction of a low dose of GLAS (2.5 mg/kg) to myocarditis animals led to a significant decrease in the MDA content and incomplete restoration of the functional state of mitochondria. A high dose (5 mg/kg) of GLAS also had a positive effect on the studied parameters, but its effect was not so pronounced. The reference drug, aspirin, did not have a significant effect on the LPO process and the functional state of mitochondria in myocardial cells. Research into the cardiotropic properties of GLAS continues.

BIBLIOGRAPHY

1. *Балтина Л. А., Кондратенко Р. М., Толстиков Г. А. и др.* Синтез новых гетеро- и карбоциклических ароматических амидов глицирризиновой кислоты – потенциальных антиВИЧ агентов // Хим.-фарм. журн. 2009. № 7. С. 11–15.

2. *Толстикова Т. Г., Сорокина И. В., Коваленко И. Л., Толстиков А. Г.* Влияние клатратообразования на активность фармакона в комплексах с глицирризиновой кислотой // Докл. АН. 2004. Т. 394. № 2. С. 189–193.

3. *S. Dalimova, SH. Kuziev, G. Umarova, G. Mukhammadjonova, M. Yunusova, N. Khamdamova and F. Eshboev.* Influence of the supramolecular complex of glycyrrhizic acid with quercetin on age-related functional changes in rat brain mitochondria // Plant Cell Biotechnology and Molecular Biology 21(45&46):63-73; 2020.

4. *М. Юнусова и др.* Изучение влияния супрамолекулярных комплексов на процессы перикисного окисления липидов и активность митохондриальных ферментов клеток сердечной мышцы при экспериментальном миокардите // DOI - 10.32743/UniChem.2021.88.10.12343 С. 38–44.

SYNTHESIS OF TRIOL N-METHYLMORPHOLINO INOSINE

E. Deusova, M. Khanchevskiy, V. Pashkovich, E. Kvasyuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
liza20010226@gmail.com

This article presents data on the synthesis of triol N-methylmorpholino inosine.

Keywords: synthesis, inosine dialdehyde, triol N-methylmorpholino inosine.

As the initial reagent for the preparation of the N-methylmorpholino inosine triol, inosine dialdehyde **1** was used. Dialdehyde was previously obtained by oxidation of inosine with sodium periodate or ion exchange resin in the IO_4^- form.

Inosine dialdehyde inhibits ribonucleotide reductase, which leads to a decrease in the synthesis of DNA, RNA and proteins and stops the cell cycle in the G2 / M phase. This agent also forms stable covalent cross-links in proteins, thereby suppressing the activity of enzymes involved in the synthesis of nucleic acids. Inosine dialdehyde also inhibited the proliferation of various tumor cells (completely suppressed the proliferation of leukemia cells in mice L1210 and P388) [1]. Morpholino derivatives obtained from ribonucleotides by a series of successive chemical transformations have been used in the synthesis of antisense oligonucleotides [2], but their biological activity has not been practically studied.

In order to further study the biological activity, the triol N-methylmorpholino inosine **2** was obtained. The synthesis scheme of compound **2** is shown in the picture.

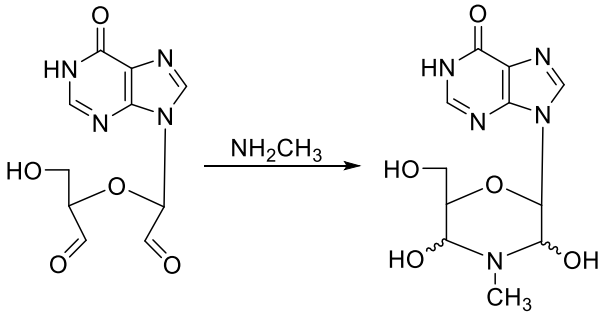


*Fig. 1 – Scheme of synthesis of triol N-methylmorpholino inosine **2** from inosine dialdehyde **1***

In the process of work, the reaction course and the content of N-methylmorpholino inosine triol **2** were monitored using thin-layer chromatography on Merck Kieselgel 60 F_{254} plates (Germany) in a solvent system: isopropyl alcohol / ammonia / water (7:2:2 vol/vol/vol). The spots of compounds were visualized on plates by considering them in ultraviolet light.

Inosine dialdehyde **1** (0.5 g, 1.88 mmol) was dissolved in 20 ml of methanol, and 0.68 g (1.93 mmol) of methylamine was added with stirring. The reaction mixture was stirred for 1 week, and evaporated to dryness. The residue was treated with ethyl alcohol (5 ml), and the mixture was concentrated in vacuum to ~1 ml. To the resulting mixture 3 ml of chloroform was added, and the amorphous precipitate was filtered off. The precipitate was dried at room temperature in air, and then in vacuum to a constant weight to give 0.3 g (53.2%) of triol N-methylmorpholino inosine **2.**

BIBLIOGRAPHY

1. *Peter, G.W.* Mechanism of Action of Inosine Dialdehyde (NSC 118994) in the Inhibition of Proliferation of Tumor Cells in Culture / G.W. Peter [et al.] // Cancer Research. – 1977. – Vol. 37. – P. 2188–2195.

2. *Chakhmakhcheva, O.* Synthesis and Properties of Some Morpholino Oligonucleotide Analogues / O. Chakhmakhcheva [et al.] // Nucleosides & Nucleotides. – 1999. – Vol. 18, № 6&7. – P. 1427–1428.

EPIDEMIOLOGICAL ANALYSIS OF THE INCIDENCE OF THE POPULATION OF THE KRUPSKY DISTRICT WITH RESPIRATORY DISEASES FOR 2014–2019

K. Dragun, A. Sysa

Belarusian State University, ISEI BSU

Minsk, Republic of Belarus

khristinadragun@yandex.ru

The epidemiological analysis of the respiratory diseases' incidence of the population of Krupsky district; the structure of the respiratory diseases' incidence by the nosological forms and the dynamics of the incidence of the main forms of respiratory diseases for the period from 2014 to 2019 were analyzed.

Keywords: incidence, respiratory diseases.

The respiratory diseases incidence of in the adult population of Krupsky district for the period from 2014 to 2019 was analyzed. As a result of the research the following conclusions were made:

1. The main contribution to the structure of the primary incidence of the adult population by nosological forms of respiratory diseases in 2014 was made by acute respiratory tract infections (66.48 %). Second place is occupied by pneumonia (1.55 %), third place – chronic diseases of tonsils and adenoids, peritonsillar abscess

(1.45 %), fourth place – vasomatory and allergic rhinitis (0.74 %) and fifth place – chronic and unspecified bronchitis, lung emphysema (0.5 %).

Acute respiratory tract respiratory infections (76.66 %) made the main contribution to the primary respiratory disease incidence structure by nosological forms in the adult population in 2019. Second place was taken by pneumonia (7.04 %), third place by chronic rhinitis, nasopharyngitis, pharyngitis, sinusitis (1.77 %), fourth place by other chronic obstructive pulmonary disease (0.72 %) and fifth place by vasomatory and allergic rhinitis (0.64 %).

Thus, acute respiratory tract respiratory infections and pneumonia are leading in the structure of respiratory diseases incidence in the adult population of Krupsky district during the whole period of observation.

2. Respiratory disease incidence rates in 2014 -2019 remained at a high level. However, no pronounced upward or downward trend in incidence could be detected.

In the dynamics of incidence of acute respiratory viral infection and vasomotor and allergic rhinitis also no pronounced increase or decrease in incidence is detected.

In the dynamics of incidence of pneumonia and chronic rhinitis, nasopharyngitis, pharyngitis, sinusitis there is a pronounced increase in the incidence (R^2=0.886 and R^2=0.76). Moderate increase is observed in the dynamics of incidence of other chronic obstructive pulmonary disease (R^2=0,62).

A pronounced decrease is observed in the dynamics of incidence of chronic diseases of tonsils and adenoids, peritonsillar abscess and bronchitis chronic and unspecified, pulmonary emphysema (R^2=0,716 and R^2=0,72).

Diseases of the respiratory system are nowadays a really urgent problem. They are one of the most common causes of incidence and mortality among people of all ages worldwide. The relevance of RDS is also due to the constant growth of the cost of treatment and rehabilitation of patients.

It is necessary to use preventive measures and to prevent the disease in advance. To reduce the incidence of disease, it is advisable to monitor the dynamics, to inform the population about risk factors and to improve the environmental situation in the country. Patients should be well informed about the causes, nature and characteristics of their disease. An important step in the education of patients is their professional background, especially in cases where the patient's profession is associated with an aggressive environment.

BIBLIOGRAPHY

1. Применение статистических методов в эпидемиологическом анализе / Е.Д. Савилов [и др.]; под общ. ред. Савилов, Е.Д. — Москва: ИНФРА-М, 2004. – 71 с.

2. *Трухан, Д. И.* Болезни органов дыхания / Д. И. Трухан, И. А. Викторова. – Санкт-Петербург: СпецЛит, 2013. – 175 с.

GENES OF SEROTONINEGIC SYSTEM AND ITS INFLUENCE ON HUMAN PSYCHOEMOTIONAL STATE

I. Drozdov, I. Mosse

Institute of Genetics and Cytology NAS of Belarus,
Minsk, Republic of Belarus,
gosha.drozdov.94@gmail.com

The problem of studying the genetic mechanisms of stress tolerance is relevant nowadays. Because, one group of people has an adequate reaction to stress under the influence of stress factors and the other group develops anxiety and depression, which can lead to serious changes in the psyche. The study of this problem will help to draw a conclusion about the contribution of stress tolerance genes to the psychoemotional state of a person.

Keywords: Stress, genotyping, marker, serotonin.

The serotonergic system is a complex of interconnected neurons located in the anterior (rostral) and posterior (caudal) nuclei of the suture of the medulla oblongata, secreting serotonin as a transmitter [1]. It inhibits the ascending activating systems of the brain and thereby reduces its effect on activating the cerebral hemispheres [2].

The size of the final sample was 1198 people from representatives of various groups of the Belarusian population. DNA isolated from peripheral blood leukocytes or buccal epithelium was used as a biological material for the study.

The results obtained in comparative genotyping of representatives of different groups by genes of the serotonergic system are shown in Table 1.

Table 1

Results of genotyping of representatives of various groups of the Belarusian population

Gene	5-HTTLPR		
Genotype	LL	LS	SS
Control, %	41,26	42,48	16,26
Special forces, %	46,54	44,65	8,81
Patients, %	48,91	38,04	13,04
p (К, S)	0,253	0,639	**0,023**
OR (95% CI)	1,24 (0,84 – 1,82)	1,09 (0,74 – 1,61)	**0,50 (0,25 – 0,93)**
p (К, П)	**0,017**	*0,069*	0,408
OR (95% CI)	**1,42 (1,05 – 1,92)**	0,76 (0,56 – 1,03)	0,84 (0,55 – 1,27)
Gene	HTR2A (rs6313)		
Genotype	CC	CT	TT
Control, %	40,75	45,28	13,98
Special forces, %	40,63	48,13	11,25
Patients, %	33,77	41,89	24,34
p (К, S)	0,978	0,528	0,376
OR (95% CI)	0,99 (0,68 – 1,45)	1,12 (0,77 – 1,63)	0,78 (0,42 – 1,38)
p (К, П)	**0,020**	0,271	**0,001**
OR (95% CI)	**0,74 (0,57 – 0,96)**	0,87 (0,68 – 1,12)	**1,98 (1,42 – 2,77)**

As can be seen from the table, statistical differences are present in the frequencies of the LL genotype and alleles of the SLC6A4 gene (5-HTTLPR) p = 0.017, OR (95% CI) = 1.42 (1.05 - 1.92), as well as between the control group and special forces by the frequency of the SS genotype, p = 0.023, OR (95% CI) = 0.50 (0.25 – 0.93).

Statistically significant differences in the HTR2A gene (rs6313) were also found between the control group and patients when comparing the frequencies of the TT genotype, p = 0.001, OR (95% CI) = 1.98 (1.42 – 2.77), which may indicate its role in the formation of psychoemotional disorders.

BIBLIOGRAPHY

1. *Siegel, G. J.* Basic neurochemistry / G. J. Siegel, S. T. Brady // Academic Press. – 2012. – 121 p.

2. *Ерофеев, Н. П.* Физиология центральной нервной системы: учебное пособие. / Н. П. Ерофеев // Санкт–Петербург – СпецЛит – 2014. –191 с.

EXPLORING THE POSSIBILITIES OF CREATING A GENETIC CONSTRUCT FOR A DNA VACCINE AGAINST SARS-COV-2

A. Dubinskaya, I. Kazlovsky, J. Venskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
angelina.lashkunova@mail.ru

This paper presents the data on the creation of a genetic construct containing a gene encoding the S-protein of the SARS-CoV-2 coronavirus based on a commercial pING vector approved for use in DNA vaccination.

Keywords: SARS-CoV-2, pING vector, plasmid DNA, vaccine.

The structure of the coronavirus includes a single-stranded RNA with a positive chain encoding four structural proteins: S protein, membrane protein (M), envelope protein (E) and nucleocapsid protein (N) [1]. Amongst them, the S protein is responsible for recognising and binding to receptors on the surface of host cells and plays an important role in the first step of viral infection. Viral cells entry is facilitated by the fusion of viral and host cell membranes after the receptor-binding domain (RBD) of S protein binds to cellular ACE2 receptor. Studies have shown that vaccines targeting SARS-CoV-2 S-protein exhibit certain protective effects against COVID-19.

Thus, the new coronavirus vaccines that are currently under research are generally developed to destabilise the S protein and disrupt or weaken the RBD interactions [2].

In the course of the work, genetic engineering, microbiological and biotechnological research methods were used. The output of reactions was monitored using 1% horizontal agarose gel electrophoresis.

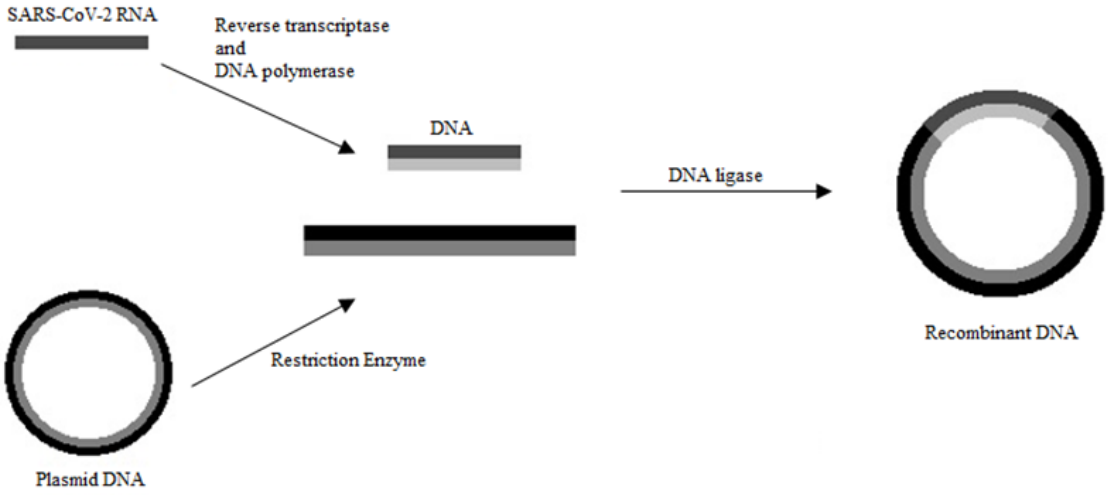


Fig. 1 – Scheme of recombinant DNA production

Plasmid DNA (pDNA) was isolated by alkaline lysis from a suspension of bacterial cells containing a commercial pING vector. The resulting pDNA was subjected to restrictase treatment using *Eco*RV endonuclease. Amplification of the target gene encoding the SARS-CoV-2 S-protein was performed using a premix containing reverse transcriptase and DNA polymerase. The linear vector molecule and the target gene were ligated using the bacteriophage T4 DNA ligase enzyme. The resulting ligase mixture was transformed into competent *E. coli* XL1Blue cells by electroporation. DNA obtained from bacterial cells colonies was subsequently subjected to PCR analysis to confirm the presence of the target gene in its composition in the correct orientation.

BIBLIOGRAPHY

1. Molecular Epidemiology Surveillance of SARS-CoV-2: Mutations and Genetic Diversity One Year after Emerging / A. Flores-Alanis [et al.] // Pathogens. – 2021. – Vol. 10, № 2. – Art. 184.

2. The COVID-19 Vaccines: Recent Development, Challenges and Prospects / Y. Yan [et al.] // Vaccines. – 2021. – Vol. 9, № 4. – Art. 349.

FUNCTIONAL ACTIVITY OF NEUTROPHILIS IN FUNGAL DISEASES OF NAILS, SKINHAND MUSCOUS MEMBRANES

N. V. Emelianenko, T. R. Romanovskaya

Belarusian State University, ISEI BSU

Minsk, Republic of Belarus

attractive675@mail.ru

In recent years, the number of systemic disseminated mycoses has increased, due to a number of reasons: unfavorable environmental factors; an increase in the number of patients with malignant diseases, especially the immune system; HIV infection; widespread use of medicines with immunosuppressive properties: cytostatics, hormones, antibiotics, and so on.The vast majority of pathogenic and opportunistic fungi cause disease only in the presence of factors that reduce the normal physiological protective function of the skin and violate the body's resistance to infection (especially in immunodeficiency states).

Keywords: onychomycosis, candidiasis, phagocytosis, phagocytic index, phagocytic number, myeloperoxidase.

In the study, the main target was to study the functional activity of neutrophils in the field of phagocytosis in fungal diseases of nails, skin and mucous membranes.

To achieve the goal, the following tasks were set: to study the parameters of the phagocytic reaction of neutrophils in fungal infections of nails, skin and mucous membranes and to analyze the mechanisms of the observed changes in the functional state of neutrophils under these conditions.

Materials and research methods. The indicators of the study were the phagocytic index and the phagocytic number. The method used is phagocytosis.

Research results and their discussion. Taking into account the reliability of the differences ($p < 0.5$), we can talk about the insufficiency of phagocytosis, and as a consequence - a decrease in the phagocytic index in women with candidiasis. In the human body, fungi of the genus Candida are under the influence of nonspecific factors (peroxidase activity of blood cells, mainly monocytes, eosinophils, neutrophils, serum lipoproteins, iron-containing proteins, the complement system) and specific cellular and humoral immunity factors. Myeloperoxidase deficiency determines the preservation of absorption of fungi by neutrophils, but the absence of fungicidal activity, that is, incomplete phagocytosis is observed, fungi are capable of reproduction inside cells, and when they rupture, dissemination occurs in the human body [1].

With onychomycosis, there are signs of stimulated phagocytosis. Phagocytic activity of neutrophils increases at the beginning of the inflammatory process, which is apparently associated with oxygen-dependent metabolism, which sharply increases in the process of cellular activation, namely, the so-called respiratory burst [2]. This event is accompanied by increased consumption of glucose and oxygen, induced by the production of reactive oxygen species.

Also, with MMT candidiasis in women, a decrease in the involvement of neutrophils in phagocytosis was observed only in 1 case (with a level of values < 40 %). This means that MMT candidiasis in women is not a sign of insufficiency of the phagocytic reaction of neutrophils. In the overwhelming majority of women from the surveyed group, AF is within physiological values, i.e. does not respond to the infectious and inflammatory process. And only in two cases with MMT candidiasis, we observed an increase in the involvement of neutrophils in the phagocytic process (with a level of values of 40–75 % and 4.5–7.5).

Conclusion. The immune competence of the biotope of fungal damage is reflected in the indicators of the phagocytic link of immunity, i.e. phagocytic test information can be used as a diagnosis-confirmatory criterion. Onychomycosis (in contrast to candidiasis of the mucous membranes) proceeds with signs of stimulated phagocytosis.

BIBLIOGRAPHY

1. *Maródi, L.* et al. Augmentation of human macrophage candidacidal capacity by recombinant human myeloperoxidase and granulocyte-macrophage colony-stimulating factor / L. Maródi et al. // Infection and Immunity. – 2018. – Vol. 66, № 6. – P. 2750–2754.

2. *Karibaeva A. T.* Modern features of the clinic, epidemiology, immune mechanisms of trichophytosis, microsporia and improvement of therapy: author. dis. ... Dr. med. Sciences / A. T. Karibaeva. – Almaty, 2011. – 40 p.

ANTITUMOR ACTIVITY OF ZOLEDRONIC ACID

V. Gamenyuk, M. Khancheuski, M. Labai

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
gamenyukvika@gmail.com

The aim of this work is to test the antitumor activity of zoledronic acid on the human hepatocarcinoma cell line HepG2.

Keywords: zoledronic acid, cytotoxicity, HepG2.

Oncological diseases are the main cause of death, their statistics are disappointing: more than 10 million new cases of cancer are diagnosed worldwide every year. Liver cancer is a malignant neoplasm (MNO) with a high mortality rate and low average survival rate in most countries of the world, and is one of the five leading causes of death from cancer. According to the WHO, more than 1.3 million people die each year from liver cancer worldwide.

The creation of new effective drugs is one of the priority areas of the modern pharmaceutical industry.

Zoledronic acid is a highly effective bisphosphonate that selectively acts on bone tissue. In addition to the inhibitory effect on bone resorption, zoledronic acid has antitumor properties that ensure the effectiveness of the drug in bone metastases.

Considering the fact that zoledronate is already used in clinical practice with good safety records, the discovered new abilities of this drug will be easy to implement for clinical use.

The studies were carried out on the basis of the Laboratory of Experimental Immunology and Microbiology of the Department of Immunology and Environmental Epidemiology, Moscow State Power Engineering Institute. HELL. Sakharov Belarusian State University. The experiment used human tumor cells of the HepG2 line, derived from human hepatocarcinoma. In the wells of a 96-well plate, 180 μl of the cell suspension at a concentra-

tion of 5×10^4 cells / ml and 20 μl of the test substance (10^{-3}, 10^{-4}; 10^{-5}; 10^{-6}; 10^{-7}) were added. Incubation was carried out for 24 h at 37 °C and 5% CO2. At the end of incubation, the number of living tumor cells of the HepG2 line was assessed by staining with 0.02% trypan blue solution.

The greatest suppression of viability occurred in the samples with the highest Zc concentration (10^{-3} M) – 6.25 %. The least suppression of viability occurred in the samples with the lowest Zc concentration (10^{-7} M) – 12.96 %, respectively.

Based on the data obtained during the experiment, we can conclude that zoledronic acid reduces the viability of HepG2 tumor cells due to its high cytotoxic activity. You can also talk about an increase in cell viability with a decrease in the concentration of a substance.

During the study of the antitumor activity of zoledronic acid in the concentration range of 10^{-7}–10^{-3} M zoledronic acid exhibits antitumor activity against the HepG2 tumor cell line. This proves the effectiveness of drugs based on the test substance and also justifies the possibility of modifying existing drugs.

Summarizing all of the above, it can be argued that the use of zoledronic acid in the composition of anti-cancer drugs is promising.

BIBLIOGRAPHY

1. *Center, J. R.* Osteoporosis medication and reduced mortality risk in elderly women and men / Center, J. R., Bliuc, D., Nguyen, N. D., Nguyen, T. V., Eisman, J. A. // The Journal of Clinical Endocrinology & Metabolism, 2011.

2. *Bellantuono, I.* Zoledronate extendes lifespan and healthspan in vivo/ Bellantuono, I., Chen, Z., Slack, C., Cordero, J., & Zeidler, M. // Innovation in Aging, 2(suppl 1), 2018.

ANALYSIS OF INCIDENCE AND TERRITORIAL DISTRIBUTION OF INFECTIOUS MONONUCLEOSIS IN BELARUS

V. Garonina, Yu. Lyakh

Belarusian State University, Moscow State Power Engineering Institute HELL. Sakharov BSU, Minsk, Republic of Belarus, Yury_Liakh.61@mail.ru

The paper examines the long-term dynamics of the incidence of infectious mononucleosis in the population of the Republic of Belarus for the period 2008-2020. The data of the official registration of morbidity were obtained from the State Institution “Republican Center for Hygiene, Epidemiology and Public Health”. The aim of the work is to analyze the distribution of infectious mononucleosis among the urban and rural population of the Republic of Belarus. Determination of the most vulnerable age groups of the population and establishment of the main causes of the disease.

Keywords: infectious mononucleosis, Epstein-Barr virus, lymphadenopathy, hepatosplenomegaly, morbidity dynamics, territorial distribution.

Infectious mononucleosis is an acute viral infectious disease characterized by damage to the reticuloendothelial and lymphatic systems and proceeding with fever, tonsillitis, polyadenitis, splenomegaly and hepatomegaly, the appearance of atypical mononuclear cells in the peripheral blood and heterophilic antibodies. It can be caused by the Epstein-Barr virus (EBV), cytomegalovirus and other pathogens, but this paper discusses only infectious mononucleosis, the causative agent of which is EBV. The Epstein-Barr virus is a γ-herpesvirus that infects at least 90% of the world's population.

The main route of transmission of the pathogen is airborne, often infection occurs through infected saliva, in connection with which infectious mononucleosis was called the "kissing disease".

The urgency of the problem of infectious mononucleosis is associated, first of all, with the widespread spread of the disease and the high degree of infection of the population by the virus, as well as the possibility of complications and the transition of infection to a chronic form. In the Republic of Belarus, since the introduction in 1995 of the official statistical registration of the incidence of infectious mononucleosis, the indicators have increased 4 times, which is due not only to the expansion of diagnostic capabilities, but also to the widespread spread of this infection.

Data analysis for the period 2008–2020 revealed a moderate trend towards an increase in the incidence of infectious mononucleosis in the total population of Belarus with an annual growth rate of 1.54 %. The average incidence rate for the analyzed period was 20.0 cases per 100 thousand population. The highest morbidity was registered in the city of Minsk (40.18 per 100 thousand population). Among the regions of the Republic of Bela-

rus, the highest average annual incidence rates were observed in the Mogilev (18.3 per 100 thousand of the population) and Brest (17.92 per 100 thousand of the population) regions, the most favorable situation in the Gomel region (11.35 per 100 thousand). population) [1, 2].

The incidence of the adult population (over 18 years old) in all the years of observation was lower than similar indicators. For children under 18 years of age, this indicator averaged 2.99 cases per 100 thousand population over the last 12 years of observation. The highest incidence rates were recorded in the age groups 0-2 years (170.01 per 100 thousand population in 2017) and 3-6 years (215.04 per 100 thousand population in 2017) [3].

The incidence of infectious mononucleosis in rural areas for 2008–2020 3.93 times lower than in the city and is 6.15 ± 0.5 and 24.17 ± 0.57 per 100 thousand of the population, respectively. However, the average annual rate of increase in the incidence of infectious mononucleosis in the rural population during the study period exceeded the indicator of the urban population by 6.26 times and amounted to 5.57 % and 0.89 %, respectively.

BIBLIOGRAPHY

1. *Бондаренко, А. Л.* Возрастные отличия инфекционного мононуклеоза Эпштейна-Барр вирусной этиологии / А. Л. Бондаренко, М.В. Савиных, Н.А. Савиных, Т.И. Калужских и др. // Журнал инфектологии. – 2018. – Т. 10. – № 1. – С. 36-41.

2. *Магомадова, Х.И.* Инфекционный мононуклеоз, обусловленный вирусом Эпштейна-Барра / Х. И. Магомадова, К. Л. Ибрагимова // Студенческий вестник. – 2019. – № 24–2 (74). – С. 88–90.

3. *Трофимова, Н. А*. Характер течения инфекционного мононуклеоза у детей / Н. А. Трофимова, Л. Д. Цыдыпова // Сборник научных трудов. – 2019. – С. 211–212.

THE IMMUNE SYSTEM DURING PHYSICAL ACTIVITY

B. Kakhorov, M. Khojamkulova

National University of Uzbekistan named after Mirzo Ulugbek
Uzbek state university of physical culture and sport
Tashkent, Republic of Uzbekistan

The reasons for the weakening of the immune system of athletes under the influence of physical activity of varying intensity remain unclear. On the one hand, the generally accepted opinion is not questioned that regular, systematic loads of moderate intensity strengthen the body.

Keywords: immune system, physical activity, reasons.

Physical activity is especially effective for the prevention and treatment of atherosclerosis, hypertension, obesity, chronic diseases lung, diseases of the musculoskeletal system and many others. The consequences of the influence of physical activity on the human immune system can be varied. After exhausting physical activity, the number of leukocytes increases, but their functional activity decreases markedly, antigen is suppressed presenting ability of macrophages depression of NK cells is observed, decreases the number of T-lymphocytes, suppresses the proliferative response of lymphocytes to T-mitogens, the disappearance of immunoglobulins from the blood or saliva occurs during the competition. Stress reactions during physical exertion are realized through the sympathoadrenal and hypothalamic-pituitary-adrenocortical systems, which leads to an increase in the level of catecholamines and glucocorticoids. In turn, catecholamines are responsible for granulocytosis and lymphocytosis, and glucocorticoids are responsible for lymphopenia. Volume and intense workouts have a powerful effect on the hormonal system. After such loads, a prolonged decrease in testosterone and other hormones involved in anabolic processes is noted in the blood. Since such loads are energy-intensive, the release of hormones decreases, which provide the synthesis of structural and contractile proteins, as resources are spent on restoring energy substrates. This is reflected in the immunological reactivity of athletes. A properly constructed training process leads to an acceleration of protein synthesis not only in the trained muscles, but also throughout the human body. Excessive accumulation of unoxidized metabolites leads to the destruction of cells, some of which are eliminated. Hydrogen ions trigger reactions of peroxidation, cause fragmentation of mitochondrial enzymes, enhancing catabolic reactions.

All of the above changes in the immune system, as well as various types of suppression of IgA, IgM in mucous secretions, the phenomenon of disappearing antibodies of immunoglobulins can be explained by the damaging effect of H + ions, an increased concentration of lactate, a decrease in blood pH on the protein structures of various organs and tissues.

PHYSICAL SORPTION OF 6-THIO-2-DESOXYGUANOSINE AND 6-METHYL-2-ETHYL-PYRIDIN-3-OL WITH NANOTUBE CNT (10,10-8)

R. Kazakov[1], M. Khancheuski[1], S. Shahab[1], L. Filippovich[2]

[1]*Belarusian State University, ISEI BSU,*

[2]*Institute of Physical Organic Chemistry of the National Academy of Sciences of Belarus*

Minsk, Belarus

roman.kazakov.02@bk.ru

The paper presents the results of physical sorption of 6-thio-2'-deoxyguanosine (6-thio-dG) and 6-methyl-2-ethyl-pyridin-3-ol with a CNT nanotube (10, 10-8).

Keywords: CNT (10,10-8) nanotube, quantum-chemical modeling, 6-methyl-2-ethyl-pyridin-3-ol, 6-thio-2-deoxyguanosine.

The antimetabolite drug 6-thio-2'-deoxyguanosine is used to treat acute myeloid leukemia and chronic myeloid leukemia. The antitumor properties of the drug are due to its transformation into thioguanosine diphosphate (TGDP) or thioguanosine triphosphate (TGTP) with the participation of the enzyme hypoxanthine guanine phosphoribosyl transferase.

Cytostaticity is associated with the incorporation of 6-thio-dG into DNA or the incorporation of this booster into RNA, which ultimately leads to the termination of replication and transcription processes. 6-thio-2-deoxyguanosine is able to be incorporated into telomeres, rendering them dysfunctional. This causes the destruction of tumor cells expressing telomerase. The results of numerous studies indicate the potential usefulness of 6-thio-2'-deoxyguanosine as a novel telomerase-dependent therapeutic anticancer agent.

5) increases the resistance of erythrocytes to mechanical injury and hemolysis, 6) has angioprotective properties, 7) improves microcirculation. The drug effectively inhibits free radical oxidation of biomembrane lipids.

During the work, the following software packages were used: ChemOffice 2016, Nanotube modeller, HyperChem 08 and Gaussian 09W [1]. The parameters were calculated: the energy of a nanotube **(E_N)**, complexes "nanotube + 6-methyl-2-ethyl-pyridin-3-ol" **(E_{E+N})**, "nanotube + 6-thio-dG" **(E_{E+T})** "nanotube + 6-methyl-2-ethyl-pyridin-3-ol + 6-thio-dG **(E_{E+N+T})**; band gap **(E_g)** of molecules. The semiempirical PM3 method was used to determine the characteristics of low-molecular-weight compounds, and the MM + molecular mechanics method was used to optimize the CNT nanotube (10, 10-8). All calculations were performed in a vacuum.

Table 1

Energy values and band gap 6-thio-dG

E_{HOMO}, eV	E_{LUMO}, eV	E_g, eV	E_N, Kcal/mol	E_{E+T} Kcal/mol	E_{E+N+T} Kcal/mol
-0.31798	-0.04428	0.2737	116.5	113.8	94.4

Table 2

Energy values and band gap of 6-methyl-2-ethyl-pyridin-3-ol

E_{HOMO}, eV	E_{LUMO}, eV	E_g, eV	E_N Kcal/mol	E_{E+N} Kcal/mol	E_{E+N+T} Kcal/mol
-0.33379	0.00052	0.33327	116.5	102.6	94.4

It was found that the complex 6-thio-dG + 6-methyl-2-ethyl-pyridin-3-ol + CNT nanotube (10,10–8) is thermodynamically the most favorable, the energy value of which is 94.4 kcal / mol. The research results can be used in the development of new drugs for the delivery of 6-methyl-2-ethyl-pyridin-3-ol and 6-thio-dG to diseased cells.

BIBLIOGRAPHY

1. *Shahab, S.* Synthesis, geometry optimization, spectroscopic investigations (UV/Vis, excited states, FT-IR) and application of new azomethine dyes / S. Shahab // J. of Molecular Structure. – 2017. – Vol. 1148. – P. 134–149.

PREVALENCE OF CONGENITAL DEFECTS IN THE DEVELOPMENT OF THE MAXILLOFACIAL REGION

V. Kazyuchits, N. Kokorina, A. Ershova-Pavlova

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
nikadanilenko41@gmail.com

The article analyzes the statistical documentation on children and fetuses with congenital malformations of the maxillofacial region for the period 2016–2020.

Keywords: congenital malformations, teratogenic factors, embryogenesis, prenatal diagnosis.

Congenital deformities of the maxillofacial region occupy a special place among the quantitatively increasing congenital malformations in recent years and rank second among all human developmental defects. Among the deformities of the maxillofacial region, the most common are congenital clefts of the lip and palate. (88 %) [1].

In the Republic of Belarus, according to the data of national genetic monitoring, an increase in the frequency of birth of children with maxillofacial pathology has also been observed over the past 10 years. The rate of increase in the incidence of malformations of the maxillofacial region is 0.025 cases per 1000 live births annually [3].

Severe congenital malformations of the maxillofacial region in children are often not only a medical, but also a social problem which requires a set of measures aimed at the prevention of these diseases, as well as the treatment and rehabilitation of patients with this pathology [2].

To conduct our own research and analyze the diagnosis of "malformations of the maxillofacial region", the medical documentation of 168 cases of maxillofacial pathology was studied. The research was carried out on the basis of the Mother and Child Republican Scientific and Practical Center. In the course of the study, a collection of cases of defects of the maxillofacial region in Minsk for 2016–2020 was carried out from the archive of the Republican Scientific and Practical Center "Mother and Child".

In the structure of all registered congenital malformations in the city of Minsk during the study period, 168 cases of malformations of the maxillofacial region were identified, which accounted for 4.7 % of all cases of congenital malformations. Of these, isolated clefts of the lip and palate accounted for 53.57 %, Pierre-Robin syndrome accounted for 4.76 %, cases of malformations of the maxillofacial region as part of multiple malformations accounted for 41.67 %. The most common concomitant defects were anomalies in the development of the nervous system, defects of the cardiovascular system and the musculoskeletal system.

When studying the frequency and structure of an isolated cleft lip and palate by nosological forms, it was revealed that the most common pathology was cleft of the soft palate (31.55 %) and congenital cleft of the upper lip (17.26 %). The most rare pathology is complete cleft lip and palate (1.19 %), right-sided cleft lip and palate (1.79 %), and median cleft lip and palate (1.79 %).

When studying the defects of the maxillofacial region, it was found that in 8 (4.76 %) cases, Pierre Robin's syndrome (cleft palate, microgenia and glossoptosis) was diagnosed. This pathology was detected in the prenatal period in 3 (1.79 %) cases. In 5 (2.98 %) children, Pierre Robin's syndrome was diagnosed only after birth.

When studying the frequency of occurrence of malformations of the maxillofacial region in the composition of multiple defects, it was found that this pathology was observed in 41.67 % of cases. In the composition of multiple defects, the most common were congenital cleft of the soft palate (23.21 %) and congenital cleft of the upper lip (17.85 %). The most rare pathology in the composition of multiple malformations is the median cleft lip and palate (0.59 %).

BIBLIOGRAPHY

1. *Кабанова, А. А.* Хирургическая стоматология и челюстно-лицевая хирургия детского возраста : учебно-методическое пособие / А. А. Кабанова, С. А. Кабанова, С. С. Стельмаченок. – Витебск : ВГМУ, 2013. – 376 с.

2. Осведомленность врачей-специалистов г. Витебска в вопросах комплексной реабилитации пациентов с расщелиной верхней губы и неба / С.А. Кабанова [и др.] // Вестник ВГМУ. – 2013. – Т. 12, № 4. – С. 118–122.

3. *Фролова О. Г.* Пренатальная диагностика – важнейшая задача региональных программ модернизации здравоохранения / О. Г. Фролова, Л. П. Суханова, В. Ф. Волгина и др. // Акушерство и гинекология. – 2012. – № 5. – 75–78 с.

PHYSIOLOGICAL ALTERATIONS OF MITOCHONDRIA UNDER DIABETES CONDITION AND ITS CORRECTION BY POLYPHENOL GOSSITAN

Sh. Khalilov[1], **M. Pozilov**[1], **U. Gayibov**[1,2], **X. Ruziboyev**[1], **M. Asrarov**[2], **N. Abdulladjanova**[3]

[1]*National university of Uzbekistan named after Mirzo Ulugbek*

[2]*Institute of Biophysics and biochemistry under the National university of Uzbekistan named after Mirzo Ulugbek*

[3]*Institute of bioorganic chemistry named after acad. A. S. Sadykov, Academy of Sciences of Uzbekistan*

Tashkent, Uzbekistan

gayibov.ulugbek@gmail.com

The state of lipid peroxidation (LPO), respiration and oxidative phosphorylation, mitochondrial permeability transition pore, (mPTP) and antiradical activity of rat liver mitochondria were studied by streptozotocin (STZ)-induced diabetes, considered the ways of correction of detected membrane damages with the use of gossitan, isolated from cotton plant *Gossypium hirsutum L.*.Gossitan eliminates the detected functional disorders of rat liver mitochondria, probably due to its antioxidant properties.

Keywords: polyphenol compounds, mitochondria, antiradical activity, antioxidant activity, diabetes.

At the development of various pathologies, along with alterations in the physiological processes of the cell, the functional state of the mitochondria is disturbed. The function of mitochondria is important in the vital activity of each cell. In addition to disturbances in GLUT signaling pathways and insulin of the cell membrane in diabetes mellitus, changes in the energy of mitochondria and the ion transport system are observed. In experimental diabetes, the formation of free radicals in the mitochondrial respiratory chain increases.

The state of lipid peroxidation (LPO), respiration and oxidative phosphorylation, mitochondrial permeability transition pore, (mPTP) and antiradical activity of rat liver mitochondria were studied by streptozotocin (STZ)-induced diabetes, considered the ways of correction of detected membrane damages with the use of gossitan, isolated from cotton plant *Gossypium hirsutum L.* It was shown that the rate of respiration of liver mitochondria in states V_3 and V_4 increases during STZ-induced diabetes, which significantly reduces the respiratory control (RC) and ADP/O coefficients in comparison with control. The findings suggest that uncoupling of respiration and oxidative phosphorylation take place during STZ-induced diabetes. It was shown that in the conditions of STZ-induced diabetes, the rate of swelling of rat liver mitochondria is higher than of the healthy ones; this means that mPTP of rat liver mitochondria is in the open state in pathology. Gossitan recovers mPTP to the normal condition, thereby removing the effect of STZ on mitochondria. Gossitan (*per os* dose is 10 mg/kg of body weight, during 8 days) eliminates the detected functional disorders of rat liver mitochondria, probably due to its antioxidant properties.

Corrective effect of polyphenol gossitan on the processes of respiration and oxidative phosphorylation of rat liver mitochondria was studied in the presence of a FAD-dependent substrate at STZ-diabetes.

At STZ intoxication, the rate of respiration of rat mitochondria in rats in the V_3 state is increased by 37,2±2,8 % compared to that of mitochondria of the control animals (Fig. 1). Also, in comparison with the control, the rate of respiration of mitochondria in the V_4 state was increased (by 98,3±5,6 %). At the same time, the coefficients of RC and ADP/O decrease by 31,0±2,8 % and 41,8±3,5 %, respectively, with respect to the indices of the norm.

For the first time it was revealed new hypoglycemic properties of polyphenol compounds. Oral administration of gossitan into diabetic animals at doses of 10,0 mg/kg of body weight for 8 days decreases amount of glucose in blood to the control indexes. The polyphenol of gossitan effectively increase ATP synthesis and decrease of the process LPO in mitochondrial membranes of liver with STZ-induced diabetes. Under conditions of STZ-induced diabetes, the liver mPTP enters an open state, which can be one of the mechanisms of damage to the function of mitochondria, as well as cells in STZ -induced diabetes. In STZ-induced diabetes, an increase in respiration rates in states V_3 and V_4 is observed, leading to the dissociation of oxidative phosphorylation in liver mitochondria and ATP deficiency in rat tissues. The hypoglycemic agent gossitan, effectively corrects the impairment of liver mitochondria caused by STZ.

ENZYMATIC SYNTHESIS OF 6-THIOGUANOSINE

M. Khancheuski[1], **L. Birichevskaya**[2], **A. Bulatovski**[2], **A. Trifonova**[1], **A. Zinchenko**[1,2]

[1]*Belarusian State University, ISEI BSU,*
[2]*Institute of Microbiology of the NAS of Belarus,*
Minsk, Republic of Belarus
maks.khanchevskiy@bk.ru

The aim of this work is to synthesize 6-thioguanosine by an enzymatic method.

Keywords: 6-thioguanosine, microbial nucleoside phosphorylases.

Nucleoside analogs are widely used as antitumor and antiviral agents. In a living cell, they exhibit biological effects through a variety of metabolic transformations, primarily as a result of phosphorylation to the corresponding triphosphates, which then act as inhibitors of metabolic pathways, or as blockers of nucleic acid synthesis [1].

6-thio-2'-deoxyguanosine is a modified nucleoside of the purine series, interest in which has increased in the last decade as a promising anticancer drug. Phosphorylated by kinases to the corresponding 5'-triphosphate, it is recognized and used by telomerase as a substrate, and then incorporated into all telomeres. This leads to a change in the structure of the end of the chromosome, as a result of which apoptosis and death of the tumor cell are triggered. The pharmacological properties of 6-thioguanosine ribonucleoside have been studied to a lesser extent than 6-thio-2'-deoxyguanosine; however, it can be assumed that the 6-thioguanine-ribonucleoside also has a certain biological activity. Further investigation of the properties of this compound is of interest.

This work describes for the first time the synthesis of 6-thioguanosine using recombinant microbial enzymes uridine phospharylase (URP) and purine nucleoside phosphorylase (PNP) *Thermus thermophilus*, obtained in the laboratory of molecular biotechnology of the Institute of Microbiology of the National Academy of Sciences of Belarus.

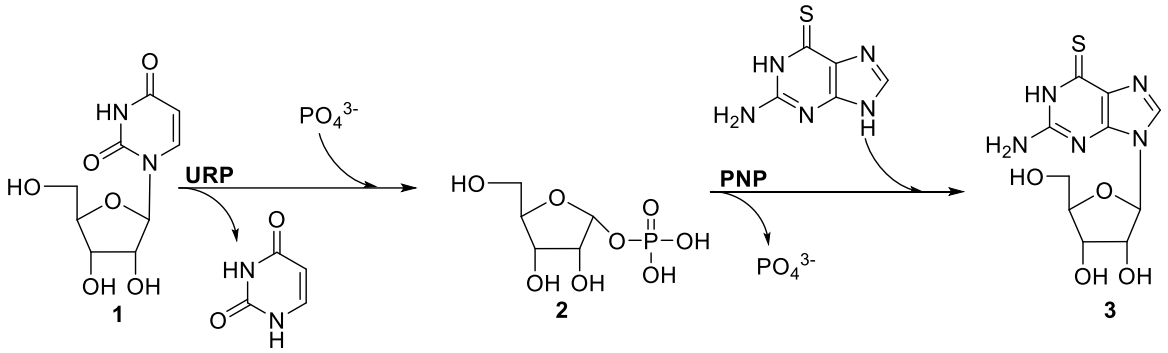


Fig. 1 – Scheme of the synthesis of 6-thioguanosine

The progress of the reaction and the accumulation of 6-thioguanosine in the reaction mixture were monitored by thin layer chromatography (TLC) on Kieselgel 60 F254 plates from Merck (Germany) in a solvent system: chloroform / ethanol (7: 1 v / v). Compounds on the plates were visualized in ultraviolet light.

Analytical synthesis of 6-thioguanosine was carried out in a reaction mixture (4 ml) containing 200 mM uridine 1 (195.36 mg, 800 mmol), 100 mM 6-thioguanine (66.8 mg, 400 mmol), 50 mM potassium phosphate buffer, pH = 7.0 and biocatalysts URP and PNP in the amount of 280 U and 700 U per 1 ml of the reaction mixture. The reaction mixture was stirred at 50° C for 5 hours to complete the reaction. Samples were taken every 30 minutes to monitor the progress of the reaction. The conversion of the base to nucleoside was more than 98 % within 5 hours. The reaction mixture containing the target product was evaporated in vacuum at a temperature of ≤30 ° C on a rotary evaporator to 2 ml and left in a refrigerator for the precipitation of crystals. The formed precipitate was filtered off and dried at room temperature in air, then in vacuum until constant weight. Were obtained 56 mg of 6-thioguanosine **3**, according to TLC data, not containing impurities of the original 6-thioguanine, as well as uridine and uracil. The yield of chromatographically pure 6-thioguanosine was 47 mol. % in terms of 6-thioguanine introduced. Further crystallization of 6-thioguanosine from the remaining filtrate yielded an additional 10 mg of a precipitate of the product containing an impurity of uracil.

Thus, the presented enzymatic method for the synthesis of 6-thioguanosine is very promising. In the future, it is planned to optimize the procedure for isolating the target product.

BIBLIOGRAPHY

1. *Guinan, M.* Recent advances in the chemical synthesis and evaluation of anticancer nucleoside analogues / M. Guinan [et al.] // *Molecules.* – 2020. – Vol. *25*. – Art. 2050.

ELISA DIAGNOSTICS OF CORONAVIRUS INFECTION

P. S. Khariton, E. E. Tarasova, N. S. Khariton

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
pollykharyton@gmail.com

COVID-19 is a viral infection caused by the SARS-CoV-2 coronavirus with severe long-term health consequences. It should be noted that there are forms of the disease, both with pronounced clinical manifestations and without pronounced symptoms, but with the presence of IgG and IgM antibodies to SARS-CoV-2, as in those who have been ill. As the object of the study, the sera of 141 volunteers were used, who had both cases of COVID-19 confirmed by a PCR test and asymptomatic forms. In the sera of volunteers with asymptomatic forms of the course of the disease, both IgM and IgG were found.

Key words: SARS-CoV-2, COVID-19 diagnosis, ELISA.

COVID-19 is a potentially severe acute respiratory infection caused by the SARS-CoV-2 (2019-nCoV) coronavirus and continues to affect populations in most of the world. Knowledge about diagnostic tests for the timely detection of severe acute respiratory syndrome caused by coronavirus type 2 (SARS-CoV-2) is updated daily.

The principle of the analysis is based on the method of solid-phase indirect ELISA and is a two-stage procedure. The reaction is stopped with a stop reagent and the optical density (OD) of the mixture in the wells is measured at a wavelength of 450/620 nm, which is proportional to the concentration of IgM and IgG to SARS-Cov-2 in the samples. In this case, we used the DIA®-SARS-CoV-2-NP-IgG and DIA®-SARS-CoV-2-NP-IgM kits (NPK DIAPROF-MED, Ukraine).

The ELISA results were recorded using a spectrophotometer, measuring the optical density in a two-layer mode: the main filter - 450 nm, the reference filter – in the range of 620-650 nm. The research results were taken into account only if the OD value (optical density) for wells with K + was 0.8 and higher, for wells with K- – no more than 0.2.

The serum of 141 volunteers were tested for the presence of free immunoglobulins of class G and M, among whom were persons with an established previous coronavirus infection (79 cases) and persons who were presumably not ill or had a disease without symptoms (62 people). The term after the transferred disease is from 1 to 6 months.

I. IgM positive and IgG negative;

May indicate a subacute phase of COVID-19 infection, including if the patient has no clinical manifestations of infection.

II. IgM positive and IgG positive;

This combination may indicate the fact of infection in the past with the SARS-CoV-2 virus with the formation of a specific immune response.

III. IgM negative and IgG positive;

A positive IgG test indicates the fact of past contact with the SARS-CoV-2 virus with the formation of a specific immune response.

IV. IgM negative and IgG negative.

There is no data indicating the contact of the body with the SARS-CoV-2 virus with the development of a specific antibody immune response.

Among persons with confirmed COVID-19 (76 sera), the following were identified:

I. 23 of 76 serum (30.3 %), with the presence of IgM;

II. 19 serum out of 76 (25 %) with IgM and IgG;

III. 29 serum out of 76 (38.1 %) with IgG;

IV. 5 serum out of 76 (6.6 %) without antibodies.

Among those who did not suffer from coronavirus or did not know about their illness (65 sera), it was identified:

1. 8 of 65 serum (12.3 %) with the presence of IgM;

2. 8 serum out of 65 (12.3 %) with the presence of IgM and IgG.

3. 9 serum out of 65 (13.8 %) with the presence of only IgG.

4. 30 serum out of 65 (46.1 %) with negative results for both classes of immunoglobulins.

Individuals of this group either did not suffer from coronavirus, or a rather long period of time has passed since the moment of their illness.

Thus, ELISA diagnostics of coronavirus infection plays an important role not only in confirmed cases, but also in the asymptomatic form of the disease, since different antibody ratios are found both in the group of people with confirmed and in the group of people with unconfirmed COVID-19.

BIBLIOGRAPHY

1. *Nandini Sethuraman, MD, Sundararaj Stanleyraj Jeremiah, MD et al.* Interpreting Diagnostic Tests for SARS-CoV-2. AMA. 2020;323(22):2249-2251. doi:10.1001/jama.2020.8259

2. *Nalla AK, Casto AM, Huang MW, et al*. Comparative performance of SARS-CoV-2 detection assays using seven different primer/probe sets and one assay kit. J Clin Microbiol. 2020; JCM.00557-20. Published online April 8, 2020. doi:10.1128/JCM.00557-20

3. *Xiao AT, Gao C, Zhang S*. Profile of specific antibodies to SARS-CoV-2: the first report. J Infect. 2020;S0163-4453(20)30138-9. Published online March 21, 2020. doi:10.1016/j.jinf.2020.03.012.

EFFECT OF INORGANIC POLYPHOSPHATES AND ADP ON THE ACTIVITY OF ENDOPLASMATIC RETICULUM CALCIUM ATPASE

F. Khasanov[1,2], **A. Baev**[1,2], **S. Dalimova**[2]

[1]*Center for Advanced Technologies under Ministry of Innovative Development*

[2]*Faculty of Biology, National University of Uzbekistan*

Tashkent, Uzbekistan

feruzbekkhasanov@gmail.com

Inorganic polyphosphates are polymers composed of phosphate residues linked by phosphoanhydride bonds and found in the cells of living organisms at all levels. To date, many functions of inorganic polyphosphates in living cells have been studied [1]. However, the enzymes involved in the metabolism of polyphosphates in mammalian cells have not been fully studied. It has been shown that the plasma membrane calcium ATPase (PMCA) can perform the function of polyphosphatkinase, i.e., it can be expressed as ATP-polyP transferase or polyP-ADP transferase (polyphosphatase) [2]. The sarcoplasmic/endoplasmic reticulum calcium ATPase (SERCA) is structurally close to PMCA [3].

Keywords: Inorganic polyphosphates, calcium pumps, PMCA, SERCA, ATP, ADP.

For this, heavy and light fractions of the endoplasmic reticulum were isolated from the leg muscle of a 3-month-old rabbit [4]. The total protein content in the fractions was determined by the Biuret method, using bovine serum albumin (Sigma) as the standard protein solution. The effect of substrates (ATP, polyP, ADP and AMP) on enzyme activity was determined using fluorescent spectroscopy Cary Eclipse (Agilent technologies) according to [4]. The amount of calcium ions in the medium was calculated using a fluorescent dye Calcium Green 5N (Invitrogen).

Our initial experiments were mainly performed on a light fraction. In this case, the presence of enzymatic activity in the fractions was tested using 25, 50, 100 and 200 mM ATP. At the same time, calcium ions in the medium decreased due to the pumping calcium into the endoplasmic reticulum cisterns using ATP energy by SERCA, and the intensity of Calcium Green began to decrease sharply. Once enzymatic activity was determined, the effect of 25, 50, 100, and 200 mM long-chain polyP (100 phosphate residues) on enzyme activity was studied. In this case, the concentration decreased due to the binding of calcium ions in the medium with polyP, but the enzyme activity was not detected. As mentioned above, PMCA can act as a polyphosphate kinase, based on which we also examined the possibility that SERCA can transfer phosphate residue from polyP to ADP and use the resulting ATP to drive calcium, and enzyme activity was observed when polyP and ADP were used together. However, this activity was observed even in the absence of polyP molecules in the presence of 100 and 200 mM ADP (n = 10). No enzymatic activity was observed when the same experiments were performed in the presence of AMP and polyP + AMP. There are no data in the literature on the activation of SERCA in the presence of ADP, therefore inhibitory analysis was performed to investigate whether ADP affects the absorption of calcium ions by SERCA. The effect of ATP and ADP on enzyme activity was observed against the background of 1mM Thapsigargin . In both cases, inhibition was observed in the same way.

Experiments have shown for the first time that SERCA can be used in conjunction with ATP as well as ADP as a substrate. However, our goal is to determine that SERCA can also use inorganic polyphosphates as a substrate , which is slightly different, so experiments are currently underway.

BIBLIOGRAPHY

1. *Holmström K. M., Marina N., Baev A. Y., Wood N. W., Gourine A. V., Abramov A. Y.* Signalling properties of inorganic polyphosphate in the mammalian brain /Nature Communications. – 2013. – 4:1362. – doi: 10.1038/ncomms2364.

3. *Rosetta N. Reuscha, Ruiping Huanga, Danuta Kosk-Kosickab.* Novel components and enzymatic activities of the human erythrocyte plasma membrane calcium pump/ FEBS Letters. – 1997. – 412: 592–596.

4. *Boczek T, Sobolczyk M, Mackiewicz J, Lisek M, Ferenc B, Guo F, Zylinska L.* Crosstalk among Calcium ATPases: PMCA, SERCA and SPCA in Mental Diseases/ Int J Mol Sci. – 2021. – Mar 10;22(6):2785. doi: 10.3390/ijms22062785.

5. *Beca S, Aschar-Sobbi R, Ponjevic D, Winkfein RJ, Kargacin ME, Kargacin GJ.* Effects of monovalent cations on Ca2+ uptake by skeletal and cardiac muscle sarcoplasmic reticulum/ Arch Biochem Biophys. – 2009. – Oct 15;490(2):110-7. doi: 10.1016/j.abb.2009.08.014. Epub 2009 Aug 23. PMID: 19706285.

COMPARATIVE ANALYSIS OF THE ANOMALIES OF THE STRUCTURE OF THE ANNUAL SCOTS PINE LAYERS IN DIFFERENT FOREST TYPES

A. Khokh

Scientific and Practical Center (SPC) of The State Forensic Examination Committee of The Republic of Belarus
Minsk, Republic of Belarus
1ann1hoh@gmail.com

The work studied different types of anomalies in the structure of the annual layers of Scots pine. It was shown that periods especially unfavorable for the life of trees are reflected in a significant decrease in the activity of cambium.

Keywords: Scots Pine, annual layers, anomalies, tracheids, forest types.

Anomalies in the structure of the annual layers are caused by a wide range of microclimatic, phytocenotic, forest pathological, silvicultural, and recreating effects on plants and their local habitat. It has been shown that the susceptibility to their formation depends on many individual characteristics of the tree, such as age, trunk thickness, tree height, growth rate or level of competition.

The aim of this work is to estimate the frequency of occurrence of anomalies in the structure of annual layers of Scots pine in contrasting environmental conditions.

In the work, we used drill cores from 4 temporary test plots (hereinafter referred to TTP), laid during field work in 2016-2017 on the territory of the Brest and Vitebsk regions of Belarus in a mossy pine forest (TTP No. 1–2) and rosemary pine forest (TTP No. 3-4).

Disturbances in the structure of annual layers were revealed by visual inspection of the samples using a stereoscopic microscope at 30x magnification. The work took into account the period from 1916 to 2016, excluding the first 20 years of the life of trees, since during this period they receive damage even with slight frosts due to a thin heat-insulating layer of bark, and therefore do not quite adequately reflect the ecological conditions of growth.

The study took into account the following types of anomalous structures: L − layer of cells of early tracheids within the late wood; L + − gradual transition from early wood to late wood (intermediate tracheids); E − layer of cells of late tracheids within the early wood; E + − gradual transition from late wood to early wood (intermediate tracheids); f − frost damage (layer of curved tracheids); m − fallen out layer (unlike other anomalies, it acts as an integral indicator of the temperature regime of the growing season as a whole). The frequency of anomalies in the annual layers (F_{rel}) structure and the stabilized frequency (F_{stab}) were calculated using the following formulas [1]:

$$F_{rel} = (n_x/N) \times 100 \quad (1)$$

$$F_{stab} = (n_x/N) \times N^{0,5} \quad (2)$$

According to the results of microscopic examination on wood cores, 368 structural anomalies and 93 fallen out layers were revealed. Differentiated results with calculated frequency of occurrence are shown in Table.

Table1

The anomalies of the structure of the annual scots pine layers

Параметр	n_x	IADF L	IADF L^+	IADF E	IADF E^+	f	m	F_{rel}	F_{stab}
TTP No1	68	26 (38%)	14 (21%)	5 (7%)	4 (6%)	13 (19%)	6 (9%)	1,7	1,08
TTP No2	196	60 (31%)	35 (18%)	19 (10%)	17 (9%)	19 (10%)	46 (23%)	4,9	3,1
TTP No3	49	26 (53%)	12 (24%)	3 (6%)	–	6 (12%)	2 (4%)	1,23	0,77
TTP No4	148	40 (27%)	21 (14%)	14 (9%)	5 (3%)	29 (20%)	39 (26%)	3,7	2,34

As a result of the analysis of the distribution of anomalies recorded on the studied samples, it was found that the leading type of anomalies in the structure of the the annual layers on the investigated TTPs are density fluctuations of late wood (type IADF L: 152 from 461). The most sensitive are pine trees with TTP No2 and TTP No4, i.e. Ledum pine forest is characterized by a large number of the annual layers anomalies (2.9 times more). As a specific feature, a sharp increase (by 10.6 times) in the number of fallen annual layers in trees in the wild rosemary pine forest compared to the moss pine forest can be noted, which indicates a more acute reaction to the weather conditions of a particular year of plants in extreme habitats.

BIBLIOGRAPHY

1. *Rigling, A.* Ecological interpretation of tree-ring width and intraannual density fluctuations in *Pinus sylvestris* on dry sites in the central Alps and Siberia / A. Rigling [et al.] //Canadian Journal of Forest Research. 2001. Vol. 31. №. 1. P. 18-31. https://doi.org/10.1139/x00-126.

VARIABILITY OF LATE AND EARLY WOOD CONTENT IN THE ANNUAL SCOTS PINE LAYER UNDER ANTHROPOGENIC LOAD

A. Khokh

Scientific and Practical Center (SPC) of The State Forensic Examination Committee of The Republic of Belarus
Minsk, Republic of Belarus
1ann1hoh@gmail.com

The paper presents a comparative analysis of the content of late and early wood in the annual layers of pine plantations experiencing a negative anthropogenic impact, in comparison with control trees growing in relatively clean areas.

Keywords: Scots pine, annual layers, late wood, early wood, anthropogenic factors.

Scots pine is fairly widely represented along suburban motorways, including the Minsk ring road, it is a perennial and experiences long-lasting effects from road pollution [1].

In Scots pine, the ratio of late and early wood in the annual layer is an important indicator of life condition. Thus, it is known that when the condition deteriorates, along with a decrease in the width of the annual layer, the proportion of late wood decreases.

Taking into account the foregoing, we analyzed the structure of annual layers of Scots pine trees growing on 3 temporary test plots (hereinafter referred to TTP) laid in 2019 at various distances from the Minsk Ring Road at 5, 100 and 500 m. In all cases, pine trees were included in the study I Craft class. The control runway was laid in similar forest conditions outside the direct influence of the Minsk Ring Road (the distance in this case was 7000 m).

The results are shown in Table.

Table

Changes in the structure of the annual layer of Scots pine trees over 10-year periods over the past 79 years

Period		1940–1949	1950–1959	1960–1969	1970–1979	1980–1989	1990–1999	2000–2009	2010–2019
7000 m	WEW	1.12/100	0.70/63	0.52/74/47	0.75/144/67	0.70/94/63	0.81/116/73	0.92/114/83	1.25/135/112
	WLW	0.68/100	0.43/63	0.27/63/39	0.35/131/51	0.36/102/53	0.46/126/67	0.52/114/76	0.59/113/86
500 m	WEW	1.15/100	0.72/63	0.53/74/46	0.77/144/67	0.73/95/63	0.94/128/81	1.10/117/95	1.41/129/123
	WLW	0.49/100	0.27/54	0.23/85/46	0.21/91/42	0.24/117/49	0.12/51/25	0.14/114/28	0.14/104/29
100 m	WEW	1.14/100	0.62/54	0.49/80/43	0.62/125/54	0.65/106/57	0.38/58/33	0.48/125/42	0.60/126/53
	WLW	0.59/100	0.38/64	0.25/67/43	0.24/94/41	0.28/117/47	0.12/43/20	0.15/125/26	0.17/113/29
5 m	WEW	1.03/100	0.62/61	0.50/80/49	0.56/112/54	0.48/87/47	0.31/63/30	0.50/164/49	0.64/126/62
	WLW	0.58/100	0.32/55	0.24/73/41	0.24/102/41	0.23/95/39	0.11/47/19	0.14/132/24	0.15/105/26

Note: WEW − the width of the early wood, WLW − the width of the late wood; specified with a slash % early and late wood in relation to the previous period and control; 1940-1949 taken as 100% and used as a control.

As can be seen, to a greater extent, negative changes affected the structure of the late wood. It should be noted that with an increase in the anthropogenic load associated with pollution by emissions from vehicles, a natural decrease in the ratio of late wood to early wood is observed. So, for TTP No4 (700 m) it is 0.54; TTP No3 (500 m) − 0.23; TTP No2 (100 m) − 0.28 and TTP No1 (5 m) − 0.10.

In general, the results obtained made it possible to analyze the patterns of the Scots pine response to vehicle emissions, which made it possible to assess adverse environmental consequences of anthropogenic impact on plant biosystems.

BIBLIOGRAPHY

1. *Хох, А. Н.* Влияние антропогенного загрязнения на морфолого-анатомические параметры и спектральные характеристики хвои сосны обыкновенной / А. Н. Хох, В. Б. Звягинцев // Вестник Оренбургского государственного педагогического университета. Электронный научный журнал. 2021. № 1 (37) С. 69–80. DOI: https://doi.org/10.32516/2303-9922.2021.37.6.

STUDY OF THE INFLUENCE OF POLYCATION POLYELECTROLYTES ON THE STATE OF IMMUNOGLOBULIN IMMOBILIZED ON NANOSTRUCTURED SILVER FILMS

I. Koktysh, Ya. Melnikova, T. Pitsko (Kaluhina), O. Matusevich, S. Maskevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
univer.yanina@gmail.com

Nanostructured silver films were formed in the wells of polystyrene plates by electrostatic deposition. It was found that coating the surface of nanostructured silver films with a layer of cationic polyelectrolyte PDADMAC leads to an increase in the fluorescence intensity of immobilized IgG-FITC from 1.5 to 3 times compared to the fluorescence intensity of IgG-FITC immobilized on the PDADMAC layer. The registered effect is in direct proportion to the concentration of the used polyelectrolyte.

Keywords: immunofluorescence analysis, silver nanofilms, cationic polyelectrolytes, monoclonal antibodies, immunoglobulin G, fluorescein isothianate conjugates.

For solving many practical problems of medical and veterinary diagnostics, as well as the food industry, environmental protection, etc. immunochemical methods of analysis using fluorescent labels and metal particles with unique physicochemical and optical properties due to their nanometer size are being actively developed and implemented. Solid-phase immunofluorescence analysis assumes not only the formation of a metal nanofilm, but also the coating of this film with a layer of positively charged polyelectrolyte for effective sorption of protein molecules.

The protein-polyelectrolyte interaction will determine both the conformational state and the functional activity of the immobilized protein molecules and thus affect the antigen-binding parameters of immunochemical test systems. The aim of this work was to study the effect of polydiallyldimethylammonium chloride (PDADMAC) polyelectrolyte on the formation of a layer of immunoglobulin molecules on the surface of a solid phase formed by silver nanofilms.

The silver sol was synthesized by the method of citrate reduction of silver nitrate. Silver nanoparticles were deposited into the wells of a polystyrene plate by electrostatic method with different exposure times from 1 to 24 h. A solution of PDADMAC in two concentrations C1 and C2 was applied to the obtained silver nanofilms. Immobilization of immunoglobulin labeled with fluorescein isothianate (IgG-FITC) was carried out for 4 hours at + 37 °C. A CLARIOstarPlus plate reader (BMG Labtech, Germany) was used to record fluorescence spectra.

Nanostructured silver films were formed on the surface of the wells of polystyrene plates and represented a continuous layer of spherical nanoparticles with sizes ranging from 30 to 80 nm. In the experiments, we used two concentrations of IgG-FITC – standard – 500 ng per well and saturating – 1000 ng per well. Coating the surface of a silver nanofilm AgNP2 with a solution of PDADMAC at a concentration of C1 led to an increase in the fluorescence intensity of immobilized IgG-FITC (500 ng per well) 1.5 times as compared to the fluorescence intensity of IgG-FITC immobilized on the surface of polystyrene coated in the same PDADMAC layer. concentration. With an increase in the amount of immobilized IgG-FITC to 1000 ng per well, the fluorescence intensity increased 2.6 times compared to the same parameter with immobilization of IgG-FITC on the PDADMAC layer. In experiments with the use of a times higher concentration of PDADMAC C2 for coating a silver nanofilm, during the immobilization of IgG-FITC (500 ng per well), an increase in signal intensity by a factor of 3.0 was recorded compared to the fluorescence of IgG-FITC immobilized on the PDADMAC layer.

Coating the surface of nanostructured silver films with a layer of cationic polyelectrolyte PDADMAC leads to an increase in the fluorescence intensity of immobilized IgG-FITC from 1.5 to 3 times as compared to the fluorescence intensity of IgG-FITC immobilized on the PDADMAC layer. The recorded effect is dose-dependent – the higher the used concentration of PDADMAC, the greater the signal intensity.

BIBLIOGRAPHY

1. Высокочувствительный иммунофлуоресцентный анализ простат-специфического антигена с использованием наночастиц серебра / И. В. Коктыш, Я. И. Мельникова, О. С. Кулакович, А. А. Романенко, С. В. Ващенкос, А. О. Муравицкая, С. В. Гапоненко, С. А. Маскевич // Журнал прикладной спектроскопии. – 2020. – Т.87, № 5. – С. 796–803.

ASSESSMENT OF BIOLOGICAL PROPERTIES OF SPECIES Achillea L. PERSPECTIVE FOR THE PRODUCTION OF DERMATOLOGICAL AND COSMETOLOGICAL PREPARATIONS

A. Kolos

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
smovzh_al@mail.ru

On the basis of literature sources, the prospects of using representatives of the species Achillea L. for obtaining medicinal products in the field of dermatology and cosmetology have been analyzed.

Keywords: milfoil, *Achillea* L., *A. millefolium* L., biological properties *Achillea* L., antioxidant activity *Achillea* L., dermatological properties *Achillea* L.

Extracts and infusions of leaves of certain species of yarrow have been used for a number of years in both domestic and foreign medicine and cosmetology. [1–4]. However, studies covering the spectrum of action of various types are fragmentary and not exhaustive.

Currently only *A. millefolium* L. and *A. Asiatica* Ohwi. – are used as active ingredients in cosmetics. Analysis of the material presented in table 1 showed the species of the genus *Achillea*, which have not found wide application in medicine and cosmetology, but have a high potential for application in this area. So, only one type has a calming, anti-inflammatory and rejuvenating effect on the skin, while it has an effect on the healing of wounds of 7 types. They have a disinfecting effect of 4 types, antioxidant properties and a lightening effect on the skin of 7 types.

Table 1

Biological properties of species *Achillea* L.

Properties	View *Achillea* L.	Literary source
Soothing and anti-inflammatory effect on the skin	*A. millefolium* L.	[5–8]
Healing wounds	*A. asiatica* Ohwi., *A. biebersteinii* Kotschy., *A. coarctata* Brebisson ex W.Smith, *A. kellalensis* Boiss. Et Hausskn., *A. kotschyi* Boiss., *A. lycaonica* Boiss. & Heldr., *A. millefolium* L.	[5], [9–13]
Skin rejuvenation	Achillea millefolium L.	[14]
Disinfectant effect against *P. aeruginosa* Migula, *S. aureus* Rosenbach и *Candida spp.* C.P. Robin	*A. ageratum* L., *A. biebersteinii* Kotschy., *A. millefolium* L., *A. teretifolia* Willd.	[15–16]
Antioxidant properties	*A. alpine* L., *A. biebersteinii* Kotschy., *A. kotshyi* Boiss., *A. millefolium* L., *A. monocephala* Boiss. & Balansa, *A. phrygia* Boiss. & Balansa, *A. teretifolia* Willd.	[12], [16–18]
Brightening effect on the skin	*A. alpine* L., *A. biebersteinii* Kotschy., *A. coarctata* Brebisson ex W.Smith, *A. millefolium* L., *A. monocephala* Boiss. & Balansa, *A. phrygia* Boiss. & Balansa, *A. teretifolia* Willd.	[12], [16–20],

Thus, in the presented work, on the basis of an extensive analysis of foreign literary sources, the prospects for the use in cosmetology and medicine of a number of yarrow species that have not found wide application at the present time are shown.

BIBLIOGRAPHY

1. *Tadić V.,* I. Arsić, J. Zvezdanović, D. Cvetković, S. Pavkov, and A. Zugić, "The estimation of the traditionally used yarrow (Achillea millefolium L. Asteraceae) oil extracts with anti-inflamatory potential in topical application," Journal of Ethnopharmacology, vol. 199, pp. 138–148, 2017

2. *Agar O. T.*, M., "Comparative studies on phenolic composition, antioxidant, wound healing and cytotoxic activities of 12 Oxidative Medicine and Cellular Longevity selected Achillea L. species growing in Turkey," Molecules, vol. 20, no. 10, pp. 17976–18000, 2015

3. *Zengin G.*, "Shedding light on the biological and chemical fingerprints of three Achillea species (A. biebersteinii, A. millefolium and A. teretifolia)," Food & Function, vol. 8, no. 3, pp. 1152–1165, 2017.

NEUROPROTECTIVE EFFECTS OF METABOLIC ACTIVATED MITOPHAGY FOR THE PATIENT'S WITH HEREDITARY FORMS OF PARKINSON'S DISEASE

Nafisa R. Komilova[1], **Zukhra Ya. Kuchkarova**[2], **Ulugbek Z. Mirkhodjaev**

[1]*Department of biophysics, National University of Uzbekistan*

Tashkent, Uzbekistan

[2]*Technical college named after Abu Ali Ibn Sino*

Tashkent, Uzbekistan

Parkinson's disease (PD) is a progressive neurodegenerative disorder induced by the loss of dopaminergic neurons in midbrain. The mechanism of neurodegeneration is associated with aggregation of misfolded proteins, oxidative stress, and mitochondrial dysfunction. As mitochondria are essential organelles that regulate cellular energy metabolism and cell death, mitochondrial homeostasis has been linked to many pathophysiological conditions and diseases. Some familial forms of Parkinson's disease are provoked by mutations in SNCA, Pink1 or Pink1/Park2 double mutations which can result defects in mitophagy.

Short-time acidification of the cytosol can activate mitophagy and autophagy. We used sodium pyruvate and sodium lactate to induce changes in intracellular pH in human fibroblasts with PD mutations (Pink1, Pink1/Park2, a-synuclein triplication, A53T). We have found that both lactate and pyruvate in millimolar concentrations can induce a short- time acidification of the cytosol in these cells. This induced activation of mitophagy and autophagy in control and PD fibroblasts and protected against cell death.

As a result of the research work, the following conclusions were made that: lactate lowers the intracellular pH in concentration dependence in cell lines with hereditary forms of Parkinson's disease; Pyruvate also lowers intracellular pH in a concentration-dependent manner in both healthy and mutated Parkinson's disease cell lines; Cell lines with phosphoglycerate kinase type 1 mutations significantly reduce intracellular pH in response to sodium pyruvate; Lactate or pyruvate activates mitophagy in both control and experimental cell lines; Lactate activates autophagy in both control and experimental lines; It has also been shown that both lactate and pyruvate reduce cell death in both control and experimental lines;

Thus, Physical exercise may contribute to the treatment of Parkinson's disease, and can play a preventive role and maintain physical fitness and health. Its practice must be spread among experts and lay people in order to demystify possible misconceptions about the capacity of a person with physical or functional limitations in performing this type of training.

BIBLIOGRAPHY

1. *Berezhnov, A. V., et al.,* Intracellular pH Modulates Autophagy and Mitophagy. J Biol Chem, 2016. 291(16): p. 8701–8.

2. *Komilova, N. R., et al.,* Metabolically induced intracellular pH changes activate mitophagy, autophagy, and cell protection in familial forms of Parkinson's disease. Febs j, 2021.

RELATION OF THE ACTIVITY OF THE COMPLEMENT SYSTEM AND THE LEVEL OF ANTICLEBSIELOUS ANTIBODIES IN ADULTS

A. Kostyuk, T. Romanovskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
anyakostyukk@yandex.by

The purpose of this work is to assess the dynamic balance of the fundamental and related elements of immunity, namely: antigen-specific antibodies and the activity of the complement system in Klebsiella infection.

Keywords: Klebsiella, acute intestinal infections, acute bronchopneumonia, passive hemagglutination reaction, 50 % hemolysis method, anticlebsiellous antibodies, complement system.

The causative agents of acute intestinal infections are various opportunistic bacteria. And one of them is a bacterium of the genus Klebsiella. In this regard, modern approaches to the prevention and treatment of hospital infections caused by Klebsiella bacteria have been studied, as well as the use of healing technologies that reduce the incidence of disease [1].

The object of the study is 15 people with a diagnosis of acute respiratory infections (8 men, 7 women) and 26 people with a diagnosis of acute bronchopneumonia (16 men, 10 women) at the age of 18–68 years. The material for the study is the blood serum of persons with acute intestinal infection and acute bronchopneumonia with confirmed bacteriologically isolated K.pneumoniae. The method for studying the titers of antiklebellia antibodies was the reaction of passive hemagglutination, the function of the functional activity of the complement system – the method of 50 % hemolysis.

An analysis of the results obtained for the detection of anticlebsiellous antibodies in the blood of persons with acute intestinal infection and acute bronchopneumonia is shown in Table 1:

Table 1

Detection of anticlebsiellous antibodies in the blood of persons with acute intestinal infection and acute bronchopneumonia

Antibody titers	Number of persons with a given antibody titer by diseases					
	1. Acute intestinal infection			2. Acute bronchopneumonia		
	Total	Men	Women	Total	Men	Women
1 : 16	3	1	2	12	4	8
1 : 32	3	1	2	2	2	0
1 : 64	3	3	0	7	4	3
1 : 128	3	1	2	4	2	2
1 : 256	1	1	0	0	0	0
1 : 512	2	1	1	1	1	0

As can be seen from the data presented, the titers of antibodies to Klebsiella in the groups of examined individuals varied from 1:16 to 1:512. This observation means differences in the strength of the immune response in different individuals with Klebsiella infection.

It can be noted that when comparing the two groups, low antibody titers (1:16) were more observed in acute bronchopneumonia (men – 15.4 %, 30.8 % – women) than in the group with acute intestinal infection (men – 6.67 %, women – 13.34 %). And high titers of antibodies (1:512) were more common in AII (men – 6.67 %, women – 6.67 %), with bronchopneumonia - to a lesser extent (men – 3.38 %, women – 0 %).

As a result of the study of the differences in the levels of anticlebsiellous antibodies in AII and acute bronchopneumonia and the functional activity of the complement system between the same groups of diseases, a statistical analysis was carried out, which indicates that no statistically significant differences were found.

Thus, the conducted study allows us to conclude that the level of activity of the humoral immune response of complement in persons with AII and acute bronchopneumonia of Klebsiella etiology is different and the localization of Klebsiella infection is not reflected in the indicators of antibody titer and activity of the complement system.

BIBLIOGRAPHY

1. *Беляева, Т.* Инфекционные болезни / Т. Беляева, Е. Шувалова, Е. Белозеров, Е. Змушко // СпецЛит. – Санкт-Петербург, 2015. – С. 53–59.

ANTIBIOTIC RESISTANCE IN LACTOBACILLUS, BIFIDOBACTERIUM AND BACILLUS

K. Kot

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
kkotkarolina@gmail.com

In the course of the study, an analysis of the antibiotic sensitivity of probiotic strains of lactic acid bacteria was carried out. For the analysis, broad spectrum antibiotics and probiotic preparations containing various bacterial cultures were selected.

Keywords: probiotics, microorganisms, lactobacilli, bifidobacteria, bacilli, antibiotics, strains, sensitivity, research.

Today, antibiotics are the most common treatment. However, antibiotic treatment in some cases violates the resistance to colonization of the gastrointestinal flora. This can lead to a number of unpleasant symptoms, primarily diarrhea. In most cases, doctors neglect the recommendations for taking probiotics while the patient is using antibiotics, which can lead to a violation of the microbiocenosis [1].

A study was carried out of the antibiotic resistance of probiotic strains of lactic acid bacteria Lactobacterium spp., Bifidobacterium spp., Bacillus to the action of broad-spectrum antibiotics: penicillins (ampicillin, carbenicillin, amoxicillin), tetracyclines (doxycolyclin, tetracycline), macrolides (erythromycin), aminoglycosides (streptomycin), nitrofurans (furazolidone).

Based on the results obtained, it can be said that the bacteria of the genus Lactobacillus, which are part of the drug "Dialact", in general, were sensitive to the action of antibiotics. Relatively resistant, in comparison with the other antibiotics used, Lactobacillus showed resistance to the action of amoxicillin. The bacteria were moderately resistant to the actions of ampicillin, vancomycin, streptomycin, furazolidone and tetracycline. The susceptible bacteria were carbenicillin, doxycycline and chloramphenicol.

Bifidobacterium, which are part of the preparation "Bifidobacterin dry", showed antibiotic resistance to the action of ampicillin, amoxicillin and streptomycin. Antibiotic resistance was also shown to the action of carbenicillin. Moderate resistance was found to vancomycin, erythromycin and furazolidone. Sensitivity was shown in relation to chloramphenicol, tetracycline and doxycycline.

The results of the analysis of the sensitivity of bacteria of the genus Bacillus included in the preparation "Bactisubtil" to antibiotics. We found that in a complex interaction the bacteria were resistant to the action of amoxicillin, but sensitive to the action of doxycycline. Moderately resistant to ampicillin, erythromycin, furazolidone, carbenicillin, vancomycin, chloramphenicol, streptomycin, tetracycline.

As a result of data processing and comparative analysis, it was revealed that:

- The drug "Dialact" has a moderate sensitivity to antibiotics;
- The preparation "Bifidobacterin dry" proved to be antibiotic-resistant;
- The drug "Bactisubtil" is resistant to the action of the antibiotic ampicillin.

Analyzing the results, we can say that the studied cultures are sensitive mainly to doxycycline, chloramphenicol and streptomycin.

BIBLIOGRAPHY

1. Engelbrektson, A. Analysis of treatment effects on the microbial ecology of the human intestine / A. Engelbrektson, A. [et al.] // FEMS Microbiol. Ecol. – 2006. V. 57. – P. 239–250.

ANALYSIS OF THE INCIDENCE OF ALCOHOLISM AND ALCOHOLIC PSYCHOSES IN THE REPUBLIC OF BELARUS

E. Kozlova, N. Gerasimovich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
lizakozlova782@gmail.com

The paper provides a comparative analysis and study of the dynamics of the incidence of alcoholism and alcoholic psychosis in the population of the Republic of Belarus for the period 2000–2019. It is shown that the highest levels of morbidity for the analyzed period from 2000 to 2019 are observed in the Grodno region. The

leading position was held by the Minsk region during 2009–2015. The lowest indicator of the average long-term incidence of alcoholism was registered in Minsk over the past period. During 2009–2019, a pronounced trend towards a decrease in the incidence of alcoholism and alcoholic psychosis was revealed throughout the territory of the Republic of Belarus. The most intense decline is observed in the most unfavorable Grodno region in terms of morbidity levels.

Keywords: withdrawal symptoms, alcoholism, alcohol psychosis, alcohol policy.

Alcoholism is a serious chronic disease that can progress. It is expressed by an unhealthy attraction to alcoholic beverages and harmfulprocesses in the human body. At the same time, there are irrevocable pathological changesия in various spheres of human life: social, spiritual, etc. This is a disease that develops very quickly, goes through several stages and stages, during which there is an appearance or increase in a person's dependence on alcohol, as well as an increase in the number of disorders of the functions of tissues, organs and the entire body as a whole [2].

The high rate of alcohol-related deaths is based on diseases caused by excessive alcohol consumption. It is primarily associated with diseases of organs and organ systems (cardiovascular, digestive, nervous, etc.). In addition, alcohol can cause a number of "own" diseases: alcoholic cirrhosis of the liver, alcoholic cardiomyopathy, alcoholic psychosis, alcoholic personality degradation, and so on [3].

Based on the above, the paper analyzes стastatistical данных data on morbidity and mortality from alcoholism and alcoholic psychosis of the population in the Republic of Belarus, taken from officialstatistical documents.

The paper provides a comparativeвнительный analysis and study of the dynamics of the incidence of alcoholism and alcoholic psychosis in the population of the Republic of Belarus for the period 2000-2019.

It is shown that the highest levels of morbidity for the analyzed period from 2000 to 2019 are observed in the Grodno region. The leading position was held by the Minsk region during 2009-2015. The lowest indicator of the average long-term incidence of alcoholism was registered in Minsk over the past period. In general, in the Republic of Belarus, there is a pronounced tendency to reduce the incidence of alcoholism and alcoholic psychosis in the population of the Republic of Belarus. The dynamics of the number of newly established diagnoses of alcoholism and alcoholic psychosis in the regions and the city of Minsk on average corresponded to the national one. The most intense decline is observed in the most unfavorable Grodno region in terms of morbidity levels.

The social consequences of alcoholism are also very extensive and have a devastating impact on many aspects of society in all countries of the world. These effects are manifested in the decrease in the level of health of the population, increased morbidity, premature death, increased temporary incapacity, the death of a person as individual, family breakdown, neglect of children, in particular, leads to their early initiation to alcohol – drinking among young people, especially among young women is of particular concern in modern society [1].

Currently, a system of various factors (legal, economic, physical) has been created that affect the availability of alcohol to an individual – the so-called alcohol policy, aimed at reducing the level of alcohol-related problems.

Thus, all the above-mentioned negative consequences of alcohol in relation not only to the drinker himself, but also to other people interacting with him, are a strong argument in favor of the relevance of this topic, as well as its study aimed at reducing the harm caused by alcohol.

BIBLIOGRAPHY

1. *Razvodovsky Yu. E.* Mediko-sotsial'nye aspekty alcoholizma [Medical and social aspects of alcoholism].RazvodovskyY.-Gr.: Grodno, 2005. – 128 p..

2. *Ulanov, V.* Alcoholism / V. Ulanov – Moscow: Litagent StrelbitskyPubl., 2018, 320 p.

3. *Entin, G.* Treatment of alcoholism.Entin, Moscow: Meditsina Publ., 1990, 416 p.

THE EFFECT OF VITAMIN D ON THE DEVELOPMENT OF TYPE 2 DIABETES MELLITUS

D. Kozlovich, N. Bogdanova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
kozlovich.darya01@mail.ru, tasha.bo@mail.ru

The aim of this work is to study the effect of vitamin D on the development of diabetes mellitus.

Keywords: vitamin D, diabetes mellitus, insulin, pancreatic β-cells.

The incidence of type 2 diabetes mellitus (type 2 DM) is increasing at an alarming rate worldwide. Defects in pancreatic β-cell function, insulin sensitivity, and systemic inflammation all contribute to the development of type 2 diabetes. Vitamin D has in vitro and in vivo effects on pancreatic β-cells and insulin sensitivity. Biological functions of vitamin D – is a regulator of bone and mineral metabolism homeostasis and has a nonskeletal effect because vitamin D receptors are found in various tissues, including brain, breast, pancreas, prostate, colon and immune cells. Vitamin D may play an important role in altering the risk of cardiometabolic outcomes, including diabetes mellitus [1].

Vitamin D deficiency plays an important role in insulin resistance leading to diabetes. The potential role of vitamin D deficiency in insulin resistance has been linked to inherited gene polymorphisms, including vitamin D binding protein, the vitamin D receptor, and the vitamin D alpha-hydroxylase 1 gene. Other roles have been suggested, including immunoregulatory function through activation of innate and adaptive immunity and cytokine release, activation of inflammation through upregulation of nuclear factor kB and induction of tumor necrosis factor α, and other molecular actions to maintain glucose homeostasis and mediate insulin sensitivity through low calcium status, obesity, or increased serum parathyroid hormone levels. All these effects of vitamin D deficiency, acting in concert or separately, contribute to increased insulin resistance [1].

Several studies have shown an association between vitamin D status and the risk of developing diabetes or glucose intolerance. It has been suggested that vitamin D plays an important role and is a risk factor in the development of insulin resistance and the pathogenesis of type 2 DM by affecting either insulin sensitivity, β-cell function, or both [2]. The prevalence of hypovitaminosis D was found to be higher in diabetic patients than in controls in one study. A growing body of evidence shows that vitamin D levels are also lower in patients with type 1 diabetes, especially during the developmental stage of the disease [3].

Calcitriol (1,25(OH)2D) plays an important role in glucose homeostasis through various mechanisms. Not only does it improve the sensitivity of target cells to insulin, it also enhances and improves the function of β-cells. In addition, calcitriol protects β-cells from harmful immune attacks by directly affecting β-cells and indirectly affecting various immune cells, including inflammatory macrophages, dendritic cells, and T cells [1].

Vitamin D is not only a regulator of bone and mineral metabolism but also a potent immunomodulator associated with many major human diseases, including glucose homeostasis and insulin resistance. Vitamin D deficiency has been shown to affect insulin secretion in both human and animal models. In conclusion, vitamin D is beneficial for improving pancreatic β-cell function, reducing insulin resistance, and has anti-inflammatory effects. Also, vitamin D can have a positive effect on insulin action, either directly by increasing insulin sensitivity to glucose transport or indirectly through its role in regulating extracellular calcium, since calcium is required for insulin-mediated intracellular processes in insulin-sensitive tissues. Vitamin D can improve insulin sensitivity and promote β-cell survival by directly modulating cytokine production and action. Vitamin D supplementation can provide appropriate treatment and help reduce insulin resistance.

BIBLIOGRAPHY

1. *Sung, CC.* Role of vitamin D in insulin resistance. / CC Sung, MT Liao // *JBiomedBiotechnol.* – 2012.

2. *Chiu, KC.* Hypovitaminosis D is associated with insulin resistance and *β* cell dysfunction. / Chiu KC, Chu A, Go VLW, Saad MF // *The American Journal of Clinical Nutrition.* – 2004.

3. *Borkar, VV.* Low levels of vitamin D in North Indian children with newly diagnosed type 1 diabetes. / Borkar VV, Devidayal VS, Bhalla AK // *Pediatric Diabetes.* – 2010.

ECOLOGICAL AND SOCIAL FACTORS AS A CAUSE OF MULTIPLE SCLEROSIS DEVELOPMENT

A. Kozorez, E. Akshevskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
kozorez.aleksa@yandex.by

In the modern world, among the variety of various serious diseases is multiple sclerosis. In this work, environmental factors are indicated, which are the main causes of this disorder in the body.

Key words: multiple sclerosis, external factors, environment, etiology.

It has been established that multiple sclerosis (MS), like a number of other diseases, has a complex etiology, which includes not only genetic aspects, but also environmental factors. Currently, more and more scientists are inclined to believe that the environment has a more significant role than genetics.

According to the WHO, there are conventionally identified 3 factors that affect the development of MS:

1.the latitude of the territory, exposure to solar radiation (UVR) and the content of vitamin D in the body (odds ratio (OR) ≈ 20);

2. the time of previous infection with the Epstein-Barr virus (EBV) and the adaptive immune response to EBV (OR = 12.5);

3. smoking (OR = 1.4) [1].

The latitude of the area can be an obvious example of how the environment affects the risk of MS. Its gradient is now well known as a true geoepidemiological association of MS, with the spread of MS increasing from very low levels near the equator, amounting to 5-10 pathologies per 100,000 inhabitants, to 200 diseases per 100,000 population at 60° of northern latitude, i.e. 20 times. A similar gradient was established for the first episodes of demyelination of the central nervous system. A logical explanation for the gradient could be a decrease in UVR exposure and a subsequent decrease in vitamin D levels, especially in winter.

Studies show that people with MS are more likely to be EBV seropositive (≥ 99 %) than healthy controls (85–95 %), suggesting that prior EBV infection may be a prerequisite for the disease process [1].

The timing of EBV infection also plays an important role in the onset of MS. Early EBV infections, although associated with an increased risk of MS, are not as strongly associated as late EBV infections, especially those associated with clinical infectious mononucleosis. The most consistent serologic evidence of EBV in relation to an increased risk of MS is an increase in antibodies to the Epstein-Barr nuclear antigen complex (EBNA), especially in anti-EBNA-1 antibody titers. In a recent meta-analysis (n = 30 studies), the pooled OR for MS risk versus anti-EBNA-1 IgG, OR = 12.1 (95% CI 3.1–46.9) [3].

Smoking and personal UV exposure are also recognized environmental factors that significantly increase the risk of developing multiple sclerosis. Vitamin D deficiency is important in the onset of the disease and is now well known as another aspect for the development of this disease [2,4].

Thus, the presented evidence provides grounds for the assertion that the external environment is more important as the cause of the onset of multiple sclerosis. Environmental conditions account for over 75% of the risk of disease. Although genetic factors are also important and are of significant importance in the development of pathology in persons who have not been exposed to these aspects of the external environment, they are by no means the main cause of the occurrence of this type of disease in the vast majority of cases.

BIBLIOGRAPHY

1. *Ascherio, A, Munger, KL*. Environmental risk factors for multiple sclerosis. Part I: the role of infection. Ann Neurol 2007; 61: 288–299.

2. *Ascherio, A, Munger, KL*. Environmental risk factors for multiple sclerosis. Part II: Noninfectious factors. Ann Neurol 2007; 61: 504–513.

3. *Goldacre, MJ, Wotton, CJ, Seagroatt, V, Yeates, D.* Multiple sclerosis after infectious mononucleosis: record linkage study. J Epidemiol Community Health 2004; 58: 1032–1035.

4. *Pittas, F, Ponsonby, AL, van der Mei, IA.* Smoking is associated with progressive disease course and increased progression in clinical disability in a prospective cohort of people with multiple sclerosis. J Neurol 2009; 256: 577–585.

PROGNOSTIC SIGNIFICANCE OF INTEGRAL INDICATORS OF CELLULAR REACTIVITY OF HOMEOSTASIS IN CORONAVIRUS INFECTION COVID-19

E. Kozyreva[1], **R. Smolyakova**[2], **N. Khokhlova**[2], **I. Antashkevich**[2], **E. Shpadaruk**[1]

[1] *Belarusian State University, ISEI BSU*

Minsk, Republic of Belarus

[2]*Republican Clinical Hospital of invalids of the Great Patriotic War named after P. M. Masherov*

smol60@mail.ru

The study of integral indicators of cellular reactivity of homeostasis was performed in the dynamics of therapy on the 1st – 10th day in 200 patients with diagnosed coronavirus infection. Prognostically significant parameters that allow clinically objective assessment of the condition of patients with coronavirus infection in the dynamics of therapy are ILSE, LII, ISNL, ISNM, ISM.

Keywords: integral indicators of cellular reactivity of homeostasis, favorable and unfavorable prognosis, "neutrophil explosion".

The COVID-19 pandemic has gone down in history as an emergency of international significance [1]. Coronavirus infection is an acute viral disease with a predominant lesion of the upper respiratory tract caused by an RNA genomic virus of the genus Betacoronavirus of the family Coronaviridae. The effect of the virus causes an increase in the permeability of cell membranes and increased transport of albumin-rich fluid into the interstitial lung tissue and the lumen of the alveoli. At the same time , it is destroyed surfactant, which leads to the collapse of the alveoli, as a result of a sharp violation of gas exchange, acute respiratory distress syndrome develops. The immunosuppressive state of patients contributes to the development of opportunistic bacterial and mycotic infections of the respiratory tract and the development of systemic inflammatory response syndrome in some cases with an unfavorable prognosis [2].

The material of this study was clinical, laboratory and diagnostic data of 200 patients with coronavirus infection in the dynamics of treatment on the 1st-10th day, who were in the intensive care and intensive care unit of the State Institution "Republican Clinical Hospital for the Disabled of the Great Patriotic War named after P.M.Masherov". Patients with coronavirus infection were divided into two groups: group 1 consisted of patients with a favorable prognosis, with an unfavorable prognosis – group 2. The control group is represented by clinically healthy individuals without pathology at the time of examination. Hemogram determination in patients with COVID-19 was performed on an automatic hematology analyzer 5-diff XN-350 (Sysmex, Japan) using reagents and control materials from the manufacturer (Sysmex Corporation, Japan). Integral hematological indicators of cellular reactivity of the organism were calculated according to the obtained values of the hemogram: the index of the ratio of leukocytes and erythrocyte sedimentation rate (ILSE), the leukocyte intoxication index according to Kalf-Kalif (LII), the index of the ratio of neutrophils and monocytes (ISNM), the index of the ratio of lymphocytes and monocytes (ISM), the index of the ratio of neutrophils and lymphocytes (ISNL) [3]. Statistical processing of the results of the study was carried out using the software SPSS (version 21, USA), STATISTICA (version 10, USA) with verification of the normality of the distribution of quantitative indicators in the sample using the Shapiro-Wilk criterion.

The results of the performed studies showed that the development and progression of the inflammatory reaction was characterized by an increase in the level of the integral parameter of ILSE on day 1 in patients of group 1 (1.44±0.08 units) by 3.4 times, in patients of group 2 (3.43±0.13 units) by 8.2 times compared to that in the control group (0.42±0.003 units) (p0,05). A comparative analysis of the performed studies showed a pronounced anti-inflammatory response of the body in patients with coronavirus infection on the 10th day of treatment in the group with a favorable prognosis of up to 152 %, an unfavorable prognosis – up to 164 % in relation to the values of the ILSE index on the 1st day, respectively (p0,05). The development of the systemic inflammatory response syndrome in patients with coronavirus infection was characterized by an increase in the LII parameter on the 1st day with a favorable prognosis (5.41±0.008 units) by 5.4 times, an unfavorable prognosis (13.65±0.007) – by 13.6 times compared with the value of the indicator in the control (1.003±0.006 units) (p0.05). In patients with a favorable prognosis, a decrease in the studied LII parameter by 25.7 % on the 10th day compared to the 1st day of observation was noted. In patients with COVID-19 with an unfavorable prognosis, the syndrome of a systemic inflammatory response with the development of severe destructive processes in organs and tissues was accompanied by an increase in the LII index from 5,415.41±0.008 units on the 1st day to 33.19±.23 units on the 10th day of observation.

The development of SARS-CoV-2 viral infection with the addition of a bacterial component is associated with a deepening of the dysfunction of the body's immune system. In patients of the 1st group, the level of the ISNL parameter was increased by 3.3 times, in the 2nd group of patients – by 8.2 times in relation to the control (2.67±0.06 units) (p0.05). The predominance in the hemogram of cellular elements of nonspecific protection over specialized immune defense cells in severe coronavirus infection was accompanied by the development of a "neutrophil explosion" with an increase in the ISNL index in patients with an unfavorable prognosis up to 924 % on the 7th day of observation compared with that in the control. In patients with a favorable prognosis on the 10th day, there was a tendency to decrease the values of the studied parameter to 8.74± 0.35 cont. relative to that on the 1st day of observation (p>0.05). Activation of micro - and macrophage protection system in these patients showed elevated values ISNV in the 1st group, 46 %, with a poor prognosis for up to 245 % compared with that in control (11,83±1,58 CONV.ed.) (P0,05).

Thus, the integral reactivity parameters of cellular homeostasis allow to predict the development of systemic inflammatory response and "neutrophilic Bang" and the disease outcome in acute coronavirus infection.

BIBLIOGRAPHY

1. WHO. Novel coronavirus – Thailand (ex-China). Jan 14, 2020. http://www.who.int/csr/don/14-january-2020-novel-coronavirusthailand/en/ (accessed Jan 19, 2020).

2. *Chen Yu*, *Qianyun Liu*, *Guo Deyin*. Emerging coronaviruses: genome structure, replication, and pathogenesis [published online ahead of print, 2020 Jan 22]. ***J Med Virol.*** 2020. Vol. 92 (4). P. 418–423.

3. *Смолякова РМ.* Клеточные тесты реактивности и показатели интоксикации в оценке гнойно-воспалительных осложнений у онкологических больных. Мед. панорама. 2004. № 5. С. 11–14.

ANTIOXIDANT PROPERTIES OF NATIVE, DEFATTED, FERMENTED AND HYDROLYZED BOVINE COLOSTRUM

P. Krasovskaya[1], **E. Tarun**[1], **E. Staselovich**[2], **T. Halavach**[2], **R. Romanovich**[2]

[1]*Belarusian State University, ISEI BSU*
Minsk, Republic of Belarus
[2]*Belarusian State University,*
Minsk, Republic of Belarus

The comparative study of the antioxidant activity of extracts of native, defatted and fermented colostrum, as well as ultrafiltrate defatted colostrum, hydrolyzed native and defatted colostrum and fermented defatted colostrum. The dependences of the fluorescence intensity of fluorescein on the logarithm of the concentration of all colostrum samples are obtained. Colostrum samples restored fluorescence of fluorescein to 66–93 % at a sample concentration of 0.23–1.0 mg/ml. IC_{50} values were in the range of 6.2–155.1 μg/ml.

Keywords: antioxidant activity, native colostrum, defatted colostrum, fermented colostrum, hydrolyzed colostrum, fluorescein.

Dry native and low-fat colostrum, dry fermented low-fat colostrum were used in the work. Colostrum hydrolysate ultrafiltrate was obtained using the proteolytic enzyme alkalase.

10 % solutions of skimmed and fermented primary milk were prepared in distilled water, centrifuged to precipitate insoluble particles for 30 min. Ultrafiltrates of hydrolyzed and fermented colostrum are represented by a fraction with a molecular weight of up to 10 kDa.

Fluorescence measurements were carried out on a fluorimeter. the fluorescence intensity was recorded at a wavelength of 514 nm. The excitation wavelength is 490 nm.

Minimal antioxidant activity was obtained for a sample of low-fat colostrum. Fluorescence of fluorescein is restored to 66 % at a high concentration of 0.66 mg/ml. The Amax index of native colostrum is 75 %, the Amax index of fermented low-fat colostrum is 78 %.

A sample of low-fat colostrum ultrafiltrate restores fluorescence of fluorescein to 76 % at a concentration of 0.36 mg/ml, a sample of fermented colostrum ultrafiltrate restores fluorescence of fluorescein to 85 % at a concentration of 0.34 mg/ml.

A sample of ultrafiltrate hydrolysate of low-fat colostrum restores fluorescence of fluorescein to 93 % at a concentration of 1 mg/ml, a sample of ultrafiltrate hydrolysate of native colostrum – up to 82 % at a concentration of 0.227 mg/ml. At the same concentration, the hydrolysate of low-fat colostrum restores the fluorescence of fluorescein only to 70 %.

The ultrafiltrate of fermented low-fat colostrum restores fluorescence of fluorescein to 85 %. Hydrolysis of colostrum using the proteolytic enzyme alkalase also leads to an increase in antioxidant activity. Ultrafiltrate of low-fat colostrum hydrolysate restores fluorescence of fluorescein to 93 % at a concentration of 1 mg/ml.

Thus, an increase in antioxidant activity is shown due to fermentation and hydrolysis of colostrum due to enrichment with a low-molecular fraction. Ultrafiltration leads to an even more significant increase in antioxidant activity. The Amax values of ultrafiltrate samples increase by 7–10 %. Samples of native colostrum show higher antioxidant activity compared to samples of low-fat colostrum. The Amax values of samples of native colostrum and ultrafiltrate of native colostrum hydrolysate are 9–11 % higher than samples of low-fat colostrum and ultrafiltrate of low-fat colostrum hydrolysate. Hydrolysis of colostrum by the enzyme alkalase results in a lower molecular fraction of protein than during fermentation using acidophilus bacillus.

BIBLIOGRAPHY

1. *Тарун Е. И.* Антиоксидантная активность гексагидрохинолонов / Е. И. Тарун, А. В. Данькова, А. Н. Пырко // Журнал Белорусского государственного университета. Экология. – 2019. – № 2. – С. 77–83.

ANALYSIS OF THE CELLULAR COMPOSITION OF PERIPHERAL BLOOD OF PATIENTS WITH STROKE

A. Krishtopenko, E. Shpadaruk, R. Smolyakova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
emmat.g.k@icloud.com

In this study, data on the cellular composition of peripheral blood were analyzed in 16 stroke patients. According to our data, diagnostically significant indicators of blood are: leukocytes, neutrophils, lymphocytes, monocytes, basophils and immunoglobulins.

Keywords: peripheral blood indicators, leukocytes, neutrophils, lymphocytes, monocytes, basophils and immunoglobulins.

Stroke is a severe pathological process that affects a number of pathophysiological conditions, including thrombosis, hemorrhage and embolism. With age, strokes occur more often: in 50–60 years, the frequency of acute cerebral circulation disorders that have turned into a stroke is 7.4, and in 60–69 years – about 20.0 cases per 1000 population. Ischemic stroke develops in about 80 % of cases, and hemorrhagic in 20 %, respectively [1-2].

Cases ending in death and profound disability in stroke patients largely depend on the timely start of treatment. So, at the beginning of stroke treatment in the first 3 hours, the damage zone can decrease by 70–90 %, when treating a patient in the acute period in a hospital, deaths from stroke – 24 %, at home – 43 %. Stroke ranks second among the causes of death (after cardiovascular diseases) [3].

The object of the study was clinical data on 16 patients suffering from stroke. The analysis of hematological indicators of peripheral blood was carried out: leukocytes, erythrocytes, hemoglobin, hematocrit, average volume of one erythrocyte (MCV), average hemoglobin in erythrocytes (MCH), average hemoglobin concentration in erythrocyte mass (MCHC), platelets, relative width of distribution of erythrocytes by volume (RDW-SD), difference of erythrocytes in size (RDW-CV), platelet distribution index (PDW), average platelet volume (MPV), coefficient of large volume of plates platelets (P-LCR), thrombocrit, nucleus-containing erythrocytes (NRBC), neutrophils, lymphocytes, monocytes, eosinophils, basophils, immunoglobulins. The hematological study was carried out on the Hemacomp 10 analyzer (Italy). Statistical analysis of the obtained results was performed using computer packages of statistical programs STATISTICA (version 13.3, "StatSoft", USA), EXCEL 2013. The study included 16 stroke patients aged 30–70 years.

A detailed assessment of the data found that the total white blood cell count was 7.29x109/L [CI 5.57; 10.44]. In 31.25 % of patients, leukocytosis was detected (the norm is 4.0–9.0x109 / l). Total number of red blood cells 4.55x1012/L [CI 4.24; 5.12]. In 25 % of patients, erythrocytosis was detected (the norm is 3.7–5.1 x1012 / l). Individual analysis of the data showed that the total amount of hemoglobin was 142 g/L [CI 139; 153.5]. In 12.5%, the level of hemoglobin is elevated (the norm is 120–160 g/L). Hematocrit score found a relative score of 41.95% [CI 40.5; 45.55]. McV was 90.1fL [CI 87.15; 94.05]. In 12.5% of those observed, this index is increased (the norm is 78-98 fL). The study showed that the MCH was 30.5 pg [CI 29.55; 32.6]. The MCHC was 341.5 g/L [CI 331.5; 349.5]. Total platelet count 189.5x109/L [CI 171.5; 226]. Thrombocytopenia was detected in 12.5 % of patients (norm 150-400 × 109 / l). Obtained RDW-SD 43.7 fL [CI 42.2; 46.85]. RDW-CV was 13.25 % [CI 12.9; 13.95]. PDW was 13.75 fL [CI 12.8; 16.15]. In 6.25 % of patients, the above indicator is elevated (the norm is 9.0–17.0 fL). Detailed analysis of the data allowed to establish the total number of MPV 11.25 fL [10.65; 11.7]. In 12.5 % of the observed patients, this indicator is elevated (the norm is 9.0-13.0 fL). P-LCR was 34.25 % [CI 30.35 to 39.1]. In 25 % of patients, the index exceeds the norm (the norm is 13.0–43.0 %). Platelet volume proportion of total blood volume (thrombocrit) was 0.21% [CI 0.19; 0.24]. Reduced thrombocrit was detected in 12.5 % of the study. Nucleus-containing red blood cells are not normally contained in the peripheral blood of an adult, but in 12.5 % of patients they were detected. Neutrophils were 67.5 % [CI 57.65; 77.7]. Neutrophilia was found in 25 % (the norm is 40.2–71.1 %). Relative lymphocyte count was 23.8 % [CI 14.15; 28.05]. In 43.5 % of patients, lymphopenia was detected (the norm is 21.9–48.5 %). Monocyte count was 8.75 % [CI 6.65; 10.3]. Monocytosis was detected in 31.25 % (the norm is 4.4–10 %). Eosinophils were 0.6 % [CI 0.05;2.15]. Eosinoponenia was found in 43.75 % of patients (norm 0.6–5.2 %). Relative basophils were 0.2 % [CI 0.05; 2.15]. In 37.5 % of patients, basophilopenia was detected (the norm is 0.2–1.4 %). Immunoglobulin content is 0.65 % [CI 0.35; 1.75]. 50 % have an increased content of immunoglobulins (the norm is 0.2–0.6 %).

Thus, according to preliminary data, it can be concluded that in patients with stroke, the most significant change in the content of the following blood elements was revealed: leukocytes, neutrophils, lymphocytes, mon-

ocytes, basophils and immunoglobulins. Evaluation of these indicators is important for the identification and treatment of patients with stroke.

BIBLIOGRAPHY

1. *Гусев Е. И.* Ишемия головного мозга / Е. И. Гусев, В. И. Скворцова. М.: Медицина, 2001. 327 с.

2. *Скворцова В. И.* Медицинская и социальная значимость проблемы инсульта // Качество жизни. Медицина. – 2004. – № 4 (7). – С. 2–6.

3. Здоровье сердечно-сосудистой системы. Инфаркт, инсульт, ИБС, ритм. Часть 2. – М.: Редакция вестника "ЗОЖ", 2014. – 256 с.

ANALYSIS OF THE MORBIDITY OF THE POPULATION OF THE REPUBLIC OF BELARUS WITH SOCIALLY SIGNIFICANT INFECTIONS (2005–2019)

L. Kurilova, N. Porada

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
kurilova_liza@list.ru

Socially significant diseases are among the most pressing problems of modern healthcare and the main threats to public health. The main feature and at the same time the key problem of socially significant diseases is the ability to spread widely [1]. Socially significant diseases cause enormous damage to society due to temporary and persistent disability, premature mortality, huge costs of prevention, treatment and rehabilitation.

Keywords: morbidity, dynamics, trend, socially significant infections, hepatitis, HIV infection, tuberculosis, mainly sexually transmitted infections.

Among infectious diseases, hepatitis, HIV infection, tuberculosis and sexually transmitted diseases are characterized by a high incidence rate and numerous complex negative social consequences. Almost all diseases belonging to the group of socially significant infections are characterized by the rejuvenation of the age of patients, occur with various complications, require long-term, sometimes lifelong, expensive treatment [1]. This group of infections has a negative impact on the demographic situation in the republic due to a decrease in the birth rate and an increase in mortality at a young age.

The aim of the work was to conduct a retrospective analysis to determine the direction of the trend in the dynamics of morbidity [2] of the population of the Republic of Belarus with tuberculosis, hepatitis B, HIV infection and sexually transmitted infections in 2005–2019, to study the epidemiological features of these infections in the period under review.

In the dynamics of the morbidity of the population with active tuberculosis for the entire period of observation from 2005 to 2019, a steady downward trend was revealed. The incidence of the rural population was 1.8 times higher than the incidence of the urban population on average. The average annual rate of tuberculosis diseases in the urban population was 32.7 cases of diseases per 100,000 populations, rural population – 57.8 % llc. By 2019, the incidence rate in the urban population decreased by 3.2 times compared to the 2005 level, in the rural population – by 2.3 times. Epidemiological patterns of morbidity reflect the mortality rate of the population from tuberculosis infection. In 2005–2019, the death rate from tuberculosis decreased by 5.5 times. The average annual mortality rate was 7.4 cases per 100,000 populations.

A statistically significant stable tendency to decrease was revealed in the incidence of hepatitis B infection - by 5.4 times. The average annual incidence of hepatitis B in 2005–2019 was 1.7 per 100,000 populations, which is a consequence of effective mandatory immunoprophylaxis. A steady downward trend was also revealed in the incidence of infections transmitted primarily by sexual means: chlamydia by 5.4 times, gonococcal infection by 7.7 times, syphilis by 7.4 times compared to the 2005 level.

The incidence of HIV infection in the population from 2005 to 2019 had a steady statistically significant increase of 3 times in relation to the level of the initial year of the study. Cases of HIV infection were mostly detected in people of fertile age, and of all the causes of infection, heterosexual contacts and injecting drugs were the most frequent.

Of all the socially significant infections considered, tuberculosis and HIV infection remain the most common, while chlamydia and gonococcal infection are among the infections transmitted mainly by sexual means.

The differences in morbidity rates at the end of the study period in relation to the initial year of the study were statistically significant.

BIBLIOGRAPHY

1. *Аствацатуров, К. Р.* Сифилис, его диагностика и лечение / Руководство для врачей. «МЕДИЦИНА». – Москва, 1971. – 424 с.

2. *Зуев, Л.П., Яфаева, Р. Х.* «Эпидемиология». – СПб., 2006. С. 238–252.

INTRAVENOUS LASER BLOOD IRRADIATION OF DIABETES MELLITUS PATIENTS

Y. Li[1], **V. Lemiasheuski**[1,2], **K. Ostrenko**[1,2], **A. Ovcharova**[2]

[1]Belarusian state University, ISEI BSU

Minsk, Republic of Belarus

[2]All-Russian research Institute of Physiology, Biochemistry and Nutrition of animals – branch of the Federal Science Center for Animal Husbandry named after Academy Member L. K. Ernst

Borovsk, Russia

lem@iseu.by

In vivo low intensity laser irradiation effect on blood of II type diabetes mellitus patients was studied. Healthy people (n=16) without chronic disease at the age of 50.19±8.45 (I control group) and patients with II type DM (n=16) at the age of 56.86±6.84 (II group) took part in the research. It shows that intravenous laser blood irradiation leads to the normalization of glucose level in II type DM patients decreasing its concentration to 12.1 % (p=0.02), decrease in total protein to 2.98 % in healthy people (p=0.11) and 2.83 % in II type DM patients (p=0.02), correction of cholesterol level that decreases by 6.88 % in healthy people (p=0.26) and 5.72 % in II type DM patients (p=0.02). Application of 7–8 sessions of intravenous laser blood irradiation has a beneficial effect on blood indications both for healthy people and II type DM patients.

Keywords: low intensity laser irradiation, helium-neon laser, photohematotherapy, phototherapy, intravenous laser blood irradiation, diabetes mellitus.

The therapeutic application sphere of low intensity laser irradiation is constantly expanding empirically. Optic irradiation effect on blood, called photohemototherapy, is a fast progressive field in advanced medicine successfully developing in the XX century. However, despite the undoubted success, the results, obtained by various authors, are difficult to generalize due to their variety, and therapeutic result prediction is difficult because of the absence of science-based criteria for successful method application: the way of its effectiveness assessment for some patients, monitoring methods of individual susceptibility to phototherapy. The analysis of the effect result of low intensity laser irradiation on blood and oxygen-dependent processes in a patient's body is a primary practical value for photohemototherapy. It should be marked that study of the patterns of blood photo modification and its influence on metabolic processes has great practical meaning not only for II type diabetes mellitus treatment, practiced application methods and gained clinical results open up the opportunity for its use in the treatment of oxygen deficiency caused by coronavirus infection.

The research purpose is to study low intensity laser irradiation in the correction of glucose level, total protein, albumin, blood cholesterol in people being examined with II type diabetes mellitus.

The practical part of the research was carried out based on the Republican Research and Clinical Center of Neurology and Neurosurgery approved by the Ethics Committee. 32 patients took part in the research. Healthy people (n=16) without chronic diseases at the age of 50.19±8.45 were in the I group; patients with II type diabetes mellitus (n=16) at the age of 56.86±6.84 were in the II group.

Blood (V=3 ml) for research was taken twice by venipuncture method: before intravenous laser blood irradiation (between 8 and 9 o'clock) before physical activity and a provision of diagnostic procedures, after intravenous laser blood irradiation into vacutainers with EDTA. The irradiation course ranged from 7 to 8 20-minutes procedures. Laser irradiation was conducted with the help of helium-neon laser «LYUZAR-MP-K». The facility provides continuous radiation action at wavelength I=0.67±0.02 μm, output capacity at the end of the light-guide 3 mW. Blood analysis was conducted at biochemical automated analyzer Olympus AU 400 (the USA), the analyzer of glucose and lactate Biosen EKF Diagnostic (Germany).

Helium-neon laser irradiation contributes to enzymatic metabolic shifts of hemic protein and accelerated elimination of their products from the body. Energy transfer from major chromophores of the helium-neon laser along the metabolic chain increases the number of heme-containing components, and also it leads to a decrease in the permeability of erythrocyte membranes and their aggregation ability due to decrease polarization of their membranes.

It is revealed that intravenous laser blood irradiation influences carbohydrate metabolism indicators normalizing glucose level in II type diabetes mellitus, reducing its concentration by 12.1 % (p=0.02).

It is proved that protein metabolism indicators (total protein level) change under low intensity laser irradiation, it reduces total protein level by 2.98 % in healthy people (p=0.11) and by 2.83 % in II type diabetes mellitus patients (p=0.02).

It is shown that there is a possibility of cholesterol level correction under low intensity laser irradiation: it reduces by 6.88 % in healthy people (p=0.26) and by 5.72 % in II type diabetes mellitus (p=0.02).

Therefore, the application of 7-8 intravenous laser blood irradiation sessions is beneficial for blood indicators both for healthy people and II type diabetes mellitus patients. It proves the reasonableness of the application of such a procedure for the correction of carbohydrate, lipid, and protein metabolism in all groups.

Thus, there are change patterns of intensity parameters of protein and lipid metabolism under influence of helium-neon laser irradiation at wave-length 632.8 nm in II type diabetes mellitus based on physiological principles, contributing to total protein concentration reduce by 2.98 % in healthy people and by 2.83 % in II type diabetes mellitus, cholesterol reduce by 6.88 % in healthy people and by 5.72 % in II type diabetes mellitus. The possibility of glucose level correction in blood with II type diabetes mellitus is determined based on low intensity laser irradiation that helps to reduce glucose concentration level by 12.1 %.

FEATURES OF THROMBIN-INDUCED PLATELET AGGREGATION IN ARTERIAL HYPERTENSION

V. Linnik, A. Bakunovich

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
vlad.linnik00@gmail.com

The paper considers the features of thrombin-induced platelet aggregation in patients with arterial hypertension. Biochemical methods and statistical data analysis were used to study the features of thrombin-induced platelet aggregation in hypertension.

Keywords: arterial hypertension, platelets, aggregation, thrombin.

Arterial hypertension (AH) is a syndrome of increased systolic blood pressure from 140 mmHg and above, and simultaneously or independently – diastolic blood pressure ≥ 90 mmHg [1]. According to WHO, at the end of 2020, 1,13 billion people in the world have hypertension, two-fifths of people do not know about their diagnosis and only one in ten hypertensive patients receives treatment.

Platelets are red blood plates 1–2 microns in size and they perform the following functions: participation in the process of blood clotting and ensuring the integrity of blood vessels. The main physiological activators of platelets are collagen (the main protein of the extracellular matrix), thrombin (the main protein of the plasma coagulation system), ADP (adenosine diphosphate emerging from destroyed vessel cells or secreted by platelets themselves) and thromboxane A2 (a secondary activator synthesized and ejected by platelets).

Thrombin plays an important role in hemostasis, platelet activation and thrombus formation. Thrombin formation occurs as a result of activation of the blood coagulation system, in particular, in the area of vessel damage. It circulates in the bloodstream in an inactive state, in the form of prothrombin, which is converted into an active enzyme by splitting two peptide bonds in a molecule.

The object of the study was blood platelets of patients with grade 1 hypertension (5 people) and healthy volunteers (5 people). To study the aggregation ability of platelets, thrombin was used at concentrations of 0.01, 0.02 and 0.05 mg/ml, as the most powerful platelet activator. In experiments, it was found that when using thrombin at a concentration of 0.01 mg/ml, the degree of aggregation in the control group (17.34±3.30 %) had no statistical differences from that in hypertension (25.45±4.23 %, $p>0.05$). At the same time, the aggregation rate in healthy volunteers (19.45±6.74 %/min) differed from the corresponding indicator in hypertension (25.31±4.95 %/min, $p<0.05$). With a thrombin concentration equal to 0.02 mg/ml, the degree of aggregation in the control group was 28.35±6.54 %, and in the group of patients with hypertension – 41.09±7.31 %, which had statistically significant differences ($p<0.05$); The aggregation rate was 46.25±5.98 %/min and 41.2±8.69 %/min, respectively ($p>0.05$). When using thrombin at a concentration of 0.05 mg/ml, the degree of aggregation in the control group was 49.56 ±4.33 % and 56.31±8.51 % in hypertension. This indicator had statistically significant differences ($p<0.05$). The aggregation rate in the group of healthy volunteers (55.23±8.34 %/min) and patients with hypertension (62.11±9.12 %/min) also had statistically significant differences ($p<0.05$).

The conducted study allows us to conclude that under the action of thrombin (0.05 mg/ml), the indicators of the degree and rate of platelet aggregation in patients with arterial hypertension were significantly higher compared to platelets of healthy volunteers, indicating their increased reactivity. Increased platelet reactivity in patients with arterial hypertension can be determined not only by a decrease in the sensitivity threshold of membrane receptors, but also by the state of other components of hemostasis: the electrical potential of cells, the state of the vascular wall, hemodynamics, and the content of other biologically active substances in the blood.

BIBLIOGRAPHY

1. *Шхвацабая, И. К.* Гипертензия артериальная / И. К. Шхвацабая [и др.] // Большая медицинская энциклопедия в 30 т. 1977. Т. 5. 3 изд. 568 с.

STUDY OF WATER AND ALCOHOL EXTRACTS OF PLANTS BY THIN-LAYER CHROMATOGRAPHY

Yu. Lozyuk, E. Tarasova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
E-mail: yulialozyuk16@gmail.com

Water and alcohol extracts of chamomile, calendula officinalis, St. John's wort, eucalyptus rod-shaped have been studied by thin-layer chromatography in order to select the best system for thin-layer chromatography and the choice of a dye for thin-layer chromatography.

Keywords: pharmacy chamomile, calendula officinalis, St. John's wort, eucalyptus rod-shaped, thin-layer chromatography, eluents, dyes for thin-layer chromatography.

Medicinal plant raw materials – whole medicinal plants or parts thereof used in dried (sometimes fresh) form to obtain medicines, or substances of plant origin and dosage forms that are approved for medical use.

The wide spectrum of action of the studied plants is due to the rich composition of biologically active plants [1]. With regard to each extract, it is possible to distinguish compounds that predominate in their content and its active action.

Extracts of chamomile, calendula officinalis, St. John's wort, eucalyptus rod-shaped were selected as the object of research as the most commonly used for medical and therapeutic purposes [2]. The composition of aqueous and alcoholic extracts of the above medicinal plants was compared in order to select the best system for conducting thin-layer chromatography and the choice of a dye for detecting compounds on TLC plates.

Thin-layer chromatography was carried out in four different eluting systems of aqueous and alcohol samples of extracts taken at different extraction times (20, 40, 60 min) [3]. System A consists of chloroform ($CHCl_3$) and methanol (MeOH) in a ratio of 4:1, system B consists of chloroform ($CHCl_3$) and methanol (MeOH) in a ratio of 9:1, system C isopropanol (iso-PrOH), ammonium hydroxide (NH_4OH) and water (H_2O) in a ratio of 7:2:2, system D consists of chloroform ($CHCl_3$), ethanol (96% C_2H_5OH) and water (H_2O) in a ratio of 26:16:3. For further research, the most saturated samples of extracts were used (60 min). The best separation of plant extracts occurs in a system consisting of isopropanol, ammonium hydroxide and water in a ratio of 7:2:2. The obtained chromatograms were treated with various reagents: alcohol solution of ninhydrin (0.5 %), Mostain Reagent, naphthoresorcin solution and iodine vapor for the presence of various BAS. A comparative characteristic of the obtained chromatograms was made. The analysis of the eluents used for thin-layer chromatography was carried out.

According to the results of the conducted research, it was concluded that there is a difference in the composition of aqueous and alcoholic extracts of the studied medicinal plants and it depends on the type of plant raw materials and the class of compounds studied. For some plants, there is a predominance of BAS in aqueous extracts (chamomile and calendula), and for others – in alcoholic (St. John's wort and eucalyptus).

On chromatograms, various dyes (alcohol solution of ninhydrin (0.5 %), Mostain Reagent, naphthoresorcin, iodine chamber) color and manifest compounds in completely different ways, even if they are indicators for the same groups of compounds. This indicates that extracts of various plants contain a complex of BAS from different classes of compounds with a diverse composition.

BIBLIOGRAPHY

1. *Васильев, И. Б.* Жидкие лекарственные формы. Настои и отвары: учебное пособие / И. Б. Васильев. – ГБОУ ВПО ИГМУ Минздрава России. – Иркутск: РПФ Весь Иркутск, 2013. – 49 с.

2. *Леонова, М. В.* Экстракционные методы изготовления лекарственных средств из растительного сырья: учебно-методическое пособие / М. В. Леонова, Ю. Н. Климочкин – Самара, Самар. гос. техн. ун-т. 2012. – 111 с.

3. *Борщ, Н. А.* Методы жидкостной хроматографии: методические указания к выполнению лабораторных работ по дисциплине «Аналитическая химия», «Аналитическая химия и ФХМА» для студентов 2 курса по направлению подготовки 04.03.01 Химия, 18.03.01 Химическая технология, 28.03.01 Нанотехнологии и микросистемная техника. / Н. А. Борщ. – Курск, Юго-Зап. гос. ун-т. 2017. – 39 с.

QUANTUM-CHEMICAL MODELING AND PHYSICO-CHEMICAL PROPERTIES OF CYCLOPYROX

M. Lubchenko, A. Yurlevich, D. Novik, S. Shahab

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
marialubchenko858@gmail.com
siyamakshahab@mail.ru

The theoretical information concerning the molecules of cyclopirox, as well as its cyclic form, is considered, its physicochemical properties are studied. The quantum-chemical modeling of cyclopirox by the semiempirical PM6 method was carried out, the theoretical physical sorption between cyclopirox and CNT(6,6-6) was proved, and the UV spectrums of the studied systems were calculated by the ab initio B3LYP/6-31G* method.

Key words: quantum chemical modeling, cyclopirox, UV spectrum.

Cyclopirox is a synthetic broad-spectrum antifungal agent with additional antibacterial and anti-inflammatory effects. This can lead to the loss of the activity of enzymes that are necessary for cellular metabolism, the organization of the structure of the cell wall and other important functions of the cell. In addition, ciclopirox exhibits its anti-inflammatory activity by inhibiting 5-lipoxygenase and cyclooxygenase (COX).

To find the starting geometry of the ciclopirox molecule, the semiempirical PM6 method of the Gaussian 09W software package was chosen [1]. The choice of this method is due to the fact that PM6 is used to calculate the total energy, changes in the Gibbs free energy, enthalpy, and entropy of organic compounds. The results were visualized using the GaussView 06 software.

To perform quantum-chemical modeling of molecules, based on the structural formulas of compounds, a special algorithm has been developed, which includes the following stages: 1) transformation of a 2D structure into a three-dimensional one; 2) estimated optimization of the geometry of cyclopirox by the PM6 method; 3) finding its thermodynamic and energy and electronic parameters; 4) calculation of the electronic spectrum of the drug (table 1).

Table 1

Electronic properties of Ciclopirox, CNT(6,6-6) and CNT (6,6-6)/Ciclopirox complex

Properties	Ciclopirox	CNT(6,6-6)	CNT(6,6-6)/Ciclopirox
Dipole moment (dB)	5.57	0.00	5.81
E(Hartree)	-672.6973	-2758.2691	-3430.9710
E_{HOMO} (eV)	-5.91	-4.41	-4.40
E_{LUMO} (eV)	-0.90	-2.75	-2.74
E_g (eV)	5.01	1.66	1.66
E_{ad} (eV)	–	–	0.0045
I (eV)	5.91	4.41	4.40
A (eV)	0.90	2.75	2.74
χ (eV)	3.40	3.58	3.57
η (eV)	2.50	0.83	0.83
μ (eV)	-3.40	-3.58	-3.57
ω (eV)	2.31	7.72	7.68
S (eV)	0.20	0.60	0.60

It was found that the UV spectrum of cyclopirox has an absorption maximum at 199 nm, and the complex with a nanotube CNT(6,6-6) at 462 nm. Using the B3LYP/6-31G* method, a theoretical model of a thermody-

namically stable complex between cyclopirox and has been calculated CNT (6,6-6). It was found that the dipole moment of the CNT(6,6-6)/Ciclopirox complex is 5.81 dB, and the total energy of the CNT(6,6-6)/Ciclopirox complex is 0.52994942989 Kcal/mol.

BIBLIOGRAPHY

1. *Shahab, S. N.* Quantum chemical Modeling of 1-(1,3-Benzothiazol-2-yl)-3-(thiophene-5-carbonyl) thiourea: Molecular structure, NMR, FMO, MER and NBO analysis based on DFT calculations / S. N. Shahab// Journal of Physical and Theoretical Chemistry. –2017. – № 13 (3). P. 277–288.

THE ROLE OF MICROBIOTA IN THE DEVELOPMENT OF METABOLIC DISEASES

A. Lukyanova, M. Statsi, M. Lobai

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
nastya.lukyanova.2000@yandex.by

The state of the intestinal microbiota has a direct effect on the immune system. Over the past 100–200 years, lifestyle, nutrition, and environmental factors have changed dramatically in the world. There are new approaches to treatment of diseases, a wide variety of antibiotics that are used not only in treatment, but also with food. As a result of these changes, there is an imbalance in the microflora. This has led to an increase in a large range of non-communicable diseases caused by chronic or systemic intestinal inflammation, including metabolic diseases.

Keywords: intestinal microbiota, metabolic diseases, obesity, dysbiosis, non-communicable diseases.

The state of the microbiota affects metabolic processes, the violation of which can lead to the development of obesity, atherosclerosis, type 2 diabetes mellitus and other metabolic diseases. Studies show that each disease has its own specific microbiota.

The involvement of intestinal microbiota in the development of metabolic diseases has been demonstrated in an experiment on the transfer of human microbiota to rodents. (Vrieze et al., 2012): the microbiota of a healthy donor can restore body weight and blood sugar levels of a recipient with obesity or diabetes.

Metabolic diseases are multifactorial non-communicable chronic diseases. Studies were conducted to determine their genetic origin. After extensive analyses, it was found that only 2–3 % of cases of metabolic diseases can be explained by about 30 gene loci (Lu & Loos, 2013). This is a consequence of the fact that a new paradigm is needed, covering many responsible mechanisms, to clarify the epidemic development of this disease. Over the past decades, it has been shown that the vast majority of rodents and obese patients are characterized by a dysbiotic microbiota.

The idea that not all obese patients necessarily have eating disorders has been confirmed. This is due to the fact that they have the same dysbiosis of the intestinal microbiota, which emphasizes the existence of several mechanisms associated with the etiology of this disease.

The influence of gram-negative bacteria and LPS on preadipocytes was studied. They have been found to cause proliferation of both normal cells and CD14-dependent macrophages (Luche et al., 2013). In the presence of excess energy, preadipocytes develop, which contribute to the development of obesity. Changes in innate and adaptive immune defenses affect the movement of bacteria and bacterial components, LPS and peptidoglycans into metabolic tissues such as lipid deposits, liver, Langerhans cells, as well as the heart and blood vessels. In these areas, these elements suppress inflammation, which leads to proliferation of preadipocytes and macrophages. The corresponding cytokines contribute to the reduction of insulin signaling. The mechanism of compartmentalization occurs, while the frequency of ILC3 increases in tissues, and inflammation is further enhanced by the release of cytokines. The tissues are also characterized by increased infiltration of B and T lymphocytes, which interact with newly recruited phagocytes and further aggravate inflammation.

These studies form an understanding of the mechanisms of microbiota disorders in the development of metabolic diseases and open up the possibility of identifying possible methods of prevention and complex therapy of metabolic disorders.

BIBLIOGRAPHY

1. *Gensollen, T.* How colonization by microbiota in early life shapes the immune system / T. Gensollen, S. Iyer, D. L. Kasper, R. S. Blumberg // Science. 2016. V. 352. № 6285. P. 539–544.

2. *Thorburn A. N.* Diet, metabolites and ‘western-lifestyle’ inflammatory diseases / A. N. Thorburn, L. Macia, C.R. Mackay // Immunity. 2014. V. 40. № 8. P. 33–42.

3. *Lumeng C. N.* Inflammatory links between obesity and metabolic disease / C. N. Lumeng, A. R. Saltiel, J. Clin. // Invest. 2011. V. 121. № 211. P. 1–7.

AGE AND GENDER STRUCTURE OF PATIENTSWHO COMPLETED RADICAL RADIOTHERAPY COURSE FORHEAD AND NECK CANCER AT THE BREST REGIONAL ONCOLOGICAL DISPENSARY FOR THE PERIOD 2016–2018

R. Lukyanovsky[1], **P. Demeshko**[2], **A. Batyan**[3], **E. Hancharova**[1, 3]

[1]*Brest Regional Oncological Dispensary,*
Brest, Republic of Belarus
[2]*N. N. Alexandrov National Cancer Centre of Belarus,*
Lesnoy, Minsk, Republic of Belarus
[3]*Belarusian State University, ISEI BSU,*
Minsk, Republic of Belarus
katsiaryna.hancharova@gmail.com

The study analyzed the age and gender data of patients who completed a radical course of radiotherapy for cancers stages I-III of the respiratory, lip, oral cavity and pharynx localization for the period from the beginning of January 2016 to the end of December 2018 at the Brest Regional Oncological Dispensary. Among them, men make up 92.8 %. Their mean age is 61.5 years old. Women are characterized by higher values of the mean and median age (excess by 5.9 and 15.5 years, respectively).

Keywords: cancer, radiotherapy, morbidity statistics, age and gender structure, oral mucosa cancer, pharynx cancer.

Currently, there is a tendency towards an increase in cancer incidence in the Republic of Belarus compared with the statistics of the 90s of the last century. In the structure of cancer morbidity in men, the proportion of cancer of the oral mucosa and pharynx has increased [1]. At the beginning of 2018, the number of patients with oncological diseases crossed the mark of 290 thousand people. At that time, it was just over 3 % of the total number of residents of our country. Everyone out of 33rd resident of the Republic of Belarus was registered as oncological one. Cancer of the oral mucosa and pharynx in the male part of the population accounted for 6.1 % of the total number of oncological diseases [2].

We analyzed data of patients who completed radiotherapy course for cancer of the respiratory system (disease codes are C30–C32), as well as lips, oral cavity and pharynx (disease codes are C00-C14) for the period from the beginning of January 2016 to the end of December 2018 in the "Brest Regional Oncological Dispensary". During this period, radiation treatment was provided to 415 such patients.

For the subsequent analysis of the effect of interruptions in the split course of radiation therapy on the long-term results of treatment, the selection of patients was carried out according to the following criteria: treatment was carried out according to a radical program and with the disease stage I–III. Thus, a database of 138 patients was formed. Radiotherapy was carried out using modern high-energy linear accelerators *Synergy* manufactured by *Elekta Ltd*, *Clinac iX* produced by *Varian*, as well as a cobalt machine *Terabalt type 80 model ACS*. Dosimetric treatment plans were created using modern 3D and IMRT planning technologies with the fulfillment of the criteria for isodose tumor coverage and maximum protection of organs at risk. Table 1 show the data on the distribution of patients by gender and age.

Table 1

Age and gender structure of patients

Gender	Nr of patients	Mean age	Age range	Median age
Male	128	61,5±9,6	39–88	61,0
Female	10	67,4±19,4	35–84	76,5

As follow from the data of the table 1, among patients who treated of a radical program and with the disease stages I-III dominated by men (92.8 %). This tendency consistent with the literature sources [1, 2]. And it is associated with a large number of risk factors in this study group. This assumption is also confirmed by the higher values of the mean and median age among women (by 5.9 and 15.5 years, respectively).

BIBLIOGRAPHY

1. Радиобиология: медико-экологические проблемы: монография / С. А. Маскевич, А. Н. Батян, Т. И. Зиматкина [и др.]; под ред. проф. С. А. Маскевича; Международ. гос. экологич. ин-т им. А. Д. Сахарова Бел. гос. ун-та; Гроднен. гос. мед. ун-т. – Минск: ИВЦ Минфина, 2019. – 256 с.

2. Рак в Беларуси: цифры и факты. Анализ данных Белорусского канцер-регистра за 2009–2018 гг. / А. Е. Океанов [и др.] ; отв. ред. Т. Б. Ипатий. – Минск : Нац. б-ка Беларуси, 2019. – 422 с.

MATHEMATICAL MODELING OF THE DISTRIBUTION OF VIRAL INFECTIONS IN URBOECOSYSTEMS

M. Madani, O. Garkovich, M. Turetsky

Odessa National Academy of Food Technologies, ONAFT
Odessa, Ukraine
madanikader50@gmail.com

The spread of viral infections in limited urban areas and their modeling. The model allows to take into account in various ways the sudden movement of infected agents over long distances.

Keywords:urban ecosystem, modeling, limited area, viral infection.

Peculiarities of the population of our state are a rather low level of prevention of viral infections, mental lack of personal protective equipment, unhealthy lifestyle, including exhausting work, stress and so on. All this contributes to the rapid spread of any infection. Under such conditions, it is extremely important to help extinguish local manifestations of infection and prevent the outbreak of an epidemic. Therefore, an important tool of modern epidemiology, which can help to better understand the fundamental mechanisms of the spread of infectious diseases, is mathematical modeling [1].

Urbanization always means the emergence of large crowds of people in certain limited areas. Even the architecture and terrain within the city play a significant role in the spread of diseases, especially respiratory viral infections, as the most common route of transmission of the virus is airborne. Eight years ago, we created a mathematical model to predict the spread of viral infections and evaluate the effectiveness of different methods of exposure depending on the situation to prevent epidemics. To date, influenza and acute respiratory viral infections rank first in the frequency and number of cases in the world (approximately 95 % of all infectious diseases) [2].

Previously, influenza was a major component of infectious morbidity and mortality. Now the situation is changing and the COVID-19 pandemic has pushed the already known to mankind. She came out on top in terms of mortality. We have tried to assess the current situation on the basis of our old research, performing a number of new ones. Especially since there is a great opportunity to verify our model by using the available information about the COVID-19 pandemic. Common to all of the above infections is that the most common route of transmission of the virus is airborne. The possibility of infection through the air increases in conditions of high population density and crowds. Small aerosol particles can enter the respiratory tract and cause infection. Particles larger than 30 microns are deposited on the mucous membrane of the nose, larynx and trachea; 3–10 μm in size - get into the bronchioles; 0.3–1 μm – can reach the alveoli. Reproduction of influenza viruses and ARI occurs very quickly with a short incubation period – 1–2 days [3]. For COVID-19 it is 5–14 days, and in some cases even more. In this case, the person begins to infect others before he begins to get sick. Another difference – the disease lasts several times longer.

Our model is based on determining the behavior and properties of individual agents and their interaction with each other, taking into account possible changes in operating conditions. Based on this, there is an integral characteristic of the state of the modeled system. The mathematical model of the spread of respiratory viral infection adequately reflects the main spatio-temporal components of the urban ecosystem, taking into account the general rhythms of life of the main social groups of society in real spatio-temporal coordinates. The motion of system elements based on Langevin dynamics in the middle of contact groups is realized. Successfully selected parameters make the program universal, allow you to customize it according to needs. The first results obtained for small settlements, in comparison with the literature data, confirm their adequacy. The model can be used to predict the situation in some small settlements with a population of several hundred people. There are no restrictions in the direction of population growth. The model allows you to take into account in various ways the sudden movement of infected agents over long distances – Levy's flights. It has been shown that epidemic processes can be effectively controlled with the simplest means – special dressings that reduce the likelihood of airborne infection. Mass use of such drugs in the pre-epidemic period can prevent infection or, if it occurs, significantly reduce the number of infected.

BIBLIOGRAPHY

1. *Keeling M. J., Rohani P.* Modeling Infectious Diseases in Humans and Animals. – Princeton: Princeton University Press, 2007. – 408 p.

2. *Эмонд Р., Роуланд Х.* Инфекционные болезни. Цветной атлас. – М.: Практика, 1998. – 439 с.

3. *Люта В. А., Загорова Г. І.* Основи мікробіології, вірусології та імунології. – Київ, Здоров'я, 2001. – 280.

THE ROLE OF HYDROGELS IN THE ECOLOGICALLY CLEAN CROP OF *CICER ARETINUM L.* IN ARID REGIONS OF UZBEKISTAN

S. Makhammadiev, Sh. Abdullaev

National University of Uzbekistan named after Mirzo Ulugbek (NUUz)
Tashkent, Republic of Uzbekistan
shoxabdullaev1996@gmail.com

Our main goal is to grow Cicer aretinum L. in the arid regions of Uzbekistan and increase yields. The field experiment was carried out according to generally accepted methods in the conditions of rainfed light-grave soils of the Khatyrchi district of the Navoi region. The experiment was carried out in 2 variants with 3 repetitions. 1 variant with an area of 200,0 m². Used the control option-1 (hydrogel was not used) and option-2 hydrogel (Gi-pan 1) at the rate of 45 kg/ha, planted at the rate of 50 kg per hectare.

Keywords: rainfed light gray soils, hydrogel, water resources, peas, ecological net harvest.

Agriculture is one of the main sectors of the republics economy. Agriculture accounts by 92 % of the total water consumed in the country. So, the pledge of the crop on irrigated lands is water. Today the demand for water around the world has increased. This naturally leads to water shortages. Lack of water brings with it a number of natural inconveniences. Especially soil erosion-desertification has become a global problem today. The use of polymer hydrogel in the prevention of such problems has a positive result.

On the basis of experiments carried out in various soil and climatic conditions of the country, it was found that the use of a hydrogel can increase the shelf life of productive moisture by 80 %. The author also analyzed the mechanism of action of the hydrogel in soil. By the same mechanism, it was concluded that the hydrogel can retain up to 100 % of water in the fertile soil layer, preventing the leaching of mineral fertilizers introduced into the soil into the groundwater [1].

The use of hydrogel polymers retains large amounts of water and nutrients in the soil and provides them when needed for plant growth [2]. The hydrogel increases the permeability of soils, due to which the root system of plants develops well [3].

In the experiments carried out by the authors to substantiate the parameters of water-saving technology based on strong hydrogels in dry horticulture, the rational norm of the hydrogel for the effective germination of almond and pistachio seedlings was 100–120 g per seedling, and its effective embedding depth in the soil should be 10–40 sm that the germination of seedlings is 40–50% higher and provides the most economical germination of seedlings due to the specific gravity of the hydrogel used in a reasonable rate [4].

When the soil gets wet, the polymer slowly transfers water and provides the plant with water. It returns to its original, dry, smaller and harder form. The main important feature of the hydrogel substance is also the accumulation of water and its gradual transfer to the surrounding plants. The aim of this study was to study the effect of growth and development of pea plants on typical irrigated gray soils.

Hydrogels improve soil porosity. Each time they absorb water, they swell and shrink, and the water crystals push the surrounding soil, creating small cracks. As soil porosity increases, air circulation and microbial activity improve. In our study, the yield in the control variant was 4,7 c/ha, and the application of hydrogel in the amount of 45 kg/ha allowed to grow 10,1 c/ha, i.e. 5,4 c/ha more than in the control.

Because the hydrogel is not only maintains soil moisture, but also plays an important role in the conversion of nutrients in the soil. This is apparently due to woodpecker microorganism; tk. the accumulated moisture in gedroll has a positive effect on them. That is, this is achieved by providing the plant at the right time by absorbing nutrients already in the soil solution, in conditions of sufficient moisture by absorbing soil moisture. The ratio of nutrients in the soil plays an important role in plant nutrition and yield formation (5).

When pea plants grow on typical irrigated gray soils, the application of hydrogel at the rate of 45 kg/ha per hectare had a positive effect, and an additional yield of 5,4 c/ha was possible compared to the control.

BIBLIOGRAPHY

1. *Shirinov Sh. D., Djalilov A. T, Yoriyev O. M., Asqarov M. A.* Synthesis of hydrogels based on industrial waste and their use in agriculture / Shirinov Sh. D., Djalilov A. T, Yoriyev O. M., Asqarov M. A. // J. Lectures of the Academy of Sciences of the Republic of Uzbekistan. – Tashkent. – 2009. – № 3–4. P. 88–90.

2. *Hüttermann, A. L. Orikiriza J. B. and Agaba H.* Application of Superabsorbent Polymers for Improving the Ecological Chemistry of Degraded or Polluted Lands / Hüttermann, A.L. Orikiriza J.B. Agaba H. // Clean-Soil, Air, Water, Vol. 37, No. 7, 2009, P. 517–526.

3. *Abedi-Koupai J., Eslamian S.S. and Kazemi J.A.* Enhancing the Available Water Content in Unsaturated Soil Zone Using Hydrogel, to Improve Plant Growth Indices / Abedi-Koupai J., Eslamian S. S. and Kazemi J. A. // J. Ecohydrology and Hydrobiology, Vol. 8, No. 1, 2008, P. 67–75.

4. *Salokhiddinov A. T., Khomidov A. O*. The effectiveness of the water-saving technology created using a durable inflatable hydrogel in a bagar horticultural environment / Salokhiddinov A. T., Khomidov A. O. // J. Irrigation and Melioration. № 2 (16), 2019, P. 6–9.

5. *Makhammadiev S. K., Sattarov Dj. S.* Interaction of winter wheat varieties and fertilizers on old-irrigated typical serozem soil / Makhammadiev S. K., Sattarov Dj. S. // J. Pladorode. – Moscow, 2016. – No. 2 (89). – P. 12–16.

EFFECT OF GUANOSINE AND GUANOSINE TRIPHOSPHATE ON THE PROCESS OF FIBRIL FORMATION OF INSULIN MOLECULES

A. Makhnach, N. Bogdanova, J. Venskaya, V. Sagan, O. Sokolovich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
Alexandra.makhnach.am@gmail.com

This article presents information on the effect of guanosine and guanosine triphosphate on the process of fibril formation of insulin molecules under temperature and intense mechanical stress.

Keywords: aggregation, amyloid formation, guanosine, guanosine triphosphate, insulin, fibril formation.

Protein aggregation is a widespread process with deleterious consequences for the body, and amyloid aggregates are detrimental not only biologically, but also for drug design and biomaterial production. Insulin is a protein widely used in the treatment of diabetes, and its amyloid aggregation underlies what is known as insulin amyloidosis.

In vitro, under destabilizing conditions, a large number of proteins aggregate and form specific ordered superstructures. These can be amyloid fibrils characterized by a typical transverse beta pattern or larger micrometric assemblies of amyloid nature, such as spherolites [1]. The variety of amyloid varieties presents a challenge for pharmaceutical drug development, where protein-based products must be optimized by controlling any byproduct particles.

Extensive efforts are aimed at screening or developing anti-amyloidogenic or anti-aggregation agents as a treatment for amyloidosis [2]. Various natural or synthesized biologically active molecules/compounds are known to inhibit or prevent fibril formation both in vitro and in vivo. Although amyloidoses are the focus of intense research, there is currently no cure for these diseases [3]. Inhibiting the production of pathogenic fibrillar/aggregated conformers and studying these structures in detail has become a potential approach to combating amyloidosis.

In this work, guanosine and guanosine-5′-triphosphate, which have biological activity, were chosen as substances that slow down/inhibit the formation of insulin fibrils.

During the study of the process of amyloid formation of insulin and insulin in complex with the studied substances, fluorescent methods based on registration of natural fluorescence of proteins were used.

As an assessment of amyloid fibril formation, the fluorescence intensity of ThT Benzothiazoline probe in complex with insulin was monitored. The increase in ThT fluorescence intensity is widely used as an indicator of the degree of amyloid fibrillation. It is believed that ThT rapidly interacts with amyloid fibrils in a specific manner, and the nature of the protein has little effect on ThT binding.

The experiment revealed a decrease in probe fluorescence in the samples when the compounds under study were added. This suggests that guanosine and guanosine-5′-triphosphate are incorporated into the active center of the insulin molecule and prevent the unfolding of the protein globule and further process of amyloid formation, which is observed during active mechanical and temperature exposure in the control sample.

During the study of the effects of guanosine and guanosine-5′-triphosphate on the processes of fibril formation of the insulin molecule and subsequent data analysis, it can be concluded that the studied nucleotides have a slowing/inhibitory effect on the fibril formation of the insulin molecule.

BIBLIOGRAPHY

1. *Porat Y., Abramowitz A., Gazit E*. (2006) Inhibition of amyloid fibril formation by polyphenols: structural similarity and aromatic interactions as a common inhibition mechanism, Chem. Biol. Drug Des., 67, pp. 27–37.

2. *Stefani M.* (2004) Protein misfolding and aggregation: new examples in medicine and biology of the dark side of the protein world, Biochim. Biophys. Acta. 1739, pp. 5–25.

3. *Wang S.S., Chen Y.T., Chou S. W*. (2005) Inhibition of amyloid fibril formation of beta-amyloid peptides via the amphiphilic surfactants, Biochim. Biophys. Acta, 1741, pp. 307–313.

EFFECT OF LOW-INTENSITY LASER RADIATION EXPOSURE TIME ON MICROORGANISMS

A. Mandrik, E. Tarasova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
mandrik.lina@yandex.ru, mlada2005@mail.ru

Low-intensity laser radiation is used in laser therapy, as it has been noted that it has a pronounced therapeutic effect: it improves tissue microcirculation, and stimulates regenerative processes, normalizes general immunity, increases the body's resistance.

Keywords: Low-intensity laser radiation, microorganisms.

The aim of this work is to experimentally prove the effect of low-intensity laser radiation of various wavelengths on Escherichiacoli and Staphylococcus Aureus. To study the relationship between the wavelength and the nature of the low-intensity laser radiation action on microorganisms, as well as between the time of exposure to radiation on the growth of Escherichiacoli and Staphylococcus Aureus.

Two strains of microorganisms isolated from the nasopharynx were taken – Escherichiacoli and Staphylococcus Aureus. To identify these microorganisms, nutrient media were used: Endo agar, and yolk-salt agar. After cultivation, smears were made, painted according to Giemsa stain. The following radiation blocks were used as a source of laser radiation:

1) wavelength – 635 nm., radiation power density – 2 MV/cm², continuous mode (red block);
2) wavelength – 527 nm., radiation power density – 0.2 MV/cm2, continuous mode (green block);
3) wavelength – 405 nm., radiation power density – 0.7 MV/cm2, continuous mode (blue block);
4) wavelength – 802 nm., radiation power density – 5 MV /cm2, continuous mode (infrared unit).

For the experiment, a suspension of microorganisms standardized according to the optical turbidity standard (5–10×10^8 colony-forming cell/ml). The resulting solution was treated with low-intensity laser light in a continuous mode for 10 minutes, 30 minutes and 1 hour. The results were evaluated after 24 hours of incubation at a temperature of 34 °C, counting colonies grown on the cups.

According to the results of the study, it was concluded that the most pronounced growth was observed when using infrared laser radiation, laser radiation of the green, blue and red spectrum caused a decrease in the growth of Escherichiacoli, Staphylococcus Aureus colonies within 10 minutes. Green spectrum laser radiation affected the growth of Escherichiacoli colonies after 60 minutes of exposure. The data obtained show that the effects of different spectra (blue, red, green, infrared) allow us to reliably regulate the number of certain cell populations (Escherichiacoli, Staphylococcus Aureus). The properties of laser radiation vary depending on the time of exposure.

BIBLIOGRAPHY

1. *Гамалея, Н. Ф.* Лазеры в эксперименте и клинике / Н. Ф. Гамалея. – Москва: Медицина, 1972. – 232 с.

THE PROBLEM OF "SMALL DOSES" IN RADIOBIOLOGY

U. Martynenko, N. Gerasimovich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
ulyana170901@icloud.com

Modern literature shows that currently there are three different points of view in assessing the effects of radiation in "small" doses: increased danger of "small" doses, lack of effects, radiation hormesis (positive effect of ionization radiation). It is assumed that studies of the effects of "small" doses from environmental sources can make a significant contribution to understanding the risk of cancer.

Keywords: "small" doses, deterministic effects, stochastic effects, hormesis.

Nowadays, researchers are increasingly interested in studying the effects of exposure to "small" doses of ionizing radiation. The term of "small doses" does not have a single definition. The UN Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) recommended doses of 200 mGr and below to be attributed to "small" doses, and a dose rate of 0.1 mGr/min and below to "small" dose capacities [1].This is due to the fact that the radiation levels of most people on Earth are "small" - both due to the natural background and all man-made sources, including the Earth's surface contaminated with radionuclides. Radionuclides are found not only in the air, but also in food and drink. Radionuclides trapped in the human body irradiate the body from the inside [2].

All biological effects and effects of ionization radiation on the body are deterministic and stochastic. Deterministic effects are clinically significant effects that manifest as an obvious pathology. These effects have a threshold character. The severity of such effects depends on the absorbed radiation dose. There is no dose threshold for stochastic (probabilistic) effects[1].

According to the UN Scientific Committee on the Effects of Atomic Radiation (NCDAR), there are two main types of stochastic effects of radiation exposure: the first affects somatic cells and can cause cancer, the second type, which occurs in the germ tissue of the gonads, can lead to inherited disorders in the offspring of irradiated people [1,3].

There are publications in which, according to the hypothesis of increased risk of exposure in "small" doses per dose unit, the risk is significantly higher than at "large" doses [3]. In part of these works, it is indicated that "small" doses are very dangerous, since organisms do not have a system of protection against them and, moreover, they provoke a variety of diseases in humans, including the cardiovascular and nervous systems, which are usually not associated with the direct action of radiation.

The linear threshold-free concept (LBC) assumes that there is no threshold below which the effects observed at "large" doses cease to occur. This is due to the fact that the effects of "small" doses are not specific to ionization radiation, they can also be caused by other natural or man-made factors – smoking, pollution of air, water and food with chemicals. Irradiation in "small" doses only increases the risk of these consequences.

The materials of the UNSCEAR also provide data on the positive effects of low doses of ionizing radiation [1,3]. In recent years, a whole set of new data has appeared on the manifestation of radiation hormesis – the body's reaction to "small" doses of any effect, the opposite of that which develops at higher doses.

It is assumed that studies of the effects of "small" doses from environmental sources can make a significant contribution to understanding the risk of cancer. However, in order to fully study the effects of "small" doses, it is necessary to overcome the limitations of these studies, including low statistical power, dosimetric uncertainties, control imperfections and other factors. Studies of the effects of radiation with a low dose rate are more subject to such restrictions than studies of the effects of a "high" dose. Further improvement of the quality of such epidemiological studies can be achieved by improving the quality of clinical diagnoses, collecting more accurate statistical data.

BIBLIOGRAPHY

1. UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation). Report: "Brief description of the health effects of low doses of radiation". New York: United Nations, 2010.

2. *Obodovsky, I. M.* The effect of radiation on human health: a textbook / I. M. Obodovsky. – Dolgoprudny : Intellect, 2018. p. 9.

3. United Nations NCDAR (United Nations Scientific Committee on the Effects of Atomic Radiation). Report: "SOURCES, EFFECTS AND RISKS OF IONIZING RADIATION". New York: United Nations, 2017.

INFLUENCE OF γ-RADIATION ON DESTRUCTION AND CRYSTALLINE STARCH

E. Maslyukov[2], **A. Bulavko**[2], **V. Litvyak**[1], **V. Kravchenko**[2], **A. Batyan**[2], **M. Atroshko**[2]

[1]*All-Russian Research Institute of Starch Products -*
branch of the FSBSI "V.M. Gorbatov FRS of Food Systems" RAS,
s. Kraskovo, Russia
Belarusian State University, ISEI BSU
Minsk, Belarus
massl2001@yandex.by

The effect of γ-radiation on the degree of potato starch crystallinity is considered, the features of X-ray diffraction patterns of native and irradiated starch, as well as their solubility, are noted.

Keywords: γ-radiation, crystallinity, amorphization, morphological structure.

The crystallinity of the potato starch is about 25 %. With an increase in the radiation dose, a significant amorphization of starch is observed. As follows from a comparison of the X-ray diffraction patterns in Fig. 1, as a result of irradiation, the intensity and resolution of diffraction reflections noticeably decrease, while the intensity of the amorphous halo increases. Broadening of diffraction reflections, a decrease in their distinctness indicates a decrease in the size and an increase in the defectiveness of starch crystallites; an increase in the proportion of amorphous halo indicates the destruction of a significant amount of crystalline formations. The degree of crystallinity of starch irradiated with a dose of 440 kGy drops to 16 %, i.e. 1.5 times.

It is noted that, according to [1], the crystallinity index of γ-irradiated cotton cellulose remains high (73%) up to an absorbed dose of 1180 kGy, and only at a dose of 9400 kGy cellulose become amorphous. Consequently, the sensitivity of the crystal structure of starch to the action of accelerated electrons is much higher than that of cellulose to γ-irradiation. At the same time, γ-irradiation noticeably disturbs the morphological structure of cellulose even at a low absorbed dose (about 10 kGy) [1].

On the contrary, the morphological structure of potato starch is very resistant to the action of accelerated electrons. Treatment even with very high doses (110–440 kGy) does not cause fundamental changes: both native and all irradiated samples of potato starch are characterized by a typical morphology, representing an aggregate of ellipsoidal grains. The average grain diameter of native starch is 24 μm, which is typical for potato starch. Irradiation with accelerated electrons does not violate the grain surface structure. At the same time, starch samples irradiated with doses of more than 470 kGy quickly dissolved in water, which [2] is explained by a change in the exclusively molecular structure as a result of the destruction of polysaccharides.

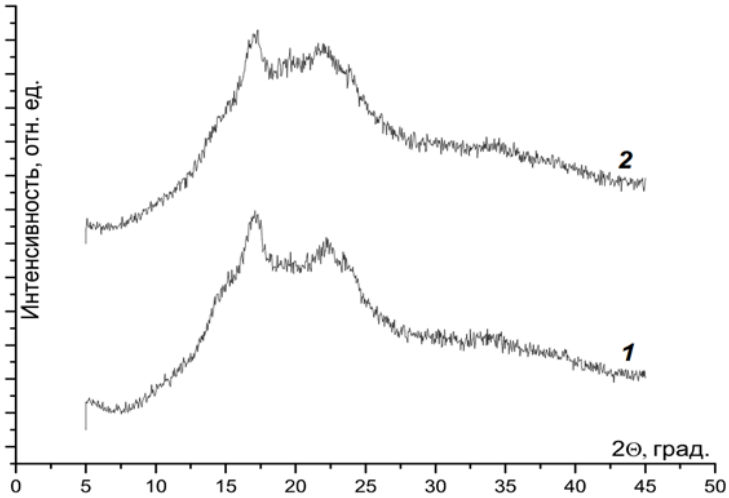


Fig. 1 – X-ray diffraction patterns of native (1) and irradiated with a dose of 440 kGy (2) starch

Thus, irradiation of potato starch with accelerated electrons (dose from 110 to 440 kGy) leads to significant amorphization of its structure with preservation of morphology. Under irradiation with doses up to 440 kGy, the contribution of oxidative processes is insignificant. Amorphization and destruction of potato starch chains increase its solubility.

MEDICINAL PROPERTIES OF SALVIA OFFICINALIS L.

A. Matkarimova, G. Ergasheva

National University of Uzbekistan named after Mirzo Ulugbek
Tashkent, Republic of Uzbekistan

Today, more than 230 species of wild-growing and cultivated medicinal plants are used in medicine. About 254 types of drugs are produced in the chemical pharmaceutical industry from 171 products of 152 types. Today, in the world, special attention is paid to the involvement in the production of valuable plants that retain medicinal, food-grade and aromatic essential oil properties, as well as the improvement of ways of cultivation.

Among such promising plants we can include Salvia officinalis L. Plants belonging to the family of mint are used in various sectors of the economy as ornamental, medicinal, food.

Medicinal marmarac- Salvia officinalis L. Cultivated in countries such as Yugoslavia, Greece, Italy, France, the Czech Republic and Slovakia. In the foothills of the provinces, spruce is found among shrubs, in the shade of trees, and sometimes in abandoned places as an alien plant, and is also planted.

Medicinal marmarax is a perennial semi-shrub up to 20–50 cm tall. Stems numerous, branched, deciduous, quadrangular, the lower part slightly woody. The leaf is simple, elongated, the upper part of the stem is bandless, arranged opposite the stem. The flowers are short-banded, small, forming a spurious inflorescence in the form of a spike-shaped circle at the top of the stem and branches. The flower is curved, the inflorescence is two-lipped, sertuk, the inflorescence is two-lipped, blue-purple, the anthers are two, the seed node is four-lobed above. The fruit consists of 4 nuts. It blooms in June-July.

The leaves of medicinal marmara accumulate more essential oil than other organs. In folk medicine, a tincture made from the flowers and leaves of marjoram is used to treat bronchitis, pyelitis, cystitis, hepatitis, enteritis, gastroenteritis, gastric ulcer, stomatitis, angina, rinsing the mouth, throat, skin diseases and dark wounds.

In modern medicine, galenic preparations made from marmara are used in inflammatory diseases of the oral cavity, nasopharynx and upper respiratory tract, bronchitis, bronchial asthma, hepatitis, cholecystitis, ulcers of the stomach and duodenum, cystitis, pyelitis, purulent wounds, dark wounds and other skin diseases prescribed for treatment. Marmara reduces sweating, so it is used during the climacteric period, when a person sweats profusely. Tea made from medicinal marmara is an important tool in the treatment of diseases of the urinary tract.

Ibn Sina said that lemon refreshes and strengthens the heart, improves digestion and helps with hiccups.

In modern medicine, the essential oil of lemon has been found to have a calming effect similar to valerian.

In China, they like to drink marmalade infusions. In the United States, it is added to salads, soups, vegetables, meat and fish.

ESTIMATION OF THE DYNAMICS OF THE LEVEL OF ENDOGENIC INTOXICATION IN PATIENTS WITH TUBERCULOSIS DURING COMBINED THERAPY

A. Mazurova, K. Shpadaruk, R. Smolyakova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
mazurova-anastasiya7@bk.ru

The work we analyzed the dynamics of the level of endogenous intoxication based on integral indicators of peripheral blood in 19 patients with tuberculosis during combination therapy. As a result of the study, we found that during therapy in patients with tuberculosis, a statistically significant decrease in indicators was revealed: the index of the ratio of neutrophils to lymphocytes by 11.4 times ($p_{(Wilcoxon)} = 0.001$), the index of the ratio of lymphocytes and eosinophils by 1.31 times ($p_{(Wilcoxon)} = 0.048$) and the index of the ratio of neutrophils and monocytes by 1.73 times ($p_{(Wilcoxon)} = 0.042$.

Keywords tuberculosis, integral indices of endogenous intoxication.

Tuberculosis is an acute infectious disease caused by Mycobacterium Tuberculosis. The main route of transmission is the aerogenic (inhalation) route of infection. Tuberculosis treatment is a complex process that requires time and an integrated approach. The development of tuberculosis is accompanied by an immune imbalance in the cellular link [1]. Часто заболевание сопровождается интоксикационным синдромом. The success in antituberculosis therapy is largely due to the ability of the body's immune system to restructure and an adequate immune response. The use of integral indicators, some of which change already in the prenosological peri-

od or at the earliest stages of the disease, allows, without resorting to special research methods, to assess the dynamics of the state of various links of the immune system [2].

The object of the study was the clinical data of the peripheral blood of 19 patients with tuberculosis. The subject of the study was the dynamics of the level of integral indices of endogenous intoxication during the combined therapy: leukocyte index of intoxication according to Kalf-Kalif (LII), index of the ratio of neutrophil to lymphocyte (IRNL), index of ratio of lymphocytes to monocytes (IRLM), index of ratio of neutrophils to monocytes (IRNM), the index of the ratio of lymphocytes and eosinophils (IRLE), the index of the ratio of lymphocytes to the erythrocyte sedimentation rate (ILSOE). Hematological examination was performed using a Hemacomp 10 analyzer (Italy). The average age of the patients included in the study was 49.3 ± 8.9 years.

In the course of the work, the level of integral hematological parameters was analyzed in patients with tuberculosis before the start of treatment and after the completed combination therapy.

Thus, when analyzing the data, the LII level according to Kalf-Kalif in patients with tuberculosis before treatment was 18.50 rel. units [CI 10.90; 21.30], which exceeds the norm (1.01 ± 0.06 rel. Units). After treatment, this indicator slightly decreased by 1.13 times ($p_{(Wilcoxon)} > 0.05$) and amounted to 16.25 rel. units [CI 11.3;0 26.30], which indicates a severe degree of intoxication of the body. The combination therapy was accompanied by a slight increase ($p > 0.05$) in the leukocyte to erythrocyte sedimentation rate index by 1.20 times the initial value was 0.29 rel. units [CI 0.15; 0.66]; after treatment, 0.355 relative units. [CI 0.20; 1.02]), this indicator was within the normal range (0.04 ± 1.32 rel. units). When analyzing the data obtained on the level of the IRNL indicator, an increase in this indicator from the norm (5.78 ± 0.73 rel. units) was revealed before the start of treatment, which amounted to 26.00 rel. units [CI 14.25; 36.00], which indicates a pronounced inflammatory process. After chemotherapy, the IRNL index statistically significantly decreased by 11.4 times ($p = 0.0009$) and amounted to 2.26 rel. units [CI 1.73; 2.42]. As a result of the analysis of the data of patients with tuberculosis before the start of treatment, there is an increased level of the index of the ratio of lymphocytes and monocytes (norm = 11.83 ± 1.31 rel. units) and amounted to 12.33 rel. units [CI 9.50; 21.00]. The result of the study may indicate the suppression of the functions of the effector links of the immunological process. After treatment, this indicator increased by 1.21 times ($p>0.05$) and amounted to 15.01 rel. units [CI 7.25; 27.50]. The index of the ratio of lymphocytes and eosinophils in the group of patients before treatment was 12.5 relative units [CI 9.25; 20.00], which significantly exceeds the norm (8.73 ± 1.26 rel. units) and shows delayed-type hypersensitivity. After treatment, there is a statistically significant decrease in the index by 1.31 times ($p = 0.048$) and is 9.50 rel. units [CI 6.75; 16.50]. As a result of the analysis of data from patients with tuberculosis before the start of treatment, the level of the neutrophil-to-monocyte ratio index was above normal (5.78 ± 0.73 rel. units) 26.00 rel. units [CI 14.25; 36.00]. After treatment, the index was 15.00 rel. units [CI 7.25; 27.5] and statistically significantly decreased by 1.73 times ($p = 0.042$). The result of the study may indicate the suppression of the functions of the effector links of the immunological process.

Thus, according to our preliminary data, we can conclude that the neutrophil-to-lymphocyte ratio (IRNL), the lymphocyte-to-eosinophil ratio (IRLE) and the neutrophil-to-monocyte ratio (IRNM) most significantly respond to changes in the body resulting from the combined chemotherapy. However, it is necessary to take into account all the studied indices of endogenous intoxication indices to assess the response of the body of patients with tuberculosis to the therapy.

BIBLIOGRAPHY

1. *Будрицкий, А. М.* Фтизиопульмонологии / А. М. Будрицкий, Н. В. Василенко, И. В. Кучко // учебное пособие. – Витебск: ВГМУ, 2016. – С.30–36.

2. *Островский, В. К.* Показатели крови и лейкоцитарного индекса интоксикации в оценке тяжести и определении прогноза при воспалительных, гнойных и гнойно-деструктивных заболеваниях / В. К. Островский [и др.] // Клин. лаб. диагн. – 2006. – № 6. – С. 50–53

EFFECT OF POLY-L-LYSINE ON THE FLUORESCENCE INTENSITY OF IgG-FITC CONJUGATES IMMOBILIZED ON THE SURFACE OF SILVER NANOFILMS

Ya. Melnikova, I. Koktysh, T. Pitsko (Kaluhina), O. Matusevich, S. Maskevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
univer.yanina@gmail.com

When forming a solid phase for the purposes of immunofluorescence analysis using plasmon resonance, consisting of nanostructured silver films coated with a poly-L-lysine polycationic polyelectrolyte, it is essential to

choose the concentration of the polyelectrolyte used, since the structure of the resulting charged surface will determine the physicochemical conditions for immobilization of protein molecules on it. The dependence of the fluorescence intensity of the IgG-FITC conjugate on the concentration of poly-L-lysine used to coat the nanofilm was established and the optimal concentration of poly-L-lysine was determined, at which the maximum increase in the fluorescence of the used protein conjugate was observed.

Keywords: immunofluorescence analysis, silver nanofilms, cationic polyelectrolytes, monoclonal antibodies, immunoglobulin G, fluorescein isothianate conjugates.

In modern immunochemistry, much attention is paid to the development of new approaches to enhance the recorded signal, including the use of new labels and highly sensitive registration systems. To improve the detection sensitivity, new types of reagents are used, such as nanoparticles of various metals, in particular, gold and silver, which can reduce the detection limit of a bioanalyte by a factor of 5 or more [1]. Nanoparticles of these metals and detection systems using them have wide biomedical applications - they are used in genomics, biosensorics, immunoassay, laser phototherapy of cancer cells, targeted delivery of drugs, DNA and antigens, bioimaging, and monitoring of cells and tissues. The aim of this work was to study the effect of the polycationic polyelectrolyte poly L lysine on the processes of immobilization of immunoglobulin molecules on the surface of a nanostructured silver film.

Silver nanoparticles were fixed on the modified surface of the wells of polystyrene plates by electrostatic deposition with different exposure times from 1 to 24 h. A solution of poly-L-lysine in two different concentrations C1 and C2 was applied to cover silver nanofilms. Immobilization of immunoglobulin labeled with fluorescein (IgG-FITC) was carried out for 4 hours at + 37 °C. A CLARIOstarPlus plate reader (BMG Labtech, Germany) was used to record fluorescence spectra.

Depending on the conditions in the process of electrostatic deposition on the surface of the wells of polystyrene plates, several types of silver nanofilms were obtained, differing in different surface structures and physicochemical properties. All nanofilms were characterized by the continuity of a layer of silver nanoparticles, ranging in size from 30 to 80 nm. An AgNP2 nanofilm was used in the experiments.

As a model protein, a conjugate of a monoclonal antibody of the IgG1 class with fluorescein IgG-FITC at working concentrations of 2.5 μg / ml and 5 μg / ml was used. The sample volume was 200 μL.

Silver nanofilms immobilized in the wells of a polystyrene plate were coated with a solution of poly-L-lysine at concentrations C1 and C2, and as a control, the coating with a solution of poly-L-lysine on the intact wells of a polystyrene plate was used. In experiments on the immobilization of model IgG-FITC at a concentration of 2.5 μg / ml, it was found that when using the coating of a silver nanofilm with poly-L-lysine at a concentration of C1, the fluorescence intensity of the immobilized protein conjugate increases by 3.8 times compared to the fluorescence intensity of IgG -FITC at the same concentration immobilized on a poly-L-lysine layer covering the wells of a silver-free polystyrene plate. A twofold increase in the concentration of poly-L-lysine (C2) to cover the two variants of solid phases (C2) practically did not change the fluorescence intensity of the immobilized IgG-FITC - it increased by 4 times compared to the control. With an increase in the concentration of the immobilized protein to 5 μg per ml, the increase in the fluorescence intensity of IgG-FITC adsorbed on silver nanofilms was 3.4 times as compared to the control at a covering concentration of poly-L-lysine C1 and 3.2 times at a covering concentration of poly- L-lysine C2.

BIBLIOGRAPHY

1. Высокочувствительный иммунофлуоресцентный анализ простат-специфического антигена с использованием наночастиц серебра / И. В. Коктыш, Я. И. Мельникова, О. С. Кулакович, А. А. Романенко, С. В. Ващенкос, А.О. Муравицкая, С. В. Гапоненко, С. А. Маскевич // Журнал прикладной спектроскопии. – 2020. – Т.87, № 5. – С. 796–803.

ESTABLISHING THE RELATIONSHIP BETWEEN THE CONCENTRATION OF SOLID PARTICLES IN THE ATMOSPHERIC AIR AND THE INCIDENCE OF ONCOLOGICAL DISEASES IN THE POPULATION OF THE REPUBLIC OF BELARUS

M. Mikulich, I. Pukhteeva

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
mariyamikulich@gmail.com

In this work, data analysis was carried out to establish the relationship between the diagnosed cases of morbidity of the population of the Republic of Belarus with oncological diseases, in particular lung cancer, and the concentration of particulate matter in the atmospheric air in the period from 2002 to 2017.

Keywords: solid particles, oncological diseases, lung cancer.

Exposure to airborne toxicants has a negative impact on human health, in some cases they are one of the factors that lead to cancer.

To establish the relationship between the concentration of solid particles, which include dust, soot particles and heavy metals, in the atmospheric air and the incidence of cancer in the population, in particular lung cancer. During the calculations based on official statistical data from the collection "Statistics of oncological diseases in the Republic of Belarus" for the time period from 2002 to 2017 inclusive, as well as data from the statistical collection "Environmental Protection in the Republic of Belarus", the following results were obtained.

In the period from 2002 to 2017, a general increase in the number of diagnosed oncological diseases was registered in all regions of the Republic of Belarus and in Minsk. The maximum number of diagnosed cases of oncological diseases in general, which reached 591.8 cases per 100,000 population, was registered in the Gomel region in 2017. At the same time, the minimum number of cases equated to 307.9 cases per 100,000 people (Brest region, 2002).

The highest average annual growth rate of the number of oncological diseases was recorded in Minsk – 3.35% [1,2].

An increase in the number of documented cases of lung cancer was also detected in the regions of the Republic of Belarus and in Minsk. The maximum number of diagnosed cases of lung cancer in the population equated to 58.5 cases per 100,000 in the Grodno region in 2015. The minimum number was registered in the Brest region in 2002 - 38.2 cases per 100,000 people. The highest average annual growth rates in the number of lung cancer diseases, which amounted to 1.81% and 1.58%, were noted in the Minsk region and Minsk, respectively [1,2].

During this period, a decrease in the concentration of solid particles in the atmospheric air was noted in all regions of the Republic of Belarus, as indicated by negative values of the absolute increase in all analyzed data. However, in the Grodno region, this indicator equated to 0. The maximum concentration of particles reached 8.2 thousand tons in the Mogilev region in 2002. The minimum concentration was 3.2 thousand tons (Brest region, 2017) [3].

A strong inverse relationship was observed between the number of cancer patients and the amount of solid particles in the atmospheric air in each of the studied cases.

A strong inverse relationship has also been established between the number of lung cancer cases detected and the concentration of particulate matter. However, in the Minsk region, a weak positive correlation was established between the number of cases of lung cancer and the concentration of solid particles.

The results obtained can be interpreted as evidence that oncological diseases are caused as a result of the influence of many factors and causes.

BIBLIOGRAPHY

1. Статистика онкологических заболеваний в Республике Беларусь (2002-2011) / под общ. ред. О. Г. Суконко. – Минск: РНПЦ им. Н. Н. Александрова, 2012. – 333 с.

2. Статистика онкологических заболеваний в Республике Беларусь (2008-2017) / под общ. ред. О. Г. Суконко. – Минск: РНПЦ им. Н. Н. Александрова, 2018. – 284 с.

3. Охрана окружающей среды в Республике Беларусь / под общ. ред. И. В. Медведьевой. – Минск: Национальный статистический комитет Республики Беларусь, 2018. – 228 с.

COMPARATIVE ANALYSIS OF ECOLOGICAL EDUCATION IN THE REPUBLIC OF BELARUS AND THE REPUBLIC OF POLAND

E. Misuno, E. Smirnova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
liza.misuno@yandex.by

The structure of environmental education in the Republic of Belarus and the Republic of Poland is analyzed, it is shown that it is similar in both countries. The results of a questionnaire survey of students in order to identify environmental competencies are presented.

Keywords: ecology, education, environmental problems, environmental competencies.

The anthropogenic impact on the environment increased significantly in the twentieth century in connection with the scientific and technological revolution, and now it has assumed alarming proportions. In the countries of the European region, which include the Republic of Belarus (RB) and the Republic of Poland (RP), environmental problems are similar, but in Belarus the unfavorable environmental situation is aggravated by the consequences of the Chernobyl accident (from which the territory of Poland suffered to a much lesser extent) and the melioration of swamps.

Solving environmental problems requires an integrated approach and one of the key directions is the organization of environmental education in all age groups and social strata of the population. The structure of environmental education in Poland and Belarus is largely similar and covers all levels of education from preschool to higher education. Programs for preschoolers (in Poland – "Jestem EKOprzedszkolakiem"), in Belarus - "Praleska") are aimed at developing children's interest in the natural environment, understanding the mutual dependence of human and nature, forming a sense of responsibility for the environment [1–2].

In school education programs, emphasis is placed on considering environmental problems, their causes and solutions. At the same time, the content of training is repeated and expanded in classes, taking into account those acquired in the study of biology, chemistry, geography and other subjects. However, in Poland the program is not divided into separate years of study. It goes beyond classroom teaching to include numerous excursions, ecological walks and direct field observation. In both countries, there are universities with specialties in the environmental range of profile.

The final goal of environmental education is the acquisition of environmental competencies by the population, including not only knowledge, but also practical skills that are implemented in everyday life. In order to identify environmental competencies, 104 students of universities in Poland (Higher School of Social and Natural Sciences in Lublin) and Belarus (Belarusian State University, ISEI) were surveyed.

To the question "How often do you dispose of batteries in specially designated containers?" 44.2 % of Belarusian students answered "always" and only 9.6 % of Polish students, "sometimes" -17.3 % of Belarusian students against 51.9% of Polish students, answers "often" and "never" were registered in 11.5 % and 28.8 % of questionnaires, respectively, among Belarusian students and 17.3 % and 21.2 % among Polish students.

To the question "Do you sort plastic, glass, paper and household waste?" the same number of students (23.1 %) in both groups answered "always" and 42.3 % – "sometimes". The answer "often" was registered by 23.1 % of Belarusian and 13.5 % of Polish students; the answer "never" was 2 times more common among Belarusian students than Polish students (21.2 % and 11.5 %, respectively). The results of the survey made it possible to conclude that the active introduction of environmental education in wide circles of the population, along with the creation of new forms of environmental education, is currently relevant for both countries.

BIBLIOGRAPHY

1. *Skoczen I.* Edukacja ekologiczna w przedszkolu. Realizacja 12 projektu . „Jestem EKOprzedszkolakiem" organizowanego przez Kolo Naukowe Sozolog6w Uniwersytetu Kardynala Stefana Wyszynskiego w Warszawie/1. Skoczen// Edukacja ekologiczna. Wybrane problemy. Krosno, Armagraf, 2014. S. 45–56.

2. *Панько Е. А.* Пралеска: программа дошкольного образования / Е. Панько [и др.]. Минск: НИО, Аверсев, 2007. – 320 с.

BEHAVIORAL ACTIVITY AND BIOCHEMICAL PARAMETERS OF THE CENTRAL NERVOUS SYSTEM TISSUE ON THE MODEL OF THE NEURODEGENERATIVE STATE OF PARKINSON'S DISEASE

M. Mustafakulov, T. Ishankhodzhaev, B. Zainutdinov, T. Saatov, Sh. Kuziev, S. Hamroyev

Institute of Biophysics and Biochemistry at NUU named after M. Ulugbek., Tashkent
National University of Uzbekistan named after M. Ulugbek.,
Tashkent
mmustafakulov@bk.ru

One of the factors causing the onset of a neurodegenerative state (NDS), which leads to the death of up to 38 % of nerve cells in the central nervous system in patients with symptoms of Parkinson's disease, is the high activity of free radical oxidation (FRO). Taking this into account, the aim of this work was to study the effect of the antioxidant quercetin on individual parameters of behavioral activity and biochemical parameters of the NDS tissue when simulating the NDS model with symptoms of Parkinson's disease.

The VAT model was induced by intranasal administration of rotenone at a dose of 1.5 mg/kg body weight for 7 days to outbred rats 11–12 months old; two hours later on the day of the experiment, quercetin was administered intranasally at a dose of 5 mg/kg. On the 3,6,9 days of the experiment, standard behavioral tests were carried out to monitor the reproduction of the SSS model. Materials for biochemical studies were selected after the slaughter of animals on the 10th day of the experiment.

The results of the study of behavioral tests showed that in the group of animals with the SDS model (active control), emotionally and motosensory activity changes, postural instability is observed, the amount of distance traveled, squares crossed, the burrow reflex decreases, in 10 % of cases animals develop rigidity and in 3 % tremor of the limbs. In cognitive tests, a decrease in the number of animals performing the conditioned passive reaction (CPAR) and active avoidance (ACAR) is observed, while the coefficient of learning the conditioned reflex (COUR) decreases. In the brain tissue of this group of animals, there is an increase in LPO products by 120 % and a decrease in the activity of enzymes of the antioxidant system (AOS): catalase, SOD, and glutathione peroxidase. In the group of animals that were injected with quercetin two hours after rotenone, the parameters of behavioral activity remained at the level of passive control values (intact rats), with the exception of a slight increase in the number of upright postures and mink reflexes in the Open Field test and a slight decrease in COUR, against the background of a decrease in MDA by 80 % and an increase in the activity of AOS enzymes in comparison with the active control.

Thus, the results of the study show that quercetin, by suppressing the activity of FRO, reduces the neurotoxic effect of rotenone when simulating the SDS model with symptoms of Parkinson's disease, preventing damage to nerve cells and preserving their functional properties.

IMMUNOCHEMICAL CHARACTERIZATION OF FRAGMENTS OF ANTIBODIES TO FERRITIN

B. Muzychenko, Y. Melnikova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
Bogdanich1313@gmail.com

Using a solid-phase competitive immunochemical analysis, the affinity of interaction with the scFv antigen of fragments of the HSF 102 monoclonal antibody with different linker peptide lengths was determined and it was found that the parameters of antigenic binding of all scFv fragments exceed the parameters of interaction with the antigen of full-sized HSF 102 antibodies by 1.5–6 times. The scFv fragment of the HSF 102 monoclonal antibody scFv-HSF102-21.11 has the best antigen-binding properties. The obtained scFv fragments of the HSF 102 monoclonal antibody are recombinant single-stranded antibodies with antigen-binding activity increased as a result of an increase in the conformational mobility of variable domains.

Keywords: monoclonal antibodies, hybridoma, biotechnologies, fragments of monoclonal antibodies, ferritin, immunochemical analysis.

An alternative method of obtaining antibodies is the creation of their recombinant analogues. This approach allows to obtain highly purified recombinant antibody preparations, as well as to change their properties using genetically engineered methods. [1]

The use of genetically engineered methods makes it possible to express light and heavy chains of immunoglobulins as individual proteins, to create a whole set of various antibody fragments, as well as to change antibody properties such as affinity, number and specificity of paratopes, domain composition, molecular mobility, spatial orientation of antigen binding sites, molecular weight, isoelectric point and potential immunogenicity. [2]

To determine the parameters of specificity of scFv fragments of HSF 102 monoclonal antibody to ferritin, the interaction of full-sized antibodies and their recombinant fragments with immobilized ferritin was studied. Comparison of antigen-binding parameters of monoclonal antibodies and their fragments upon their contact with immobilized ferritin was carried out under conditions of identical amounts of antigen.

Using a solid-phase competitive immunochemical analysis, the affinity of interaction with the scFv antigen of fragments of the HSF 102 monoclonal antibody with different linker peptide lengths was determined and it was found that the parameters of antigenic binding of all scFv fragments exceed the parameters of interaction with the antigen of full-sized HSF 102 antibodies by 1.5–6 times.

The scFv fragment of the HSF 102 monoclonal antibody scFv-HSF102-21.11 has the best antigen-binding properties.

The obtained scFv fragments of the HSF 102 monoclonal antibody are recombinant single-stranded antibodies with antigen-binding activity increased as a result of an increase in the conformational mobility of variable domains.

BIBLIOGRAPHY

1. *Ahmad, Z. A.* scFv antibody: principles and clinical application. Clin. Dev. / Z. A. Ahmad // Immunol. – 2012. – V.87. – P. 42–49.

2. *Steinitz, M.* Production of human monoclonal antibodies by the epstein-barr virus method / M. Steinitz // Methods Mol Biol. – 2014. – № 1060. – P.111–122.

BIOLOGICAL CHARACTERISTICS OF ADENOSINE MONOPHOSPHATE

D. Novik, A. Yurlevich, M. Lubchenko, S. Shahab

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
novik301199@gmail.com
siyamakshahab@mail.ru

The theoretical information concerning the adenosine monophosphate molecule is considered, and its biological characteristics are determined.

Keywords: adenosine monophosphate, lipophilicity, bioactivity, Lipinski's rule, molecule optimization.

Adenosine monophosphate (AMP, adenylic acid) is a nucleotide consisting of a nitrogenous base of adenine, a ribose carbohydrate, and a phosphoric acid residue [1]. It is contained in the body in the composition of RNA, coenzymes and in free form. The terminal residue of adenosine monophosphate, which can always be found in transport RNA, is important for the binding of amino acids involved in protein synthesis.

To determine biological characteristics, the Molinspiration Internet resource was used. The Molinspiration Internet resource provides the ability to calculate molecular properties and predict indicators of the biological activity of organic molecules. Theoretical data calculated using this Internet resource are presented in Table 1.

Table 1

Biological characteristics of adenosine monophosphate

logP	-1,52
Volume, A^3	263,88
Molecular mass, g/mol	347,22

According to Lipinski's rule, an organic compound can be "like" a drug if:

1. Has less than 5 donor atoms of hydrogen bonds due to the fact that their large number leads to a low permeability of the membrane due to the additional energy used to destroy hydrogen bonds during the transition from an aqueous medium to a lipid membrane;

2. Has a molecular weight of less than 500, since high molecular weight is associated with low solubility and permeability through membranes;

3. Lipophilicity logP should be less than 5. There is an increase in undesirable manifestations of toxicological properties associated with a high value of logP [2];

For AMP, the logP is -1.52, which indicates a weakening of undesirable manifestations of toxicological properties. The molecular weight is 347.22 g/mol, therefore, it can be concluded that the compound has a high permeability through the cell membrane.

Low toxicity and high permeability through biological membranes are important indicators for substances that can be used as a medicine.

BIBLIOGRAPHY

1. *Novik, D.* Quantum-chemical modeling and physico-chemical properties of Adenosine monophosphate / D. Novik, S. Shahab, A. Yurlevich // Actual environmental problems. – 2020. – P. 121–122.

2. *Hughes, J. D.* Physiochemical drug properties associated with in vivo toxicological outcomes / J. D. Hughes // Bioorganic & Medicinal Chemistry Letters. – 2008. – № 18. – P. 4872–4875.

DETERMINATION OF ERCC1 EXPRESSION LEVEL IN PATIENTS WITH COLORECTAL CANCER

M. Oev, E. Shpadaruk, R. Smolyakova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
serenkovaalena1@gmail.com

In this study, the level of ERCC1 expression was determined in 72 patients with colorectal cancer. When analyzing the data obtained, we found that the average expression level was 3.42±2.11 rel. units, while the studied gene was dominated by hypo-expression in 77.8% of patients. In the group of patients with disease progression, the hypo-expression of ERCC1 was detected in 84.1% of cases.

Keywords: colorectal cancer, patients, expression level, ERCC1 gene, molecular genetic markers, therapy.

Colorectal cancer or colon cancer is a group of malignant neoplasms of epithelial origin located in the colon and anal canal. It is one of the most common forms of cancer. It accounts for almost 10% of the total number of diagnosed cases of malignant epithelial tumors worldwide [1].

ERCC1 (excisionrepaircrosscomplementing – complementary excision DNA repair enzyme) refers to a group of enzymes involved in DNA repair by recognizing and removing single erroneously paired nucleotides. Increased expression of ERRC1 gene in patients with colorectal cancer was associated with a more effective response to chemotherapy (61.9 %) compared to patients with lower expression [2].

As a result of the study, the expression level of the ERCC1 oncogene was determined in the tumor tissue of 72 patients suffering from colorectal cancer who received various types of therapy. The levels of expression of the ERCC1 gene in the clinical material of patients with colorectal cancer were determined by polymerase chain reaction with hybridization-fluorescence detection in real time using the High Capacity cDNA Reverse Transcription Kit for RNA isolation (Ambion, USA) and detection on the iCycler amplifier, BioRad (USA).

Patients suffering from colorectal cancer (n=72) were included in the study with mandatory morphological confirmation of the diagnosis and written informed consent to the study. Analysis of clinical data showed that the average age of patients was 63.2 ± 1.2 years, women 54.1 %, men 45.7 %. Distribution of patients suffering from colorectal cancer, depending on the prevalence of the tumor process, stage IIIB prevailed in 58.5 %, and by histological type, moderately differentiated adenocarcinoma prevailed, detected in 54 % of patients.

During the study, patients were divided into 2 groups depending on the type of treatment performed. The first group (I) consisted of 40 patients with performed radical treatment, the average age of patients was 68.2 ± 1.4 years; the second (II) – 32 patients with performed radical treatment and polychemotherapy (PCT) according to the scheme 5-fluorouracil at a dose of 400 mg/m2 per day, the average age of patients was 56.6 ± 1.6 years.

The expression of the ERCC1 gene was determined in 72 patients with colorectal cancer. The results of the study showed that the expression level in colorectal cancer varied from 0.001 to 144.0 rel. units, the average value of the expression level was 3.42 ± 2.11 rel. units. Individual data analysis revealed hypo-expression, established (from 0 to 1 rel. units) in 77.8 % of patients, moderate expression (from 1 to 5 rel. units) – in 15.2% and hyperexpression (over 5 rel. units) – in 7 %.

In 84.1 % of patients with disease progression, the expression level of oncogene ERCC1 ranged from 0 to 1 rel. units, 5.3 % – from 1 to 2 rel. units, from 2 to 3 rel. units and more than 5 rel. units, respectively. In the course of the study and analysis of the data obtained in the group of patients with a diagnosed relapse of the disease, hypo-expression was detected in 84.1 % of cases, a moderate level of expression – in 10.6 %, hyperexpression – in 5.3 % of cases. Correlation analysis showed that the overall survival of patients is characterized by a direct weak relationship with the level of ERCC1 expression (Rs=0.203; p(Spearman) <0.05).

When analyzing the data obtained in the group of patients receiving radical treatment (group I), hypo-expression was detected in 77.5 % of cases, moderate expression level – in 17.5 %, hyperexpression – in 5 % of cases.

When analyzing the data obtained in the group of patients receiving combined treatment (group II), hypo-expression was detected in 78.2 % of cases, moderate expression level – in 12.5 %, hyperexpression – in 6.3 % of cases.

When comparing the expression levels of the ERCC1 gene in patients of groups I and II with each other using the Mann-Whitney U-test, it was revealed that the obtained value of U (431.5) is unreliable. Consequently, the differences between the groups are not statistically significant (p0,05).

Thus, the hypo-expression of oncogene ERCC1 may be an unfavorable additional factor in the development of early relapse of the disease.

BIBLIOGRAPHY

1. Интернет портал [Электронный ресурс] / https://gco.iarc.fr/today/data/factsheets/cancers/10_8_9-Colorectum-fact-sheet.pdf. – Дата доступа: 05.03.2021.

2. *Новык, А. В*. Значение биомаркеров для диагностики и определения тактики лечения больных с опухолями с неизвестной первичной локализацией / А.В. Новык, А.С Жабина // Практическая онкология. – 2011. – Т. 12. – № 4. – С. 178–184.

SYNTHESIS OF 8-AZIDOFLUDARABINE

E. Osipova, E. Deusova, M. Khancheuski, E. Kvasyuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
lena.osipova.01@mail.ru

The paper presents data on the synthesis of a new fludarabine derivative 8-azidofludarabine.

Keywords: fludarabine, 8-bromofludarabine, 8-azidofludarabine, antitumor activity.

Fluorinated nucleosides exhibit a wide spectrum of biological activity and are widely used as antineoplastic and antiviral agents. In many cases, the stability of the nucleoside analog, especially the stability of the glycosyl bond, is an important factor in determining the biological activity as well as the therapeutic value of nucleosides as drug candidates [1].

To date, other biological properties of fludarabine and its analogues have not been sufficiently studied, and their further study is very promising.

The prerequisite for the synthesis of 8-azidofludarabine is data on the biological activity of 8-substituted analogues of purine nucleosides [2]. The scheme for the synthesis of 8-azidofludarabine (**2**) from 8-bromofludarabine (**1**) is shown in the figure.

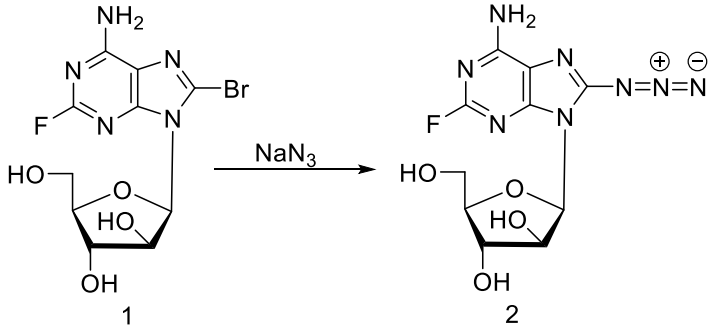


*Fig. 1 – Scheme of the synthesis of 8-azidofludarabine (**2**) from 8-bromofludarabine (**1**)*

The reaction progress and the contents of the reaction mixture were monitored using thin layer chromatography (TLC) on «Kieselgel 60 F_{254}» plates from «Merck» (Germany) in a solvent system: chloroform / methanol (4:1 v/v). The spots of the compounds were visualized on the plates by viewing them in ultraviolet light.

A mixture of 8-bromofludarabine (**1**) (500 mg, 1.37 mmol) and sodium azide (98.15 mg, 1.51 mmol) in 40 ml of distilled water was heated until a solution was obtained. The solution was stirred at room temperature for 24 h until the reaction was complete, and then concentrated to 5–10 ml on a rotary evaporator in a vacuum at a temperature of ≤30°C. The resulting mixture was left in the refrigerator until a precipitate formed. The precipitate was filtered off, washed on a filter with cold water (2x2 ml) and chilled alcohol (2x2 ml). The precipitate was dried at room temperature in air, and then in vacuum to constant weight to give 423 mg (85%) of 8-azidofludarabine (**2**).

BIBLIOGRAPHY

1. *Квасюк, Е. И.* Оптимизация методов синтеза и выделения противоопухолевого соединения флударабинфосфата / Е. И. Квасюк, И. Г. Гриб, О. В. Колядко // Сахаровские чтения 2020 года: экологические проблемы XXI века: материалы 20-й международной научной конференции 23-24 мая 2019 г., г. Минск, Республика Беларусь / под ред. С. А. Маскевича, С. С. Позняк – Минск: ИВЦ Минфина, 2019. – Ч. 2. – С. 89–92.

2. *Tatani, K.* Identification of 8-Aminoadenosine Derivatives as a New Class of Human Concentrative Nucleoside Transporter 2 Inhibitors / K. Tatani [et al.] // ACS Med. Chem. Lett. – 2015. – Vol. 6, № 3. – P. 244–248.

RETROSPECTIVE ANALYSIS OF MORBIDITY ADULT POPULATION OF THE CITY OF BYKHOV (2007–2018)

V. Papruga, M. Dubina

Belarusian state University,ISEI BSU
Minsk, Republic of Belarus
viktoriapapruga@gmail.com

Abstract: the paper provides retrospective analysis of the incidence of the population of Bykhov for the period from 2007 to 2018; the dynamics was analyzed, the growth rates were calculated and the main trends in the general and primary morbidity of the population were revealed on the basis of the available statistical data.

Keywords: Morbidity, primary morbidity, general morbidity, epidemiology, statistics, growth rates.

In the result of a retrospective analysis of long-term dynamics (2007–2018) of the general and primary morbidity of the population of Bykhov, a tendency towards an increase in the overall morbidity and an increase in the primary morbidity was noted.

It was noted that the first rank places in the structure of the overall morbidity in 2007 were occupied by the following diseases: diseases of the circulatory system (23.54 %), diseases of the respiratory system (19.74 %), diseases of the musculoskeletal system and connective tissue (11.03 %), diseases in the class "Injuries, poisoning and some other effects of external causes" – 6.74 % and mental disorders – 6.38%. At the end of the study period, the structure of the general morbidity in the population of Bykhov changed. Diseases of the circulatory system are also in the first rank – 33.06 %; on the second rank – diseases of the respiratory system – 14.81 %; in third place - diseases of the musculoskeletal system and connective tissue 10.76%; on the fourth – diseases of the digestive system – 5.96 %, and on the fifth – neoplasms – 5.77 %.

The first rank places in the structure of primary morbidity in 2007 were occupied by diseases of the respiratory system (36.2 %), in second place were diseases in the class "Injuries, poisoning and some other effects of external causes" – 15.2 % , in third place – diseases of the circulatory system (7.22 %), in fourth - diseases of the skin and subcutaneous tissue (5.65%) and in fifth - diseases of the musculoskeletal system and connective tissue - 5.62 %. At the end of the study period, the structure of primary morbidity in the population of Bykhov changed somewhat. Respiratory diseases are also in the first rank (45.75 %); in second place – diseases of the circulatory system – 17.47 %; in third place – diseases in the class "Injuries, poisoning and some other effects of external causes" (9.06 %); in fourth place – Diseases of the skin and subcutaneous tissue (5.08 %) and in fifth place – diseases of the genitourinary system – 4.46 %.

Analysis of the dynamics of the primary morbidity of the population of Bykhov revealed an increase in the incidence of respiratory diseases, diseases in the class "Injuries, poisoning and some other effects of external

causes", diseases of the musculoskeletal system and connective tissue, diseases of the skin and genitourinary system.

Analysis of the dynamics of the general morbidity of the population of Bykhov revealed a steady increase in the incidence of respiratory diseases, diseases in the class "Injuries, poisoning and some other effects of external causes", diseases of the musculoskeletal system, diseases of the circulatory system and diseases of the digestive system.

A healthy lifestyle and the prevention of non-communicable diseases are one of the most important cross-sectoral problems in the development of the Republic of Belarus. The formation of a healthy lifestyle among citizens, starting from childhood, is ensured by carrying out activities aimed at informing citizens about the risk factors for their health.

Among the key areas, it should be noted, first of all, the elaboration of mechanisms for the provision of medical care and an increase in their rationality, the impact on the medical activity of the population and its motivation to maintain a healthy lifestyle, the optimization of state participation in financing health care, and the provision of a widespread increase in the standard of living of the population. It is obligatory to develop a national strategy for preserving the health of the population as a program document that brings together all efforts to improve the demographic situation in the country.

BIBLIOGRAPHY

1. *Georgieva, L.* Health determinants in the scope of new public health / L. Georgieva, G. Burazeri:// Hans Jacobs Publishing. – Sofia. – 2005. – 633 p.

2. *Revich, B. A.* Environmental priorities and health: vulnerable areas and groups at risk / B. A. Revich // Ekologiya cheloveka. – 2010. – №7. – P. 3–9.

INFLUENCE OF SOPHOROFLAVONOSIDE ON THE ACTIVITY OF THE CYTOCHROS-C-OXIDASE ENZYME IN RAT LIVER MITOCHONDRIA UNDER INTOXICATION WITH HALOXIFOP-R-METHYL PESTICIDE

M. Parpieva[1], **H. Ruziboev**[2], **M. Pozilov**[2], **S. Nishanbaev**[3]

[1]*Andijan State University*

[2]*National University Uzbekistan*

[3]*Institute of the Chemistry of Plant Substances, Uzbekistan*

The enzyme cytochrome oxidase is a large transmembrane protein complex found in the 4th respiratory chain of mitochondria. In total, there are 3 types of cytochromes in mitochondria: a, b and c. They are very similar in molecular structure and differ from each other in the location of side radicals. The enzyme cytochrome oxidase is involved in the transport of electrons from 3 respiratory complexes to 4 complexes of the mitochondrial membrane. By increasing the electrochemical potential gradient, allowing protons to move across the membrane, it is then used by ATF synthetase to synthesize ATF [Wilson, 2014]. Under the influence of various factors of oxidative stress, a change in the activity of the cytochrome oxidase enzyme located in the mitochondrial membrane can lead to a decrease in the membrane potential and ATP synthesis. It was shown that some insecticides cause swelling of liver mitochondria in mammals, alter the process of respiration, oxidative phosphorylation, and cytochrome oxidase activity [Toualbia et al., 2017]. However, many pesticides, including haloxyfop-R-methyl, have not been studied for the effect of cytochrome oxidase activity on rat liver mitochondria.

The widespread use of these pesticides in agriculture in Uzbekistan stimulates their further research.

To study the effect of sophoroflavonolonoside (SFL) on the activity of cytochrome-c-oxidase in the liver mitochondria of rats poisoned with the pesticide haloxyfop-R-methyl, depending on the 10–40-day dynamics.

The experiments were carried out on male white rats weighing 180-200 g. The rats selected for intoxication with the pesticide haloxyfop- R -methyl were divided into the following groups:

Group I healthy (control) (n = 5);

Group II haloxyfop- R -methyl (n = 5-7);

Group III haloxyfop- R -methyl + SFL (n = 5–7):

Animals of groups II and III of the experiment were poisoned once with the pesticide haloxyfop-R-methyl at a dose of 1/10 LD50 using a special probe. After the pesticide was administered haloxyfop-R-methyl, the flavonoid SFL was orally administered to group III once a day at a dose of 10 mg/kg for 10 days. Rat liver mitochondria were isolated by the W.C. Schneider method.

The results showed that after 10-40 days in rats of group II, poisoned with the pesticide haloxyfop-R-methyl, the activity of cytochrome oxidase of liver mitochondria sharply decreased by 71.7 %, 68.5 %, 58.7 % and 43.9 %, respectively. This indicates that under the action of the pesticide, the transport of electrons in the respiratory chain of mitochondria is seriously impaired. In rats of group III, which received pharmacotherapy with SFL, on day 10, no effect was observed in comparison with the indicators of group II. However, by 20, 30 and 40 days, it increased by 26.5 %, 22.2 % and 16.6 %, respectively, compared with the indicators of group II.

Thus, under the action of this pesticide, a sharp decrease in the activity of cytochrome oxidase in liver mitochondria was observed. This prooxidant effect of pesticides can increase the formation of free radicals in the respiratory chain by reducing the activity of cytochrome oxidase, cause the destruction of lipoprotein membrane structures and induce lipid peroxidation.

It was found that the flavonoid SFL, chosen for the experiment, increases the stability of the inner and outer membranes by restoring the activity of the cytochrome oxidase enzyme in intoxicated liver mitochondria.

ION-EXCHANGE RESIN AS A REAGENT IN THE SYNTHESIS OF SECO-8-BROMOXANTHOSINE

V. Pashkovich, M. Khancheuski, Y. Gretskaya, V. Yaroshevich

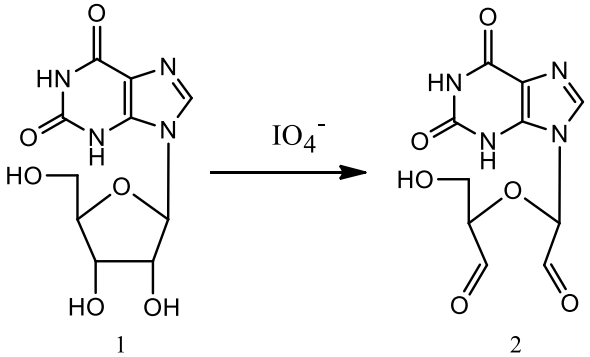
Belarussian State University, ISEI BSU
Minsk, Republic of Belarus
noryha2020@mail.ru

This paper presents data on the synthesis of 8-bromoxanthosine dialdehyde (seco-8-bromoxanthosine) obtained by the action of Dowex1x2 ion exchange resin (100-200 mesh) in IO_4^- form on 8-bromoxanthosine. A prerequisite for the synthesis of seco-8-bromoxanthosine was the data on the diverse biological activities, including antitumor and antiviral activities, of nucleoside-dialdehydes based on natural and modified nucleosides [1, 2].

Keywords: seco-8-bromoxanthosine, synthesis, dialdehyde, antitumor activity.

The periodate oxidation reaction of ribonucleosides leading to the formation of nucleoside-dialdehydes is used in the determination of the 3′-terminal ribonucleoside in RNA, to produce affinity sorbents, radioactively labeled derivatives, and nucleosides with a morpholine heterobase instead of ribofuranose. In this case, sodium periodate is used as a reagent to oxidize the diol group of ribonucleosides.

To simplify the procedure of seco-nucleoside isolation, Dowex1x2 ion exchange resin (100-200 mesh) in IO_4^- form was used in this work. The synthesis scheme of 8-bromoxanthosine dialdehyde (**2**) from 8-bromoxanthosine (**1**) is shown in the figure.



1 2

*Fig. 1 – Scheme of the synthesis of 8-bromoxanthosine dialdehyde (**2**) from 8-bromoxanthosine (**1**)*

Dry and distilled solvents were used in the process. The course of the reaction and the content of 8-bromoxanthosine dialdehyde were monitored using thin-layer chromatography on Merck Kieselgel 60 F_{254} plates (Germany) in a solvent system: isopropyl alcohol / ammonia / water (7: 2: 2 v/v/v). The compounds were visualized on plates by examining them in ultraviolet light.

To obtain 8-bromoxanthosine dialdehyde, 10 ml of Dowex1x2 ion exchange resin (100-200 mesh) in IO_4^- form form was used. The chromatographic column with ion exchange resin in Cl^- form was prewashed with 0.5 M sodium hydroxide solution until the eluate was alkaline. After charging the Dowex1x2 resin with hydroxide ions, the alkali residues were washed off the column by elution with distilled water. The column was then eluted with sodium periodate solution (2 g, 9.35 mmol in 200 ml water). The excess of sodium periodate was removed from the column by elution with distilled water (200 ml).

IO_4^- ion charged Dowex1x2 resin was added to a solution of 8-bromoxanthosine **(1)** (0.25 g, 0.69 mmol) in water under stirring. The solution was kept in the dark for 24 hours to complete the reaction. Then the resin was applied to a chromatographic column, and the column eluted with 200 ml of water to completely desorb the product of the reaction from the resin. The resulting solution was evaporated to dryness in vacuum at ≤40 °C on a rotary evaporator. The resulting white precipitate was dried at room temperature to constant weight. The yield of seco-8-bromoxanthosine **(2)** was 65 mg (26%).

BIBLIOGRAPHY

1. *Dvonch, W.* Antitumor Activity of Periodate-Oxidation Products of Carbohydrates and Their Derivatives / W. Dvonch [et al.] // Cancer Research. – 1966. – Vol. 26. – P. 2386–2389.

2. *Plagemann, P.G.* Mechanism of action of inosine dialdehyde (NSC 118994) in the inhibition of proliferation of tumor cells in culture / P. G. Plagemann, J. C. Graff, M. Behrens // Cancer Research. – 1977. – Vol. 37. – P. 2188–2195.

COMBINED ANTIHYPERTENSIVE THERAPY

T. Piliushyna, A. Bakunovich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
tatsiana.piliushyna@yandex.ru

Taking into account the different pathogenetic mechanisms of the development of arterial hypertension, it is advisable to use combined antihypertensive therapy, namely, to combine complementary groups of drugs to minimize side effects and achieve a sustainable decrease in target blood pressure levels, as well as reduce the risks of cardiovascular complications.

Keywords: blood pressure, arterial hypertension, combined therapy, pharmacological effect.

Arterial hypertension is one of the important problems of modern medicine, since this pathology often leads to complications that end in death. Currently, there are different groups of antihypertensive drugs with different mechanisms of action, the purpose of which is to achieve the target level of blood pressure (BP) and minimize life-threatening complications such as myocardial infarction, acute cerebrovascular accident, cardiac arrhythmias and sudden cardiac death.

The magnitude of blood pressure is determined mainly by three factors: renal sodium excretion, which determines the volume of plasma and the total volume of body fluids; work of the heart and vascular tone. These factors control intravascular volume, cardiac output, and systemic vascular resistance, which are direct hemodynamic determinants of blood pressure.

The increase in blood pressure, as a rule, is multifactorial, which makes it difficult to normalize it by acting on any one pressor mechanism. Therefore, in practice, two or three groups of drugs are used, or combined drugs containing several active substances. The main condition for the use of any combination is proof that it lowers blood pressure to a greater extent than monotherapy.

The combination of two drugs may result in partial or complete additivity of their antihypertensive effects, depending on the extent to which their pharmacological effects are different and complementary. Fully additive combinations are more effective in lowering blood pressure. Usually a combination of drugs from complementary classes in action is about five times more effective in lowering blood pressure than increasing the dose of one of the drugs. Another important requirement is pharmacokinetic compatibility (when the combination of drugs leads to a smooth and continuous decrease in blood pressure throughout the interval between doses of the drug).

There are seven main classes of antihypertensive drugs with many representatives in each class, so the number of possible combinations is quite large. Currently, the most effective combinations are the following groups of drugs:

1. Angiotensin-converting enzyme (ACE) inhibitors + diuretic. ACE [1] inhibitors inhibit the action of the angiotensin-converting enzyme, and diuretics initially reduce intravascular volume and activate the renin-angiotensin-aldosterone system (RAAS), which leads to vasoconstriction, as well as salt and water retention. The addition of an ACE inhibitor to a diuretic weakens the effect of this mechanism.

2. ACE inhibitors + calcium channel blockers (CCBs). Their combination gives a completely additive effect of lowering blood pressure. The addition of RAAS inhibitors, due to their antisympathetic effects, attenuates the increase in heart rate that may occur with dihydropyridine CCBs.

3. β-blockers (βAB) + diuretic. βABs weaken the activation of the RAAS, which is accompanied by the use of thiazide diuretics, and the use of such combinations gives a completely additive effect of lowering blood pressure [2].

4. CCB + diuretic. Long-term treatment with drugs of both classes is associated with the effect of vasodilation, while diuretic therapy does not cause hypovolemia [3].

5. CCB + βAB. The pharmacological effects of the combination of these two classes of drugs are complementary in lowering blood pressure [2], [3].

Thus, combination therapy is a long-term, cost-effective and safe treatment for hypertension, which improves the quality of life of patients and significantly reduces the risk of cardiovascular complications.

BIBLIOGRAPHY

1. *Joseph, L.* Angiotensin-Converting Enzyme Inhibitors / L.Joseph, R.Matther. ASH Special Issue. Epub., 2011. V. 13. № 9. P. 635–702.

2. *Ripley, L. Toni*. β-Blockers: A Review of Their Pharmacological and Physiological Diversity in Hypertension / Toni L. Ripley, Joseph S. Saseen. Sage Journals. 2014. V. 48. № 6. P. 723–733.

3. *Toyoda, S*. Pleiotropic effects of calcium channel blockers / S. Toyoda, M. Sakuma, K. Node. Hypertension Research. 2018. V. 41. P. 230–233.

RELATIVE DOSIMETRY OF SMALL FIELDS

V. Piskunou, S. Siamionau, T. Chikova

Vitebsk Regional Clinical Oncology Center

Vitebsk, Republic of Belarus

x_serg@tut.by

The main provisions of increasing the reliability of the relative dosimetry of small fields, obtained on the basis of clinical experience of radiation therapy in Vitebsk Regional Clinical Oncology Center are stated.

Keywords: radiation therapy, small fields, lateral beam profile, linear accelerator.

Currently, there is growing interest in the use of such radiation techniques as stereotactic radiosurgery (SRS), stereotactic body radiotherapy (SBRT), intensity modulated radio-therapy (IMRT), in which small fields are widely used. Their use has increased the uncertainties in clinical dosimetry, especially for small fields, which has a significant impact on the outcome of the course of radiation therapy [1, 2].

At the Vitebsk Regional Clinical Oncological Dispensary, two linear accelerators are in operation: TrueBeam and Clinac IX manufactured by VARIAN, which implement such techniques as intensity modulated radiation therapy (IMRT) and volume-modulated arch therapy (VMAT). With high-quality and timely control of the accelerator parameters, the error in the radiation dose during patient treatment is minimized.

The relative dosimetry of small fields includes the determination of the lateral profiles of the beam, the percentage-depth dose along the central axis of the beam, and the factors of the release of radiation fields. When choosing equipment for relative dosimetry of small fields, it is necessary to take into account such features as the need to use detectors with a small volume, the ability to measure with a high spatial resolution and the need to overcome the problems of detector positioning. An ideal detector for dosimetry of small fields should measure the flux at a point, be equivalent to water, and have a linear response that is independent of energy and absorbed dose rate.

Fields less than 4 cm × 4 cm are considered to be outside the scope of conventional dosimetry and require special care in both measuring and calculating the radiation dose. When measuring lateral beam profiles, it is important to pay attention to the orientation of the detectors (diode and diamond) (Fig. 1) and the orientation of the ionization chamber to measure the lateral beam profiles (Fig. 2).

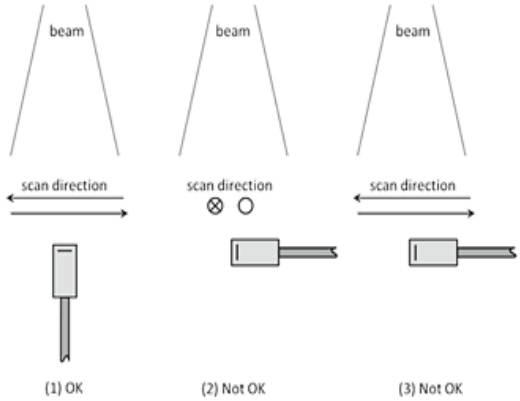


Fig. 1.

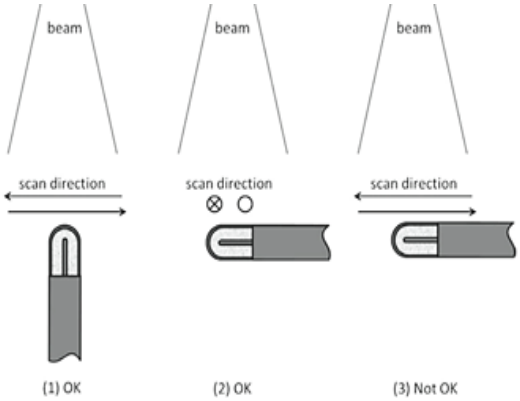


Fig. 2.

When measuring low-field profiles and percentage-depth doses, the resolution of the detector and accurate positioning of the detector along the central axis of the field are important.

When measuring low field yield factors, the correction factors for the detector used must be taken into account. Depending on the design features, some detectors overestimate the measured dose or vice versa. Coefficients for a number of detectors are given in the IAEA report on small field dosimetry (TRS No. 483) [1].

The choice of the most suitable detectors for a particular type of measurement is made based on the parameter being measured. Since there is no ideal detector, it is recommended to use two or three different types of detectors suitable for a particular measurement to ensure that no significant errors are allowed.

BIBLIOGRAPHY

1. Dosimetry of Small Static Fields Used in External Beam Radiotherapy: An International Code of Practice for Reference and Relative Dose etermination. / IAEA TRS 483. Vienna, 2017. – 211 p.

2. Absorbed Dose Determination in External Beam Radiotherapy. An International Code of Practice for Dosimetry Based on Standards of Absorbed Dose to Water / IAEA Technical Report Series. № 398. Vienna, 2000. – 183 p.

ANALYSIS OF THE INCIDENCE OF ARVI IN THE POPULATION OF MOLODECHNO DISTRICT IN 2011–2020

V. Radzevich[1, 2]

[1]*Belarusian State University, ISEI BSU*
Minsk, Republic of Belarus
[2]*Molodechno center for hygiene and epidemiology*
Molodechno, Republic of Belarus
olia.radevich@tut.by

The incidence of acute respiratory viral infections, including influenza, remains high, showing an annual increase in autumn and in winter. The specific weight of ARVI in the structure of infectious diseases is 95.19 %. The conducted analysis of morbidity did not reveal a pronounced tendency to increase /decrease. Children get sick 10 times more often than adults. The most frequent cases of ARVI were recorded in November, December and in March, April. In 2019,41,35 % of people were vaccinated against influenza in the Molodechno district.

Keywords: influenza, acute respiratory viral infections, morbidity, vaccination.

Last years are marked by a widespread increase in viral infections, regardless of the level of socio-economic development of the country. The infections are noted for a more severe clinical course, resistance and torpidity to the applied etiotropic therapy. The most common and socially significant infections include influenza, acute respiratory viral infections (ARVI), viral hepatitis, herpes infection and others. Influenza and ARVI account for 90 % of all infectious diseases. ARVI are the most common diseases on the globe. Up to 80 % of the population is ill every year.

The incidence of acute respiratory viral infections, including influenza, remains high, showing an annual increase in autumn and in winter.

The diversity and new discoveries of respiratory viruses, the variability of the latter, leading to rapid expansion of strains resistant to antiviral agents and eluding adaptive immune responses, as well as the high frequency

of viral mixed infections indicate the relevance of studying acute respiratory viral infections at the present stage, and the above problems dictate the need to analyze the prevalence of this group of infections.

The paper carried out a retrospective analysis of the morbidity rates of the adult and child population, analyzed the dynamics and identified the main trends. A comparative analysis of the morbidity of the population of the Molodechno district and other districts of the region was carried out.

The average annual incidence of ARVI in the population of the Molodechno district amounted to 33715.3=1409.6 cases per 100,000 population. Moreover, children get sick 10 times more often than adults. For the child population, the average annual rate was 122982.5±3295.6 cases per 100,000 population, and for an adult – 11503.9±1211.3.

The conducted analysis of morbidity did not reveal a pronounced tendency to increase /decrease. It can be noted that during the studied period, the average morbidity rates of the population of the Molodechno district are higher than similar indicators in the Minsk region. The exception was 2015-2017. The highest incidence of ARVI in the Molodechno district is observed in 2020, and the lowest in 2015.

The share of ARVI in the structure of infectious diseases in 2019 was 95.19%. Since 2008, there has been an increase in the proportion of ARVI and influenza in the structure of infectious and parasitic morbidity. The most frequent cases of ARVI were recorded in November, December and in March, April.

In 2019, 56579 people were vaccinated against influenza in the Molodechno district (which is 41.35 % with the required indicator of at least 40 %).

The results of the study of morbidity suggest that diseases of acute respiratory viral infections are quite common that timely prevention is an integral part of human life. In the autumn months, it is necessary to vaccinate with influenza vaccines and seasonal prophylaxis by means of non-specific protection.

ALZHEIMER'S DISEASE: BIOLOGICAL AND ECOLOGICAL PREREQUISITES, PROMISING DIAGNOSIS AND THERAPY METHODS

A. Rafalskaya, L. Major

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
major@iseu.by

In this article the mechanism of pathogenesis of Alzheimer's disease, its biological and environmental prerequisites are described. Promising therapeutic and diagnostic approaches aimed at earlier detection of the disease and minimization of symptoms are proposed.

Keywords: Alzheimer's disease (AD), ®- amyloid peptide(Aβ), mitochondrial dysfunction, photosensitizer.

Alzheimer's disease (AD) this is a neurodegenerative disease characterized by atrophic changes in the brain, neuronal cell death, impaired attention and memory, progression of dementia and complete loss of cognitive functions. Death occurs within 3–9 years after diagnosis. Due to the increase in life expectancy and the associated aging of the population of developed and developing countries, it is expected that by 2050 the total number of people diagnosed with Alzheimer's disease will exceed 115 million. However no effective methods of treatment and prevention of this disease have been developed.

It is known that the pathogenesis of AD is largely associated with amyloidogenesis (deposition of extracellular ®- amyloid peptide(Aβ) in the form of plaques in the spaces between nerve cells) and neurofibrillary degeneration (formation of intracellular tangles of tau- protein fibers)-the amyloid cascade hypothesis.[1] In this regard, earlier studies of the disease usually focused on evaluating the production of Aβ by the brain However, due to the failures of therapy aimed at reducing the level of beta-amyloid, it became obvious in patients with a sporadic form of AD, that the amyloid cascade hypothesis is relevant only for the early, hereditary form of AD (~5 % of cases), and with the late, sporadic form of the disease, which accounts for ~95 % of cases, the hyperproduction of Aß becomes a secondary event [2]. The key factor initiating the development of sporadic AD is the dysfunction of mitochondria-cell organelles, which not only generate most of the chemical energy needed to power the cell's biochemical reactions but also directly related to the processes of apoptosis and necrosis.

According to the mitochondrial cascade hypothesis [3], oxidative stress can induce mitochondria to activate excessive Aß production, which in turn has a toxic effect on mitochondria, aggravating neurodegenerative processes.

Thus, it is obvious that mitochondria should be considered as the main object of diagnosis as well as the therapeutic target.

The techniques available today, namely lumbar puncture, positron emission and computed tomography, make it possible to capture the disease at a stage when the brain is already undergoing irreversible qualitative and structural changes and are mainly aimed at detecting accumulations of beta-amyloid peptide.

As a promising diagnostic approach, the authors propose to consider the technique of visualizing the activity of mitochondria using confocal microscopy, which is already actively used against glioblastoma cells [4] – malignant brain tumor, average survival after diagnosis – 14.6 months [5] where a self-expressed fluorescing protein (mitoGFP) activated by integrating the plasmid DNA into the cell can serve as an alternative to a photosensitizer, in case of impossibility of the optimal dosage selection.

It is assumed that the use of photosensitizers or their alternatives, can also be considered as the future AD therapy basis since this technique not only allows selectively destroying damaged organelles or cells entirely, but also has proven itself in the treatment of certain types of cancer such as actinic keratosis, advanced cutaneous T-cell lymphoma, Barrett esophagus, basal cell skin cancer, esophageal (throat) cancer, non-small cell lung cancer, squamous cell skin cancer [6].

It is also worth paying attention to the development of a set of preventive measures aimed at minimizing the risk of oxidative stress, and hence Alzheimer's disease, in the human body, due to the influence of established exogenous environmental triggers, such as exposure to cigarette smoke, UV radiation, heavy metal ions, ozone, allergens, drugs or toxins, pollutants, pesticides or insecticides [7].

The integration of the ecological approach into the classical concept will expand the understanding of the AD and provide an opportunity to search for new ways of its prevention and treatment.

However to develop full-fledged techniques aimed at reducing AD pathology future research is needed.

BIBLIOGRAPHY

1. *Ricciarelli1 R., Fedele E.* The Amyloid Cascade Hypothesis in Alzheimer's Disease: It's Time to Change Our Mind / R.Ricciarelli1, E. Fedele // Curr Neuropharmacol. 2017 Aug; 15(6): P. 926–935.

2. *Тюменцев М.А.* Анализ вклада дисфункции митохондрий в развитие признаков болезни альцгеймера у крыс OXYS дис. ... канд. биолог. наук: 03.03.04/ М. А. Тюменцев. Новосибирск., 2018. 105 с.

3. *Swerdlow R.H., Khan S.M.* A«mitochondrialcascade Hypothesis» for sporadic Alzheimer'sdisease. / R. H. Swerdlow, S.M. Khan//Med. Hypotheses. 2004;63: P. 8–20.

4. *Dučić T., Paunesku T., Chen, Ninković M., Speling S., Wilke C., Lai B., Woloschak G*. Structural and elemental changes in glioblastoma cells in situ: complementary imaging with high resolution visible light- and X-ray microscopy / T.Dučić, T.Paunesku, S.Chen S., M.Ninković, S.Speling, C.Wilke, B.Lai, G.Woloschak // Analyst, 2017, 142, P. 356–365.

5. *Stupp R., Mason W.P., van den Bent M. J., et al.* European Organisation for, T. Treatment of Cancer Brain, G. Radiotherapy, G. National Cancer Institute of Canada Clinical Trials Radiotherapy plus concomitant and adjuvant temozolomide for glioblastoma N. Engl. J. Med., 352 (2005), pp. 987–996.

6. Photodynamic Therapy for Cancer – [E-resource] – Mode of access:https://www.cancer.gov/ about-cancer /treatment/types/photodynamic-therapy (Date of access: 10.10.2021)

7. *Ferrer A., Marques Gonçalves B., Tsatsakis F., et al.* Oxidative stress in methylmercury-induced cell toxicity / A., Ferrer, B., Marques Gonçalves, F., Tsatsakis, A. M., Renieri, E. A., Skalny, et al.// Toxics. 2018; 6(47): P. 135–142.

MICROARTHROPODS IN THE SOIL LAYERS OF SOUTH UZBEKISTAN

M. Rakhimov, Z. Elmuratova, D. Majidova

National University of Uzbekistan named after Mirzo Ulugbek
Tashkent, Republic of Uzbekistan

The increase in demand for agricultural production in the world is also leading to an increase in the demand for agrocenoses to increase productivity and ensure biosafety. However, the increase in pressure on soils of natural and artificial ecosystems in recent years has led to a decrease in the diversity of microfauna representatives, which is important in increasing soil fertility. In this regard, the identification of the fauna of microarthropods (collembolas and armored bites) and the assessment of their ecological and taxonomic composition in arid climates are of great scientific and practical importance.

Research materials During 2018–2021, agrocenoses of Surkhandarya and Kashkadarya regions were collected from natural ecosystem soil layers. Samples were obtained from soils of agrocenoses 0–10 cm, 10–20 cm, 20–30 cm. 1 dm3 of samples were taken from the layers.

The generally accepted Berleze-Tulgren apparatus was used to isolate microartropods from soil samples [1,2]. E. in determining the species composition of armored canals. M. Bulanova-Zakhvatkina's "Keys to the mites inhabiting the soil. Sarcoptiformes" and "Collembola fauna of the USSR" and "Keys to collembolans of the fauna of the USSR" determinants were used to determine the species composition of collembolas [3].

As a result of a comprehensive study of microartropods in the soils of agrocenoses and natural ecosystems of southern Uzbekistan, 36 species of collembolas and 54 species of oribatid bites were found. The identified 36 species of collembolas belonged to 3 subcategories, 8 families and 30 generations, and 54 types of armored canals belonged to 41 generations and 31 families.

BIBLIOGRAPHY

1. *Потапов М. Б., Кузнецова Н. А.* Методы исследования сообществ микроартропод. М.: Товарищество научных изданий КМК, 2011. – 84 с.

2. *Rakhimov M. Sh., Elmuratova Z. U.* "Fauna and seasonal dynamics of the collembolans of Uzbekistan" «International Journal of Advanced Science and Technology» № 28 Австрия 2019 vol. 28. – № 14. p. 68–87.

3. *Rakhimov M. Sh., Majidova D. Z.* "Fauna And Ecology Of Shell Mites Of Cenoses Of Southern Uzbekistan" "Test Engineering & Management". July-August 2020. P. 3852–3856.

RARE REPTILES OF THE KASHKADARYA REGION

M. Rakhimov, E. Yangiboyev

National University of Uzbekistan named after Mirzo Ulugbek
Tashkent, Republic of Uzbekistan

On the territory of the Republic of Uzbekistan 64 species of reptiles live, of which 16 species are in the Red Book of the Republic of Uzbekistan[1]. From 64 species, 32 species are founded in Kashkadarya and 7 species of them are listed Red Book of Republic Uzbekistan.

The distribution and biological characters of reptiles species in the Kashkadarya region was studied by A.M Nikoliskiy in 1915–16, S.K Dalya in 1936, M.V Kaluzhina in 1951, O.P Bogdanov in 1950–60. Our research is of scientific interest, primarily in the fact that scientific research aimed at studying the Reptilia class in the Kashkadarya region was carried out for the last time by V.P Karpenko, X.S Salikhbayev, D.Y Kashkarov, M.M Ostapenko, A.A Petrova, A.Zakirov, N.A Pirnazarov in 1963-65. Then only places of residence of these species was mentioned on the common expeditions of the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan.[2]

The Steppe tortoise (Agrionemys horsfieldii Gray, 1844) is a declining Central Asian endemic species. Included in the IUCN Red List [VU]. This species is distributed outside of Uzbekistan Kazakhstan, Turkmenistan Kyrgyzstan, Tajikistan, Iran, Afghanistan, Northwest China, and Northwest Pakistan. It is spread many at the Kashkadarya region. There are small local areas with up to 20–21 specimens/ha. [2]

The Transcaspian gray monitor (Varanus griseus ssp. caspius Eichwald, 1831) has the status in the Red Book of the Republic of Uzbekistan 2 (VU: D), is a vulnerable declining Central Asian endemic species. of the southern West-palaearctic species. Is included in the IUCN Red List. [1, 2, 3]

The Black-ocellated racerunner (Eremias nigrocellata Nikolsky, 1896) is vulnerable, shrinking mosaic stranded endemic species. This species is distributed in the Central Kyzylkum, southern Surkhandarya region [2,3].

The Tartar Sand Boa (Eryx tataricus ssp. tataricus Lichtenstein the, 1823) is (Near threatened 3(NT)), mosaically distributed and locally distributed subspecies. It is spread at the Ustyurt Plateau, the Southern Aral Sea area, the Central Kyzylkum, the Zeravshan Valley, the Karshi steppe of Kashkadarya, the Jizzakh. [1,3]

The Northern wolf snake (Lycodon striatus ssp. bicolor Nikolsky, 1903), has the status in the Red Book of the Republic of Uzbekistan 2 (VU: R). It is a vulnerable, naturally rare, locally distributed subspecies[1,2,3].

The Afghan Awl-headed snake (Lytorhynchus ridgewayi Boulenger, 1887) is vulnerable, naturally rare 2(VU:R), locally distributed species. It is reported in South-Western Kyzylkum desert, Kugitang range, and Sherabad district. It in habits sandy and clayrock debris parts of plains and foothills, low mountains, precipices of dry hollows and dry riverbeds [1,3].

The Central Asian cobra (Naja oxiana Eichwald, 1831) is a close to vulnerable, mosaic widespread species and has status in the Red Book of the Republic of Uzbekistan 3 (NT). Included in the IUCN Red List [DD]. Nowadays, according to WWF, a cobra in the Uzbekistan is considered a restored species. It is protected in the Surkhan, Kitab, Nurata and Gissar reserves [1, 3].

BIBLIOGRAPHY

1. Red Book of Republic Uzbekistan II volume. – Chinor ENK, 2019.

2. *Карпенко В. П.* and al. Пресмыкающиеся // Экология позвоночных животных Каршинской степи. – Ташкент: Фан, 1967.

3. *Вашетко Э. В., Есипов А. В., Быкова Е. А., Бочкарев С. М.* К изучению фауны позвоночных Гиссарского заповедника // Труды заповедников Узбекистана. – Ташкент: ФАН РУз, 1996.

INFLUENCE OF SOIL SALINATION ON THE EXCHANGE OF PHOSPHOLIPIDS IN PLANTS

N. Rakhmonova, **M. Abdullaeva**

[1]*National University of Uzbekistan named after M. Ulugbek*
Uzbekistan, Tashkent
nodira.rakhmonova.92@gmail.com

The study of phospholipids in plants is less studied than in phospholipids of animals and microorganisms, which are much lower, given the importance of the role of plants in the life of the earth and living things. Therefore, it is important to study the phospholipids necessary for the plant and its vital activity, its application in medicine, agriculture and other fields.

Keywords: salinity, cotton, phospholipid, phosphotidylcholine, phosphotidylinositol, phosphotidiletanolamine, phosphotidylserine, phosphotidic acid, lysophosphotidylcholine, cardiolipin.

Currently, the problem of soil salinization is one of the most pressing environmental problems. Almost 60 % of agricultural land in Uzbekistan is saline, of which 35 % is cotton. As a result, agriculture and cotton growing suffered for many years. We know that cotton yield depends not only on climatic conditions, but also on soil salinity. [2]

We all know that soil salinization negatively affects the growth and development of plants. [1]

Many experiments have been carried out in this regard and it has been found that salinity negatively affects plant growth and development, as well as its levels. Usually, in a saline environment, seed germination is delayed, in some plants the growth process slows down, as a result, the plant becomes a slow-growing variety.

The experiment was carried out with cotton. For this, the seeds were first treated with concentrated sulfuric acid. We then rinsed with water until the pH was neutral and kept in a thermostat at 27 °C for 1 day. After a while, the germinated seeds were placed in a 0.5 %, 0.9 %, 1.4 % sodium chloride solution and controls in simple aqueous media and Belausov's nutrient medium between wet papers and grown in a thermostat at 27 °C for 9 days.

Experiments show that phospholipids undergo hydrolytic changes during seed germination, that is, the amount of phospholipids decreases due to an increase in water content due to seed germination. An increase in the amount of phospholipid fractions with increasing salinity indicates that the plant is not using enough water. [1]

In connection with the germination of cotton seeds, cotton seeds contain its main phospholipids, phosphotidylcholine, phosphotidylinositol, phosphotidylethanolamine, phosphotidylserine and phosphotidic acid, as well as lysophosphotidylcholine and cardiolipin. The amount of phospholipids decreases from the first to the tenth day of the germination period.

Different levels of salinity negatively affect the quantitative and qualitative parameters of phospholipids in cotton seeds.

BIBLIOGRAPHY

1. *Юлдашева Н. К., Ульченко Н. Т., Глушенкова А. И., Ахмеджанов А. И.* Липиды семян и масла хлопчатника, выращенного на засоленной почве. Журнал Химия природных соединений. Т. 2. 2014. с. 158.

2. *Ташкузиев М. М., Бердиев Т. Т.* Применение системы агротехнологий, направленных на повышение плодородия почвы в условиях пустынной зоны Узбекистана // «Аграрная наука – сельскому хозяйству» VII Международная научно-практическая конференция, Барнаул 2012.

THYROID DISEASE IN ADOLESCENT GIRLS IN THE REPUBLIC OF BELARUS

Y. Reznik[1], **N. Kokorina, A. Avetisova**[2]

[1]*Belarusian State University, ISEI BSU*
Minsk, Republic of Belarus
[2] *Belarusian State Medical University*
Minsk, Republic of Belarus
janareznik8@gmail.com

In the concept of reproductive health care, a special place is given to the problems of adolescence. This is the age when the most active growth and puberty processes take place. In recent years, research on the role of the thyroid gland in adolescent girls in the process of puberty has developed.

Keywords: thyroid gland, adolescent girls, reproductive system.

The poor quality of health of adolescent girls on the territory of the Republic of Belarus is closely related to the deterioration of the environmental situation. High technogenic load, deficiency of vital elements, such as iodine, create extreme conditions for the developing body of a teenager.

In the Republic of Belarus, thyroid diseases have always been widespread as a result of iodine deficiency in soil and water. The Chernobyl accident significantly complicated the ecological situation in our country. The number of thyroid diseases is growing from year to year, which is associated with the deterioration of the environmental situation [2].

It has now been established that the main forms of thyroid lesion are euthyroid goiter and autoimmune thyroiditis. The overwhelming majority of adolescent girls have a low quality of health, accompanied by impaired physical development, puberty, and an enlarged thyroid gland. Most adolescent girls with thyroid diseases are characterized by disharmonious physical development with excess body weight, delayed sexual development, and menstrual dysfunction [3].

The complex of diagnostic measures includes general clinical examination, clinical and laboratory examination, ultrasound of the thyroid gland, determination of the concentration of hormones of the anterior lobe of the pituitary gland (thyroid-stimulating, follicle-stimulating, luteinizing hormones, prolactin), thyroid gland (triiodothyronine, total thyroxine) and sex hormones, progesterone testosterone) in serum.

In order to prevent puberty disorders in adolescent girls with thyroid pathology, a screening program has been developed, including early diagnosis, the allocation of children to the risk group for the development of thyroid pathology and impaired puberty, and monitoring of children with puberty and thyroid diseases. [1].

Thus, adolescent girls with disabilities in physical and sexual development due to thyroid pathology need constant medical supervision with the involvement of an endocrinologist and gynecologist throughout the entire period of formation of reproductive health.

BIBLIOGRAPHY

1. Актуальные проблемы профилактики в медицине : материалы 31 науч-метод, конф. преподавателей мед.-профилакт. фак. БГМУ, 26 марта 2014г. / Бел. гос. мед. ун-т; под ред. А. Р. Аветисова. – Минск : БГМУ, 2014. – 100 с.

2. *Мохорт, Т. В*. Йодная обеспеченность населения Республики Беларусь: итоги 2017 года / Т. В. Мохорт [и др.] // Лечебное дело. – 2018. – № 4. – С. 5–13.

3. *Сметник, А. А.* Влияние щитовидной железы и ее патологии на репродуктивную функцию женщин / А. А. Сметник, А. И. Сазонова // Акушерство и гинекология. – 2019. – № 3. – С. 46–52.

THE COMPOSITION OF FRUIT BODIES OF MUSHROOMS WITH MEDICINAL SIGNIFICANCE

A. Rodzkin, N. Ikonnikova, M. Labai, E. Ateba

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
sofnat@mail.ru

The content of the main biochemical components: protein, polysaccharides, lipids, melanin pigments and phenolic compounds in the fruit bodies of strains of fungi of the genera *Ganoderma, Inonotus, Phallus* and *Pleurotus*, has been studied.

Keywords: fungal fruit bodies, basidiomycetes, biochemical composition, polysaccharides, melanin pigments, protein, lipids, phenolic compounds.

Higher basidial fungi are producers of a number of biologically active compounds: proteins, lipids, polysaccharides, organic acids, enzymes, vitamins, pigments, etc. Many of these compounds are pharmacologically active and, compared with chemical synthesis products, are less toxic and more effective when used in medical practice. The sources of the release of biologically active compounds are fruit bodies, basidiospores, vegetative mycelium, culture fluid during artificial cultivation. Currently, mushroom-based preparations are used as adjuncts to the main therapy. In this regard, a comprehensive study of the composition of biologically active compounds of bisidiomycetes and their biological action is very relevant in order to further develop the substances of medicines with their subsequent registration in official medicine. The fruit bodies of many basidiomycetes from the genera Ganoderma, Lentinula, Grifola, Laetiporus, Schizophyllum, Pleurotus, Trametes are known for their valuable medicinal properties in various countries of the world, which confirms the long-term experience of their use in folk medicine in South-east Asia.

The content of the main biochemical components: protein, polysaccharides, lipids, melanin pigments and phenolic compounds was studied in the fruit bodies of strains of fungi of the genera Ganoderma, Inonotus, Phallus and Pleurotus. The amount of total and true protein was 14.6–28.0 % and 10.9–18.5 %, respectively, polysaccharides -10.8–28.4 %, lipids – 3.1–3.5 %, phenolic compounds – 580–2200 mg%. Higher protein content was observed in the strains of the fungus *Pleurotus* ostreatus, polysaccharides – in the strains of *Ganoderma* lucidum and *Phallus* impudicus, phenolic compounds in the strains of the fungus I. obliquus. The largest amount of polysaccharides (22.0–24.0 %) was isolated from the fruit bodies of G. lucidum (reishi). The leader in the content of polysaccharides in the dry biomass of fruit bodies is the fungus Phallus impudicus (common veselka). The fruit bodies of chaga *Inonotus* obliquus (strains KI 5, KI 7) and veselka Ph. impudicus (strains PI 2, PI 5, and PI 9) contained significant amounts of melanin pigments – 10.3–13.8 % and 7.1–7.4 %, respectively.

BIBLIOGRAPHY

1. *Wasser, S. P.* Medicinal mushroom science: history, status, future trends, and unsolved problems / S. P. Wasser // International Journal of Medicinal Mushrooms. – 2010. – V. 12. – P. 1–16.

2. *Gerasimenia, V. P.* Extracts of basidial fungi and their multifunctional biomedical activity / V.P. Gerasimenia. – M.: Institute of Chemical Physics named after N.N. Semenova RAS, LLC "iNbiopharm", 2014. – 128 p.

INDICATORS OF THE INFLAMMATORY SYNDROME IN ARVI AND INFLUENZA

E. Romantsevich, T. Romanovskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
llromancevich@gmail.com

Acute respiratory viral infections (ARVI), including influenza, are the most widespread diseases in the world. Currently, more than 200 viruses are known to be etiologically associated with ARVI. On average, there are 3-4 cases of ARVI per adult per year, a child gets sick from 6 to 9 times during the year. 3.9 million deaths worldwide are associated with SARS annually. There are seasonal features of the circulation of SARS viruses. Epidemics occur, as a rule, in autumn or winter. The intensive incidence rate of ARVI in the Republic of Belarus is 452.7 per 100 thousand population.

Keywords: acute respiratory viral infections, influenza, viruses, immune response, phagocytosis, indicators of inflammation.

ARVI is a group of diseases characterized by a short incubation period, a short fever, intoxication and damage to various parts of the respiratory tract. The most common pathogens of ARVI are representatives of three families of RNA-containing viruses-paramyxoviruses (respiratory syncytial virus, parainfluenza virus, human metapneumovirus), coronaviruses and picornaviruses (rhinoviruses) and two families of DNA-containing viruses-adenoviruses (types B, C, E), parvoviruses (human bokavirus) , etc.

Influenza is also an acute respiratory viral infection, the most common and severe. It is caused by RNA-containing viruses that belong to the family Orthomyxoviridae (genus Influenzae), which includes influenza viruses of types A, B and C.

The results are taken into account under the immersion system of the microscope with a magnification of 10×90. The function of neutrophils in antimicrobial protection was evaluated in the nitrosine tetrazolium reduction test (NST). The HCT dye enters the phagosome, where, after merging with the lysosome, it is degraded un-

der the influence of lysosomal enzymes and reactive oxygen species with conversion to formazane. Formazan granules, unlike HST, have a blue color. The test makes it possible to judge the phagocytic and metabolic function of granulocytes by the formation of formazan granules in the cytoplasm. In 2 wells of a 96–hole flat-bottomed tablet, 10 ml of a stimulant solution is added for each study. To set up a spontaneous version of the test, 10 μl of Hanks ' solution (without Ca 2+ and Md 2+) is added to 2 other wells, 40 μl of HST solution at a concentration of 0.25 % is added to all wells, 50 μl of cell suspension at a concentration of 2×10 6 cl/ml is added to all wells in a complete culture medium, carefully resuspended and incubated at 37C for 30 minutes in an atmosphere with 5% CO 2. After the incubation stage, the test tubes are centrifuged for 5 minutes at 400 g, after which the nadosad is removed, the neutrophil film deposited on the erythrocyte layer is removed and the resulting cells are resuspended and smears are prepared, which are fixed and stained according to Romanovsky-Giemse, 100 neutrophils are counted, the number of HST-positive cells and the degree of filling of the cytoplasm with formazane granules formed in the cells are determined. The average cytochemical coefficient is calculated:

$$CCS=((A\times0)+(In\times1)+(C\times2)+(D\times3))/(A+B+C+D).$$

Investigation of the concentration of C-reactive protein: Turbidimetry - a method of quantitative chemical analysis. The principle of the method is based on measuring the intensity of light of a certain wavelength that has passed through a cuvette containing a colloidal solution. The analytical signal is the intensity of non-scattered light.

There was an increased level of ESR in both influenza and ARVI. The main factor affecting ESR is the protein composition of the blood, which, in turn, changes in various physiological (pregnancy, menstruation) and pathological (inflammation, infections) conditions. From the onset of the disease, it may take from 24 to 48 hours before the ESR value goes beyond the normal limits. The phagocytosis assessment indicators allow us to assess mainly the absorption activity of phagocytes, and the NST test–the intensity of the "oxygen explosion" that occurs inside phagocytic cells. The decrease in the phagocytic activity of neutrophils according to the AF indicator in influenza should be considered as a consequence of the suppressive effect of bacteria on phagocytic cells. The indicators of the HST test are increased, this may indicate the normal functional activity of neutrophils, and may be regarded as a sufficient level of oxygen-dependent mechanisms of neutrophil bactericidal activity. High indicators of the HST test reflect the completeness of phagocytosis. The level of C-reactive protein in the blood partially depends on the patient's gender, and its increase indicates the presence of infection, inflammation, and it is more pronounced in the flu. With a viral infection, the level of CRP, as a rule, does not exceed 20 mg/l. Our indicators may indicate an uncomplicated course of SARS and influenza.

Stimulated phagocytosis was observed in ARVI, which characterizes the reserve capabilities of oxygen-dependent intracellular antibacterial systems. It was found that the basis of influenza is the insufficiency of phagocytosis, which caused a violation not only of non-specific cellular protection, but also to induce changes in the functioning of the immune system.

Indicators of the inflammatory syndrome were tests for ESR and CRP. The analysis for DRR is often compared with ESR. The degree of aggregation increases significantly when markers of inflammatory and destructive processes appear in the blood plasma: fibrinogen, CRP, ceruloplasmin, immunoglobulins and others. Both indicators reflect inflammation and increase at the beginning of the disease, but CRP appears and disappears earlier than ESR. It is important to understand the pathogenesis of complications, since viruses can cause quite strong inflammatory processes that can play a role in the development of chronic diseases. Toxic–allergic and autoimmune reactions play an essential role in the pathogenesis of influenza. All this is the basis for the development of an intense and massive inflammatory process, first of all, it concerns the respiratory canal, as the "entrance gate" for viral invasion, and the microcircular bed.

BIBLIOGRAPHY

1. *Ageeva, M. R.* Underestimated infection-to the question of the pathogenicity factors of human adenoviruses. Questions of virology / M. R. Ageeva, S. B. Yatsyshina, 2019 – 53–55 c.

2. *Belova, E. G.* Influenza-a disease of all ages / E. G. Belova, the attending physician. – 2003. – № 10. – 73–75 c.

3. *Bulygin, G. V.* features of structural–metabolic parameters of T– and b–lymphocytes of a healthy person and in some pathological conditions / G. V. Bulygin, G. N. Kazakova, E. V. Kasparov. – Krasnoyarsk, 1998. – 127 s.

4. *Bulygin, V. G.* Metabolic bases of regulation of the immune response / G. V. Bulygin, N. And. Kamzalakova, A. V. Andreychikov. – Novosibirsk: SB RAMS, 1999. – 346 s.

5. *Velkov, V. V.* S-protein-structure, function, methods of determination / V. V. Velkov. – Medical digest. Medical examiner. – 2008. – № 2. – 33–36 c.

EPIDEMIOLOGICAL ANALYSIS OF THE MORBIDITY OF THE ADULT POPULATION OF THE MINSK REGION WITH DISEASES OF THE ENDOCRINE SYSTEM FOR 2015–2019

D. Rotova, V. Stelmakh

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus,
petrotova@gmail.com

The paper provides an epidemiological analysis of the morbidity of the adult population of the Minsk region with diseases of the endocrine system for the period from 2015 to 2019; analyzes the dynamics, identifies the main trends in the general and primary morbidity of the endocrine system organs in the adult population on the basis of available statistical data.

Keywords: endocrine system, morbidity, tendency.

As a result of epidemiological analysis of the long-term dynamics (2015–2019) of the total morbidity of the adult population of the Minsk region with diseases of the endocrine system, a pronounced tendency to increase the incidence was noted.

It was noted that the following diseases occupied the first rank places in the structure of the total morbidity of the adult population of the Minsk region with diseases of the endocrine system in 2015: type 2 diabetes mellitus (50.64 %), nodular goiter (13.06 %), autoimmune thyroiditis (7.73 %), other forms of hypothyroidism (6.54%) and postoperative hypothyroidism (4.74 %). At the end of the study period, the structure of the total morbidity of the adult population of the Minsk region with diseases of the endocrine system changed. The first rank is also occupied by the disease – type 2 diabetes mellitus (52.48 %), whose contribution to the structure of morbidity increased by 1.84 %; in the second rank – nodular goiter (12.98 %); in the third place – other forms of hypothyroidism (9.02 %); in the fourth – autoimmune thyroiditis (6.99 %), and in the fifth – postoperative hypothyroidism (4.61 %).

When analyzing the dynamics of the overall morbidity of the adult population of the Minsk region, there was a pronounced tendency to increase the incidence of type 2 diabetes mellitus, nodular goiter, other forms of hypothyroidism, autoimmune thyroiditis, postoperative hypothyroidism.

The analysis of the long-term dynamics (2015–2019) of the primary morbidity of the adult population of the Minsk region with diseases of the endocrine system, there was no pronounced change in the dynamics towards an increase or decrease in the incidence.

The first rank in the structure of primary morbidity in 2015 was occupied by type 2 diabetes mellitus (46.09 %), nodular goiter (15.85 %), other forms of hypothyroidism (8.70 %), autoimmune thyroiditis (7.87 %) and postoperative hypothyroidism (2.98 %) took the second place. At the end of the study period, the structure of the primary morbidity of the adult population of the Minsk region with diseases of the endocrine system did not change. The first rank place is also occupied by a disease – type 2 diabetes mellitus (45.90 %), whose contribution to the structure of morbidity decreased by 0.19 %; in the second place – nodular goiter (16.90 %); in the third place – other forms of hypothyroidism (8.96 %); in the fourth – autoimmune thyroiditis (6.48 %), and in the fifth – postoperative hypothyroidism (3.66 %).

When analyzing the dynamics of the primary morbidity of the adult population of the Minsk region, there was no pronounced change in the dynamics towards an increase or decrease in the incidence of type 2 diabetes, nodular goiter, other forms of hypothyroidism, autoimmune thyroiditis, but there was a tendency to increase the incidence of postoperative hypothyroidism.

To prevent the spread of diseases of the endocrine system, it is necessary to carry out timely detection, treatment and preventive measures among the population in each specific case. Preventive work aimed at reducing the morbidity of the population due to micronutrient insufficiency remains one of the priority areas. For example, the main way to prevent iodine deficiency among the population is the use of iodized salt. Also, for any type of disease, a diet is an indispensable condition for successful treatment [1–2].

BIBLIOGRAPHY

1. *Долгова, М. Ю.* Оценка эффективности способов профилактики йододефицитных состояний среди населения / М. Ю. Долгова, А.Ж. Ахтямова, М.В. Мурзаева // Бюллетень медицинских интернет-конференций. – 2017. – Т. 7, № 6. – С. 1110–1111.

2. *Мисюк, М. Н.* Основы медицинских знаний: учебник и практикум для СПО / М. Н. Мисюк. – 3-е изд., перераб. и доп. – М.: Юрайт, 2015. – 499 с.

THE EFFECT OF ZINC IONS ON THE INSULIN MOLECULE

V. Sagan, N. Bogdanova, A. Makhnach, O. Sokolovich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
sagan_lera@mail.ru

Diabetes mellitus (DM) is one of the most common diseases in the world and the number of people with this pathology is growing. Insulin is a hormone of protein nature, which is produced by beta cells of the islets of Langerhans of the pancreas. Insulin forms amyloid-like fibrils, which creates a number of problems in its biomedical and biotechnological applications (especially in insulin pumps). Amyloid deposits of insulin were observed both in patients with type II diabetes mellitus and with normal aging, as well as after subcutaneous insulin infusion and after repeated injections.

Keywords: insulin, insulin therapy, fibrillation, zinc ions.

In the solution, insulin is mainly in the form of a mixture of monomers, dimers and hexamers, the composition of which varies depending on the pH of the solution and the concentration of protein. Zn^{2+} ions have been proven to slow down the process of insulin fibrillogenesis. The formation of two complexes with the Zn^{2+} cation involves histidine residues at the B-10 position of all six subunits. Each octahedral complex includes one Zn^{2+} cation, three histidine residues and three water molecules [1].

However, for rapid diffusion in insulin pumps, the protein must be in the form of free monomers. The tendency of insulin monomers to form amyloid fibrils during prolonged storage in solution at a temperature above room temperature is the main difficulty to the use of the peptide in an insulin pump. In the treatment of diabetes, insulin penetrates the muscles by injection, where it aggregates with the formation of amyloid fibrils at the injection site of drugs to diabetic patients and causes a pathological condition called insulin injectable amyloidosis. Aggregation occurs due to the fact that the large size of the insulin hexamer slows down its adsorption, since the hexamer must pass through the dimers in a monomeric state and only thus penetrate into the bloodstream. This leads to a slowdown in the interaction with insulin receptors and the need to take insulin 1-1.5 hours before meals. In this pathology, amyloid insulin fibrils form a solid subcutaneous mass at the injection site, where an immune response may also occur [2].

It is known that for insulin, the first among proteins, the complete amino acid sequence was determined and the presence of disulfide bonds necessary to maintain the activity of the hormone was revealed. The existence of the crystal structure of insulin granules has also been proven. The crystals are formed by six insulin molecules and two Zn^{2+} atoms. It is proved that the biosynthesis and storage of insulin is regulated by zinc and calcium cations.

Insulin biosynthesis occurs in the beta cells of the pancreas from the precursors of pre-proinsulin and proinsulin. When the signal sequence is split off , proinsulin is formed from pre-proinsulin, which is transported to the Golgi complex, where it is sequestered into Zn^{2+}- and Ca^{2+}-enriched secretory vesicles in the form of aggregated Zn^{2+} and Ca^{2+}-containing hexamer complexes. The complex of hexamers with zinc and calcium ions is a form of storage of an inactive hormone, which should subsequently turn into an insulin monomer. The insulin monomer is much more sensitive than the hexamer to thermal and mechanical (fibrillation) denaturing effects. The formation of proinsulin hexamers with zinc is a necessary condition for its processing into insoluble insulin-Zn crystals. Sufficient amounts of Zn^{2+} in the β-cell, especially in insulin granules, are necessary for correct hexamerization and insulin processing. When crystalline insulin is released from beta cells, the crystals dissolve and the hexamer dissociates into active insulin monomers and Zn^{2+} ions, the osmotic pressure of Zn^{2+} ions decreases and the pH decreases from 5.5 to 7.4. The change in extracellular pH increases the solubility of insulin and promotes the dissociation of hexamers into monomers.

Thus, zinc takes part in the processing and storage of insulin. Removal of Zn^{2+} to stop crystallization and accelerate the action of insulin provides an opportunity to obtain fast-acting insulin preparations.

BIBLIOGRAPHY

1. *Кольман, Я.* Наглядная биохимия / Я. Кольман, К.-Г. Рем ; под ред. П. Д. Решетова, И. Соркина. – Москва: Мир. – 2000. – 469 с.

2. *Uversky, V. N.* Conformational constraints for amyloid fibrillation: the importance of being unfolded / V. N. Uversky, A. L. Fink // Biochim Biophys Acta. 2004. – vol. 1698. – P. 131–135.

QUANTITATIVE ASSESSMENT OF THE HEALTH STATUS OF THE POPULATION OF DYATLOVO, GRODNO REGION IN 2014–2020

J. Salash, N. Porada

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
salashulia2001@gmail.com

An important criterion for the health of the population in the socio-hygienic aspect is the level of morbidity. Morbidity indicators allow us to judge the state of the human body's resistance to adverse environmental factors, the quality of medical care. The data on the morbidity of the population living in Dyatlovo and Dyatlovo district of Grodno region in 2014-2020 were analyzed.

Keywords: morbidity, long-term dynamics, trend, respiratory diseases, diseases of the circulatory system, diseases of the endocrine system, mental disorders, diseases of the esophageal organs, injuries.

When characterizing the health of the population, a quantitative assessment of morbidity is important. Currently, the level of morbidity of the population of the republic is determined by chronic non-communicable diseases. The aging of the population, the difficult environmental situation, psycho-emotional overload, economic factors and many other adverse effects have caused an increase in the incidence of the population in almost all classes of diseases [1].

To quantify the morbidity of the population of Dyatlovo and Dyatlovo district of the Grodno region for the period from 2014 to 2020, the calculation of intensive and extensive indicators of morbidity, the calculation of the relative magnitude error, the calculation of a long-term trend in the first-order parabola, the calculation of the reliability of differences in indicators at the end of the study period in relation to the initial year of the study were carried out [2].

In the period from 2014 to 2020 a moderately pronounced upward trend was revealed in the dynamics of the general and primary morbidity of the adult population of Dyatlovo and Dyatlovo district of the Grodno region (R^2=0,67 и 0,53 respectively). The average annual value of the total morbidity (A_o) was 12268,7 ‰. The incidence increased by 39,1 %. The average annual value of primary morbidity was at the level of 3182,5 ‰. During the follow-up period, the primary incidence increased 2,2 times. The ratio of indicators of primary and general morbidity averaged 1:3, which indicates the predominant spread of chronic forms of diseases.

In the structure of the general morbidity, the first ranked places were occupied by diseases of the circulatory system, respiratory organs, mental disorders, diseases of the endocrine system and digestive organs. In the structure of primary morbidity, the first rank places belong to diseases of the respiratory system, circulatory system, injuries and other external influences, diseases of the musculoskeletal system and endocrine system.

In 2014-2020 a steady upward trend was revealed in the dynamics of morbidity of the population of Dyatlovo and Dyatlovo district with diseases of the cardiovascular system (total morbidity increased by 28,1 %, primary morbidity by 1,4 times), respiratory diseases (by 2 and 2,3 times, respectively) and digestive organs (by 18,2 and 12,4 %, respectively). There is a downward trend in the incidence of mental disorders in the population: the total incidence – by 10,3 %, the primary incidence – by 1,9 times. The general incidence of endocrine pathology had an uncertain trend direction in the dynamics over the years under review, while the primary incidence decreased by 3 times. Differences in morbidity rates at the end of the study period in relation to the initial year of the study were statistically significant.

The research of the structure, dynamics and local characteristics of the morbidity of the population is the basis for the development and implementation of effective health promotion measures. Of great importance is the study of issues related to risk factors for diseases most commonly reported among the population.

BIBLIOGRAPHY

1. Здравоохранение Республики Беларусь: прошлое, настоящее и будущее / Жарко В. И., Малахова И. В., Новик И. И., Сачек М. М. – Минск: Минсктиппроект, 2012. – 320с.

2. *Кучеренко, В.З.* Применение методов статистического анализа для изучения общественного здоровья и здравоохранения: Учебное пособие / корр. РАМН, проф. В.З. Кучеренко. – Москва: ИНФРА-М, 2006. − 30 с.

FEATURES OF ADP- AND COLLAGEN-INDUCED PLATELET AGGREGATION IN ARTERIAL HYPERTENSION

A. Saley, A. Bakunovich

Belarussian State University, ISEI BSU
Minsk, Republic of Belarus
annasaley35@gmail.com

One of the most significant problems of modern medicine is arterial hypertension. Increased platelet activity contributes significantly to this phenomenon. In experiments, the indicators of the rate and degree of platelet aggregation in patients with arterial hypertension with ADP- and collagen-induced aggregation were considered.

Key words: arterial hypertension, platelets, aggregation, ADP, collagen.

High blood pressure is one of the most important problems of modern medicine. Arterial hypertension (AH) still attracts the attention of specialists in the field of therapy, cardiology and endocrinology. It has been established that 20-30% of the adult population suffers from arterial hypertension. With age, the prevalence of the disease increases and reaches 50-65% in people over 65 years of age. [1]. Since the blood is constantly in motion, hemostatic mechanisms must act extremely quickly and efficiently. At the same time, it requires the presence of regulatory mechanisms that maintain an ideal balance and do not allow spontaneous activation of hemostatic reactions. Platelets play an important role in disrupting the rheological properties of blood and triggering a hemostatic reaction, which includes several stages: recognition by a platelet of a damaged blood vessel wall, adhesion to the endothelium, its activation and subsequent aggregation.

The main physiological activators of platelets are collagen (the main protein of the extracellular matrix), thrombin (the main protein of the plasma coagulation system), ADP (appearing from destroyed vascular cells or secreted by platelets themselves) and thromboxane A2 (a secondary activator synthesized and released by platelets) [2]. An increase in the level of platelet aggregation in response to collagen is associated with hyperaggregational syndrome, characteristic of arterial hypertension, and an increase in the level of aggregation in response to ADP may be due to hyperaggregational syndrome, inflammatory processes, myocardial infarction or the presence of diabetes mellitus in the subject.

Blood samples for the study of platelet aggregation ability were obtained in clinical conditions. Platelet aggregation was studied in 10 female patients with confirmed primary hypertension according to the WHO classification (stable blood pressure values above 140/90 mm Hg. absence of target organ damage) for a duration of 6 months to 5 years. Particular attention was paid to the assessment of renal function, since impaired renal function can affect some parameters of platelet function.

The following were used as aggregation inductors ADP (final concentrations of 2 and 5 microns) and collagen (2.5 and 7.5 mg/l). In experiments, it was found that when using collagen at a concentration of 2.5 mg/l, the degree of aggregation in the control group was 52.6 ± 4.7, and in the group of patients with hypertension – 68.5 ± 2.5, which had statistically significant differences ($p<0.05$). At the same time, the aggregation rate in healthy volunteers (44.9=7.1) had no statistical differences from the corresponding indicator in hypertension (51.1=6.36; $p>0.05$).

With a concentration of collagen equal to 7.5 mg/l, the degree of aggregation in the control group was 69.4 ± 3.1 and 75.3 ± 5.3 with hypertension. This indicator had no statistically significant differences ($p>0.05$). The aggregation rate in the group of healthy volunteers (62.4±8.1) and patients with hypertension (68.9±7.4) also had no statistically significant differences ($p>0.05$).

In experiments using ADP at a concentration of 2 microns, the degree of aggregation in the control group (32.2 ± 3.1) had statistically significant differences with the group of patients with hypertension (56.1±3.1; $p<0.05$). At the same time, the aggregation rates were: 41.3±3.7 and 49.9±5.2, respectively ($p>0.05$).

When using ADP at a concentration of 5 microns, the degree of aggregation in the control group was 63.7±5.4, and in the group of patients with hypertension – 70.9±3.2, which had statistically significant differences ($p<0.05$). The aggregation rate in the control group (70.9±4.5) and patients with hypertension (61.6±4.7) also had statistically significant differences ($p<0.05$).

Based on the data obtained, it can be concluded that the sensitivity (aggregation ability) of platelets of patients with hypertension to the used inducers (collagen, ADP) is increased compared to the control.

Extended monitoring and premature detection of increased platelet aggregation capacity in persons with arterial hypertension has the opportunity to significantly contribute to the timely diagnosis, prevention and therapy of hypertension.

BIBLIOGRAPHY

1. *Бова, А. А*. Гипертоническая болезнь: состояние проблемы и принципы лечения / А. А. Бова // Медицинские новости, 2000. – 25–34 с.

2. *Jackson, S. P.* Procoagulant platelets: are they necrotic? / S. P. Jackson, S. M Schoenwaelder // J. Blood. 2010. P. 116–120.

SYNTHESIS OF 8-METOXYADENOSINE-DIALDEHYDE

N. Serdjukova, M. Khancheuski, A. Trifonova, E. Kvasyuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
maks.khanchevskiy@bk.ru

This article presents data on the synthesis of 8-methoxyadenosine-dialdehyde.

Keywords: adenosine, 8-bromoadenosine, 8-methoxyadenosine, 8-methoxyadenosine-dialdehyde.

8-Halogenated purine nucleosides are an interesting object not only for studying their biological activity, but also for their use as starting compounds for the synthesis of various 8-substituted analogs that are promising for practical use in medicine. For example, 8-chloro and 8-amino derivatives of adenosine are effective inhibitors of transcription in multiple myeloma cells [1, 2]. Since ribonucleosides are relatively easily transformed into their seco-derivatives, the creation of modified nucleosides, modified simultaneously in the heterocyclic base and in the carbohydrate fragment, is of undoubted interest for studying their biological activity. Figure 1 shows a scheme for the synthesis of 8-methoxyadenosine-dialdehyde **4** based on the natural nucleoside adenosine **1**.

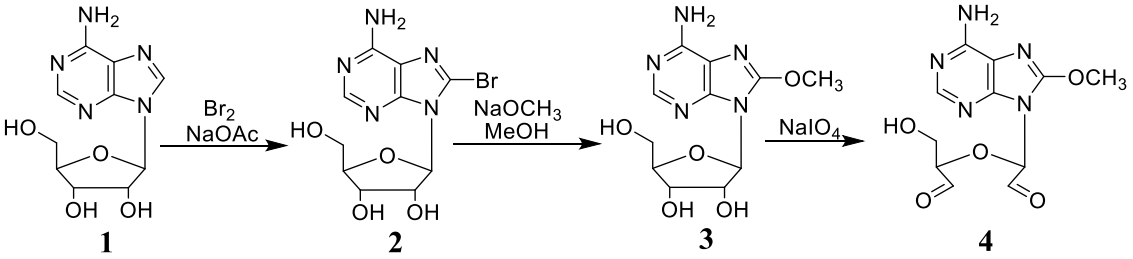


Fig. 1 – Scheme of the synthesis of 8-methoxyadenosine-dialdehyde

The reaction progress and the content of reaction products were monitored by thin layer chromatography on Kieselgel 60 F254 plates from Merck (Germany) in a solvent system: chloroform / methanol (4: 1 v / v). Compounds were visualized on plates by viewing them in ultraviolet light.

8-Bromoadenosine (2). To a solution of adenosine **1** (1 g, 3.74 mmol) in 40 ml of sodium acetate buffer with pH 4.7 with stirring in portions was added a solution of bromine (0.23 ml, 0.72 g, 4.49 mmol) in 20 ml of water. The reaction mixture was stirred for 1 hour, during which a brown precipitate formed. The resulting precipitate was filtered off and washed with chilled alcohol. The precipitate was dried at room temperature in air, then in vacuum to constant weight, and recrystallized to give 0.8 g of 8-bromoadenosine (**2**). The product yield was 62%.

8-O-Methoxyadenosine (3). To a solution of 8-bromoadenosine (**2**) (0.5 g, 1.44 mmol) in 10 ml of methanol 3 ml of 0.5 M solution sodium methoxide was added, and the mixture was refluxed for 2 hours. After completion of the reaction, the solution was neutralized by adding of 2 ml 1 M hydrochloric acid. The resulting solution was evaporated to dryness on a rotary evaporator in vacuum at ≤30°C. The residue was dried at room temperature in air, then in vacuum to constant weight, and recrystallized to give 0.37 g of 8-O-methoxyadenosine (**3**). The product yield was 86%.

8-Methoxyadenosine-dialdehyde (4). To a solution of 8-O-methoxyadenosine (**3**) (0.3 g, 1 mmol) in 10 ml of water with stirring sodium periodate (0.24 g, 1.1 mmol) was added. The mixture was stirred for 30 minutes, and then 0.2 ml of ethylene glycol was added. The reaction mixture was stirred for another 5 minutes, and a saturated solution of 0.23 g of barium chloride in water was added. The formed milky precipitate was filtered off. The resulting solution was evaporated to dryness on a rotary evaporator in a vacuum at ≤30°C. The residue was dried at room temperature in air, then in vacuum to constant weight, and recrystallized to give 0.22 g of 8-O-methyladenosine-dialdehyde (**4**). The product yield was 75%.

BIBLIOGRAPHY

1. *Gandhi, V.* 8-Chloro-cAMP and 8-chloro-adenosine act by the same mechanism in multiple myeloma cells / V. Gandhi [et al.] // Cancer Research. – 2011. – Vol. 61. – P. 5474-5479.

2. *Tatani, K.* Identification of 8-aminoadenosine derivatives as a new class of human concentrative nucleoside transporter 2 inhibitors / K. Tatani [et al.] // ASC Med. Chem. Lett. – 2015. – Vol. 6, № 3. – P. 244–248.

ANALYSIS OF THE PREVALENCE OF PANCREATIC CANCER MORPHOTYPES AND CLINICAL CHARACTERISTICS OF PATIENTS

E. Serenkova, E. Shpadaruk, R. Smolyakova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
serenkovaalena1@gmail.com

The paper presents an analysis of the prevalence of pancreatic cancer morphotypes and clinical characteristics of patients suffering from this disease. In the course of the work, clinical data on 70 patients with an established morphotype of pancreatic cancer were analyzed. Thus, the morphological characteristics of the tumor, the degree, differentiation and localization of the tumor process, as well as the age and gender of patients were studied.

Keywords: pancreatic cancer, adenocarcinoma, ductal, mucinous, metastatic, neuroendocrine carcinoma.

Pancreatic cancer is an aggressive oncological disease, which is the most fatal in modern oncological practice. It is among the top five in terms of prevalence in the world [1]. The degree of malignancy of the tumor and the prevalence of the tumor process are of great importance for the correct choice of treatment tactics for cancer patients. Progress in molecular biology in recent decades suggests that genetic mechanisms underlie the development of pancreatic cancer [2].

The object of the study was the clinical data of 70 patients suffering from pancreatic cancer who were treated at the N. N. Alexandrov RSPC OMR. Depending on the morphotype of the tumor, patients were distributed as follows: ductal adenocarcinoma was detected in 47 cases (67.1%), mucinous adenocarcinoma – in 8 cases (11.4%), metastatic adenocarcinoma – in 5 cases (7.1%), neuroendocrine carcinoma – in 5 cases (7.1%), mixed ductal-endocrine carcinoma – in 3 cases (4.3%), intestinal adenocarcinoma – in 1 case (1.4%), clear cell adenocarcinoma – in 1 case (1.4%).

In the course of the study, we analyzed the clinical data of patients with the most common morphotypes of pancreatic adenocarcinoma. In patients with diagnosed ductal adenocarcinoma, the tumor was found in 51% of men and 49% of women. The average age was 61.4±11.2 years. When analyzing the localization, it was found that in 61.7% of patients the tumor was localized on the head of the pancreas, in 12.7% of cases the tumor affects the body, in 10.6% - the head and body, in 4.2% - the body and tail, in 2.1% - the tail. In 8.5% of cases, the gland is totally affected. The analysis of the prevalence of the tumor process showed that stage IA was diagnosed in 2.1%, stage IV - in 4.2%, stage IIA - 23.4%, stage IIB - 19.1%, stage III - 6.4%, stage IV - 44.6%. At the same time, a tumor with a moderate degree of differentiation prevails (74.5%), a high degree occurs in 8.5% of cases, a low degree occurs in 12.8% of cases, 4.2% of cases are not differentiated.

The tumor was found in 50% of men and 50% of women with the diagnosis of mucinous adenocarcinoma. The average age of the patients was 64.5±12 years. In 37.5% of cases, the tumor affects the head of the pancreas, in 25% of cases – the body, in another 25% of cases - a total lesion of the gland and in 12.5% the head and body are affected. Stage IIA of the tumor process was diagnosed in 25% of patients, IIB - in 37.5%, III - in 12.5%, IV - 25%. In 75% of patients, the degree of tumor differentiation is moderate, in 25% – low.

Metastatic adenocarcinoma was diagnosed in 40% of men and 60% of women with an average age of 62.6±9.7 years. In 20% of cases, the tumor affects the head of the pancreas, in 80% of cases - the head and body. All patients have stage IV of the disease. Tumors with a moderate degree of differentiation predominate (80% of cases), a high degree is detected in 20% of cases.

Among patients diagnosed with neuroendocrine carcinoma, 20% are men and 80% are women. The average age of patients was 55.6±11.2 years. In 40% of cases, the tumor is localized on the head of the pancreas, in 40% of cases it affects the body, in 20% of patients the body and tail are affected. Stage IIA was diagnosed in 20% of patients, IIB - in 20%, III - in 40%, IV - in 20%. Tumors with a high moderate degree of differentiation prevail in 40% of cases, respectively, a low degree - in 20%.

Thus, the most common mofotypes were: ductal adenocarcinoma with localization in the head of the pancreas, stage IV and moderate degree of differentiation; mucinous adenocarcinoma with localization in the head,

stage II and moderate degree of differentiation; metastatic adenocarcinoma with localization in the head and body, stage IV and moderate degree of differentiation; neuroendocrine carcinoma adenocarcinoma with localization in the head or body, stage III and a high and moderate degree of differentiation.

BIBLIOGRAPHY

1. *Cherenkov, V. G.* Oncology / V. G. Cherenkov, S. V. Yablonsky. Moscow: GOETAR-Media, 2020. – 512 p.

2. *Zhahg, L.* Challenges in diagnosis of pancreatic cancer/ L. Zhahg, S/ Sanagapalli, A Stolita // World J. Gastroenterology. 2018. V. 24. № 19. P. 2047–2060

EPIDEMIOLOGICAL ASPECTS OF THE INCIDENCE OF COLORECTAL CANCER OF THE POPULATION OF THE REPUBLIC OF BELARUS

V. Sergeenko, A. Sysa

Belarusian state university, ISEI BSU

Minsk, Republic of Belarus

pikcabu@gmail.com

The retrospective analysis of the structure of oncopathology of the female and male population of the Republic of Belarus for the period from 2003 to 2017 was carried out. The incidence of colorectal cancer of the population of the Republic of Belarus is analyzed, as well as the mortality due to colorectal cancer of the population of the Republic of Belarus.

Keywords: colorectal cancer, morbidity, polyps, mortality, pathogenesis.

Epidemiological studies on the prevalence of colorectal cancer in the territory of the Republic of Belarus are promising in terms of identifying risk factors and developing organizational and preventive measures aimed at reducing the incidence of colorectal cancer, and today is one of the most urgent tasks of public health.

The number of cases of colon and rectal cancer of the male population does not differ much from the number of cases of diseases of the female population and occupies the 4th-5th place among all forms of malignant neoplasms. The analysis of the dynamics of the incidence of rectal and colon cancer of the population of the Republic of Belarus in 2003-2017 showed a pronounced tendency to increase of the incidence of both urban and rural populations. The average annual rate of rectal cancer of the urban population is 19.8 cases of diseases per 100 thousand of the population and 21.9 cases per 100 thousand of the rural population, respectively. During almost the entire study period, positive rates of the increase in the incidence of cancer of the rectum and colon of both urban and rural populations are recorded, which indicates the presence of an upward trend. In the dynamics of the incidence of the population of the Republic of Belarus of rectal and colon cancer in 2003-2017, a pronounced tendency to increase the incidence of both male and female populations was revealed.

Regression analysis of the incidence revealed that the incidence of colorectal cancer increases with age and the peak is observed in the age group of 75-79 years (171.4 cases of rectal cancer of the male population and 73.6 cases of diseases of the female population; 250.4 cases of colon cancer of the male population and 151.5 cases of diseases of the female population per 100 thousand people). From 0 to 29 years of age, there were no cases of rectal and colon cancer in the Republic of Belarus among the female and male population.

The conducted retrospective analysis of the long-term dynamics of mortality showed that the dynamics of mortality of male and female populations from rectal cancer is not traced, it is impossible to say for sure whether the mortality rate increases or decreases during this period. The average annual mortality rate of the male population was 12.4 cases of diseases per 100,000 populations. The average annual indicator of the mortality rate of the female population was 9.8 cases of diseases per 100,000 populations. The contribution of the age component of the disease is significant.

In the dynamics of mortality of the male and female population from colorectal cancer, a pronounced tendency to increase mortality was revealed. The average annual mortality rate of the male population was 12.2 cases of diseases per 100,000 populations and the female population was 12.6 cases of diseases per 100,000 populations. The contribution of the age-related component of the disease is significant.

During the study period, a significant increase in the incidence of colorectal cancer is measured in the Republic of Belarus, which may be due to environmental degradation and the presence of risk factors such as smoking, alcohol abuse, overt use of red meat, physical inactivity, conduction, inflammatory bowel diseases, etc.

BIBLIOGRAPHY

1. *Брусина, Е. Б.* Эпидемиология рака: учеб. пособие для последиплом. подгот. специалистов / Е. Б. Брусина, Ю. А. Магарилл, А. Г. Кутихин. – Кемерово: КемГМА, 2011. – С. 89-93.

2. *Имянитов, Е. М.* Клинико-молекулярные аспекты колоректального рака: этиопатогенез, профилактика, индивидуализация лечения / Е. М. Имянитов // Практ. онкология. – 2005. – Т. 6, № 2. – 65 с.

STUDY OF THE EFFECT OF MODIFICATIONS OF PYRIMIDINE NUCLEOTIDE ON THE ABILITY TO BIND TO HUMAN SERUM ALBUMIN BY FLUORESCENCE ANALYSIS

M. Serpitovskaya, T. Zhukovets

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
m.serpitovskaya@gmail.com

To understand the pharmacokinetic and pharmacodynamic processes underlying the interaction of drugs with blood transport proteins, the mechanisms of binding of modified nucleotides with human serum albumin in vitro were studied. The concentration quenching of protein fluorescence upon binding to ligands was investigated.

Keywords: human serum albumin, nucleotides, fluorescence, pyrimidine analogues.

The experiment was carried out using two models during incubation at a temperature of 25°C and 37°C: the first model of the interaction of the transport protein of HSA in an aqueous solution, the second model – in a buffer PBS solution of 0.1 mol /l, to reproduce the physiological conditions of the body during the interaction of protein with ligand. When studying the quenching of albumin fluorescence as a result of its interaction with substances of modified nucleosides and nucleotides, the emission spectrum was scanned in the wavelength range from 290 to 400 nm at an exciting light wavelength of 280 nm. In this experiment, a modified nucleotide of the emoxypine salt of arabinofuranosyl-5' monophosphate was used to study the affinity of ligands with a serum transport protein.

In an aqueous solution of albumin with a solution of the substance emoxypine salt arabinofuranosyl-5'-monophosphate, the fluorescence intensity increases within a concentration of 10^{-6} – 10^{-4} mol/l and drops sharply at concentrations of 10^{-4} – 10^{-3} mol/L. At a concentration of 10^{-3} – 10^{-2} mol/l, fluorescence reaches a plateau state.

In a buffer solution of albumin, the emoxypine salt of arabinofuranosyl-5'-monophosphate behaves the same as in an aqueous solution, except for an increase in the fluorescence intensity. It shows a sharp increase in the concentration range of 10^{-6} – 10^{-4} mol/ l, a sharp quenching of fluorescence from 10^{-4} to 10^{-3} mol/ l and reaches a plateau state within concentrations of 10^{-3} – 10^{-2} mol/l. [1]

The dependence of the fluorescence change on the temperature at which the protein binds to the ligand was analyzed, as a result of which it can be concluded that the quenching mechanism is statical or dynamic. Graphs of albumin fluorescence quenching, which were obtained at temperatures 25 °C and 37 °C, are shown in Fig. 1 and 2. Based on the first graph, it can be concluded that dynamic fluorescence quenching is observed water solution. The second graph shows that at a high concentration of the ligand, a static component of fluorescence quenching is observed, and at lower concentrations, a dynamic one. Thus, the specific formation of the complex is observed with a high content of the ligand in the reaction solution.

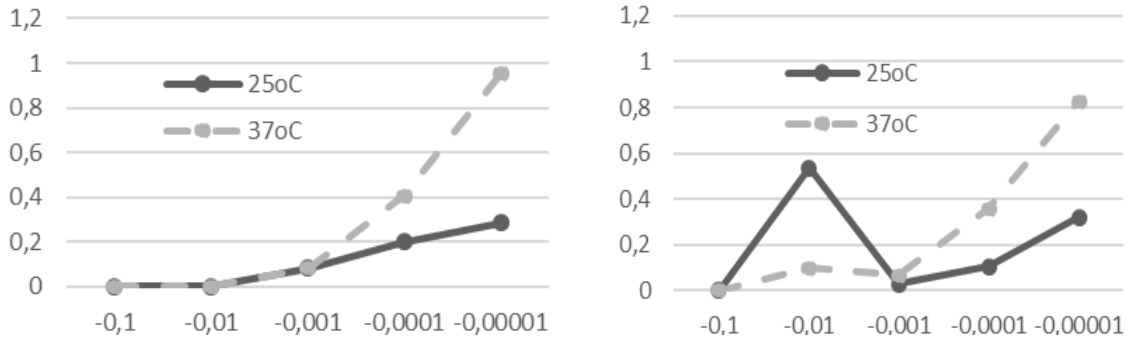


Fig. 1, 2 – Stern-Vollmer graph for concentration quenching of albumin fluorescence with emoxypine salt of arabinofuranosyl-5'-monophosphate in aqueous solution (fig.1) and buffer solution (fig.2). Along the ordinate axis is the ratio of total albumin fluorescence to its residual fluorescence after ligand addition, F_0/F. By abscissa – the concentration of ligands [Q]

BIBLIOGRAPHY

1. *Пшенкина Н. Н.* Кинетический и термодинамический анализ взаимодействия лигандов с альбумином / Н. Н. Пшенкина // Медицинский академический журнал. 2010. Т. 10. № 3. – С. 130 – 138.

ANALYSIS OF ANTIBACTRIAL ACTIVITY OF CYTIDINE 3',5'-CYCLIC MONOPHOPHATE IN *PROTEUS MIRABILIS*

A. Shihad, A. Sysa, E. Gritskevitch

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
arshedalmansori@gmail.com

The incidence of antibacterial resistance is on continued rise with a threat to return to the "pre-antibiotic" era. This has led to emergence of such bacterial infections, which are essentially untreatable by the current armamentarium of available treatment options. Various efforts have been made to develop the newer antibacte-rial with novel modes of action, which can act against these multi-drug resistant strains. Modified nucleotides are one of the important drugs class from an antibacterial perspective. A pharmacologically diverse class of drugs that arose from chemically modified natural ribose or 2′-deoxyribose nucleosides.

Keywords: cytidine 3',5'-cyclic monophosphate, Proteus mirabilis, 2', 7'-dichlorodihydrofluorescein diacetate.

The appearance of anti-infection agents had further developed humankind's wellbeing status and personal satisfaction colossally. Notwithstanding, abuse and abuse of anti-infection agents had brought about expanded turn of events and event of bacterial opposition against industrially accessible anti-toxins. Hence, the quest for novel anti-microbials of normal starting points, especially from marine assets and plants has been attempted industriously. One of the promising classes of antimicrobial mixtures are subordinates of the parts of nucleic acids: nucleosides, nucleotides, just as their analogs. These atoms are engaged with an enormous number of organic cycles, including, for instance, the capacity of hereditary data, quality articulation, energy digestion and cell flagging. These cycles are essential for all living life forms, including microbes. Nucleoside analogs are perhaps the main classes of drug utilized in the center. The most well-known utilization of nucleoside analogs as antiviral and antitumor specialists. Notwithstanding, as of late there is something else and more information on their viability against microorganisms [1].

A natural side effect of aerobic respiration is the production of reactive oxygen species (ROS). These ROS are generated via successive single-electron reductions and can damage DNA, proteins and lipids, ultimately leading to cell death. To protect themselves against the deleterious effects of ROS, aerobic bacteria are equipped with enzymes (catalases and superoxide dismutases) that can detoxify ROS and regulatory mechanisms (SoxRS, OxyRS, and SOS regulons) to counter the damage. Interestingly, in 2007 Kohanski et al. identified a common mechanism involving the production of hydroxyl radicals by which all bactericidal antibiotics could induce cell death. Currently, a mechanism is proposed in which bacterial membrane disturbance triggers envelope stress and subsequent perturbation of the Arc regulatory system accelerates respiration [2]. Hyperactivation of the electron transport chain induces the formation of superoxide and hydrogen peroxide which damage iron-sulphur clusters, thereby releasing ferrous iron. This iron can then react with hydrogen peroxide in the Fenton reaction and generate hydroxyl radicals which can directly damage DNA, lipids and proteins or oxidize the deoxynucleotide pool and indirectly damage DNA. However, this theory has recently become the subject of much debate. A major point of criticism is the use of hydroxyphenyl fluorescein as a stain to demonstrate ROS production, although various studies have used other direct (chemiluminescence, electron paramagnetic resonance (EPR)) or indirect methods (quantification of protein carbonylation or expression of proteins involved in antioxidant strategies) to confirm production of ROS. Moreover, it was found that protection against ROS has a positive effect on bacterial cell survival not only after treatment with oxidizing agents but also after treatment with antibiotics [3]. Most studies investigating the contribution of ROS in antibiotic-mediated killing have focused on planktonic cultures, but cells in a biofilm may respond differently. For example, for Pseudomonas aeruginosa biofilms higher bactericidal concentrations were needed to induce ROS production compared to planktonic cultures , and it has been shown that ciprofloxacin only induces oxidative stress in planktonic Proteus mirabilis cells but not in biofilms . ROS production most likely contributes to antibiotic-mediated killing, but the extent depends on the specific conditions. Hence, differences in experimental procedures could be at the basis of the conflicting results reported in literature [4].

To determine whether antibiotics induce the generation of ROS in Proteus mirabilis species we used fluorescent reporter dye, 2', 7'-dichlorodihydrofluorescein diacetate (H2DCFDA) and, to directly measure ROS production. These dyes have already been used in previous studies, but their use has recently been the subject of considerable debate. In the present study we investigated whether they can be used to measure ROS production in Proteus mirabilis bacteria [5].

In the present study direct and indirect methods to measure the production of ROS in Proteus mirabilis upon exposure to antibiotics were compared. Both planktonic and biofilm cultures were studied and antibiotics belonging to different classes (H2DCFD) were included.

Our results highlight some methodological key issues to be considered when evaluating the contribution of ROS in antibiotic mediated killing. Since not a single ideal method could be identified, we recommend to evaluate different methods. Whether or not increased ROS production is measured, is highly dependent on the antibiotics used and the species tested, and even varies between biofilms and planktonic cultures. However, more sensitive and specific methods are needed to obtain a complete understanding of the exact role of ROS in antibiotic mediated killing and to investigate whether the production of ROS is biologically relevant.

REFERENCES

1. *Imlay JA,* Superoxide production by respiring membranes of *Escherichia coli* / Fridovich I // Free radic Res Commun, 1991;12–13 Pt 1:59–66.

2. *Wang X,* Contribution of oxidative damage to antimicrobial lethality/ Zhao X // Antimicrob Agents Chemother. 2009;53(4):1395–402. pmid:19223646

3. *Kohanski MA,* A common mechanism of cellular death induced by bactericidal antibiotics /Dwyer DJ /Hayete B / Lawrence CA /Collins J // J.Cell 2007;130(5):797–810.

4. *Kohanski MA,* of membrane proteins and two-component system activation trigger antibiotic-mediated cell death /Dwyer DJ / Wierzbowski J/ Cottarel G / Collins J // J. Mistranslation Cell. 2008;135(4):679–90.

5. *Liu Y,* Cell death from antibiotics without the involvement of reactive oxygen species / Imlay JA. // Science (New York, NY). 2013;339(6124):1210–3/

IN VITRO ANTIBACTERIAL ACTIVITY OF NELARABINE PHOSPHATE AGAINST SARCINA LUTEA STRAIN

A. Shihad, A. Sysa, E. Gritskevitch

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
arshedalmansori@gmail.com

The increase in prevalence of antimicrobial-resistant bacteria is currently a serious threat, thus there is a need for new classes antimicrobial compounds to combat infections. The recent emergence of clinical isolates resistant to the last monotherapy against this bacterium, the cephalosporins, illustrates the need for new antigonococcal agents. Here we have characterised a new modified nucleotide of antimicrobials based on the compound nelarabine that exhibit robust activity against sarcina *lutea* in vitro. Nelarabine phosphate inhibits the growth of a broad range of Sarcina *lutea* isolates.

Keywords: Nelarabine phosphate , resazurin, antibacterial activity, Lutea.

The advent of antibiotics had improved mankind's health status and quality of life tremendously. However, overuse and misuse of antibiotics had resulted in increased development and occurrence of bacterial resistance against commercially available antibiotics. Therefore, the search for novel antibiotics of natural origins, particularly from marine resources and plants has been undertaken persistently. One of the promising classes of antimicrobial compounds are derivatives of the components of nucleic acids: nucleosides, nucleotides, as well as their analogues. These molecules are involved in a large number of biological processes, including, for example, the storage of genetic information, gene expression, energy metabolism and cell signaling. These processes are vital for all living organisms, including bacteria. Nucleoside analogues are one of the most important classes of drugs used in the clinic. The most common use of nucleoside analogues as antiviral and antitumor agents. However, recently there is more and more data on their effectiveness against microorganisms [1].

At the moment, the inhibitory activity of nucleosides has been detected both among those isolated from natural sources and among synthetic analogues . Antimicrobial properties have also been found in already known nucleosides that have been used or are being used to treat other diseases [2]. There is not much data on clinical trials of nucleosides as antibacterial drugs. In this regard, their research can be an important step to start using them as full-fledged antibiotics. Structural modification of antimicrobial drugs to which resistance has developed has been proven to be an effective means of extending the lifespan of antifungal agents such as the azoles , antiviral agents such as the nonnucleoside reverse transcriptase inhibitors, and various antibacterial agents including *β*-lactams and quinolones. It is not surprising then that, in response to antimicrobial resistance, major pharmaceutical companies have tended to concentrate their efforts on improving antimicrobial agents in established classes.

However, with the portfolio of chemotherapeutics currently available, it has been acknowledged that researchers are getting close to the end game in terms of parent structure alterations. A call has therefore been made for the development of new classes of drugs that work on different target sites to those in current use [3].

Most of the currently used classes of antibiotics were discovered before the 70s of the last century . Such a low activity in the search for new antimicrobial compounds can be explained by the high monetary and time costs for bringing the drug to the market, as well as a limited set of methods for identifying leading compounds . In addition, the vast majority of existing antibiotics exhibit significant cytotoxicity, which limits the possibilities of their use. It is obvious that there is an urgent need to create new classes of antibiotics that will act on new targets and have activity against resistant strains of microorganisms [4].

The resazurin-based turbidometric (TB) assay was first used to quantify bacterial content in milk by Pesch and Simmert in 1929. Resazurin (7-Hydroxy-3H-phenoxazin-3-one 10-oxide) is a blue dye which can be irreversibly reduced to a pink and highly red fluorescent substance, resorufin by oxidoreductase within viable cells. The resorufin can be further reduced to a colorless and non-fluorescent molecule, hydroresorufin. In light of the simplicity and high-throughput of the resazurin-based TB assay, it has been employed in many studies as an antibacterial screening assay however, these studies only involved screening of antimicrobial activity of phytochemicals.

However, the current review intends to focus on the significance of Nelarabine phosphate as antimicrobial agents based on resazurin along with clinical and *in vitro* applications of pyrimidine derivatives to facilitate the development of more potent as well as effective antimicrobial agents [5].

In short, the resazurin-based Nelarabine phosphate assay is a simple, reliable and feasible screening assay in assessing the antibacterial activity of modified nucleotides. This assay evidently demonstrated the antibacterial activity of Nelarabine phosphate against Lutea.

CHANGES IN BLOOD BIOCHEMICAL INDICATORS IN PATIENTS WITH PREVIOUS CORONAVIRUS INFECTION

O. Shinkevich, E. Tarasova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
olga15.06.200078@gmail.com

Biochemical monitoring of COVID-19 patients through in vitro diagnostic studies is critical to assess the severity and progression of the disease and serves as a monitoring tool for therapeutic interventions. A biochemical blood test allows you to determine the degree of damage in the work of various organs. Therefore, the purpose of this work is to study changes in the indicators of a biochemical blood test upon admission to an inpatient department and upon discharge from a medical institution of patients who have undergone COVID-19.

Keywords: COVID-19, biochemical blood test, coronavirus infection, biochemical parameters.

The data of a biochemical blood test carried out upon admission to the hospital and upon discharge in patients of the Healthcare Institution of the Minsk Region "Krupskaya Central District Hospital" who had undergone COVID-19 were studied. The average age of the patients was 60 years. The following indicators were studied: total bilirubin, urea, AST (aspartate aminotransferase), ALT (alanine aminotransferase), creatinine, potassium, sodium, chlorides, C-reactive protein.

As a result of the research, it was found that in patients both at the beginning of infection with COVID-19 and after recovery, most of the studied biochemical parameters corresponded to normal values and the average values were: total bilirubin – 10.05 μmol/l (norm 3.41 – 17.0 μmol/L), urea – 6.20 mmol/L (norm 2.39 – 6.39 mmol/L), AST – 28.00 U/L (norm 10 – 40 U/L), creatinine – 89.00 μmol/l (norm: men – 63-115, women – 54–97), cholesterol – 4.20 mmol/l (norm 3.0–6.0 mmol/l), K^+ – 4.32 mmol / l (norm 3.4 – 5.5 mmol/l), Na^+ – 139.10 mmol/l (norm 136 – 145 mmol/l), Cl^- – 105.70 mmol/l (norm 98 – 107 mmol/l).

However, the amount of ALT in the blood of patients at discharge was 50.00 U/L (normal: women – up to 31 U/L, men – up to 44 U/L), which was higher than normal and significantly higher compared to the onset of the disease 25.00 units/l. Such differences in the concentration of ALT can be caused primarily not by the coronavirus infection COVID-19, but by the load on the liver due to the hepatotoxicity of the prescribed drugs. Medicinal lesions of the liver account for about 10 % of all adverse reactions caused by the use of pharmacological drugs. The dynamics of the amount of protein was the opposite: at the beginning of the disease in covid patients, its amount was 68.00 g/l (norm 64 – 83 g/l), and at the end – significantly lower than 60.00 g/l.

It was also determined that in patients with confirmed coronavirus infection, the concentration of C-reactive protein (CRP) was significantly increased, both in severe and mild forms of the disease. Studies of patients with

COVID-19 have shown that CRP levels are directly correlated with disease, with critically ill patients experiencing significant increases in CRP levels.

The decrease in protein at discharge is possibly due to the fact that during a long and severe course of the disease, the body compensates for energy costs due to internal reserves, including protein. The restoration of dead cells takes place, a large amount of protein is consumed for the formation of new ones, as the main building material of the body.

Based on the studies carried out, it was revealed that in patients with COVID-19, the features of the biochemical blood test were expressed in a significant increase in the amount of ALT and a decrease in protein at the end of the disease compared to its onset. These changes in indicators can be caused by the duration and severity of the course of the coronavirus infection COVID-19, as well as the drugs used.

The most important diagnostic advantage of C-reactive protein is that it is a very early marker of inflammation that occurs during infection with COVID-19: its concentration rises as early as 6–8 hours after infection. When the SARS-COV-2 virus enters the body, an immune response is triggered to fight this pathogen, which leads to an increase in CRP levels.

A biochemical blood test has a certain prognostic value and affects the choice of drugs and / or their dosage regimen.

BIBLIOGRAPHY

1. Routine laboratory testing to determine if a patient has COVID-19 / I. Stegeman [et al.] // Cochrane Database Syst Rev. – 2020. – Vol. 11.

2. *Lippi G., Plebani M.* Laboratory abnormalities in patients with COVID-2019 infection. Clin. Chem. Lab. Med. (CCLM). 2020. DOI: 10.1515/cclm-2020-0198. Published online: 03 Mar 2020.

PHOTON AND ELECTRON OUTPUT CONSTANCY

A. Shish, T. Chikova

N. N. Alexandrov National Cancer Centre of Belarus
Minsk, Republic of Belarus
dorohedoro1315@gmail.com

The conditions for quality assurance of external beam radiation therapy using photons and electrons at a linear accelerator are considered. Requirements for checking the constancy of the output of photons and electrons from the linear accelerator are formulated.

Keywords: radiation therapy, quality assurance, output constancy, tolerance range.

Quality assurance is the process of verifying whether a product or machine function is within certain criteria. The goal of quality assurance in radiotherapy is to ensure constancy of equipment function [1].

Linear accelerator output constancy is an important part of a regular quality assurance program because the absolute dose received by the patient is the primary determinant of treatment outcome. Verification of photon and electron output important for the general confidence that the patient's dose during treatment fraction is constant and nominally accurate to the expected prescribed dose. These measurements are not a calibration of the beam's output but are confirmation that the outputs have not changed within reasonable limits [2].

The measured output should be within 3 % of the established baseline for daily and monthly output checks. But, if the output measurement is outside the ±3 % tolerance range but within ±5 %, treatment can be continued, but the measurement must be repeated. If re-measurement still shows a deviation of ± 3 %, the cause of the nonconformity should be investigated as soon as possible using a quality management plan. For annually output measurements must be within 1 % of dose calculated [3].

Ideally, each treatment vault will have its own dedicated daily measurement system. The system used to measure daily dose output constancy normally, although not always, consists of a phantom embedded with at least five or more ionization chambers or diodes and electrometers. These devices usually contain sensitive electronics. Radiation damage to these electronics could cause drifts in the readings; therefore, it is important that the setup avoids irradiating electronics during measurements. The important features of the measurement procedures are the reproducibility in the setup geometry, the correct functionality of the measuring system, data recording, and analysis. In addition, for electron output, the inherent buildup of the device used for measurements should not be positioned in the steep distal falloff of the depth dose, which is a particular problem for low electron energies. Small changes in electron energy may cause a false dose constancy error relative to the dose at depth of clinical interest.

The measurement system and repeatability of the procedure should be such that the two standard deviations for three or more repeated consecutive measurements are less than the tolerance value. This usually requires an ionization chamber system that can be equipped with sensors to correct temperature and pressure. Alternatively, diode and metal–oxide–semiconductor field-effect transistor (MOSFET) systems could be used if their calibration is carefully established.

BIBLIOGRAPHY

1. *Sanghangthum, T.* Retrospective analysis of linear accelerator output constancy checks using process control techniques / T. Sanghangthum, S. Suriyapee, S. Srisatit, T. Pawlicki // Journal of Applied Clinical Medical Physics. 2013. Vol. 14, No. 1. S. 143-160.

2. *Hanley, J.* AAPM Task Group 198 Report: An implementation guide for TG 142 quality assurance of medical accelerators / J. Hanley, S. Dresser, W. Simon, R. Flynn // Medical Physics. 2021. Vol. 1. S. 1–56.

3. *Smith, K.* AAPM Medical Physics Practice Guideline 8.a.: Linear accelerator performance tests / K. Smith, P. Balter, J. Duhon, G. A. White. // Med Phys 2017. 1 Vol. 8:4. S. 23–39.

RADIOCHROMIC FILM DOSIMETRY

A. Shish, T. Chikova

N. N. Alexandrov National Cancer Centre of Belarus
Minsk, Republic of Belarus
dorohedoro1315@gmail.com

The dosimetric characteristics of radiochromic films are analyzed. The main sources of uncertainty in the radiochromic dosimetry system are shown. The features of the dose-response curve for a certain wavelength range of the optical densitometer readout system are presented.

Keywords: radiochromic films, dose-response curve, optical density, pixel values.

Radiochromic films (RCFs) are dosimeters based on the property to change the structural characteristics of their crystalline sensitive element when exposed to ionizing radiations. The main base of RCF is a radiation sensitive monomer that is incorporated into a water-soluble polymer matrix coated onto a polyester base. The dyeing process of RCF occurs due to radiation polymerization of diacetylene molecules and the formation of polymers of polydiacetylene dyes. Because they are blue, the RCFs absorb light in the red and green parts of the visible spectrum. As with conventional silver halide film, the measured property of RCFs is light absorption, which is related to absorbed radiation dose [1]. As the absorbed dose increases, the RCFs become darker and less light is transmitted. Since the formation of the dye in the RCF occurs almost instantaneously, the color change is almost immediately visible to the naked eye.

The dosimetric characteristics of RCFs are described by an absorption spectrum for a given dose value and a dose–response curve for a certain wavelength band [2, 3]. The absorption spectrum for a given dose is measured with a spectrophotometer and is a plot of optical density (OD) against the light wavelength. The dose–response curve is a plot of OD against dose for a certain wavelength band of the optical densitometer readout system. Alternatively, the response curve may be a plot of the pixel values (PV) versus doses for a given output channel (red, green, or blue) of a color flatbed scanner. The dose–response curve is not linear regardless of the choice of OD or PV. The OD increases with dose while the PV decreases with dose for a 16-bit scan for each color channel.

A radiochromic dosimetry system consists of two parts, namely, RCF and a readout system (such as a spectrophotometer, densitometer or scanner). The optimal quantitative performance of RCF dosimetry system can be achieved by selecting the film model with appropriate sensitivity to the specific type and energy of radiation and by matching the readout system with its ability to detect radiolytic color change.

The main sources of uncertainty are the lateral scanning effects and the warm-up of the scanner, as well as the dependence on the on film orientation on the flatbed scanner. Consideration should also be given to changes in environmental conditions affecting the RCF reading, such as the temperature, humidity, exposure to UV light, etc.

RCF dosimetry is considered a reliable method for accurate dose estimate and quality checks in many applications of radiation physics RCFs are reliable, easy to use, cheap and non-invasive instruments, providing accurate and constant dose values. It is sensitive to all types of ionizing radiation (photons, electrons, protons and heavy ions).

BIBLIOGRAPHY

1. *Casolaro, P*. Real-time dosimetry with radiochromic films / P. Casolaro, L. Campajola, G. Breglio, S. Buontempo // Scientific Reports. 2019. Vol. 9. S. 75–99.

2. *Azam Niroomand-Rad, A*. Report of AAPM Task Group 235 Radiochromic Film Dosimetry: An Update to TG-55 / A. Niroomand-Rad, S. Chiu-Tsao, M. P. Grams, D.F. Lewis // Med Phys. 2020. Vol. 47. № 12. S. 5986–6027.

3. Radiochromic Films for the Two-Dimensional Dose Distribution Assessment / Pierluigi Casolaro // Appl. Sci. 2021. Vol. 11. S. 2132–2149.

PHOTODYNAMIC THERAPY DOSIMETRY

A. Shish, T. Chikova

N. N. Alexandrov National Cancer Centre of Belarus
Minsk, Republic of Belarus
dorohedoro1315@gmail.com

The role and effectiveness of photodynamic therapy in clinical practice is considered. Four main methods of photodynamic dosimetry are outlined, which make it possible to determine the dose delivered to the target.

Keywords: photodynamic therapy, light-activated chemotherapy, implicit dosimetry, biophysical/biological tissue response monitoring, explicit dosimetry, direct dosimetry.

Photodynamic therapy (PDT) is light-activated chemotherapy in which light is used to activate a light-sensitive drug that accumulates in cells and causes oxidative damage to cells. It is a light-activated chemotherapy. And it's use for treatment of age-related macular degeneration, actinic keratosis, esophageal cancers, some skin and eye conditions and non-small cell lung cancer. A photon is absorbed by the photosensitive drug, which puts the drug in an agitated state. The excited drug can then transfer its energy to oxygen to create a chemical radical called «singlet oxygen». Singlet oxygen attacks cellular structures by oxidation. Such oxidative damage can be oxidation of cell membranes or proteins. When the accumulation of oxidative damage exceeds a threshold level, the cell begins to die.

PDT dosimetry is complex due to the nature of the dynamic interactions between light, photosensitizer and oxygen. The clinical efficacy of PDT depends on the type of complex dosimetry performed, as well as on the total dose, time of exposure to light, method of delivery, and fractionation scheme.

Currently, most PDT treatments are performed by specifying three treatment parameters, namely the administered photosensitizer dosage (mg per kg body weight), the treatment light dose and drug-light interval. The inaccuracy of these parameters to reflect the «effective dose» that is actually delivered to the target tissue often results in unpredictable response rates or failure to control the disease. First, the photosensitizer concentration can vary from site to site and from patient to patient due to intra- and inter-patient heterogeneity in pharmacokinetics. Second, the penetration of light into the target depends on the tissue optical properties which can also be different intra- and inter-patient. Thirdly, tissue oxygenation is not taken into account. The amount of singlet oxygen reacted will be lower than expected if the tissue is hypoxic or becomes hypoxic during PDT treatment. In addition, the number of all parameters can change and influence others during PDT treatment. Recognizing and strategically considering all of these variations to guide PDT treatment and / or predict treatment outcomes is the essence of successful PDT dosimetry.

Measurement of dose delivered to the target is critical in photodynamic therapy. Four different dosimetric methodologies can be used for PDT dosimetry: implicit dosimetry, biophysical/biological tissue response monitoring, explicit dosimetry, and direct dosimetry.

Implicit dosimetry has been used clinically during intraoperative pleural PDT. Other metrics include implicit dosimetry with photosensitizer photobleaching through monitoring the photosensitizer fluorescence. Photobleaching during PDT is the irreversible destruction of the photosensitizer in the ground state. The advantage of this is that it is relatively simple and practical to implement. Measurement of the photoproducts from photobleaching with fluorescence spectroscopy has also been used as a dose metric; however, this does not apply to all photosensitizers.

Monitoring biophysical and biological tissue response can also be used as a dosimetric method. This includes monitoring vascular shut down, treatment-induced necrosis, and blood flow monitoring using laser Doppler spectroscopy or diffuse correlation spectroscopy.

Explicit dosimetry involves the measurement of the main components that are involved in the photodynamic reaction (light, photosensitizer, and oxygen) and incorporation of these measurements into a dose model. The PDT process can be described using velocity equations.

Direct methods of PDT dosimetry involve singlet oxygen luminescence dosimetry which can be technically challenging due to the weakness of the near-infrared luminescence emission of oxygen and its short lifetime.

CONCEPT DEVELOPMENT OF A QUALITY GUARANTEE PROGRAM OF EXAMINATION IN THE DEPARTMENT OF RADIOISOTOPE DIAGNOSTICS OF MINSK CITY CLINICAL ONCOLOGY CENTER

D. Shpak, T. Chikova

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
101dashka@mail.ru

The work substantiates the relevance of the development of a quality assurance program for the examination in the department of radioisotope diagnostics. The content of the main stages in the development of a clinically acceptable program for ensuring the quality of examination of patients with malignant neoplasms using radiopharmaceuticals in the department of radioisotope diagnostics of the Minsk City Clinical Cancer Center is analyzed.

Keywords: oncology, nuclear medicine, radiation diagnostics, diagnostic equipment, quality assurance, quality control.

The relevance of the development of a quality assurance program for the examination in the department of radioisotope diagnostics of the Minsk City Clinical Cancer Center is due to the fact that at present there is no universal program for guaranteeing the quality of examination of patients by methods of radioisotope diagnostics in the department of nuclear medicine in the world. Each department is equipped with an individual set of devices and equipment in accordance with the clinical specifics. The development of a quality assurance program for patients undergoing examination in a particular department of radioisotope diagnostics should be based on taking into account the specifics of its equipment.

The concept of «quality assurance» in nuclear medicine implies obtaining the ideal end result of the study, eliminating errors and artifacts at the minimum dose received by the patient. The concept of «quality control» means the implementation of basic control and measuring procedures, confirming the quality of the study. Quality assurance requirements in radioisotope diagnostics should apply to all stages of a patient study.

Achievement of high standards of efficiency and reliability of radioisotope diagnostics is ensured by the development of: a) high-quality protocols for examining patients, b) methodology and procedures for ensuring the quality of equipment operation, c) algorithms for diagnosing malignant neoplasms when using radiopharmaceuticals.

Despite the fact that the radiation doses to patients from radiopharmaceuticals are significantly lower than during X-ray examination, the problem of radiation protection is a priority task of nuclear medicine throughout the world. In recent years, programs to ensure the quality of radiation diagnostics and radiation therapy have been intensively developed, which ensure the maximum possible dose reduction to normal tissues and organs at high dose values in the tumor. The most appropriate radiopharmaceutical and nuclear medicine procedure should be selected for each individual patient.

To develop a quality assurance program for patients undergoing examination in the department of radioisotope diagnostics of the Healthcare Institution «Minsk City Clinical Cancer Center», taking into account its equipment, it is necessary to perform the following.

Stage I. Justification of the choice of radiopharmaceuticals for the effective development of a quality assurance program for diagnostic equipment.

Stage II, Development of protocols of the order and quality of the study using diagnostic equipment in the department of radioisotope diagnostics, equipped with a single-photon emission computed tomograph combined with a computed tomograph (SPECT-CT) from Siemens and a positron emission computed tomograph combined with a computed tomography (PET) CT) from Siemens.

Stage III. Development of an algorithm for the diagnosis of malignant neoplasms using radiopharmaceuticals.

Stage IV. Testing of the developed program of quality assurance of examination in the department of radioisotope diagnostics and its introduction into clinical practice of the department of radioisotope diagnostics of the Healthcare Institution «Minsk City Clinical Cancer Center».

At present, the equipment and technologies used in modern laboratories for radioisotope diagnostics are constantly being improved, their range is expanding, fundamentally new devices are being created, and the latest re-

search methods are being developed. As diagnostic nuclear medicine techniques improve and the latest equipment is introduced into clinical practice, the relevance of developing procedures for acceptable testing, commissioning and quality assurance of radioisotope diagnostic planning systems will continue to grow. The approved program for the quality assurance of the examination in the department of radioisotope diagnostics of the Minsk City Clinical Oncological Center can be used in other healthcare institutions of the oncological profile of the Republic of Belarus with similar equipment.

STAGES OF IMPLEMENTATION OF THE QUALITY ASSURANCE PROGRAM OF EXAMINATION IN MINSK CITY CLINICAL ONCOLOGY CENTER

D. Shpak, T. Chikova

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
101dashka@mail.ru

The stages of implementation of the quality assurance program for the examination in clinical practice of the nuclear medicine department of the Minsk City Clinical Oncological Center are analyzed. It has been shown that they include a comparison of radiopharmaceuticals to ensure the quality of diagnostics and to ensure the stability of the quality assurance of the parameters of diagnostic devices.

Keywords: nuclear medicine, radiation diagnostics, diagnostic equipment, quality assurance, quality control.

Based on the recommendations of international organizations, Belarusian regulatory documents and our own clinical experience, a program has been developed to ensure the quality of examination of patients with malignant neoplasms using radiopharmaceuticals in the department of radioisotope diagnostics of the Minsk City Clinical Oncological Center. The implementation of the quality assurance program for the examination in the clinical practice of the nuclear medicine department is a system of measures to control the quality of the entire technological process of radiation therapy. There are two main stages in this process.

1. Comparison of radiopharmaceuticals for quality assurance in the nuclear medicine department.

In the nuclear department of the Minsk City Clinical Oncological Center, radiopharmaceuticals 131I and 99m Tc are used. Since gamma cameras are used to image radionuclides with a wide energy range, a practical comparison of 131I and 99m Tc radiopharmaceuticals has been carried out. Calibrations with 131I have shown that not only 99m Tc, but also 131I can be used to control and ensure the quality of the gamma camera parameters.

2. Ensuring the stability of the quality assurance of the parameters of diagnostic devices.

Nuclear medicine apparatus and devices are the main element in the patient irradiation process. The instability of the parameter of the diagnostic apparatus reduces the reliability of the assessment of the state of the investigated organ. Verification of the quality of work of medical equipment is a guarantee of the stability of its functioning, which ensures high quality of treatment of patients. The following parameters are checked at the Minsk City Clinical Oncological Center.

a) Stability of the quality of the parameters of the light marker.

When checking the light markers, the system phantom is centered and aligned so that the light markers hit the engraved notches of the phantom. The phantom image scanned with narrow collimation is used to check the coincidence of the engraved notches with the scanning plane, as well as the sagittal and frontal planes.

b) Position of the image viewing quality stability.

On the image of the topogram of the system phantom, the position of the tomographic scan with narrow collimation is selected for the engraved notches on the phantom. The coincidence of the engraved notches with the scanning plane is checked by the recorded tomographic image of the phantom.

c) Stability of the quality of the cut parameters.

The thickness of the tomographic section is analyzed by measuring the width of the image of the inclined aluminum ramp at the intersection of the ramp with the cut. Width is defined as the full width at half maximum (FWHM) of the baseline-corrected CT profile. The measurement is performed for two sets of scan parameters.

d) The stability of the quality of the parameters of the homogeneity / water signal.

The measurement is performed for two sets of scan parameters, representing a typical head mode and a typical body mode. Water number and homogeneity are analyzed by measuring the CT mean of the five regions of interest (ROI) on a 20 cm diameter cylindrical water phantom image.

e) Stability of the quality of noise parameters.

The measurement is performed for two sets of scan parameters, corresponding to the typical head mode and the typical body mode. Image interference is assessed by measuring the standard deviation of the region of interest (ROI) CT numbers on an image of a 20 cm diameter cylindrical water phantom.

f) Stability of quality of MTF parameters.

By analyzing the image of the thick tungsten wire, a point spread function is obtained and a modulation transfer function (MTF) is determined, which is calculated as a Fourier transform of the point spread function.

g) Stability of the quality of contrast parameters.

The contrast scale is analyzed from the CT mean values in the central region of interest (ROI), measured when scanning a cylindrical water phantom with a diameter of 20 cm and when scanning without a phantom. The analysis uses attenuation coefficients 0 1 / cm for air and 0.192 for water. The analysis is performed for a typical body mode.

BIOLOGICAL ACTIVITY OF LOPINAVIR, RITONAVIR AND NELFINAVIR AS POTENTIAL INHIBITORS OF SARS-COV-2 MAIN PROTEASE M^{PRO}

A. Sidorova, A. Bakunovich

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
apelsincocos@gmail.com

Ritonavir, nelfinavir and lopinavir are a group of protease inhibitors. These inhibitors are widely used in combination with other protease inhibitors in the therapy and prevention of human immunodeficiency virus. Also, the combination of these inhibitors is an effective therapeutic agent that acts on the main protease M^{pro} of the coronavirus and provides long-term suppression of viral load in the disease of severe acute respiratory syndrome caused by coronavirus 2 (SARS-CoV-2).

Keywords: inhibitor, protease Mpro, coronavirus, SARS-CoV-2.

Ritonavir is a peptidomimetic human immunodeficiency virus (HIV) protease inhibitor that acts by binding to the catalytic site of the viral protease, thereby preventing the cleavage of viral polyprotein precursors into mature functional proteins required for viral replication. Lopinavir is a novel protease inhibitor structurally related to ritonavir. Lopinavir is a potent inhibitor of HIV-1 protease, producing immature, non-infectious virions. It has low bioavailability so it is supplied with ritonavir, which dramatically increases blood levels of lopinavir [1]. Nelfinavir is a synthetic antiviral drug from the group of protease inhibitors. Nelfinavir inhibits the retroviral aspartic protease, which is necessary for the correct proteolytic cleavage of viral precursor proteins to their mature forms. Combined with reverse transcriptase inhibitors, this highly active combination antiretroviral therapy has reduced the spread of HIV infections by suppressing viral loads to sub-infectious levels [2].

The druglikeness was evaluated through calculating the properties that constitute "Lipinski rule of 5" (RO5) using Molinspiration software (www. molinspiration.com). RO5 supply a heuristic indicator for determining if a compound will be orally bioavailable. RO5 states that molecules exhibit good absorption or permeation when they have an octanol-water partition coefficient (miLogP) < 5, molecular weight (MW) < 500, number hydrogen bond donors (nOHNH) ≤ 5, number hydrogen bond acceptor (nON) ≤ 10 (table 1).

Table 1

Pharmacokinetic properties of lopinavir, ritonavir and nelfinavir

	miLogP	TPSA	natoms	MW	nON	nOHNH	nviolations	nrotb	volume
Lopinavir	5.69	119.99	46	628.81	9	4	2	15	607.96
Ritonavir	7.51	145.78	50	720.96	11	4	3	18	663.10
Nelfinavir	5.47	101.89	40	567.80	7	4	2	10	544.79

The results from Table 1 reveal that all compounds according to RO5 have poor oral bioavailability. However, this does not exclude their effectiveness in the case of injections. Druglikeness may be defined as a complex balance of various molecular properties and structure features which determine whether particular molecule is similar to the known drugs. Table 2 shows the bioactivity of three protease inhibitors.

Table 2

Bioactivity of lopinavir, ritonavir and nelfinavir

	GPCR ligand	Ion channel modulator	Kinase inhibitor	Nuclear receptor ligand	Protease inhibitor	Enzyme inhibitor
Lopinavir	0.04	-0.78	-0.55	-0.66	0.42	-0.37
Ritonavir	-0.33	-1.41	-1.02	-1.41	0.35	-0.74
Nelfinavir	0.19	-0.25	-0.28	-0.25	0.58	-0.02

Bioactivity scores from 0.0 to 5.0 may refer that compound has a significant biological activity; scores from -5.0 to 0.0 – moderate activity and if scores are less than -5.0 the compound is inactive. On this observation, all presented inhibitors were found to be significant bioactive as protease inhibitors. Lopinavir also shows significant biological activity as GPCR ligand.

BIBLIOGRAPHY

1. *Magro, P*. Lopinavir/ritonavir: Repurposing an old drug for HIV infection in COVID-19 treatment / P. Magro [et al.] // Biomedical Journal. 2021. V. 44. № 1. P. 43–53.

2. *Bolcato, G*. Targeting the coronavirus SARS-CoV-2: computational insights into the mechanism of action of the protease inhibitors lopinavir, ritonavir and nelfinavir / G. Bolcato [et al.] // Scientific Reports. 2020. V. 10. № 20. P. 64–72.

INFLUENCE OF NUCLEOSIDES ON FIBRILL FORMATION OF INSULIN

O. Sokolovich, N. Bogdanova, V. Sagan, A. Mahnach

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
helgahawk23@mail.ru

The study of the structure of ordered protein aggregates – amyloid fibrils, the effect of the native structure of the protein and external conditions on the process of fibrillation is currently a very important topic for research.

Keywords: amyloid formation, insulin, nelarabine, cAMP.

The generally accepted point of view is that the process of amyloid formation includes a nucleation stage. The process of aggregation of protein monomers into a fibril can be divided into two stages - the lag period, during which embryos are formed, and the time of transition of all monomers into the aggregate. It should be noted that the last phase varies depending on the protein and can be both linear and exponential. Reactions with a nucleation stage have been fully studied both from a theoretical and experimental point of view for a wide range of substances, mainly in the context of crystallization for both large and small molecules. As for other processes with a stage of nucleation (including crystallization), the addition of seeds from already formed embryos during the process of amyloid formation practically levels the lag period, since the rate of aggregation is no longer limited by the stage of nucleation. It is known that the introduction of certain mutations in aggregating proteins or certain changes in the experimental conditions can also practically level the lag period, while it is assumed that nucleation ceases to be the limiting stage of the process. The absence of a lag period, however, is not necessarily due to the fact that the description of an aggregation mechanism having a nucleation step is no longer applicable, but rather means that the time required for fibril formation is sufficiently long relative to the rate of nucleation and thus nucleation. is no longer a rate-limiting step in the transition of a protein from a soluble form to an amyloid. Despite the fact that fibrils are not formed during the lag period, it is clear that this is an important stage during which various oligomers are formed, including those that can serve as a seed for the formation of mature fibrils [2].

There are compounds that have a chaperone-like activity and thereby inhibit the aggregation of destabilized proteins. These compounds include cAMP, nelarabin, 6-methoxyguanosine, 6-chloro-2-aminoarabinoside, etc.

Nelarabine is a purine nucleoside analog used as an antineoplastic agent for the treatment of T-cell lymphoblastic leukemia or lymphoma.

cAMP-α is one of the most important cellular signaling molecules including the regulation of insulin and glucagon secretion by β- and α-cells of the pancreas, respectively. cAMP is generally regarded as an enhancer of insulin secretion caused by an increase in Ca2 + in β-cells.

The presence or absence of cAMP and nonarabin in the allosteric center leads to significant structural changes in protein molecules. The mechanism of nucleotide interaction in the allosteric center was based on the establishment or loss of hydrophobic interactions with the adenine ring, leading to subsequent changes in the position of the helical structures of proteins [1].

It is known that in the process of fibrillation, the helical parts of insulin molecules are converted into β-folded structures. It can be assumed that adenyl nucleotides will be capable of allosteric interactions with the insulin molecule and hinder the availability of α-helices for transformation into β-folded structures [3].

BIBLIOGRAPHY

1. *Melvin R Hayden.* Type 2 Diabetes Mellitus as a Conformational Disease// Melvin R Hayden, Suresh C Tyagi, Michelle M Kerklo, Mark R Nicolls// JOP. J Pancreas. 2005. V. 6. P. № 4. 287–302.

2. *Довидченко Н.К.* Механизмы образования амилоидных фибрилл //Н.К. Довидченко, Е.И. Леонова, О.В. Галзитская// Успехи биологической химии.2005. V. 54. P. 203–230.

3. *Селиванова О.М.* Структурный полиморфизм и возможные пути образования амилоидных фибрилл на примере белка инсулина// О.М. Селиванова, О.В. Галзитская// Биохимия. 2012. V. 77. № 11, P. 1478–1490.

PHILLOSPHERE PATHOLOGIES OF DOMINANT PLANT SPECIES OF SMALL RECREATION ZONES IN MINSK ON THE EXAMPLE OF MIKHAILOVSKY SQUARE

Y. Sorgovitskaya, A. Chernetskaya

Belarusian state University, ISEI BSU
Minsk, Republic of Belarus
yana5265233, chealval@gmail.com

The article examines the main diseases of the phyllosphere of small recreational zones in Minsk on the example of Mikhailovsky Square. The species composition of the dendroflora of the Mikhailovsky square was analyzed, and the dominant plant species were identified.

Keywords: phyllosphere, pathology, recreation zones, tilia cordata Mill.

The species composition of the dendroflora of the Mikhailovsky square was considered. The species composition of the dendroflora of the Mikhailovsky public garden in Minsk, according to the data obtained, is represented by the following families: Tiliaceae, Salicaceae, Sapindaceae, Pinaceae, Betulaceae. The Tiliaceae family is predominant for numerous woody plants (Fig.1).

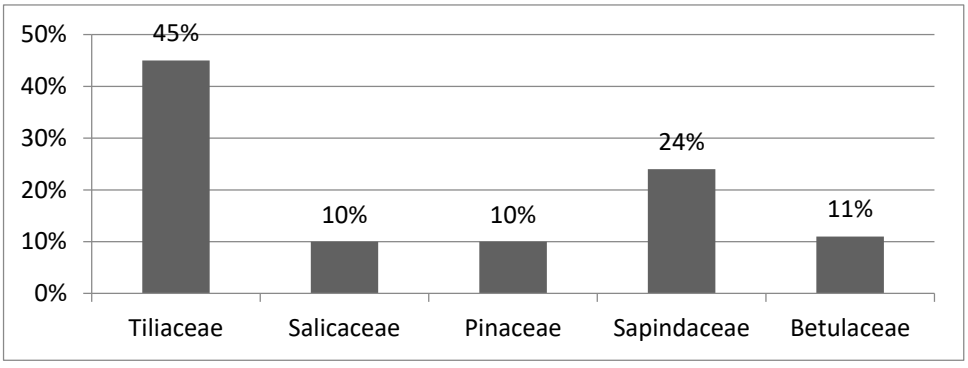


Fig. 1 – Species composition of tree plantations of Mikhailovsky square

Analysis of the results of the Mikhailovsky square of the study showed that the dominant species is the small-leaved linden *(Tilia cordata Mill.)* (45 %). In the degree of representation: common hazel (*Corylus avellana*) (11 %), Norway willow (*Salix acutifolia*) (10 %), Scots pine (*Pinus sylvestris*) (10 %), Norway maple (*Acer platanoides L.*) (24 %).

During the study, the main pathologies of the phyllosphere were identified: small-leaved linden (*Tilia cordata Mill.*) are mosaic, alternaria and dry spot, caused by the virus Pyrusvirus 2 Smith and fungi of the genus Alternaria, respectively; Norway maple (*Acer platanoides L.)* – powdery mildew caused by fungi of the species Podosphaera fuliginea, Erysiphe cichoracearum and Oidium; white or silver poplar (*Populus alba L.*) – spots caused by fungi of the genera Ascochyta, Colletotrichum, Phyllosticta, Pestalotia, Septoria, Vermicularia; rough elm (*Ulmus glabra)* – ascochitis caused by a fungus of the genus Ascochyta.

The dominant pest of the small-leaved linden (*Tilia cordata Mill.*) is the linden gall mite, which forms numerous cone-shaped green galls on the leaves of the linden, which turn red over time. The offspring of mites develop inside the galls.

Norway maple *(Acer platanoides L.)* is most often affected by two types of pests: maple leaf weevil, maple whitefly. They actively feed on maple leaves. As a result, the leaves lose color and fall off prematurely [1].

Pests of white poplar *(Populus alba L.*) are leaf-eating insects. They are quite numerous and are represented by species from various families of butterflies, sawflies and beetles.

The rough elm *(Ulmus glabra)* is a plant that is vulnerable to pests and diseases. Most often, the tree is damaged by leaf-eating insects, such as the elm leaf beetle, springtail and sapwood.

The main pest of common hazel *(Corylus avellana*) is the gall mite – a pest that sucks juices from leaves.

Pathologies and pests of phyllosphere of dominant plant species of small recreational zones are quite numerous and species-specific. The most common are ascochytosis, mungbean dew, spot blight, and gall mite.

BIBLIOGRAPHY

1. *Sorgovitskaya, Y.* The main pathogens of dendroflora of the square «Trinity mountain» on the example of small-leaved linden / Y. Sorgovitskaya, A. Chernetskaya // Actual environmental problems, isei BSU, November 19–20, 2020. – Minsk. – P. 219–220.

SOME REGIONAL FEATURES OF MODERN THYROID PATHOLOGIES OF THE URBAN POPULATION OF THE REPUBLIC OF BELARUS

A. Soropyatova

Belarusian State University, ISEU BSU
Minsk, Republic of Belarus
soropyatova@mail.ru

In this paper, the spatial and temporal features of thyroid pathologies are considered: nodular pathology. The object of the study is the pathology of the thyroid gland. The aim of the work is to study the regional features of modern thyroid pathologies in an urban environment. To analyze the statistics of the Ministry of Health on the incidence of nodular pathology in the regions of the Republic of Belarus.

Keywords: thyroid pathology, diseases of the urban population, goiter, hypothyroidism, disease statistics.

The modern pathology of the thyroid gland is a violation of the function of the immune system. The greatest manifestation of thyroid pathology in urban conditions is manifested in diseases: hypothyroidism and goiter. Since the Republic of Belarus is located in the iodine deficiency zone, it is problematic to obtain iodine naturally in the conditions of the city. The urban environment exacerbates iodine deficiency.

Hypothyroidism is a disease caused by a decrease in the function of the thyroid gland and insufficient production of hormones by it.

Goiter is a whole group of thyroid diseases associated with an increase in its volume.

According to modern experts, approximately 30 % of the morbidity of the population is associated with the provoking effect of environmental pollution, namely the deterioration of the environmental situation.

Thyroid pathology is quite common and ranks third among the diagnosed diseases in the territory of the Republic of Belarus after cardiovascular diseases and diabetes mellitus. [1]

In this work, statistical data on thyroid pathology were analyzed.

According to the statistical data of the Ministry of Health, the incidence of simple non-toxic goiter decreased to 59.9 per 100,000 population in 2016 compared to 2000, where it reached up to 325.0 per 100,000 population. The highest incidence of goiter was registered in the Brest region in 2013 and 2015, the lowest in 2018, but there were no statistically significant differences. In 2020, the highest incidence of goiter was found in the city of Vitebsk and the Vitebsk region, which amounted to 21 % of the surveyed. In the other cities where the study was conducted, this indicator was Grodno – 4 %, Mogilev – 5 %, Brest – 8 %, Minsk – 12 %, Gomel – 14 %. [2] The prevalence of goiter as a whole in the surveyed regions ranged from 4.0 % to 21 %. Based on the data obtained, it can be concluded that the greatest incidence in the territory of Vitebsk and the Vitebsk region is primarily associated with poor diet, deficiency of trace elements and insufficient diagnostic possibility of pathology.

The dynamics of the incidence of hypothyroidism indicates a decrease in the disease from 1.96 per 100,000 population in 2006 to 1.27 per 100,000 population in 2016 [3].

The severity of iodine deficiency disorders has decreased and can now be assessed as mild by region. This can be explained by the fact that the population living in the city prefer to receive food in stores whose products contain a normalized amount of all nutrients and trace elements. This is also due to the regular use of iodized salt.

BIBLIOGRAPHY

1. *Мохорт Т.В., Коломиец Н.Д., Петренко С.В., Федоренко Е.В., Мохорт Е.Г.* Динамический мониторинг йодной обеспеченности в Беларуси: результаты и проблемы // Проблемы эндокринологии. – 2018. – Т. 64. – №3. – С. 170–179.

2. Здравоохранение в Республике Беларусь [Электронное издание]: офиц. стат. сб. за 2018 г. – Минск: ГУ РНПЦ МТ, 2019. – 261 с.: табл.

3. Журнал Белорусского государственного университета. Экология. 2018. № 4. С. 109–118.

ANTIOXIDANT ACTIVITY OF WHEY AND COLOSTRUM HYDROLYZATES COMPLEXES WITH CYCLODEXTRIN

E. Staselovich[1], **E. Tarun**[1], **P. Krasovskaya**[1], **T. Halavach**[2], **R. Romanovich**[2]

[1]*Belarusian State University, ISEU BSU*
Minsk, Republic of Belarus
[2]*Belarusian State University,*
Minsk, Republic of Belarus
liza.staselovich@yandex.com

The comparative study of the antioxidant activity of whey protein concentrate, native colostrum, their ultrafiltered hydrolysates, as well as complexes of ultrafiltered hydrolysates with cyclodextrin was carried out. The dependences of the fluorescence intensity of fluorescein on the logarithm of the concentration of all samples were obtained, from which the IC_{50} values were graphically determined, which were in the range of 6,83–77,53 μg/ml. Complexes of ultrafiltrate hydrolysates with cyclodextrin restored fluorescein fluorescence to 84–96 % at a sample concentration of 0,68–0,75 mg/ml.

Keywords: antioxidant activity, native colostrum, hydrolyzed colostrum, whey hydrolyzate, cyclodextrin, fluorescein.

Cow's milk, cheese and fermented milk products are available sources of biologically active peptides (BAP). BAP are formed as a result of the effect of digestive enzymes of the gastrointestinal tract on milk proteins, during technological processing with purified proteases.

The purpose of creating complexes of milk and colostrum protein hydrolysate with β-cyclodextrin was to eliminate the bitter taste of the hydrolysate and study the effect of complexation on the functional properties of peptides. In this work, fluorescein, which has a high extinction coefficient and a fluorescence quantum yield close to 1, was used to detect free radicals. Free radicals were generated using the Fenton system, in which hydroxyl radicals are formed by the interaction of an iron (Fe^{2+}) complex with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide [1]. When fluorescein interacts with free radicals, its fluorescence is extinguished, which can be restored by adding substances that exhibit antioxidant properties to the system. Therefore, the following were taken: milk whey protein concentrate, native colostrum, their ultrafiltered hydrolysates, as well as complexes of ultrafiltrates of hydrolysates with cyclodextrin.

Preparation of ultrafiltrate of milk whey protein hydrolysate and colostrum hydrolysate:

10 % solutions of hydrolysates were prepared in distilled water, centrifuged to precipitate insoluble particles at 6000 g and a temperature of 4 ˚C for 30 min. The obtained supernatants were fractionated using Spin X UF Concentrator 20 filters (Corning, England) with a separating capacity of 10 kDa.

Preparation of complexes of ultrafiltrates hydrolysates with cyclodextrins:

Ultrafiltrates of hydrolysates were taken in proportion with cyclodextrin 5 %:3 %. 2 ml of distilled water was added to 0.1 g of the dry mixture. To obtain a homogeneous suspension, a glass with a complex of hydrolysates with cyclodextrins was placed in a water bath at a temperature of 50 ˚C and mixed. A solution of hydrolysate complexes with cyclodextrins with a concentration of 50 mg/ml was obtained.

For all samples, the dependences of the fluorescence intensity of fluorescein on the logarithm of the concentration of milk and colostrum were obtained.

The minimum antioxidant activity was obtained for a sample of whey protein concentrate. Fluorescence of fluorescein is restored to 67 % at a concentration of 0.508 mg/ml. The IC_{50} values for dry matter (112.2 μg/ml) and protein (77.53 μg/ml) also have maximum values. A sample of ultrafiltrate of milk whey protein hydrolysate

restores fluorescence of fluorescein to 76 % at a concentration of 0.234 mg/ml. The IC_{50} values for dry matter (25.12 μg/ml) and protein (14.7 μg/ml) decrease by 4.5/5.3 times, respectively. A sample of the ultrafiltrate complex of milk whey protein hydrolysate with cyclodextrin restores fluorescence of fluorescein to 84 % at a concentration of 0.752 mg/ml. The IC_{50} values for dry matter (39.81 μg/ml), by protein (7.25 μg/ml). Cyclodextrin restores fluorescence of fluorescein to 75% at a concentration of 0.5 mg/ml. The IC_{50} values for dry matter (114.82 μg/ml). A sample of colostrum hydrolysate ultrafiltrate restores fluorescence of fluorescein to 82 %. The IC_{50} values for dry matter (21.38 μg /ml) and protein (9.14 μg /ml).. The colostrum sample restores fluorescence of fluorescein to 75 % at a concentration of 0.485 mg/ml. The IC_{50} values for dry matter (102.33 μg/ml) and protein (66.46 μg/ml). A sample of colostrum hydrolysate ultrafiltrate complex with cyclodextrin restored fluorescence of fluorescein to the maximum value at a concentration of 0.68 mg/ml. The IC_{50} for dry matter (47.86 μg/ml), by protein (6.83 μg/ml).

Thus, an increase in antioxidant activity is shown due to hydrolysis and subsequent ultrafiltration of milk and colostrum due to enrichment with a low-molecular fraction.

BIBLIOGRAPHY

1. *Тарун Е. И.* Антиоксидантная активность гексагидрохинолонов / Е.И. Тарун, А.В. Данькова, А.Н. Пырко // Журнал Белорусского государственного университета. Экология. – 2019. – № 2. – С. 77–83.

MODELING OF THE BIOLOGICAL ACTIVITY OF THE ESSENTIAL OILS COMPONENTS

A. Stasevich, A. Hryhoryeu, A. Bakunovich

Belarusian State University, ISEU BSU
Minsk, Republic of Belarus
anastasiastasevic@gmail.com

Bioinformatic approaches are effective and inexpensive methods for predicting the pharmacokinetic properties of biosubstrates before their further experimental studies. The aim of this work is to predict the pharmacokinetic properties of essential oils components and analyze their biological activity.

Keywords: essential oils, biological activity, bioavailability.

Essential oils and their components are often used for medical and pharmaceutical purposes as analgesics, antimicrobials and anti-inflammatory agents. However, the specific compounds that have an effect and the molecular mechanisms of their action are largely unknown. The most commonly used source of essential oils is eucalyptus. The components of eucalyptus oil include 1,8-cineol (61.46 %), limonene (13.68 %), p-cimene (8.55 %), γ-terpinene (5.87 %), α-pinene (4.95 %) and α-fellandren (1.09 %) [1].

For the study of essential oils components the "Lipinski rule of five" was used: lipophilicity (LogP <5), molecular weight of the ligand (MW <500 Da), number of hydrogen bond donors (nHBD <5), number of hydrogen bond acceptors (nHBA <10). Violation of more than one of this parameters prevented further analysis of a particular molecule. Bioactivity of the studied essential oils where predicted by calculating activity scores for G-protein-bound receptors (GPCR ligand), ion channel modulator, nuclear receptor ligand, kinase inhibitor, protease inhibitor and enzyme inhibitor (Table 1). All the above parameters were calculated using the Molinspiration Cheminformatics software [2].

Table 1

Pharmacokinetic properties and bioactivity indicators of essential oils components

Compound	LogP	TPSA	MW	nHBA	nHBD	GPCR ligand	Ion channel modulator	Kinase inhibitor	Nuclear receptor ligand	Protease inhibitor	Enzyme inhibitor
1,8-cineole	2.72	9.23	154.25	1	0	-0.93	0.01	-1.60	-1.07	-0.90	-0.15
Limonene	3.62	0.00	136.24	0	0	-0.91	-0.27	-2.01	-0.34	-1.38	-0.21
ρ-cymene	3.90	0.00	134.22	0	0	-1.18	-0.61	-1.40	-1.21	-1.42	-0.78
α-pinene	3.54	0.00	136.24	0	0	-0.48	-0.43	-1.50	-0.62	-0.85	-0.34
α-phellandrene	3.79	0.00	136.24	0	0	-1.00	-0.40	-1.40	-0.32	-1.38	-0.15

The results from Table1 reveal that all compounds obeyed the rules and showed good druglikeness score. All compounds have a reasonable probability of good absorption, their LogP value ranged between 2.72 to 3.90

that is not exceed 5.0. Molecular weights ranged between 134.22 – 154.25 that is below 500. Number of hydrogen bond donors are less than 5 and hydrogen bond acceptors are less than 10. Topoligical polar surface area (TPSA) is a very useful parameter for the prediction of drug transport properties. The tested compounds were found to have TPSA below 140 Å. From the results reveal that the essential oils components obeyed Lipinski rule and may be orally bioactive.

Taking into consideration, that bioactivity scores from 0.0 to 5.0 may refer to significant biological activity, biological activity scores from -5.0 to 0.0 is moderately active and finally if biological activity scores is less than -5.0 the compound is inactive. On this observation, all presented essential oils components were found to be moderately bioactive according to all parameters (GPCR ligand, Ion channel modulator, Kinase Inhibitor, Nuclear receptor ligand, Protease inhibitor, Enzyme inhibitor) except 1,8-cineole, which shows significant biological activity as Ion channel modulator.

BIBLIOGRAPHY

1. *Y. S. Jun*. Effect of eucalyptus oil inhalation on pain and inflammatory responses after total knee replacement: a randomized clinical trial / Y.S Jun [et al.] // Evidence-Based Complementary and Alternative Medicine. 2013.V. 2013. P. 7.

2. *A. Husain*. Synthesis, molecular properties, toxicity and biological evaluation of some new substituted imidazolidine derivatives in search of potent antiinflammatory agents / A. Husain [et al.] // J. Saudi Pharmaceutical. 2016. V. 24. P. 104–114.

FEATURES OF THE DIAGNOSIS OF FELINE VIRAL IMMUNODEFICIENCY AND FELINE VIRAL LEUKEMIA

M. Statsi, Y. Melnikova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
nik.dragomirov@ya.ru

Viral immunodeficiency of cats is a severe incurable disease that cannot be specifically prevented, the causative agent of which, Feline immunodeficiency virus (FIV), affects the nervous and immune systems of the animal. The course of the disease can be aggravated by viral leukemia.

Keywords: cat viral diseases, PCR, ELISA, microbiological methods, FIV, FeLV.

High contagiousness of the disease is currently one of the most common causes of cat’s death worldwide. The results of modern studies indicate a direct dependence of FIV and FeLV diseases on many external and internal factors. The difficulty in systematizing the results obtained by different research groups lies in the peculiarities of statistical analysis, for example, when only sick or homeless cats are included, the prevalence is much higher.

Great importance in the diagnosis of cat's viral diseases should be attached to the economic development of countries, in particular, the high level of development of medicine. Firstly, this leads to an increase in survival and a decrease in euthanasia, since testing is carried out at an early stage and using the most advanced methods. Secondly, the widespread use of vaccination protects cats from viral infections.

An important diagnostic factor is the commercial availability of test systems, since this affects the number of tests performed.

One of the limitations of the diagnosis may be false positive results that affect the assessment of the level of infection. However, ELISA test kits used in laboratory studies have high sensitivity and specificity.

The combination of the main type of diagnosis with additional ones, such as PCR or highly sensitive ELISA tests, will help to correct the initial results of studies. The disadvantage of conducting a clarifying diagnosis is the increase in costs.

The absence of positive ELISA results against the background of a positive result in PCR can be observed as a result of immunosuppression.

A positive result in PCR and a negative result in ELISA may be due to the presence of a "serological window". In conditions of constantly increasing concentrations of antigen, as a result of virus reproduction, an active decrease in the concentration of antibodies occurs due to their inclusion in the composition of the "antigen-antibody" immune complexes. There is also a suppression of the humoral link of the immune response as a result of the synthesis of a set of cytokines that stimulate the cellular link of immunity. It should be emphasized that the results of the ELISA risk being incorrectly interpreted. For example, a high titer of antibodies indicates not a dis-

ease, but a sonation of infection. The increased level of antibodies can persist for many months after full recovery, which is associated with the individual characteristics of the immune system.

A negative result in PCR and a positive result in ELISA may be due to the detection of residual IgG levels after a previously transmitted infection. Another reason for the discrepancy in the results may be the use of genus-specific test systems for ELISA.

Nevertheless, comparing the possibilities of ELISA and PCR in the diagnosis of diseases, it should be noted that the PCR method does not allow to establish the stage of the infectious process. In this regard, the role of ELISA in the interpretation of the results of the study can be very significant, since this method allows you to determine the avidity of antibodies. PCR is the gold standard in the diagnosis of viral diseases, but it is an expensive method.

BIBLIOGRAPHY

1. *Westman, M. E.* Diagnosing feline immunodeficiency virus (FIV) and feline leukaemia virus (FeLV) infection: an update for clinicians / M. E. Westman, R. Malik, J. M. Norris // Aust Vet J. 2019. Vol. 97 №3. P. 47–55.

2. *Gleich, S. E*. Prevalence of feline immunodeficiency virus and feline leukaemia virus among client-owned cats and risk factors for infection in Germany / S. E. Gleich, S. Krieger, K. Hartmann // Feline Med Surg. 2009. Vol. 11 № 12. P. 985–992.

ANALYSIS OF THE DYNAMICS OF RESPIRATORY DISEASES OF THE POPULATION OF LARGE CITIES OF THE MINSK REGION

O. Susha

Belorussian State University, ISEI BSU
Minsk, Republic of Belarus

The analysis of the above data showed that half of the major cities of the Minsk region (Borisov, Dzerzhinsk, Soligorsk) have a significant increase in the overall incidence of respiratory pathologies in recent years among the population. And in such cities of the Minsk region as Molodechno and Slutsk, there is a slight increase in the incidence of this group of pathologies.

Keywords: respiratory diseases, morbidity, population of Minsk region.

Having analyzed the dynamics of the incidence of respiratory pathologies in the population of large cities of the Minsk region, such as Borisov, Dzerzhinsk, Molodechno, Nesvizh, Slutsk and Soligorsk for 2015-2020, it was found that there is an increase in the incidence of respiratory pathologies in the Minsk region.

Thus, it can be observed that in the period from 2015 to 2020, inclusive, the smallest number of total morbidities of the population in the city of Borisov increased by 892 people.

In the city of Dzerzhinsk, an analysis of the dynamics of the general incidence of respiratory pathology, according to the data presented for the period from 2015 to 2020, showed that the total incidence of respiratory pathologies in the population increased by 1,301 people. This dynamic may be associated with an increase in the population in the city, the development of industry, the consequence of the Covid19 pandemic.

In the city of Molodechno analysis, according to the data presented for the period from 2015 to 2020, the number of total morbidities of the population with respiratory pathologies increased by 923 people.

The analysis of the general morbidity of the population of the city of Slutsk with respiratory pathologies showed: from 2015 to 2020, the number of general morbidities of the population with respiratory pathologies increased by 1,460 people.

According to the presented data for the city of Soligorsk, for the period from 2015 to 2020, the number of general morbidities of the population with respiratory pathologies increased by 2,354 people.

This dynamics can be explained by the fact that more than 90% of the total volume of the city is occupied by the production of "Belaruskali", as well as related industries: sewing and meat processing, and as a result, the development of allergic reactions in the population, leading to the development of chronic diseases of the respiratory system. It may also be due to such possible factors as high population density, poor nutrition, which is typical for large cities.

BIBLIOGRAPHY

1. Национальный статистический комитет Республики Беларусь. – Минск. – Режим доступа: http://www.belstat.gov.by/. – Дата доступа: 09.07.2021.

2. Министерство здравоохранения Республики Беларусь [Электронный ресурс]. – 2020. – Режим доступа: http://minzdrav.gov.by – Дата доступа: 09.07.2021.

COMPARATIVE ANALYSIS OF THE DYNAMICS OF THE INCIDENCE OF RESPIRATORY DISEASES OF THE POPULATION SERVED IN THE UZ "28TH CITY POLYCLINIC" OF PERVOMAISKY AND UZ "17TH CITY POLYCLINIC" OF THE ZAVODSKY DISTRICT OF MINSK

O. Susha

Belorussian State University, ISEI BSU
Minsk, Republic of Belarus

The analysis of the presented data showed that the population served in the UZ "17th city polyclinic" of the city of Minsk is more susceptible to respiratory diseases than the UZ "28th city polyclinic of the city of Minsk.

Keywords: polyclinic, respiratory diseases, population served, Zavodskoy district and Pervomaysky district of Minsk.

UZ "28th city polyclinic" began its activity on March 9, 1992. This polyclinic is an institution for the organization and provision of qualified and specialized care to the adult population. At the time of 2020, 35650 people are served here. UZ "17th city polyclinic" begins its history since 1975. At the time of 2020, 36120 people are served here. Almost the same number of the served population gives a more accurate dynamics of the assessment of respiratory morbidity.

It was found that about 19310 cases were registered with diseases of the respiratory system in the UZ "28th city polyclinic", and 23632 cases were registered in the UZ "17th city polyclinic", which makes up the majority of the population served.

A greater number of respiratory diseases in the UZ "17th city polyclinic" of Minsk is associated with the unfavorable environmental situation in the Zavodsky district of Minsk, the location of factories and several dozen enterprises, such as the Minsk Automobile Plant, Bearing Plant, Belschettechnika, Mirror Factory, Dairy Plant, Minskdrev, Minskjelezobeton, etc. Resulting in the development of allergic reactions in the population, leading to the development of chronic diseases of the respiratory system.

In turn, in Pervomaisky district there is a large number of large forest park areas, squares, woodlands, the presence of a small number of industrial enterprises, such as the Minsk Watch Factory, Margarine Factory, the tHermoplast plant and the plant named after him. Vavilov. Also, on the territory of Pervomaisky district is the Slepyanskaya water system, with a length of 22 kilometers, along the entire length there are several water intakes and a reservoir.

Thus, it can be assumed that living in an area like Pervomaisky in Minsk will favorably affect the health of the population, and an area like Zavodskoy in Minsk is not favorable for living.

BIBLIOGRAPHY

1. Министерство здравоохранения Республики Беларусь [Электронный ресурс]. – 2020. – Режим доступа: http://minzdrav.gov.by – Дата доступа: 09.07.2021.

2. Национальный Интернет-портал Республики Беларусь [Электронный ресурс] / Национальный статистический комитет Республики Беларусь. – Минск. – Режим доступа: http://www.belstat.gov.by/. – Дата доступа: 23.08.2021.

A RETROSPECTIVE ANALYSIS MORBIDITY OF THE POPULATION MIORY DISTRICT VARICELLA

K. Sushko, M. Dubina

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
kslink1989@gmail.com

Abstract: The article presents a retrospective analysis of the incidence of chickenpox among the population of the Miory region, analyzes the dynamics, calculates the growth rates and identifies the main trends in the general and primary morbidity of the population on the basis of available statistical data.

Keywords: chickenpox, morbidity, mortality, analysis.

The incidence of chickenpox is formed under the influence of 3 groups of factors: the first is internal factors - the interaction of the pathogen population and humans, the second is external factors of the natural environment, and the third is external social influences [1].

Mostly children aged 6 months to 7 years get sick. Adults rarely get chickenpox. In older children, the severity of chickenpox increases markedly, and adults are extremely sick [2].

According to statistics, about 3 % of people get chickenpox again. In a person who has had chickenpox, the varicella-zoster virus remains for life in the spinal ganglia, in the nuclei of the cranial nerves. Possible reactivation of the varicella-zoster virus, "sleeping" inside, against the background of a sharp weakening of immunity in humans, or re-infection with chickenpox from an external source, if there were not enough antibodies to chickenpox in the body at that moment [3].

The paper analyzed the incidence of chickenpox among the population of the Vitebsk region and Miory region for the period from 2014 to 2019.

When analyzing the incidence of chickenpox among the population of the Vitebsk region, there was no pronounced change in the incidence of an increase or decrease, so during the study period the indicators changed slightly from 631.2 per 100 thousand population in 2014 to 655.7 per 100 thousand population in 2019 year.

The work also analyzed the age distribution of the incidence of chickenpox among the population of the Miory region. It was noted that more than 85 % of all cases of chickenpox in the population of the Miory region are cases among the child population (under 18 years of age), the contribution of the incidence of the adult population during the study period reached its maximum value in 2019 and amounted to 11.76%.

Analysis of the distribution of morbidity by sex among the adult population showed that among the female population, cases of chickenpox were more common (with the exception of 2016 and 2019) and averaged about 60% of all cases of the disease in the adult population of the district[2].

The work analyzed the age distribution of the incidence of chickenpox among the children of the Miory region.

It is noted that the largest contribution to the structure of the incidence of chickenpox among children in the Miory region was made by groups of 4-7 years old and 8-15 years old and averaged 50% and 40%, respectively, of all cases of chickenpox disease in the children's population of the area during the study period. Among children under 1 year old, only 2 cases of the disease, one each in 2014 and 2015, were registered for the entire study period.

Analysis of the incidence of chickenpox in the population of the Miory region in the context of settlements (Fig. 3.) at the beginning and end of the study period showed that in 2014 the highest incidence rate was registered in the city of Disna and amounted to 86.77 per 10 thousand population. it was also noted that in the city of Disna and in the city of Miory, the incidence exceeded the average incidence of chickenpox in the Miory region.

As a result of the study, the following conclusions were made:

1. The incidence of chickenpox among the population of the Miory region is less than the incidence in the Vitebsk region by an average of 3.5 times during the study period.

2. Analysis of the distribution of morbidity by sex among the child population did not show a pronounced prevalence of the incidence of chickenpox cases for boys or girls.

BIBLIOGRAPHY

1. Airborne infections: the state report of the Ministry of Healthcare of the Republic of Belarus "On the sanitary and epidemiological situation in the Republic of Belarus in 2012". – Minsk. – 2013 . – P. 47.

2. *Kuzmina, T. Yu.* Features of the course of chickenpox in adults / T.Yu. Kuzmina [and others]. // Siberian Medical Review. – 2013. – No. 2. – S. 72–75.

3. *Wenzel, R .P.* Nosocomial Infections / Edited by Richard P. Wenzel. – M., 2004 . – S. 214.

THE PRODUCTION OF SUPEROXIDE DISMUTASE 3 AND VASCULAR ENDOTHELIAL GROWTH FACTOR RECEPTOR BY MULTIPOTENT MESENCHYMAL STROMAL CELLS UNDER HYPOXIA CONDITION

A. Svirskaya[1], **M. Yakauleva**[1], **A. Dubko**[1], **D. Nizheharodava**[1,2]

[1]*Belarusian State University, ISEI BSU*

[2]*Belarusian Medical Academy of Post-Graduate Education*

Minsk, Republic of Belarus

alesjswirskay@mail.ru

Antioxidant and regenerative potentials were identified in bone marrow- and adipose-derived multipotent mesenchymal stromal cells characterizing by increased production of superoxide dismutase 3 and vascular endo-

thelial growth factor receptor what can be used in the development of new cell therapy approaches of oxidative stress modulation.

Keywords: multipotent mesenchymal stromal cells, superoxide dismutase 3, vascular endothelial growth factor receptors, cell therapy.

Multipotent mesenchymal stromal cells (MMSC) are actively used in cell therapy of a wide range of diseases due to their immunomodulatory and reparative properties. Currently, the antioxidant and regenerative potential of MMSC are being actively studied, since an imbalance between active oxygen forms and the endogenous antioxidant defense system plays a key role in the pathogenesis of many diseases [1]. Superoxide dismutase 3 (SOD 3) is a one of antioxidant enzymes that has immunomodulatory, anti-angiogenic, anti-chemotactic and anti-inflammatory properties. By synthesizing hydrogen peroxide, SOD3 can stimulate the formation of vascular endothelial growth factor (VEGFR) which stimulates the proliferation of endothelial cells, regulates the development and formation of blood vessels as well as increases vascular permeability and chemotaxis of endothelial cells [2].

The aim of the study was to evaluate the production of SOD3 and VEGFR in bone marrow- and adipose-derived MMSC cultures under hypoxia condition.

Human MMSC was isolated from bone marrow aspirate and subcutaneous adipose tissue according to standard methods after informed consent of donors (n=10), aged from 31 to 45 years. MMSC were cultured in Dulbecco's modified Eagle's medium supplemented with 10 % fetal bovine serum, 1 % L-glutamine, 1 % antibiotic mixture for 72 hours under gas hypoxia conditions (1–2 % O_2) using the Microbiology Anaerocult A® mini kit (Millipore, Germany) at 37 °C or normoxia conditions in CO_2-incubator. The concentrations of SOD3 and VEGFR were determined in cultures supernatants using "Human SOD3 Elisa Kit" (Elabscience, USA) and "Human VEGFR2 Elisa Kit" (Fine Test, China) and were calculated per 1×10^5 cells. Statistical data processing was done using STATISTICA 8.0 program.

A significant increase in the concentration of SOD3 (85.7 (52.6÷182.9) ng/ml) and VEGFR (72.1 (48.7÷140.7) pg/ml) in MMSC supernatants cultivated under hypoxia conditions was revealed as compared to control cultures cultivated at normal oxygen content (51.2 (34.2÷74.8) ng/ml and 5.3 (4.4÷7.6) pg/ml, respectively, $p<0.05$). At the same time, under hypoxia conditions the SOD3 stimulation indices (SI) with respect to normoxia were equal in the both bone marrow- (SI=2.0) and adipose-derived (SI=2.3) MMSC cultures while the intensity of VEGFR stimulation was more pronounced in adipose-derived MMSC cultures (SI=15.5) as compared to MMSC from bone marrow. Herewith, the baseline levels of SOD3 (36.4 (21.0÷74.8)) ng/ml and VEGFR (4.7 (4.2÷7.6)) pg/ml in adipose-derived MMSC cultures were significantly decreased as compared to bone marrow-derived MMSC (93.5 (51.2÷135.8) ng/ml and 12.5 (7.6÷17.3) pg/ml, respectively) and a similar trend was observed in hypoxia-stimulated SOD3 production in adipose- (83.8 (51.3÷135.4) ng/ml) and in bone marrow-derived MMSC (200.9 (182.9÷219.0) ng/ml) but there were no significant differences in VEGFR secretion in O_2-deficient cultures (99.2 (57.7÷140.7) pg/ml and 72.1 (30.4÷166.1) pg/ml, respectively). The established increase in the synthesis of both SOD3 and VEGFR in all MMSC cultures under hypoxic conditions indicates the ability of SOD3 to enhance VEGFR production due to the formation of hydrogen peroxide which activates VEGFR signaling pathways.

Thus, hypoxia condition stimulates antioxidant and regenerative potentials of MMSC via increasing the synthesis of SOD3 and VEGFR, respectively, regardless of the cell sources what can be used for the development of new approaches in cell therapy of socially significant diseases, the pathogenesis of which is accompanied by oxidative stress.

BIBLIOGRAPHY

1. *Sah, S. K.* Insights into superoxide dismutase 3 in regulating biological and functional properties of mesenchymal stem cells / S. K. Sah, G. Agrahari, T. Kim // Cell Bioscience. 2020. № 22. P. 1–12.

2. *Wang, X.* Molecular Bases of VEGFR-2-Mediated Physiological Function and Pathological Role / X. Wang [et al.] // Frontiers in Cell and Developmental Biology. 2020. № 8. P. 1–12.

MOLECULAR DOCKING OF 5-(2-HYDROXYBENZYLIDENE)PYRIMIDINE-2,4,6(1H,3H,5H)-TRIONE WITH A CRYSTAL STRUCTURE OF THE PROTEIN COMPLEX 7D2S

I. Syrytskii, S. Shahab, V. Linnik, A. Pyrko, L. Filippovich

Belarusian State University, ISEI BSU,
Institute of Physical Organic Chemistry of the National Academy of Sciences of Belarus
Minsk, Republic of Belarus
Foxinn@mail.ru

Using chemical packages for quantum chemical modeling ChemOffice 2016, Gaussian 09W and Hyper-Chem 08, a theoretical model of the formation of a complex between 5- (2-hydroxybenzylidene) pyrimidine-2,4,6 (1h, 3h, 5h) -trione and the crystal structure of the protein is presented 7D2S.

Keywords: Quantum modelling, 7D2S.

The structure of 7D2S is taken from the database of 3D structures of proteins: https://www.rcsb.org/. One structure with a resolution of 1.65 Å was selected. This model is purified from low molecular weight compounds included in the protein structure. The calculation of the starting geometry of the molecule was carried out by the Amber 99 method of the HyperChem 8.0.10 software package [1]. The following parameters were used to optimize the geometry: Algorithm - Polak-Ribiere, RMS gradient - 0.1 kcal / mol, maximum cycles – 35000.

For the estimated optimization of the ligand, the MM2 method of the ChemOffice Professional 2018 software package was used [2]. Its full optimization was performed using the density functional theory method CAM-B3LYP / 6-311G * in Gaussian 09W.

The results were visualized using the Molegro Molecule Viewer 5.0 software.

As a result of molecular docking, complexes with total energies in the range from -2607.1462 to -2471.8841 kcal / mol were calculated. During docking, 5 stable complexes were obtained (table 1).

Table 1

Hydrogen and steric bonds, their energy and length

№	1	2	3	4	5
Hydrogen bond	1	4	1	4	4
Steric bond	9	28	8	17	10
Energy of hydrogen bond, kkal/mol	-0.108361	-0.564765	-0.315578	-1.82898	-2.46183
Length bond, Å	3.5628	3.15413	3.10087	2.59066	2.67952

Conclusions: It was found that the values of the total energies of the complexes are in the range from –2607.1462 to -2471.8841 kcal / mol. The formation of the complex is accompanied by an increase in the thermodynamic stability of the system under study. The docking of the ligand with 7D2S is strong due to the formation of hydrogen bonds (Fig. 1).

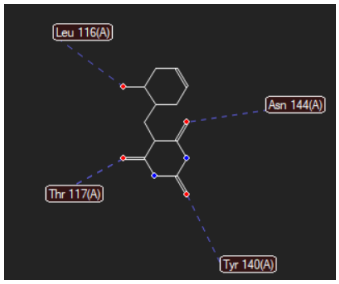


Fig. 1 – Formed hydrogen bonds between the ligand and the 7D2S

The formation of a complex can lead to adhesion of tumor cells, which will help in the prevention of tumor diseases.

BIBLIOGRAPHY

1. *Sheikhi M*. New derivatives of (E,E)-azomethines: design, quantum chemical modeling, spectroscopic (FT-IR, UV/Vis, polarization) studies, synthesis and their applications: experimental and theoretical investigations // J. of Molecular Structure. 2018. Vol. 1152. P. 368–385.

2. *Shahab S.* Synthesis, geometry optimization, spectroscopic investigations (UV/Vis, excited states, FT-IR) and application of new azomethine dyes // J. of Molecular Structure. 2017. Vol. 1148. P. 134–149.

ANTIOXIDANT ACTIVITIES OF THE 5-(2-HYDROXYBENZYLIDENE)PYRIMIDINE-2,4,6(1H,3H,5H)-TRIONE

I. Syrytskii, S. Shahab, A. Pyrko, L. Filippovich

Belarusian State University, ISEI BSU,
Institute of Physical Organic Chemistry of the National Academy of Sciences of Belarus
Minsk, Republic of Belarus
Foxinn@mail.ru

In the study, for the first time, the physicochemical properties of 5-(2-hydroxybenzylidene) pyrimidine-2,4,6(1H,3H,5H)-trione were calculated using the theory of density functions. The energies HOMO, LUMO, band gap (E_g), ionization potential (IP), electron affinity (EA), hardness (η), softness (S) and electronegativity (μ) are calculated.

Keywords: Quantum modelling, Density Functional Theory.

For the estimated optimization of the ligand, the MM2 method of the ChemOffice Professional 2018 software package was used [2]. Full optimization of the molecule was carried out by the ab initio method of density functional theory CAM-B3LYP / 6-311G * in Gaussian 09W (Fig. 1).

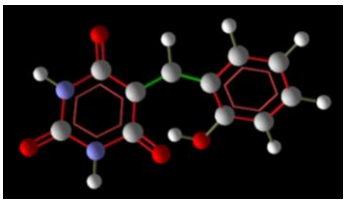


Fig. 1 – Optimized molecule of 5-(2-hydroxybenzylidene)pyrimidine-2,4,6(1H,3H,5H)-trione

To calculate the physicochemical properties of molecules, the following formulas were used:
Ionization potential (IP) = - E_{HOMO} (eV),
Electron affinity (EA) = - E_{LUMO} (eV),
Hardness (η) = (IP - EA) / 2 (eV),
Softness (S) = 1 / 2η (eV),
Electronegativity (μ) = (IP + EA) / 2 (eV),
Band gap (E_g) = E_{HOMO} - E_{LUMO} (eV).
The calculation of the biological activity of the substance was carried out at *molinspiration.*
The results of calculations of physical and chemical properties are shown in table 1.

Table 1

Physicochemical properties of a molecule

E_{HOMO}, eV	E_{LUMO}, eV	E_g, eV	IP, eV	EA, eV	η, eV	S, eV	μ, eV
-0,295	-0,069	0,225	0,295	0,069	0,113	4,425	0,182

The results of calculating the biological activity are shown in table 2.

Table 2

Bioactivity

GPCR ligand	Ion channel modulator	Kinase inhibitor	Nuclear receptor ligand	Protease inhibitor	Enzyme inhibitor
-0.87	-1.17	-0.61	-0.47	-0.99	-0.38

A low E_g value (0.225 eV) indicates that the molecule has high biological activity. Negative bioactivity indices (Table 2) indicate a low activity of the substance as an inhibitor of kinase, protease, enzyme, as a GPRC ligand and a nuclear receptor, an ion channel modulator. The molecule is soft (4.425 eV), has a low electronegativity (0.182 eV), and also has a high ionization potential (0.295 eV), which indicates a high bioactivity of the molecule.

BIBLIOGRAPHY

1. *Sheikhi M*. New derivatives of (E,E)-azomethines: design, quantum chemical modeling, spectroscopic (FT-IR, UV/Vis, polarization) studies, synthesis and their applications: experimental and theoretical investigations // J. of Molecular Structure. 2018. Vol. 1152. P. 368–385.

2. *Shahab S*. Synthesis, geometry optimization, spectroscopic investigations (UV/Vis, excited states, FT-IR) and application of new azomethine dyes // J. of Molecular Structure. 2017. Vol. 1148. P. 134–149.

ANTIOXIDANT ACTIVITY (Z)-4-(2-HYDROXYBENZILIDENE)-3-METHYLISOXAZOL-5 (4H)–ONE

I. Syrytskii, S. Shahab, A. Pyrko L. Filippovich

Belarusian State University, ISEI BSU,
Institute of Physical Organic Chemistry of the National Academy of Sciences of Belarus
Minsk, Republic of Belarus
Foxinn@mail.ru

In the study, for the first time, the physicochemical properties of (Z)-4-(2-hydroxybenzylidene)-3-methylisoxazole-5(4H)-one were calculated using the theory of density functions. The energies HOMO, LUMO, band gap (Eg), ionization potential (IP), electron affinity (EA), hardness (η), softness (S) and electronegativity (μ) were calculated.

Keywords: Quantum modelling, Density Functional Theory.

For the estimated optimization of the ligand, the MM2 method of the ChemOffice Professional 2018 software package was used [2]. Full optimization was performed using the ab initio method of density functional theory CAM-B3LYP / 6-311G * in Gaussian 09W (Fig. 1).

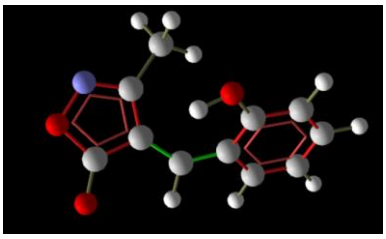


Fig. 1 – Optimized molecule of 5-(2-hydroxybenzylidene)pyrimidine-2,4,6(1H,3H,5H)-trione

To calculate the physicochemical properties of molecules, the following formulas were used:
Ionization potential (IP) = - E_{HOMO} (eV),
Electron affinity (EA) = - E_{LUMO} (eV),
Hardness (η) = (IP - EA) / 2 (eV),
Softness (S) = 1 / 2η (eV),
Electronegativity (μ) = (IP + EA) / 2 (eV),
Band gap (Eg) = E_{HOMO} - E_{LUMO} (eV).
The calculation of the biological activity of the substance was carried out at *molinspiration.*
The results of calculations of physical and chemical properties are shown in table 1.

Table 1

Physicochemical properties of a molecule

E_{HOMO}, eV	E_{LUMO}, eV	E_g, eV	IP, eV	EA, eV	η, eV	S, eV	μ, eV
-0,303	-0,065	0,238	0,303	0,065	0,119	4,202	0,184

The results of calculating the biological activity are shown in table 2.

Table 2

Bioactivity

GPCR ligand	Ion channel modulator	Kinase inhibitor	Nuclear receptor ligand	Protease inhibitor	Enzyme inhibitor
-1,12	-0,69	-0.45	-0.33	-1,15	-0.45

Conclusions: A low Eg value (0.238 eV) indicates that the molecule has high biological activity. Negative bioactivity indices (Table 2) indicate a low activity of the substance as an inhibitor of kinase, protease, enzyme, as a GPRC ligand and a nuclear receptor, an ion channel modulator. The molecule is soft (4.202 eV), has a low electronegativity (0.184 eV), and also has a high ionization potential (0.303 eV), which indicates a high bioactivity of the molecule.

BIBLIOGRAPHY

1. *Sheikhi M.* New derivatives of (E,E)-azomethines: design, quantum chemical modeling, spectroscopic (FT-IR, UV/Vis, polarization) studies, synthesis and their applications: experimental and theoretical investigations // J. of Molecular Structure. 2018. Vol. 1152. P. 368–385.

2. *Shahab S.* Synthesis, geometry optimization, spectroscopic investigations (UV/Vis, excited states, FT-IR) and application of new azomethine dyes // J. of Molecular Structure. 2017. Vol. 1148. P. 134–149.

SYNTHESIS OF 8-BROMOISOGUANINE

A. Trifonova, M. Khanchevsky, E. Kvasyuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
alina25060180@mail.ru

The paper presents data on the synthesis of 8-bromoisoguanine.

Keywords: bromination. 8-bromoisoguanine, isoguanine.

As a result of oxidative stress, a number of minor heterobases are formed in DNA, one of which is isoguanine (2-hydroxyadenine, 6-amino-2-hydroxypurine). The appearance of isoguanine in DNA leads to mutations. This is due to the fact that complementarity and Watson-Crick interactions, which are hydrogen bonds, are disturbed between isoguanine and cytosine heterobases [1]. Interestingly, such interactions are completely preserved between isoguanine and isocytosine (Picture 1).

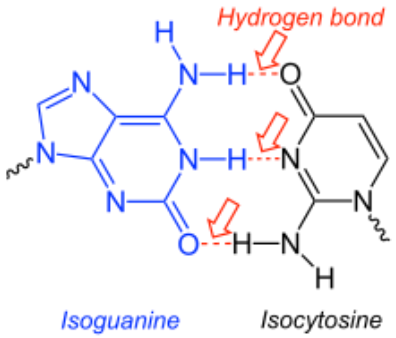


Fig. 1 – Complementary interaction between isoguanine and isocytosine

Isoguanine was isolated from pig blood, where it is present at a concentration of ~ 5 mg / L. Subsequently, isoguanine was found in the wings of some butterflies, causing some of their coloration due to its weak fluorescent properties. As a nucleoside, isoguanine has been found in croton beans. The acid-base properties of isoguanine are slightly different from those of guanine. Quantum-chemical calculations for isoguanine and 8-bromoisoguanine molecules show that the free energies for them are 8.38 and 5.92 kcal / mol, respectively, which indicates a greater stability of 8-bromoisoguanine. There are very few data on the biological activity of isoguanine. In this regard, it is of interest to study some comparative biological activity for guanine and isoguanine, as well as for their 8-bromo derivatives.

The scheme of the synthesis of 8-bromoisoguanine **(2)** by bromination of isoguanine **1** is shown in picture 2.

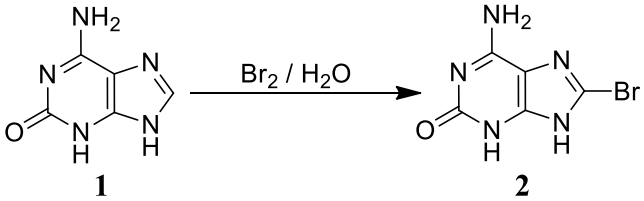


Fig. 2 – Scheme of the synthesis of 8-bromoisoguanine

The reaction progress and the content of 8-bromisoguanine were monitored by thin-layer chromatography on Kieselgel 60 F_{254} plates from Merck (Germany) in a solvent system: isopropanol / ammonia / water (7: 2: 2 v / v / v). Spots of compounds on the plates were observed by viewing them in ultraviolet light.

To a suspension of isoguanine **1** (1 g, 6.53 mmol) in 40 ml of water, a solution of bromine (0.4 ml, 1.25 g, 7.84 mmol) in 20 ml of water was added with stirring in portions. The reaction mixture was stirred at room temperature for 1 hour, which led to a decrease in the pH value and dissolution of the starting isoguanine. After completion of the reaction, 3 ml of a freshly prepared saturated potassium carbonate solution was added to the solution, which caused a white precipitate to form. The precipitate was filtered off, washed with chilled water and alcohol, and dried at room temperature in air, then in vacuum until constant weight. 0.7 g of 8-bromoisoguanine **(2)** was obtained. The product yield was 46%.

BIBLIOGRAPHY

1. *Saenger, W.* Principles of Nucleic Acid Structure / W. Saenger. – M.: Mir, 1987. – 584 p.

ANALYSIS OF DISABILITY AND MORTALITY OF THE POPULATION OF THE REPUBLIC OF BELARUS DUE TO DIABETES MELLITUS FOR 2015–2019

V. Trosko, Yu. Lyakh

Belarusian State University, ISEI BSU;
Belarusian State University,
Minsk, Republic of Belarus

The paper considers the problem of the incidence of diabetes mellitus in the population of the Republic of Belarus. The subject of the study is the incidence of diabetes mellitus. The purpose of the work is to analyze the incidence of diabetes mellitus in the population of the Republic of Belarus for 2015–2019. Diabetes mellitus is a serious medical and social problem of the XXI century. This disease is a global problem that is only growing over the years. Diabetes mellitus has acquired the character of a "non-infectious epidemic", which continues to grow regardless of the race of people or the level of economic development of the country.

Keywords: diabetes mellitus, insulin, glucose, prevention, morbidity, growth rate.

Diabetes mellitus is a group of endocrine diseases associated with impaired glucose uptake and developing due to absolute or relative (violation of interaction with target cells) insufficiency of the hormone insulin, resulting in hyperglycemia - a persistent increase in blood glucose.

According to WHO, diabetes mellitus increases the mortality rate of the population by 2–3 times and shortens life expectancy. According to the International Diabetes Federation, twenty years ago, the number of people diagnosed with diabetes worldwide did not exceed 30 million. Today, the number of patients with diabetes is 370 million, and by 2025 their number will increase to 550 million people. A particularly catastrophic increase in morbidity is associated with type II diabetes mellitus, which accounts for more than 85 % of all cases, and which is largely the result of overweight and physical inertia.

Often, in the early stages, this disease proceeds unnoticed, and, gradually damaging target organs such as the heart, kidneys, eyes, large and small vessels, it is detected already at the stage of complications. The risk of lower limb amputation and subsequent disability in diabetic patients increases by 20 % compared to the general population.

The incidence of diabetes mellitus is growing very rapidly. If 10 years ago there were 150 thousand patients with diabetes mellitus in Belarus, today about 370 thousand people have already been registered. This "dramatic growth" is mainly due to type 2 diabetes mellitus – over 93 %. As for patients with type 1 diabetes, their number remains relatively stable. There are about 1 million such patients in the world, in our country – a little more than 17 thousand.

Mortality from diabetes mellitus ranks eighth in the overall mortality structure, 1.5 million people die from diabetes every year in the world. The analysis of mortality due to diabetes mellitus among the able-bodied population of the Republic of Belarus showed: the maximum value of the indicator is noted in 2018, the minimum – in 2019. Mortality from other types of diabetes mellitus has the maximum value in the period from 2015–2017, the minimum – in 2018–2019.

Both at the beginning and at the end of the studied period, the Mogilev region occupies the first rank in mortality due to diabetes mellitus among the able-bodied population of the Republic of Belarus (1.3 cases per 100 thousand population). The Brest region has the lowest mortality rate of the able-bodied population from insulin-dependent diabetes mellitus in 2015 – 0.5 cases per 100 thousand population.

BIBLIOGRAPHY

1. *Sagdieva, S. S.* Diabetes mellitus: the current state of the issue / S. S. Sagdieva, M. U. Sharofova. – M.: Peter, 2019. – pp. 502–508.

2. *Spasov, A. A.* Experimental model of diabetes mellitus / A. A. Spasov. – M.: Biomedicine, 2011. – pp. 94–103.

THE PHENOTYPE OF γδT-LYMPHOCYTES IN PATIENTS WITH INFLAMMATORY BOWEL DISEASES

D. Tsekhanovich[1], **A. Starastsin**[2], **A. Dybau**[2], **D. Nizheharodava**[1,2]

[1]*Belarusian State University, ISEI BSU*

[2]*Belarusian Medical Academy of Postgraduate Education*

Minsk, Republic of Belarus

dima29non@gmail.com

In patients with chronic autoimmune relapsing and remitting inflammatory bowel diseases a dysregulation of the immune response was demonstrated characterizing by a change in the phenotype and functional status of γδT-lymphocytes what may be used as a differential diagnosis of autoimmune pathology.

Keywords: γδT lymphocytes, autoimmune inflammation, Crohn's disease, ulcerative colitis, flow cytometry, phenotype.

γδT-lymphocytes are a subpopulation of T-cells which are characterized by functions of both innate and adaptive immunity, such as cytotoxicity, immunoregulation, antigen presentation, reparation [1] and may be implicated in inflammatory bowel disease (IBD) immunopathogenesis, in particular, Crohn's disease (CD) and ulcerative colitis (UC). The role of γδT-cells in IBD is still not fully understood: on the one hand, they are thought to involve in a dysregulated immune response to a commensal bacteria in genetically susceptible individuals, but on the other side, γδT-cells may initiate the reparation the epithelial damage in the gut [2].

The aim of the study was to characterize the phenotype of γδT-cells in the peripheral blood of patients with CD and UC.

Peripheral venous blood was obtained from CD patients (n=23) aged 30,0 (21,0÷47,0) years (19 men, 4 women) and from patients with UC (n=10) aged 32,0 (22,0÷47,5) years (5 men, 5 women), as well as healthy donors (n=20) at the age of 40,0 (36,0÷45,0) years (11 men, 9 women). The diagnoses were confirmed by morphological examination of patients' biopsy materials. The phenotype of γδT-lymphocytes was determined using a panel of antibodies (CD3-FITC, CD314-PE, CD45RO-ECD, CD8-PC5, TLR4-APC, TCRγδ-PC7, Beckman Coulter, India) and a CytoFLEX S flow cytometer (Beckman Coulter, USA). Statistical data processing was done using the STATISTICA 8.0 program.

The relative number of T-lymphocytes did not significantly differ in IBD patients as compared to the control group (75,0 (63,5÷81,4) % – in CD patients, 76,8 (62,0÷82,8) % – in UC patients and 70,6 (67,2÷76,8) % – in donors, respectively). The investigation of T-cells subsets based on the type of T-cell receptors (αβTCR or γδTCR) expression revealed a statistically significant increase in the number of γδT-cells up to 6,5 (3,5÷11,7) % in UC patients ($p<0,05$) as well as the tendency to the increase in CD patients (4,1 (2,5÷11,8) %, $p=0,06$) as compared to the control group (2,8 (2,0÷5,5) %) what supposed γδT-lymphocytes involvement in IBD immunopathogenesis. As γδT-lymphocytes have the properties of innate immunity, the expression of the pattern-recognition receptor TLR4 has been studied in IBD patients and the elevation of $γδTCR^+TLR4^+$T-cells rate was established in peripheral blood of CD patients (22,9 (8,7÷35,7) %) and UC patients (21,1 (10,3÷37,9) %) as compared to the healthy donors (9,0 (4,7÷26,6) %, $p<0,05$) what reflects the immunological activity of innate cellular immunity towards extracellular antigens including components of the normal intestinal microbiota. For estimation of γδT-lymphocyte cytotoxic functional status the expression of the co-receptor CD8 molecule and the killer receptor NKG2D (CD314) were determined. The number of $CD314^+$γδT-lymphocytes was higher in the both patients' groups (91,6 (83,7÷95,6) % and 92,7 (89,8÷94,3) % in CD and UC patients, respectively) than in control group (84,9 (73,7÷90,1) %, $p<0,01$). While CD8 expression was increased only in UC patients (43,8 (32,7÷48,2) %, $p<0,05$) and did not statistically differ in CD patients (33,95 (19,4 ÷ 44,6) %) from that in healthy donors (23,4 (19,0 ÷ 37,5) %). These data reflect the increased immune surveillance and possible causes villous atrophy and crypt hyperplasia. Taking into account that γδT-cells can act as adaptive immunity cells the number of $CD45RO^+$γδT-cells was investigated. It was shown the significant decrease of $CD45RO^+$ cells percentage in patients with IBD as compared to healthy donors: 16,7 (10,5÷55,6) % in CD patients, 21,3 (11,4÷50,0) % in UC pa-

tients and 34,0 (21,0÷56,3) % in healthy donors ($p<0,05$) what indicates the further differentiation of effector cells to terminally differentiated effector memory cells re-expressing CD45RA.

Thus, a persistent increase in γδT-lymphocytes rate with up-regulated TLR4 expression, cytotoxic profile as well as terminally differentiated effector memory phenotype in peripheral blood of patients with CD and UC were established what may be one of the potential mechanisms of mucosal barrier damage and gut inflammation contributing to the chronicity and systemic reactions to antigens of the gastrointestinal microbiota.

BIBLIOGRAPHY

1. *Kadivar, M.* CD8αβ$^+$γδT Cells: A Novel T Cell Subset with a Potential Role in Inflammatory Bowel Disease / *M. Kadivar,* [et al.] // The Journal of Immunology. 2016. № 197. P. 4584–4592.

2. *McCarthy N.* Human γδT-Cell Control of Mucosal immunity and inflammation / *N. McCarthy* [et al.] // Frontiers in Immunology. 2018. № 985.

EPIDEMIOLOGICAL ANALYSIS OF MORBIDITY OF MENTAL AND BEHAVIORAL DISORDERS IN 2010–2019

E. Tserlyukevich, N. Porada

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
alenaterlukevic@gmail.com

The modern way of life is characterized by pronounced activity, a large flow of information, emotional and stressful loads. All this is reflected in the mental health of a person. According to the World Health Organization, one in five people worldwide has a behavioral or mental disorder. The causes of many mental disorders are not fully understood [2]. The indicators of the incidence of mental and behavioral disorders in the population of the Republic of Belarus in the period from 2010 to 2019 were analyzed.

Key words: morbidity, long-term dynamics, tendency, mental disorder, mental retardation, schizophrenia, alcoholism, alcoholic psychoses.

Four of the six main reasons for shortening a fulfilling life are mental disorders: depression, schizophrenia, bipolar mental disorder, and alcohol dependence.

The aim of the work was to conduct a retrospective analysis to determine the direction of the trend in the dynamics of morbidity [1] of the population of the Republic of Belarus with various forms of mental disorders, to study the epidemiological features of these disorders in the period from 2010 to 2019.

The proportion of mental and behavioral disorders in the structure of primary morbidity in the population of the Republic of Belarus at the beginning and at the end of the study period was 2 %.

Having studied the dynamics of the incidence of mental disorders and behavioral disorders of the population of the Republic of Belarus, it was revealed that the direction of the trend of primary morbidity for the studied period is unclear ($R2 = 0.25$). The average annual incidence rate was A0 = 767.69 % ooo. In the dynamics of the general morbidity, the direction of the trend has a pronounced character to increase ($R2 = 0.69$). The average annual incidence rate was A0 = 1119.38 % ooo. The ratio of primary and general morbidity was 1: 1.4, which indicates the prevalence of chronic forms of pathology. When calculating the average long-term indicator for the territories, it was revealed that in the city of Minsk and the Minsk region during the observation period there was a relatively favorable situation in the incidence of mental disorders. The average annual level in these regions is lower than the republican level by 17 % and 28 %, respectively. Mental disorders are more often registered in women (on average, 54 % of all diagnosed cases of diseases). In the structure of the incidence of mental disorders by nosological forms during the observation period, psychoses averaged 35 %, of which non-psychotic disorders – 40 %. The share of mental retardation accounted for an average of 17 %, the share of schizophrenia – 8 %. The analysis of morbidity by nosological forms revealed a steady increase in the primary and general morbidity with mental retardation by 15.5 % and 2 times, respectively. In the dynamics of the morbidity of the population with schizophrenia, a 2-fold increase in the primary morbidity and a statistically significant decrease in the overall morbidity were revealed. It is noted that 99 % of patients with newly diagnosed schizophrenia are persons 18 years of age and older.

In the incidence of the population with various forms of dependence, the leading pathology throughout the entire period remained alcoholism, which accounted for more than 90 % of all identified cases. The primary incidence of alcoholism in 2019 decreased by 36.5 % in relation to the level of 2010. In the dynamics of the overall incidence of alcoholism and alcoholic psychoses, the trend towards a decrease is also stable ($R2 = 0.96$). A steady

tendency towards a decrease in the number of juvenile patients under preventive care due to alcohol consumption was revealed (R2 = 0.82). In the morbidity of the population with alcoholism and alcoholic psychosis, the proportion of cases of diseases registered among the male population is 4.7 times higher than among women. A steady downward trend (3.6 times) was revealed in the dynamics of the primary incidence of drug addiction (R2 = 0.92).

The differences in incidence rates for all considered nosological forms at the end of the study period in relation to the initial year of the study were statistically significant.

BIBLIOGRAPHY

1. *Герасимов, А.* Медицинская статистика / А. Герасимов. Мн.: МИА, 2007. 480 с. – С. 115–142.

2. *Обухов, С. Г.* Курс лекций по психиатрии / С. Г. Обухов / Психиатрия: учеб. пособие. – Гродно, 2006. – С. 53–54.

MEDICAL REHABILITATION AFTER POSTED CORONAVIRAL COVID-19 INFECTION

A. Tsvetkova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
anastasia.cvet@mail.ru

The coronavirus epidemic, which has developed into a pandemic, has affected not only human health, but also social relations. Hundreds of thousands of seriously ill coronavirus leaving hospitals are faced with a new and difficult task - rehabilitation. Obviously, social rehabilitation and psychological support for a Covid-19 patient is just as important as medical care.

Keywords: medical rehabilitation, Covid-19, infection, coronavirus, clinic.

Covid-19, an infectious disease caused by a new, previously unknown coronavirus, has had a huge impact on various aspects of human life around the world. The coronavirus epidemic, which has developed into a pandemic, has affected not only human health, but also social relations. [1] It is known that coronavirus infection enters the body through the mouth and throat, but Covid-19 is not a pure lung disease, but a multisystem one. This means that the virus can infect almost any cell in the body. In addition to the lungs, the heart, kidneys, liver, and brain are affected. [2] Patients with obstructive pulmonary disease or bronchitis, cardiovascular diseases, stroke, cancer patients, smokers, pregnant women suffering from obesity, diabetes are especially susceptible to coronavirus infection and have a more severe course of the disease. Most people tolerate coronavirus infection relatively easily, some are even asymptomatic. [3] But, as practice shows, even in such cases, the consequences can manifest themselves and have a long-term negative impact on the physical performance of a person. [2]

In Italy, many patients still feel unwell 60 days after the onset of the disease. 55 % of them actually had three or more symptoms, including fatigue, difficulty breathing, joint pain, and chest pain. [3] German researchers believe that about 45 % of inpatients suffer from the long-term effects of coronavirus infection and need further treatment. [2] Rehabilitation procedures can be a way out in this situation. This applies both to those who have shown physical (long-term) consequences and to people suffering psychologically from illness and quarantine. Patients who have received prolonged ventilation of the lungs during the course of the Covid-19 illness are especially recommended special pneumological rehabilitation. Today, the leading clinics in the world, along with the traditional one, also offer interdisciplinary rehabilitation to eliminate the remaining disorders in the human body after a coronavirus infection.

As noted, beyond the physical, all psychological effects associated with Covid-19, such as depression, anxiety or obsessive-compulsive disorder, should not be underestimated. Due to the lack of social assistance, job loss, existential fears, secondary psychological disorders caused by the coronavirus can also be expressed in the form of addictive behavior, for example, alcohol or drug addiction. Special rehabilitation programs offer help in this case too. For example, psychosomatic rehabilitation supports not only patients but also medical personnel suffering from depression from exhaustion or from high stress in the health sector.

Currently, rehabilitation options are diverse. For patients, a personal treatment plan is drawn up, related to the individual course of the disease and its consequences. So, in German and American clinics the following programs are offered: "Long-term rehabilitation", "Interdisciplinary rehabilitation", "Post-coronation pulmonary rehabilitation", "Psychosomatic post-coronation rehabilitation", "Post-coronation rehabilitation taking into account drug addiction", "The course of general treatment after illness." [3]

Respiratory muscle development, strength and endurance training, respiratory physiotherapy, as well as creative therapeutic procedures are widely used in these clinics, depending on the purpose within the framework

of the rehabilitation stay in different proportions. The duration of treatment depends on the type of rehabilitation and the individual needs of the patient. But usually special pneumological rehabilitation requires 21 days, about the same - interdisciplinary post-coronation rehabilitation, rehabilitation for addictions – from 12 to 15 weeks, in the case of specific psychosomatic rehabilitation, the period can be up to 3 years.

BIBLIOGRAPHY

1. *Зайцев, Д. М., Цветкова, А. Е.* Проблемы социальной реабилитации в условиях пандемии COVID-19 // Новые информационные технологии в телекоммуникациях и почтовой связи: материалы XXI науч.-техн. конф., 12 мая–13 мая 2021 года, Минск, Респ. Беларусь. – Минск: БГАС, 2021. – С. 187–188.

2. Spezifische Reha nach Corona. [Electronic resource]. – Mode of access: https://www.mediclin.de /medizin-gesundheit/medizinische-schwerpunkte/reha-nach-corona-covid-19/.

3. Medizinische Rehabilitation nach einer Covid-19-Erkrankung. [Electronic resource]. – Mode of access: https://www.median-kliniken.de/de/patienten-angehoerige/informationen-zu-corona/.

ANALYSIS OF ANTIOXIDANT ACTIVITY OF GROOVE MUSHROOMS COLLECTED IN RUSSIA, BELARUS AND CHINA

A. Tuboleva, Y. Pavlovskaya, E. Tarun

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
ktarun@tut.by

The comparative study of the antioxidant activity of extracts of 21 species of groove mushrooms was carried out. The dependences of the fluorescence intensity of fluorescein on the logarithm of the concentration of extracts of groove mushrooms are obtained, from which IC_{50} values are graphically determined. Groove mushrooms extracts restored fluorescence of fluorescein to 81–98 % at a sample concentration of 0,1–1 %. IC_{50} values were in the range of 0,66 –$25 \cdot 10^{-4}$ %.

Keywords: antioxidant activity, extracts of groove mushrooms, fluorescein.

Pharmacological studies of different types of groove mushrooms provided evidence supporting antibacterial, antiparasitic, antiviral, anti-inflammatory, anticancer [1], neuroprotective, antioxidant [2–4] and antidiabetic effects. Comparative study of antioxidant activity (AOA) of extracts of 21 types of groove mushrooms collected in Russia and Belarus has been carried out. The method of determining AOA with respect to activated oxygen species (ROS) is based on measuring the fluorescence intensity of the oxidized compound and reducing it under the influence of ROS. The generation of free radicals was carried out using a Fenton system in which hydroxyl radicals are formed by reacting an iron ($Fe^{2+)}$ complex with ethylenediaminetetraacetic acid (EDTA) and hydrogen peroxide [5]. When fluorescein interacts with free radicals, its fluorescence is extinguished, which can be restored by adding substances that exhibit antioxidant properties to the system. Fluorescence measurements were performed on a RF-5301 PC fluorimeter ("Shimadzu," Japan). Fluorescence intensity at 514 nm was recorded. The excitation wavelength is 490 nm. For all samples, the fluorescein fluorescence intensity and logarithm of the concentration of groove mushrooms extracts were obtained. Studies were carried out in a wide range of concentrations of 10–7 – 1 %.

Samples of groove mushrooms extracts began to exhibit AOA at a concentration of 10-7-10-5 %. The subsequent increase in the concentration of extracts shows an increase in the suppression of the action of free radicals and an increase in fluorescence of fluorescein to 81–98 % at a concentration of samples of 0.1–1 %, which corresponds to a dilution of the initial extract by 1000–100 times. Graphically determined IC_{50} – concentration of extracts of groove mushrooms, at which 50 % inhibition of free radicals is achieved.

The minimum value of IC_{50} (0,66·10–4 %) was obtained for a trichaptum sample Trichaptum is twofold, which indicates its maximum antioxidant activity. This sample also has a high A_{max} value (95 %). The same high A_{max} values were obtained for samples Trutovik bugry (94 %), Trutovik flat (Belarus) (95 %), Trutovik flat (Russia) (98 %), Birch sponge (Russia) (94 %), Trutovik real (Belarus, birch) (94 %) Trutovik bordered (Belarus) (93 %), Birch sponge (Belarus) (95 %) and Trametis multi-colored (94 %). However, their rates are IC_{50} (3,16; 5,5: 6,76; 10; 12,6; 13,8 and 25·10–4 %) in 4.5; 8,3; 10,2; 15,2; 19; 20,9 and 38 times higher.

The maximum value of IC_{50} (25 ·10–4 %) was obtained for a Trametis multi-colored sample, which indicates its minimal antioxidant activity. This sample also has a high A_{max} value (95 %).

Comparison of groove mushrooms of the same species shows a difference in IC_{50} and A_{max} scores.

The obtained data show that each type of groove mushrooms contains an individual set of substances responsible for antioxidant activity. The place where the groove mushrooms grow also affects the qualitative and quantitative composition of antioxidant substances.

BIBLIOGRAPHY

1. *Duru, K.* The pharmacological potential and possible molecular mechanisms of action of Inonotus obliquus from preclinical studies/K. Duru , E. Kovaleva , I. Danilova , P. van der Bijl// Phytother. Res. – 2019. – V. 33 (8). – P. 1966–1980.

2. *Khadhri, A.* Screening of Bioactive Compounds of Medicinal Mushrooms Collected on Tunisian Territory/A. Khadhri , C. Aouadhi , S. Aschi-Smiti// Int. J. Med. Mushrooms. – 2017. – V. 19 (2). – P. 127–135.

3. *Li, Z.* Chaga Medicinal Mushroom, Inonotus obliquus (Agaricomycetes) Polysaccharides Suppress Tacrine-induced Apoptosis by ROS-scavenging and Mitochondrial Pathway in HepG2 Cells / Z. Li , J.Mei , L. Jiang , C.Geng, Q. Li , X. Yao , J. Cao// Int. J. Med. Mushrooms. – V. 21 (6). – P. 583–593.

4. *Prendecka, M.* Stimulation of the activity of a novel tannase produced in white-rot fungi Phellinus pini, Fomes fomentarius, and Tyromyces pubescens by medium supplementation/M. Prendecka , M. Jaszek, M. Grąz, N. Głuszak , K. Małysz , A. Nowak , J. Żuchowski , T. Małecka-Massalska// Biotechnol. Appl. Biochem. – 2016. – V. 63 (5). – P. 652–658.

5. *Тарун Е. И.* Антиоксидантная активность гексагидрохинолонов / Е. И. Тарун, А. В. Данькова, А. Н. Пырко// Журнал Белорусского государственного университета. Экология. – 2019. – № 2. – С. 77–83.

PHYSICAL SORPTION BETWEEN NANOTUBE (8,10) AND RESVERATROL

A. Tushinskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
anya.tushinskaya@bk.ru

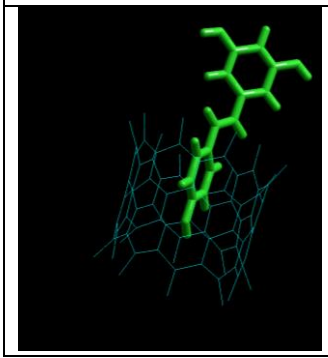
Resveratrol is a natural phytoalexin, a trans-stilbene derivative, a polyphenol. Synthesized by some plants as a defense against parasites such as bacteria or mushrooms. Resveratrol works much better in combination with nanotubes. A carbon nanotube is an allotropic modification of carbon, which is a hollow cylindrical structure with a diameter from tenths to several tens of nanometers and a length from one micrometer to several centimeters, consisting of one or more graphene planes rolled into a tube.

Keywords: resveratrol, nanotube, energy, complex, HOMO, LUMO.

3D modeling methods were used to create the most energetically advantageous complex between nanotubes (8.10) and resveratrol. The energy of the nanotube was also established, it was 145.2 kcal/mol. The energy of the complex was 119.98 kcal/mol. Since the energy of the complex is lower than the energy of the nanotube, we can say that the complex is energetically advantageous. In addition, we have established the energy of LOMO and HOMO resveratrol. HOMO was -11,582 eV, and LOMO was -4,131 eV. The discovered complex is the most thermodynamically stable.

Table 1

Energy of the complex and components of this complex

Complex	E_{HOMO} (eV)	E_{LUMO} (eV)	E_{NANO} (kcal/mol)	E_{COMP} (kcal/mol)
	-11,582	-4,131	145.2	119.98

In accordance with the conducted modeling, the complex between the nanotube (8.10) and resveratrol is the most advantageous for further research. The beneficial properties of resveratrol are more pronounced in this complex, which makes the study scientifically valuable. Using the above parameters, the width of the forbidden zone of the resveratrol was detected. The width of the resveratrol band gap indicates that this molecule can exist in vivo.

BIBLIOGRAPHY

1. *Shahab, S. N*. DFT investigations (geometry optimization, UV/Vis, FR-IR, NMR, HOMO-LUMO, FMO, excited states) and the syntheses of new pyrimidine dyes / Shahab Siyamak [et al.] // Chinese J. Struct. Chem. 2018. V. 37. № 8. P. 1201–1222.

2. *Shahab, S.* A DFT study of Se-decorated B12N12 nanocluster as a possible drug delivery system for ciclopirox / S. Shahab, S. Kaviani, M. Sheikhi, V. Potkin H. Zhou // Comp. and Theor. Chem. 2021 B. 1201. № 65. P. 113246.

3. *Shahab, S*. Quantum chemical analysis of the sorption interaction between psoralene and carbon dioxide (II) / Sakharov Readings 2021 B. 1. P. 358–360.

ANTIOXIDANT ACTIVITY OF PYRIMIDINE DYES

A. Tushinskaya, A. Augustinovich, A. Hryhoryeu, D. Ustymchuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
anya.tushinskaya@bk.ru

Nowadays, studying of the physical and chemical properties of pyrimidine compounds for medical purposes is perspective field for pharmacological studies, which is based on a wide range of pharmacological activity of these organic compounds: antibacterial, antifungal, antitumor, antioxidant, and cardioprotective.

Keywords: pyrimidine, radicals, antioxidant, orbitals, HOMO, LUMO.

The majority of heterocyclic compounds are synthesized in laboratory conditions, as they have a wide spectrum of biological activity. Pyrimidine derivatives are synthetic exogenous antioxidants that are synthesized directly in the laboratory and introduced into the body.

Free radicals are formed under the influence of various physicochemical factors, as well as the products of certain reactions inside the cell, and play an important role in various processes such as lipid metabolism, peroxidation, gluconeogenesis, electron transfer in the respiratory chain, and also provide protection against many microorganisms and play a significant role in the regulation of blood pressure.

To compare the antioxidant properties of molecules (table 1), electronic properties were calculated by the non-empirical method of the theory of the density functional B3LYP/6-31G** in water as a solvent.

Table 1

Electronic properties of Molecule 1 and Molecule 2

Properties	Molecule 1	Molecule 2
E_{HOMO} (eV)	-5.71	-5,44
E_{LUMO} (eV)	-1.36	-1.63
E_g (eV)	4.35	3.81

Molecule 1 possesses less HOMO-energy (-5.71) and that is why it is stronger than molecule 2 in electron acceptance which means first molecule has less expressed antioxidant activity. The most important property of compounds expected to be an antioxidant is the energy gap between HOMO and LUMO orbitals. The energy gap of first pyrimidine structure is 4.35 eV, and the energy gap of second compound is 3.81 eV. Thus, we can conclude that N-(4,6-dimethylpyrimi-din-2-yl)-5-phenylisoxazole-3-carboxamide has stronger antioxidant properties in comparison with (4,6-dimethylpyrimidin-2-ylamino)(5-p-tolylisoxazol-3-yl)methanol.

BIBLIOGRAPHY

1. *Shahab, S. N*. DFT investigations (geometry optimization, UV/Vis, FR-IR, NMR, HOMO-LUMO, FMO, excited states) and the syntheses of new pyrimidine dyes / Shahab Siyamak [et al.] // Chinese J. Struct. Chem. 2018. V. 37. № 8. P. 1201–1222.

2. *Shahab, S.* A DFT study of Se-decorated B12N12 nanocluster as a possible drug delivery system for ciclopirox / S. Shahab, S. Kaviani, M. Sheikhi, V. Potkin H. Zhou // Comp. and Theor. Chem. 2021 B. 1201. № 65. P. 113246.

3. *Shahab, S.* Quantum chemical analysis of the sorption interaction between psoralene and carbon dioxide (II) / Sakharov Readings 2021 B. 1. P. 358–360.

FORMATION OF A COMPLEX IN A SYSTEM: NANOTUBE (8,10) AND RESVERATROL

D. Ustymchuk

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
daria.u.18.01@mail.ru

A model of the interaction of a nanotube (8, 10) with a resveratrol molecule has been studied. The energy of the complex formed between these molecules is found. The band gap of resver-trol was calculated by the method of molecular mechanics MM +. The most thermodynamically stable complex has been found.

Keywords: Nanotube (8,10), resveratrol, complex, Homo energy, Lumo energy, total system energy.

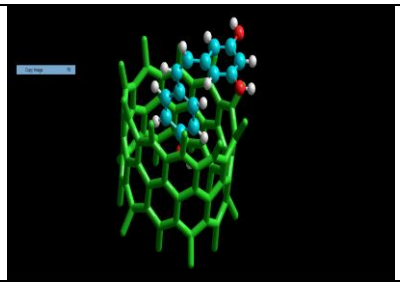
A nanotube is an allotropic modification of carbon, which is a hollow cylindrical tube measured in nanometers. The relevance of studying nanotubes is due to the fact that they have a high coefficient of strength, excellent thermal and electrical conductivity, fire resistance, and a weight coefficient that is an order of magnitude higher than that of most known materials.

Resveratrol belongs to the category of polyphenols and is found in the peel and grape seeds. It is thanks to him that red wine acquired the fame of a healthy drink that slows down the aging process. Resveratrol is known as a powerful antioxidant and an active fighter against free radicals, which are formed as a result of oxidative stress caused by negative environmental factors. In cosmetic formulas, resveratrol stimulates the natural antioxidant protection of the skin, prevents intracellular damage by free radicals, and promotes the regeneration of mature skin.

A model of the interaction of a nanotube (8, 10) with a resveratrol molecule has been studied. The calculated energy of the nanotube is 126.75 Kcal. The energy of the resveratrol molecule is -2.7 eV, which means that the molecule is thermodynamically stable in nature. The most stable complex of a nanotube (8, 10) and a resveratrol molecule was found (Table 1), at which the lowest energy of the complex was observed among the studied ones.

Table 1

Properties and structure of the complex

Structure of the complex	E Lumo Resveratrol, eV	E Homo Resveratrol, eV	Eg Resveratrol, eV	E nanotube, Kcal/mol	E Resveretrol, eV	E complex, Kcal/mol
	-4,132	-11,58	7,448	126,75	-2.7	122,66

BIBLIOGRAPHY

1. *Shahab, S.* Investigation of encapsulation of Talzenna drug into carbon and boron-nitride nanotubes [CNT(8,8-7) and BNNT(8,8-7)]: a DFT study / S. Shahab // J. Springer 2021 V. 75 №12 P. 1521–1533.

2. *Shahab, S.* Theoretical investigation of adsorption effects Ciclopirox drug over CNT (6, 6-6) nanotube as factor of drug delivery: a DFT study / S. Shahab // J. Springer 2020 V. 26 №3. P. 913–924.

LABORATORY DIAGNOSTICS OF CORONAVIRUS INFECTION SARS-COV-2

J. Venskaya, A. Makhnach, A. Dubinskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
venskay.yana@yandex.ru

This article presents information on laboratory diagnosis of SARS-CoV-2 coronavirus infection in two main types: nucleic acid testing for detection of SARS-CoV-2 RNA, and serological assays for detection of SARS-CoV-2 specific IgG and IgM patient antibodies.

Keywords: COVID-19, SARS-CoV-2 diagnosis, RT-PCR, diagnostic testing, immunoassay.

SARS-CoV-2 (formerly, 2019-nCoV) infection was first reported in Wuhan (China) in December 2019, and then it has rapidly spread around the world, causing ~234 million active cases with ~4 million deaths as of October 2021 [1, 2]. There is a need for rapid and accurate diagnostics to better monitor and prevent the spread of COVID-19. The diagnosis tools available so far have been based on: a) viral gene detection, b) human antibody detection, and c) viral antigen detection, among which the viral gene detection by RT-PCR has been found as the most reliable technique [1].

In particular, I cover and compare tests such as express antigen SARS-CoV-2-LFA, test system "ArtTest COVID-19", express-IgG / IgM SARS-CoV-2-LFA, "ELISA-IgG, IgM -SARS-CoV 2" Algimed Techno, enzyme-linked fluorescence analysis "VIDAS® SARS-COV-2 IgM, IgG" device Biometrix, I-CHROMA II immunofluorescence assay.

Antigen detection methods:

- Express antigen SARS-CoV-2-LFA is a qualitative immunochromatographic assay for detecting SARS-CoV-2 coronavirus antigen in a sample (human nasopharyngeal swab). Based on the principle of thin layer chromatography and involving the reaction between an antigen and its corresponding antibody in biological materials.
- The "ArtTest COVID-19" test system is designed for the qualitative detection of RNA of the coronavirus COVID-19 by a one-stage RT-PCR method with "real-time" detection of results.

Antibody detection methods:

- Express-IgG / IgM SARS-CoV-2-LFA is a qualitative immunochromatographic assay for the detection of IgG and IgM antibodies to SARS-CoV-2 in whole blood, serum or plasma samples. The principle of the test is based on the immunochemical method for the determination of specific immunoglobulins.
- "ELISA-IgG, IgM -SARS-CoV 2" Algimed Techno is a quantitative analysis, the principle of which is based on the method of enzyme-linked immunosorbent assay. A combination of a highly specific immunological response with sensitive catalytic action of the enzyme marker. A 96-well plate with immobilized antigen.
- Enzyme-linked fluorescence analysis "VIDAS® SARS-COV-2 IgM, IgG" device Biometrix. The assay principle combines a two-step sandwich enzyme-linked immunosorbent assay with definitive fluorescence detection (ELFA). The reagent strip contains 10 wells.
- The I-CHROMA II immunofluorescence assay is a qualitative assay based on the sandwich immunodetection method.

In the course of studying the methods of laboratory diagnosis of SARS-CoV-2 coronavirus infection and subsequent analysis of the data, it can be concluded that antigen tests that target the viral biomarkers such as spike, envelope, or nucleocapsid proteins could be useful to support the current RT-PCR-based systems and accelerate the detection speed worldwide. Antibody tests or serology tests are equally important to see how many people have already had the virus and developed protective antibodies, which may be later used as a databank to survey potential plasma donors for the disease treatment.

BIBLIOGRAPHY

1. *Tian X, Li C, Huang A, et al.* Potent binding of 2019 novel coronavirus spike protein by a SARS coronavirus-specific human monoclonal antibody. Emerg Microbes Infect. – 2020. – Vol. 9. – P. 382–385.

2. *Супотницкий, М. В.* Новый коронавирус SARS-CoV-2 в аспекте глобальной эпидемиологии коронавирусных инфекций / М. В. Супотницкий // Вестник войск РХБ защиты. – 2020. – Т. 4, № 1. – С. 32–65.

THE DIAGNOSTIC VALUE OF DETERMINING THE TITERS OF ANTIBODIES TO HEPATITIS B AND C IN SERUM SAMPLES

A. Voroshnina, E. Tarasova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus

The aim of this work is to confirm the relevance and importance of the use of ELISA in the diagnosis of viral hepatitis.

Keywords: enzyme immunoassay, hepatitis B and hepatitis C.

Viral hepatitis constitutes a large group of human infectious diseases characterized by symptoms of general intoxication. Diseases have a similar clinical picture and occur in icteric, anicteric and asymptomatic forms. Viral hepatitis (VH) is a group of infectious diseases characterized by predominantly liver damage. [1] ELISA is one of the most actively developing areas of chemical enzymology. The purpose of ELISA is to detect a variety of substances in extremely small quantities, including antigens of pathogens and antibodies to them. In the body of patients, specific antibodies are formed to each of the viral antigens at different stages of the disease; therefore, the basis for serodiagnostics is knowledge about the dynamics of the appearance and disappearance of the main HBV markers. Identification of immunochemical markers of HBV allows you to determine the form of infection and make a prediction of its course (Table 1).

Table 1

Dynamics of the appearance of serum HBV markers in hepatitis B and interpretation of laboratory parameters

Diagnosis	HBsAg	Anti-HBs	Anti-HBc		HBeAg	Anti HBe	HBV-DNA
Acute hepatitis B	+ -	-	IgM +	IgG +	+ -	- +	+
Reconvalescence	- +	- +	- +	+	-	+	-
Recovery	-	+ -	-	+	-	+	-
Fulminant hepatitis	+ -	+	+	+	+	- +	+
Chr. Hepatitis (phase replication	+ -	-	+	+	+	-	+
Chr. Hepatitis (phase integration)	+	-	-	+	-	- +	-
Active immunization	-	+	-	-	-	-	-
Passive immunization	-	+	-	+	-	-	-

Results of analyzes for ELISA-HBsAg, ELISA-HBeAg, ELISAantiHBcIgM, ELISA-antiHCV. 1 Results of screening patients for hepatitis B virus and hepatitis C virus Based on the data, it can be concluded that of 183 samples for HBsAg, 34 patients tested positive, which may indicate acute or chronic HBV infection. In acute illness, HBsAg is detected in serum in the last 1-2 weeks of the incubation period and in the first 2–3 weeks of the period of clinical manifestations. The detection rate of HBsAg depends on the sensitivity of the test method used. The ELISA method allows detecting HBsAg in more than 90% of patients. However, HBsAg can be detected in practically healthy people, as a rule, during prophylaxis. Examination of patients for hepatitis B virus and hepatitis C virus (total 725 people) For hepatitis B virus (total 398) Detected Ab and Ar Number of patients examined HBsAg results 183 Positive Person% 34 4.6 Negative 149 20.6 Anti-HBcAg IgM 103 Positive 68 9.4 Negative 35 4.8 HBeAg 112 Positive 16 2.2 Negative 96 13.2 For hepatitis C virus (total 327 people) Total anti- HCV IgM and IgG 327 Positive 207 28.6 Negative 120 16.6

As a result of the analysis of the data of the examination results for HBsAg, HBeAg, anti HBc IgM using immunological test systems "ELISA-HBsAg", "ELISA-HBeAg", "ELISA-antiHBc IgM" and "ELISA-antiHCV", the need for a comprehensive examination was proved. patients for the presence of HBsAg, HBeAg, anti HBc IgM. With a comprehensive examination, the most promising, more sensitive, highly specific, combined with the speed and simplicity of the study, is the method of diagnosing viral hepatitis of all serological reactions, which is currently considered to be enzyme immunoassay, which has been introduced into the work of many medical centers.

BIBLIOGRAPHY

1. *Chirkin A. A.* Clinical analysis of laboratory data / A. A. Chirkin M .: Med. Literature, 2008. – 384 p.

DESIGN AND SYNTHESIS OF A BIOLUMINESCENT PROBE PRECURSOR (AMPPD)

Wanghui, S. Shahab

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
wanghui2010@163.com

A simple method for the preparation of AMPPD, the precursor of biological fluorescent probe, is reported. Using cheap and easily available methyl m-hydroxybenzoate and adamantanone as raw materials, the condensation product was obtained by McMurry reaction, and then reacted with phosphorus oxychloride to realize the phosphorylation process, and then esterified with trihydroxypropionitrile to form a phosphate intermediate.

Keywords: methylm-hydroxybenzoate, Adamantone,McMurray reaction, sodium 3-(((1r,3r,5R,7S)-adamantan-2-ylidene)(methoxy)methyl)phenyl phosphate, phosphoric esterification.

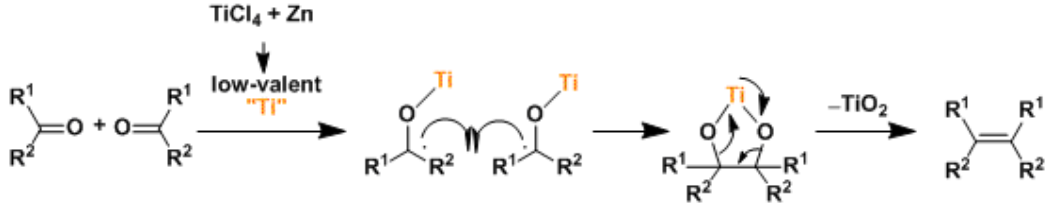
Some chemical substances, enzymes and biological macromolecules in the body of organisms have important influence on the life activities of organisms. Therefore, the detection and imaging of these substances have important guiding significance for researchers to explore the unknown world of life science. At present, researchers have developed a series of methods for the detection and imaging of chemical and biological substances in organisms, such as high performance liquid chromatography, electron spin resonance, nuclear magnetic resonance imaging and so on. Although these methods can achieve some results, their use is limited by their dependence on expensive equipment and their time consuming. Compared with the detection and imaging methods mentioned above, fluorescent bioprobes have attracted extensive attention due to their high sensitivity, high speed and non-destructive properties.

When the outside world provides appropriate energy to the molecule, the molecule selectively absorbs the corresponding energy, leading to energy transfer of the active electrons inside the molecule. Electrons jump from a low energy state to a high energy state. The energy normally given to molecules is provided by electromagnetic waves of a certain length, such as ultraviolet light. When the electron reaches a high energy state, that is, the excited state, the molecule needs to reach a stable state of low energy as time goes by. At this time, the electron in the high energy state releases energy in several ways to return to the lower energy state, that is, the ground state. One way is to release energy as heat through the vibration of molecules, called vibrational relaxation, and the other way is to release energy as light through radiation. If in the process of energy release, there is no symmetry change of electron structure in the molecule, then the released light is called fluorescence. Bioluminescent probes are designed based on this principle. Bioluminescent probes can accurately, quickly and specifically detect one or several ions, and can be assisted by instruments to observe obvious phenomena. With fluorescent probes, we can easily obtain the specific conditions inside cells and reflect them with an accurate value. This has given a huge boost to the study of biology.

It is based on this idea that we chose the synthesis methods of AMPPD with great development significance in signal amplification, light lighting materials, biomolecular probes and imaging and other related fields to do the following breakthrough research.

In the synthetic study, we first use cheap comes easily to the commercialization of hydroxy benzoic acid esterification between raw materials, in a quantitative yield of methyl get products of B1, and then use another commercial material compound B1 and easy adamantane ketone with relatively high yield of B2 by mike Murray condensation compound C, the steps for the synthetic route of one of the most critical step, The whole reaction needs to be completed in anhydrous and anaerobic state. On the premise of in-depth study of the reaction mechanism, we found that the main side reaction of this reaction is the own bimolecular condensation reaction of B1 and B2 respectively, and B2 has a high condensation activity. In order to effectively reduce the occurrence of this side reaction, we first controlled B1: The molar ratio of B2=5:1 was mixed and dropped into the system as slowly as possible. Meanwhile, in order to complete the reaction of B1 as much as possible, 1.8-equivalent B2 was subsequently added to slowly control the dropping rate, and finally the intermediate C was obtained with a good yield of 85 %.

The McMurray reaction mechanism is as follows:



The reaction mechanism for McMurray coupling

Next, compound C was phosphorylated by phosphorus oxychloride in pyridine as an acid-binding agent with a remarkable yield of 82 % under mild conditions, and then compound C was esterified and condensed with 3-hydroxypropionitrile in a high yield to obtain diphosphonate. Finally, the traditional synthesis method was broken through and the precursor F of AMPPD was efficiently transformed into metal sodium in methanol in situ.

In this synthesis method, carbon – carbon double bond is constructed by McMurray reaction in a single step with high yield, while retaining methoxyl as the key functional group. Adamantane – phenylenol ether compound was successfully synthesized. The operation is simple and avoids the tedious process of using protective base. In addition, the equivalent ratio of diamantadone to m-hydroxybenzoate was controlled during the reaction process to avoid the by-product formation of the coupling of diamantadone. It provides a strong support for the development of synthetic route of AMMPPD, a precursor of bioluminescent probe. In the last step, sodium methoxide was prepared in situ and hydrolyzed successfully avoiding the destruction of the original phosphate ester structure. And the formation of easy to remove by – product acrylonitrile. The purification of the final product saves a lot of time and manpower and material resources, and the yield is high.

In this paper, a relatively efficient synthesis method of AMPPD precursor by biological probe was discussed. The enol ether skeleton structure was efficiently constructed by McMurray reaction using amantadone and m-hydroxybenzoate methyl ester, and the AMPPD precursor F was successfully prepared by hydrolysis of sodium methoxide in situ.

EFFECT OF MESENCHYMAL STROMAL CELLS ON IL-18 PRODUCTION IN CROHN'S DISEASE

M. Yakauleva, M. Zafranskaya, V. Timchenko

Belarusian State University, ISEI BSU

Minsk, the Republic of Belarus

E-mail: mariamariam2000@mail.ru, zafranskaya@gmail.com, violettapolyanskaya@gmail.com

The article analyses the effect of mesenchymal stromal cells (MSCs) on IL-18 production in Crohn's disease.

Keywords: Crohn's disease, enzyme-linked immunosorbent assay, interleukin-18, inflammatory diseases, mesenchymal stromal cells.

To date, diseases characterized by the involvement of the inflammatory process affecting the digestive system rightfully occupy one of the leading positions in practical medicine on the basis of broad generalization and significance in society.

Unfortunately, the percentage of morbidity with these pathologies increases every year due to various reasons. Triggers such as untimely diagnostics, illiterate method of treatment, are the basis for the occurrence of complications that can eventually lead to disability of different degrees of people of working-age groups. [1]

The Crohn's disease is one of the most common inflammatory pathologies. This disease is a chronic granulomatous pathology of the intestine of a wide etiology, characterized by such a feature as the involvement of a transmural inflammatory process. Mobilization of pro-inflammatory and anti-inflammatory cytokines in the pathological process characterize the immunopathogenesis of this disease. [3]

Currently, the pro-inflammatory cytokine IL-18 is considered as a key component involved in the pathogenesis of nonspecific inflammatory bowel diseases, which together with other cytokines determine the characteristic distinctive features of the pathological processes. The condition of patients with Crohn's disease is characterized by a certain imbalance between anti-inflammatory and pro-inflammatory cytokines in the mucosa of the predominantly large intestine towards the predominance of the latter. [2]

Based on the fact that chronic inflammatory diseases, namely Crohn's disease and ulcerative colitis, are characterized by rapid «rejuvenation» and progression, there is a need to search for alternative, new methods of treatment. One of these methods is the use of mesenchymal stromal cells (MSCs). MSCs have been widely used

in cell therapy in recent years. The directions of this therapy are oriented in accordance with the basic properties of this type of cells. Based on this, three groups can be identified: the use of MSCs to maintain hematopoiesis during cotransplantation with hematopoietic stem cells, replacement and further restoration of the function of nonhematopoietic tissues subjected to damage, suppression of immune conflicts during unrelated allogeneic transplantation. Performing the role of modulators of inter-lymphocytic interactions is the unique feature of MSCs stands out in a separate group.

Influence of the MSCs on IL-18 production is estimated by the methods of the enzyme-linked immunosorbent assay (ELISA) and joint cultivation of peripheral blood mononuclears and MSCs. Cultivation conditions: in the first holes of the peripheral blood mononuclears was introduced in a certain concentration of 100 μl RPMI-1640 without the addition of antigens, in the next holes— peripheral blood mononuclears 100 μl RPMI-1640 containing nonspecific polyclonal mitogen PHA at a concentration of 2.5 mcg/ml, in the last holes – peripheral blood mononuclears and MSCs in 100 μl specific autoantigen Mannan.

After analyzing the monitoring of changes in the concentration of IL-18 in different periods of MSCs therapy, an increase in the concentration of this cytokine is observed after 1 month of MSCs therapy, and after 3 months of therapy, a decrease, in some cases, after 3 months of therapy, the cytokine concentration is lower than the concentration before therapy. Based on the above, it can be assumed that short-term MSCs therapy will not have such a tangible effect for suppressing the pathological process in Crohn's disease, however, if MSCs are used as the main direction of treatment for a longer period, the probability of long-term remission in this pathology is much higher.

BIBLIOGRAPHY

1. *Baumgart, D. C.* Crohn's disease / D.C. Baumgart, W.J. Sandborn // Lancet. 2012. № 7. P. 380.

2. *Tsianos, E. V.* Role of genetics in the diagnosis of Crohn's disease / E. V. Tsianos, K. H. Katsanos // World J. Gastroenterol. 2012. №18 (2). P. 18.

3. *Long M. D.* A clinical review of recent findings in the epidemiology of different inflammatory bowel disease / M. D. Long, A. Ponder // Clin. Epidemiol. 2013. № 5. P. 237–247.

«ANALYSIS OF INCIDENCE WITH PRIMARY LOSS OF EMPLOYMENT DUE TO INJURY AT JSC « SKBZ «ALBERTIN» (2016–2020)

S. Yakovchik, V. Stelmakh

Belarusian State University, ISEI BSU
Minsk, the Republic of Belarus
svetlana1971god @

An occupational injury is a sudden injury and disability caused by an occupational accident. The recurrence of work-related accidents is called work-related injuries.

Keywords: safe labor, technical safety, fire safety, demographic safety, occupa–tional injury.

Labor protection in organizations or enterprises has been and remains an integral part of the technological process. There is a risk of danger in the production of even simple products in the workplace. The sum of all injuries sustained at work or during free time from work represents a risk to life and health. The problem is relevant for workers, because all safety rules are not always observed at their places of work. Any injury implies a set of possible damage to the human body, and as a result, a violation of its functions.

The purpose and task of my work is to substantiate and develop measures to reduce temporary disability and eliminate the causes that caused increased levels of morbidity based on determining the patterns of formation of levels of labor loss in workers, studying the role of working conditions and other risk factors and their impact on indicators of temporary disability, determining priority directions of improving working conditions and health im–provement of workers.

The material under study was provided by the labor protection department of the Slonim cardboard and paper plant «Albertin».

Research methods and technical means used: statistical research methods are the study of the causes of in–juries according to documents in which accidents are recorded for a certain period of time.

To assess the level of injury, we used the relative statistical indicators of frequency and severity.

The frequency coefficient of total industrial injuries expresses the number of accidents per 1000 employees.

The severity coefficient expresses the number of days of disability per injury.

In addition to the given ratios, when analyzing industrial injuries, we calculated the disability rate.

So, industrial injuries are a rather complex phenomenon. You can get rid of it by resolving three reasons: technical, organizational and personal (psychophysiological).

Technical causes of industrial accidents are eliminated by improving technological processes, replacing equipment that has design flaws and high wear and tear, constant monitoring (diagnostics) of the technical condition of equipment, buildings and structures, tools and means of collective and individual protection. Effective and purely technical safety measures are engineering measures to protect people from sources of harmful effects by isolating hazardous elements, as well as installing barriers between workers and potential sources of injury. These include (but are not limited to) automation, remote control, the use of auxiliary equipment and automatic protection. The normalization of working conditions also plays an important role: high-quality atmosphere, good lighting, absence of noise and vibration, normal microclimate, etc.

Organizational causes of industrial accidents are eliminated by the introduction of a corporate OSH man–agement system. Organizational safety measures include, among other things, protecting workers from sources of hazardous and (or) harmful effects by providing workers with personal protective equipment and rational temporary organization of the work process. An important role in improving labor protection is played by product quality man–agement, which inevitably eliminates shortcomings in the organization of workplaces and violations of technologi–cal regulations, rules and regulations for transportation, storage and storage of materials and products, scheduled preventive maintenance of equipment, vehicles and tools.

Personal (psychophysiological) causes of accidents at work can be eliminated through the correct selection of personnel, as well as with constant training, instruction and education, stimulating the safe behavior of workers. Since it is not possible to completely eliminate hazards through technical and organizational measures, the safety of an employee is often determined only by his behavior.

STUDY OF THE GENE EXPRESSION OF GHRELIN AND NESFATIN-1 GENES IN RAT ORGANS

I. Yakubov, A. Kuliboev

National University of Uzbekistan named after Mirzo Ulugbek,
Tashkent, Uzbekistan
iskandar2014a@gmail.com

Ghrelin is secreted by X/A-like cells in the stomach. Ghrelin has two main physiological functions: activity to release GH and activity to stimulate appetite. Ghrelin also exhibits: cardiovascular effects, mediates an increase in gastric movement and gastric acid secretion, and helps to regulate glucose metabolism. Ghrelin, produced primarily in the organs of the gastrointestinal tract in response to hunger, circulates in the blood, serving as a peripheral signal that prompts the central nervous system to stimulate nutrition. The concentration of ghrelin in plasma is 130 femtomol / ml. Plasma ghrelin levels rise during fasting and decrease after feeding.

Nesfatin-1, a novel 82 amino acid polypeptide, was identified in 2006 by Oh and colleagues as the amino terminal fragment of nucleobindin 2 (NUCB2), a protein (2) that is highly conserved in humans, mice and rats. The protein contains a 24 amino acid N-terminal signal peptide sequence followed by a 396 amino acid sequence that is proteolytically processed by a prohormonal convertase to at least three peptides, nesfatin-1, nesfatin-2 and nesfatin-3. Only nesfatin-1 suppresses nocturnal food intake and body weight gain in free-eating rats when injected into the rat brain ventricle. Ранее несфатин-1 был обнаружен в эндокринных клетках эпителия желудка (3). Previously, nesfatin-1 was found in the endocrine cells of the gastric epithelium (3).

The aim of this work is to study the expression of the ghrelin and nesfatin-1 genes in various rat organs.

Total RNAs from various rat organs were isolated according to a standard technique. Then, cDNA was obtained from the total RNA using reverse transcriptase. cDNA was amplified by polymerase reaction using specific primer pairs for ghrelin and nesfatin-1. The amounts of amplifiers were estimated using the ImageJ software after agarose gel electrophoresis, as well as using Real Time PCR.

We found that ghrelin is expressed mainly in the stomach, duodenum and other parts of the intestine, as well as in the brain. At the same time, nesfatin-1 is expressed in the pancreas, heart, ovary, liver, brain, and rat kidney. The expression levels of these hormones differ in different organs of the rat. Further studies of the expression of proteins in various organs makes it possible to elucidate the functions of peptides in the peripheral regulation of acid secretion in the stomach.

BIBLIOGRAPHY

1. *M Kojima 1, H Hosoda, Y Date, M Nakazato, H Matsuo, K Kangawa*. Ghrelin is a growth-hormone-releasing acylated peptide from stomach.// Nature.. 1999, V. 9, N 402, N 6762, pp. 656–660.

2. *Shinsuke Oh-I 1, Hiroyuki Shimizu, Tetsurou Satoh*. Identification of nesfatin-1 as a satiety molecule in the hypothalamus // Nature, 2006, V. 443, N 7112, pp.709–712.

3. *A. Stengel., M. Goebel., I. Yakubov., Lixin Wang, et. al.* Identification and characterization of nesfatin-1 immunoreactivity in endocrine cell types of the rat gastric oxyntic mucosa.// Endocrinology, 2009, V. 150, N 1, pp. 232–238.

EFFECTS OF ANTHROPOGENIC FACTORS ON THE GEOLOGICAL ENVIRONMENT OF SHANDONG PROVINCE

Xu. Yanhui[1], **V. Lemiasheuski**[1,2]

[1]*Belarusian State University, ISEI BSU*

Minsk, Republic of Belarus

[2]*All-Russian research Institute of Physiology, Biochemistry and Nutrition of animals – branch of the Federal Research Center for Animal Husbandry named after Academy Member L. K. Ernst*

Borovsk, Russia

lem@iseu.by, 2826380336@qq.com

With economic and social development, scientific and technological progress and accelerated urbanization, human activities have become a major geological force on earth. As a province with a large population in China, Shandong province has a population of 102 million in 2021. Human factors have a great impact on the geological environment. These changes are subtly affecting people's lives, and these negative effects have attracted more and more attention.

Keywords: geological environment, anthropogenic effects, geological disasters.

Geological environment system is an organic whole within a certain range which responds to human economic and technological activities. It is a complex artificial and natural complex system.

Research Objective. To study the causes and countermeasures of geological environment destruction in Shandong Province.

I. Effects of anthropogenic factors on geology. Human activities have a profound impact on landforms and processes, both constructive and destructive, from the erosion of arable land to construction and mining. The man-made damage to geological environment is mainly caused by engineering excavation, loading, blasting, soil abandonment, land reclamation, excessive extraction of groundwater and so on.

II. Introduction of Shandong Province. Shandong province located in the northeast part of the east coast of China, the lower reaches of the Yellow River, and belongs to the North China Plain, between 114°47 '30 "~ 122°42' 18" E and 34°22 '54 "~ 38°27' 00" N. The total land area is 157,100 square kilometers, the sea area is 170,000 square kilometers, and the coastline is 3,345 kilometers.

Shandong is an economic powerhouse along the east coast of China. In 2020, Shandong's GDP reached 7,312.9 billion yuan, ranking the third in China. Shandong lies between Beijing and Shanghai, connecting the vast interior of China with the vast Western Pacific Ocean and facing Japan and South Korea across the sea.

Up to now, more than 150 kinds of mineral resources have been discovered in Shandong Province. Among them, there are more than 80 kinds of minerals whose total reserves have been identified.

III. The impact of human factors on the geological environment of Shandong. In China, most geological disasters occur in southern provinces, such as Hunan, Fujian, Jiangxi, Guizhou and Sichuan, etc.

The geological environment problems in Shandong are more prominent, such as mining-out collapse, ground subsidence, seawater intrusion, ground fissures and collapse. By 2002, the accumulated land subsidence in Dezhou, Jining and Heze has been more than 300mm, 200mm and 100mm. Saltwater intrusion occurred to varying degrees in the coastal areas of Laizhou Bay and some downstream rivers of coastal cities such as Qingdao, Yantai and Weihai, as well as ground fissure in the southwest and east Shandong [5].

The main reasons are as follows:

1. Demographic factors. Shandong province has a large population base and rapid population growth, which causes pressure on the environment, such as the expansion of cultivated land area and housing space, which causes great damage to the ecological environment.

2. Industrial production factors. In the process of industrial production, if the measures are not appropriate, it is easy to destroy the geological environment. Mining, road construction, building and other indiscriminate digging of soil, waste slag, abandoned soil, will cause surface water and soil pollution, sometimes also cause groundwater pollution.

3. Urban planning and construction factors. In the municipal planning and construction of improper, geological environment assessment is not comprehensive enough to carry out construction, such as foundation engineering geological exploration in accordance with the provisions, foundation design does not adapt to geological environment conditions, easy to induce geological disasters.

4. Excessive groundwater harvesting. Due to the rapid development of industrial enterprises, the pollution of water resources is large, the normal water source has been unable to ensure the living water of enterprises and residents, can only increase the use of groundwater.

IV. Prevention and control countermeasures. Geological environment is the basis for human survival and provides many production materials for human beings, so we must pay attention to the protection of geological environment to ensure ecological sustainable development.

1. Government departments shall strengthen the detection and control of geological environment, strengthen management of relevant departments, enterprises, and individuals, and do a good job in planning services. It can be arranged from the perspective of Shandong's economic structure and productivity development to do a good job in overall control and government services.

2. Correctly handle the relationship between ecological and geological environment protection and economic development and reduce man-made damage. There has always been a contradiction between environmental protection and economic development, but in fact, protection and development are not opposite.

3. Strengthen the publicity of geological environment protection, raise the public awareness of protection, and jointly safeguard the sustainable development of ecological environment.

Conclusions. Shandong is part of China, and China is part of the world. We are working hard to create a sound ecological environment, establish environmental protection awareness, strengthen the protection of the geological environment, and actively repair or stop destroying the damaged geological environment. Maintain the safety of eco-geological environment and contribute to the sustainable development of mankind.

SYNTHESIS OF DISODIUM SALT OF DI-BISULFITADENOSINE

V. Yaroshevich, J. Gretzkaya, M. Khancheuski, E. Kvasyuk

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
kitooo9851@gmail.com

This article presents data on the synthesis of disodium salt of di-bisulfitadenosine.

Keywords: adenosine dialdehyde, disodium salt of di-bisulfitadenosine, nucleoside derivatives, anticancer activity.

Matrix metalloproteinase-9 (MMR-9) can cleave many extracellular matrix proteins. It can also cleave many surface plasma proteins to release them from the cell surface. MMP-9 has been found to be associated with cancer pathology, including but not limited to invasion, metastasis and angiogenesis. Increased MMP-9 expression in lymphoma cell lines is closely related to tumor invasion. In addition, elevated MMP-9 has been reported in patients with higher stages of metastasis. Overexpression of MMP-9 has also been reported in transfected non-metastatic tumor cells that have acquired invasive capacity [1].

Adenosine dialdehyde suppresses the invasive ability of breast cancer and glioma cells by reducing MMP-9 levels. We found that inhibition of MMP-9 by adenosine dialdehyde occurs at the transcriptional level by inhibiting AP-1 and its upstream signaling cascade.

The reason for the synthesis of the disodium salt of di-bisulfitadenosine was the data about the anticancer properties of some nucleoside dialdehydes and di-bisulfite derivative of uridine [2]. From the chemical point of view, di-bisulfite derivatives of nucleoside can act as a prolonged form of dialdehyde nucleosides. Di-bisulfitadenosine **2** was obtained from adenosine dialdehyde **1** according to the scheme, presented on a figure below.

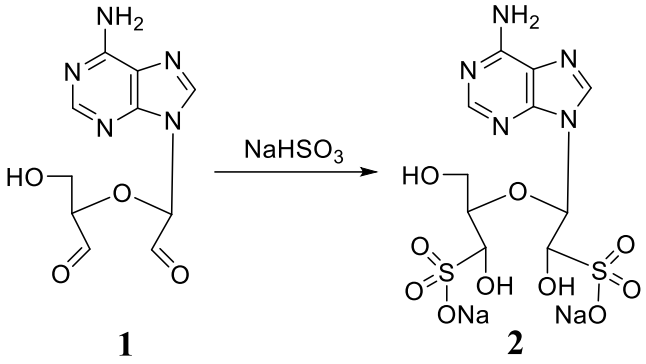


Fig. 1 – Scheme of the synthesis of the disodium salt of di-bisulfitadenosine

The course of the reaction and the content of the disodium salt of di-bisulfitadenosine were monitored using thin-layer chromatography on "Kieselgel 60 F254"plates by Merck (Germany) in the solvent system: isopropyl alcohol/ammonia/water (7:2:2 vol./vol.). The compounds were visualized on plates by viewing them under ultraviolet light.

To a solution of adenosine dialdehyde **1** (1 g, 3.77 mmol) in 40 ml of water a solution of $NaHSO_3$ (0.81 g, 7.54 mmol) in 5 ml water was added under stirring. The reaction mixture was stirred for 1 hour, evaporated to a small volume and left in the refrigerator for 18-20 hours. Then to a residue 2 ml ethanol was added. The precipitate was filtered off and washed with alcohol (4x5 mL). The precipitate was dried at room temperature on air, and then in vacuum to constant weight. A 0.65 g disodium salt of di-bisulfitadenosine **2** was obtained. The yield of the product was 39 %.

BIBLIOGRAPHY

1. *Kim, J. H.* Adenosine dialdehyde suppresses MMP-9-mediated invasion of cancer cells by blocking the Ras/Raf-1/ERK/AP-1 signaling pathway / J. H. Kim [et al.] // Biochemical Pharmacology. – 2013. – Vol. 86. – P. 1285–1300.

2. *Dvonch, W.* Antitumor activity of Periodate-Oxidation of Carbohydrates and Their Derivatives / W. Dvonch [et al.] // Cancer Res. – 1966. – Vol. 26. – P. 2386–2389.

SYNTHESIS OF SECO DERIVATIVES OF ADENOSINE AND URIDINE

V. Yaroshevich, J. Gretskaya, V. Pashkovich

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
vikajaroschewich@gmai.com

This paper presents the data on the synthesis of dialdehyde and trialcohol derivatives of uridine and adenosine from the corresponding natural ribonucleosides uridine and adenosine.

Keywords: adenosine, uridine, seco-nucleoside, synthesis, biological activity.

The prerequisite for the synthesis of dialdehyde and trialcohol derivatives of the nature nucleosides were the data about the different type of biological activity for some seco-nucleosides, including antitumor activity [1, 2]. For example, cytidine dialdehyde inhibited the growth of leukemia L1210 cells in culture at a 50 % inhibitory concentration of 3.5×10−5 M and, when administered i.p. at 200 mg/kg daily for 5 days, increased the mean survival of L1210 tumor-bearing mice by up to 171 % [1]. Inosine dialdehyde inhibited the proliferation of various tumor cell lines (Novikoff rat hepatoma, mouse L-cells and P388 mouse leukemia and Chinese hamster ovary cells) in suspension culture in a concentration-dependent manner.

With the aim of further study of biological activity, some of the seco-derivatives of adenosine and uridine have been synthesized. Seco-derivatives of adenosine and uridine **3-6** were prepared from the adenosine **1** and uridine **2** according the scheme presented on the figure below.

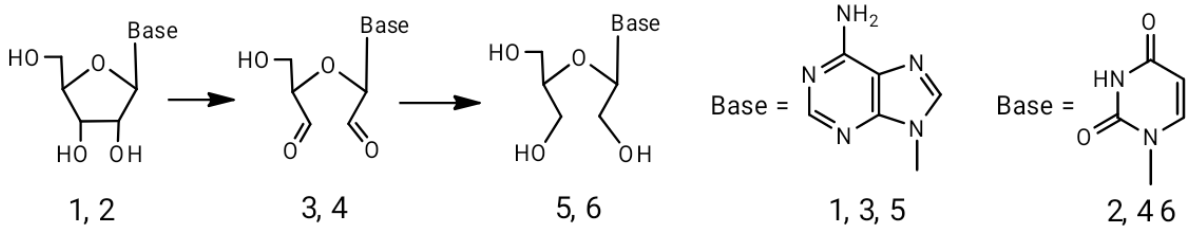


Fig. 1 – Scheme of the synthesis of seco-derivatives of adenosine and uridine

The course of the reaction and the content of the starting compounds and the products of the reaction were monitored using thin-layer chromatography on Kieselgel 60 F254 plates (Merck, Germany) in the solvent system: chloroform/methanol (4: 1 v/v). The compounds were visualized on the plates by viewing them in ultraviolet light. Nucleoside-dialdehydes **3** and **4** were synthesized by the treatment of the water solutions of adenosine or uridine with anion exchange resin Dowex 1x2 (100–200 mesh) in IO_4^- form. Compounds **3** and **4** were isolated as an amorphous powder in 60–70 % yield. For the preparation of trialcohols **5** and **6** dialdehydes **3,4** were dissolved in water and $NaBH_4$ was added under stirring. The reaction mixture was stirred for 1 hour, neutralized by adding of HCl solution, evaporated to a small volume and left in the refrigerator for 18–20 hours. The precipitate of NaCl was filtered off and washed with alcohol. The filtrate was evaporated to dryness, and the residue was treated with ethyl alcohol. The amorphous precipitate was filtered off, dried at room temperature on air and then in vacuum until constant weight. The yield of isolated trialcohols was 30–50 %.

BIBLIOGRAPHY

1. *Kinahan, J. J.* Antitumor Activity of Cytidine Dialdehyde and Its Effects on Nucleotide and Nucleic Acid Synthesis / J. J. Kinahan [et al.] // Cancer Res. – 1980. – Vol. 40. – P. 598–603.

2. *Ефремова, А. С.* Избирательное токсическое действие диальдегидных производных пиримидиновых нуклеозидов на опухолевые клетки человека / А. С. Ефремова [и др.] // Биомед. Химия. – 2015. – Т. 61, вып. 4. – С. 497–502.

THE INFLUENCE OF THE URBAN ENVIRONMENT ON THE DIAGNOSIS ON THE OF MALE AND FEMALE INFERTILITY IN THE POPULATION OF THE REPUBLIC OF BELARUS

M. Yaskevich, P. Kirvel

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus

The article examines the influence of the urban environment on the diagnosis of female infertility in the population of the Republic of Belarus. The object of the research is married couples diagnosed with infertility. The aim of the work is to study the factors and problems of male and female infertility in a married couple. To analyze the main modern method of infertility treatment – In Vitro Fertilization.

Keywords: infertility, in vitro fertilization, world health organization, tubal and peritoneal infertility, cervical factor, infection.

One of the most important and relevant aspects of family planning is infertility treatment, which makes it possible to have the desired children. It is no coincidence that the WHO international program "Health for All by the Year 2000" pays great attention to the regulation of fertility and the creation of conditions for the reproduction of healthy offspring – a special WHO program for human reproduction has been created.

According to statistics from the Ministry of Health of the Republic of Belarus, in 2019, infertility was registered in 11 thousand 275 women over the age of 18, for the first time a diagnosis was made in 3 thousand 694 women.

According to WHO (1986), a marriage is considered sterile if a woman does not become pregnant for one year during regular sexual activity without the use of any means of contraception, provided that the spouses are of childbearing age. WHO data indicate that infertile marriage has a greater impact on demographic indicators than miscarriage and perinatal pathology combined.

In recent years, there has been a trend towards an increase in the frequency of infertile marriages. The reasons are quite diverse. Along with the presence of a genetic determinism of a number of endocrine disorders leading to infertility, social factors and features of reproductive behavior play an increasing role - early onset of sexual activity, the presence of several sexual partners, and the lack of contraception. All of these factors can lead

to infection, the development of inflammatory diseases of the pelvic organs and, ultimately, to tubal or peritoneal infertility.

According to modern concepts, the reproductive system of the male body produces sperm in the testicles, the accessory glands provide an environment - seminal fluid, in which sperm can be delivered to the genital tract of a woman without injury. Nature has set more complex tasks for the reproductive function of the female body: in addition to the production of an egg, this system provides conditions for the advancement of sperm to the egg. At the same time, a careful biological selection of healthy, viable and most fertile sperm takes place in all parts of the genital tract. In addition, conditions must be created in the woman's genital tract for fertilization, transport of a fertilized egg to the uterus and its implantation in the uterus, fetal development and childbirth.

In this work, the main modern method of infertility treatment, In Vitro Fertilization, was studied and analyzed.

Indications for IVF:

Female infertility:

– absolute tubal infertility (absence of fallopian tubes or their obstruction);

– infertility due to endometriosis (with unsuccessful drug therapy);

– endocrine infertility (with the failure of hormone therapy),

– infertility of unknown etiology;

– infertility due to the cervical factor (with the failure of treatment by intrauterine insemination);

BIBLIOGRAPHY

1. *Kozhukhov M.A.* The influence of environmental and population-demographic factors on the reproductive health of women: Author's abstract. dis. ... Cand. medical sciences: 14.00.33 / Kursk state. honey. un-t. – M., 2002 . – 326 p.

2. *Kulakov V. I.* Treatment of female and male infertility // Help. reproductive. technologies.- M., 2005. – 345 p.

STATISTICAL ANALYSIS OF THE DATA OF REGISTRATION OF CONGENITAL DEVELOPMENTAL FAULTS

A. Yatskov, A. Ershova-Pavlova, N. Kokorina

Belarusian State University, ISEI BSU,
Republican scientific and practical center "Mother and Child",
Minsk, Republic of Belarus
artemjackov@gmail.com

The aim of this work is the analysis of the structure of the prevention of congenital malformations strictly registered in the city of Minsk throughout 2016.

Keywords: Congenital malformation, register systems, developmental anomalies.

The information base of the Belarusian register of congenital malformations creates the necessary prerequisites for studying many aspects of impaired embryonic development, including the causes of congenital malformations.

The system of the Belarusian register of congenital malformations allows obtaining information about all cases of congenital malformations in individual regions and the republic as a whole and their dynamics over the years of observation. The database for monitoring malformations allows you to study the etiology of malformations by collecting and analyzing information about the impact of teratogenic, endogenous and environmental factors on the body of a pregnant woman and assessing the contribution of preventive measures to reducing the population frequency and fertility of children with birth defects, more than 600 pregnancies are terminated annually in the republic. in connection with the identification of severe fetal malformations.

Empirically, the principle of organizing the work of the system of registers of congenital malformations was established, namely: collecting, recording and analyzing data on cases of detecting developmental anomalies in the fetus in the prenatal period and in newborns.

The information of medical records of 222 married couples who underwent examination on the basis of the Republican Scientific and Practical Center “Mother and Child” in 2016 in the city of Minsk was studied and statistically processed, it was established:

- The highest birth rate of children with congenital malformations was noted at the optimal childbearing age from 20 to 35 years (50.45 %). The lowest birth rate was in the age group of mothers under 20 years old – (1.801 %).
- In 13.95 % of cases, there was a complicated gynecological and obstetric anamnesis due to chronic diseases of the mother and diseases transferred during pregnancy.
- When analyzing the outcomes of pregnancies with congenital malformations of strict accounting, it was found that live births accounted for 42, 65 %; stillborn – 1.35 %; aborted – 56 %.
- In the study of the frequency of occurrence of congenital malformations of strict accounting, it was revealed that the most common pathology is Down's syndrome (33.3 %). The most rare pathology is atresia of the large intestine (0.45 %), esophagus (0.45 %), as well as anomalies of the sex chromosomes of the male phenotype (0.45 %).
- In children with multiple malformations, when analyzing the karyotype, Down's syndrome was also most often encountered – 36 %.
- The most rare pathology is atresia of the large intestine (0.45 %), esophagus (0.45 %), as well as anomalies of the sex chromosomes of the male phenotype.
- The indicator of the effectiveness of prenatal diagnostics of congenital malformations of strict accounting in the course of calculations was 56 %, which indicates a high dynamics of improvement of methods of prenatal diagnostics.
- The percentage of abortions in the total number of pregnancy outcomes in the study sample was 56 %.
- Down syndrome was the most common diagnosis among aborted fetuses. Thus, the number of cases of Down syndrome interrupted for gene indications was 72.97 % (54 cases) in a separate group and 24.32 % in the whole sample (125 cases).

In the course of the study, it was found that the analysis of the monitoring data of congenital malformations in the Republic of Belarus made it possible to determine the prevalence and population frequencies of congenital malformations for 2016. and to evaluate the effectiveness of prenatal diagnostics in the city of Minsk.

BIBLIOGRAPHY

1. International Statistical Classification of Diseases and Related Health Problems 10th Revision/ World health organization. — https://icd.who.int/browse10/2019/en. 2019.

2. *Кокорина, Н. В*. Тератогенез: учеб-метод. пособие / Н. В. Кокорина, Л. В. Грик, Е. Н. Альферович. – Минск: ИВЦ Минфина, 2018. – 64 с. – Библиогр.: 45–59 с.

DETERMINATION OF THE MOLECULAR BIOLOGICAL PROFILE AMONG PATIENTS WITH ESTABLISHED BREAST CANCER CARCINOMA AND HORMONE EXCRETION IMBALANCE

K. Yurchenkova, A. Prokopuk, E. Shpadaruk, R. Smolyakova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
karinayurchenkova@gmail.com

During the analysis of the relationship between the hormonal status of patients of various reproductive periods, it was found that among patients in the preserved ovarian-menstrual period with elevated levels of estradiol and prolactin, a luminal B (HER-2-negative) subtype was detected. Among postmenopausal patients, an increased concentration of estradiol, progesterone and prolactin is associated with the luminal A subtype, and an increased content of estradiol and progesterone is associated with the triplet-negative subtype.

Keywords: breast cancer, hormones, radioimmune analysis, immunohistochemical method, estrogen and progesterone receptors, Ki-67, HER-2/neu.

Breast cancer is a heterogeneous disease, which is one of the main problems of clinical oncology. The increase in breast cancer according to the Belarusian Cancer Registry is 1.2–1.5 % every year and ranks 1st among oncological pathology among women [1]. The risk of developing radiation-induced breast cancer increased among women exposed to radiation during hormonal changes of the body (menarche, menopause, pregnancy and lactation). An increase in the frequency of general oncological morbidity and the prevalence of breast cancer was recorded 20-30 years after irradiation among women [2]. The success of breast cancer treatment largely depends on its molecular biological subtype and hormonal status, determined in the tumor tissue and peripheral blood of patients.

The object of the study was clinical data, tumor tissue and peripheral blood of 42 patients suffering from breast cancer and receiving special treatment at the State Research Center of Oncology and Medical Radiology named after N.N. Alexandrov. The average age of the patients was 53.5±13.8 years. The entire contingent of patients was divided into two subgroups according to the reproductive status of women. The first subgroup included 18 patients with clinically established preserved ovarian-menstrual function, the second subgroup of the study included 24 patients in the established postmenopausal period. The levels of expression of tissue antigens (estrogen receptors, progesterone receptors, Her-2/neu, Ki-67) among patients suffering from breast cancer were determined by immunohistochemical method using DAKO kits (Denmark), with an imaging system (EnVision+), and quantitative determination of blood concentrations of hormones (estradiol, progesterone and prolactin) by radioimmune method on the analyzer "470-0050 WIZARD", PerkinElmer (USA), using reagent kits "RIA-ESTADIOL-ST", "RIA-PROGESTERONE-ST", "IRMA-PROLACTIN-ST" (Republic of Belarus).

In the course of the study, it was found that among patients with preserved ovarian-menstrual function, the estradiol content was in 12.5 % of cases higher than normal, in 37.5 % lower. Increased and decreased progesterone excretion was observed in an equal ratio of 25 % of cases. In the first subgroup, 25 % of patients had an increased concentration of prolactin. Among postmenopausal patients, the levels of estradiol and progesterone excretion were increased in 100 % of cases. In the study of prolactin levels in the second subgroup, the majority of cases (64 %) were patients with an increased content of the studied indicator [3].

Using the immunohistochemical method, the molecular biological profiles of breast cancer were determined. Luminal A subtype was diagnosed among 10 patients (22 %), luminal B (HER-2/neu negative) subtype was detected among 6 patients (16 %), luminal B (HER-2/neu-positive) subtype was detected among 13 patients (31 %), Her-2/neu-positive (non-luminal) subtype was diagnosed among 5 patients (11 %), and triplet-negative subtype was detected among 8 patients (22 %) [4].

As a result of the work, a joint analysis of data related to the concentration of hormones and the molecular biological prognostically significant profile of patients with breast cancer was carried out.

Thus, among postmenopausal patients with elevated blood levels of estradiol, progesterone and prolactin, luminal A subtype was detected in 100 % of cases, characterized by the most favorable course of the disease. With a joint increase in estradiol and progesterone, a luminal B (HER2-positive) subtype was detected in 100 % of cases. Elevated blood levels of estradiol, progesterone and prolactin in 100 % of cases are associated with the luminal B (HER2-negative) subtype. A reduced estradiol content in the blood serum in 33 % of patients, as well as a reduced progesterone level in 83 % of patients, in 100 % of cases an increased prolactin content, is associated with the Her-2/neu-positive subtype. The combined elevated content of estradiol and progesterone in the blood was detected in 100 % of cases with a triplet-negative subtype, which is characterized by an unfavorable prognosis and aggressive course of the disease.

Among patients with preserved ovarian-menstrual function, increased estradiol content in 37.5 % of cases is associated with the luminal B (HER-2-positive) subtype. The combined elevated content of estradiol, progesterone and prolactin in 50 % of patients is associated with the luminal B (HER-2-negative) subtype, the determination of which is necessary for individualized treatment tactics Elevated and decreased estradiol content in the blood serum of patients of this group was detected in an equal ratio of 33.3 % of cases with a triplet-negative subtype.

Thus, the study of the complex characteristics of the concentration of hormones in the blood with molecular biological subtypes helps in predicting the course of the disease and allows pathogenetically justified selection of a personalized volume of antitumor therapy among this category of patients.

BIBLIOGRAPHY

1. Новые показатели функционального состояния HSP27 в опухолевых клетках рака молочной железы при различных вариантах Her2/neu – статуса / Е. В. Кайгородова [и др.] // Сибирский онкологический журнал. – 2015. – Т. 1. – С. 38–44.

2. Молекулярно-генетические и радиационные факторы риска развития рака молочной железы (обзор литературы) / Б.А. Апсаликов [и др.] // Вестник. – 2016. – Т.1. – С.215–219.

3. *Юрченкова, К. В*. Оценка агрессивного потенциала карцином молочной железы у пациенток различного репродуктивного периода / К. В. Юрченкова, Р. М. Смолякова, Е. М. Шпадарук, И. Н. Андреева // Журнал Белорусского государственного университета. Экология. – 2020. – № 3 – С. 82–89.

4. *Прокопук, А. И.* Молекулярно-генетическая характеристика карцином молочной железы / А. И. Прокопук, Р. М. Смолякова, Е. М. Шпадарук, И. Н. Андреева // Сахаровские чтения 2020 года: экологические проблемы XXI-го века. – Минск. – 2020. – С. 252–255.

BIOLOGICAL CHARACTERISTICS OF FLUDARABINE

A. Yurlevich, D. Novik, M. Lubchenko, S. Shahab

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
ann.yurlevich@gmail.com
siyamakshahab@mail.ru

With the help of the Internet resource Molinspiration, the calculation of the main biological parameters of fludarabine has been performed. The fludarabine molecule was evaluated according to Lipinski's rule. It was found that drugs synthesized on the basis of fludarabine have high biological activity.

Keywords: fludarabine, quantum-chemical modelling, biological activity, logP, TPSA.

Fludarabine is a chemotherapy drug used in the treatment of a wide range of neoplastic diseases [1]. Fludarabine is more resistant to deamination, therefore it is widely used as a drug in the treatment of B-cell chronic lymphocytic leukemia (CLL), acute myeloid leukemia (AML) and some types of non-Hodgkin's lymphomas (NHL) [2].

To assess the bioavailability of medicinal compounds of the form, it is important to know about the ability of a substance to pass through the cell membrane, the method of signal transmission and inhibition. This information in an accessible form provides biological parameters such as lipophilicity index, TPSA, and the volume and molecular weight of the molecule.

Lipophilicity (LogP) is one of the components of Lipinski's rule – it is a rule of thumb that evaluates the bioavailability of a chemical compound with certain pharmacological parameters and its ability to be a drug. The logP value of a molecule, over 5 units, indicates possible difficulties in the passage of a substance into a cell. In the case of fludarabine, it is -1.04, which indicates the moderate activity of the molecule and its ease of penetration through the membrane.

The area of molecular polar atoms (TPSA) is a measure associated with the passive transport of a molecule across a membrane. It is often used to predict the ability of a substance to penetrate cells or during intestinal absorption [3]. The TPSA of a molecule is calculated as the sum of the surface overall polar atoms or molecules, that is, oxygen and nitrogen. The TPSA value, which is up to 140 units, indicates the normal penetration of the substance into the cell. The TPSA of fludarabine is 186.06 units, which indicates a possible retention of the substance when it passes through the membrane.

The parameters of the volume and molecular weight of a molecule indicate its magnitude. Molecular weights up to 500 g/mol are considered the most optimal for membrane penetration. The molecular weight of the studied molecule is 365.212 g/mol, which means that fludarabine is quite mobile.

BIBLIOGRAPHY

1. *Yurlevich, A.* Quantum-chemical modeling and physico-chemical properties of fludarabine / A. Yurlevich [et al.]. // Actual environmental problems. – 2020. – P. 121–122.

2. *Holzer, S.* Structural basis for inhibition of human primase by arabinofuranosyl nucleoside analogues fludarabine and vidarabine / S. Holzer [et al.]// ACS Chem. Biol. – 2019. – № 21. – P. 1904–1912.3. Lykov PV Quantum-chemical calculation of dipole moments and ionization potentials of triglycerides / Lykov PV and Dudkin VI. // Bulletin of Altai State University, vol. 1, no. 1 (81), 2014, P. 215–217.

3. *Urazaeva, Ya.M.* Determination of lipophilicity and establishment of correlations "structure - biological activity" in a series of some derivatives of pyrazolines / Ya.M. Urazaeva; FSBEI VO TSU. - Togliatti, 2016. – P. 10–15.

FREQUENCY OF OCCURRENCE OF THE OPEN DUCTUS ARTERIOSUS IN NEWBORNS OF THE CITY OF MINSK

E. Zheleznaya[1], **N. Kokorina**[1], **A. Ershova-Pavlova**[2]

[1]*Belarusian State University, ISEI BSU,*
Minsk, Republic of Belarus
helenagel2017@gmail.com
[2]*Republican Scientific and Practical Center "Mother and Child",*
Minsk, Republic of Belarus

The article analyzes statistical documentation on the frequency of occurrence of an open ductus arteriosus in the city of Minsk for the period 2016–2020.

Keywords: open ductus arteriosus, pulmonary trunk, aorta, newborns.

Heart defects are persistent anatomical disorders of the valvular apparatus and the main vessels of the heart, leading to a violation of hemodynamics. Congenital heart defects are the result of a violation of the formation of the heart in embryogenesis [1].

An open ductus arteriosus is normally present in the fetus and closes shortly after birth, turning into an arterial ligament. It is believed that normally the open ductus arteriosus should close within the first two weeks of life [2].

An open ductus arteriosus in the postnatal period is a congenital heart defect, which is characterized by the presence of constant communication between two main blood vessels coming from the heart: the pulmonary trunk and the descending aorta [2].

Risk factors for the development of an open ductus arteriosus are:

1. *Premature birth.* Open ductus arteriosus occurs in 80 % of deeply premature babies.

2. *Hereditary predisposition.* Open ductus arteriosus is combined with other genetic diseases (Down syndrome).

3. *Intrauterine infection during pregnancy.* The cause of the development of congenital heart defects and, in particular, an open ductus arteriosus may be transferred rubella in the early gestational period [3].

The frequency of occurrence of an open ductus arteriosus in newborns in the Republic of Belarus is about 10% of all heart defects. With a complicated course of the open ductus arteriosus, it is possible to attach pulmonary hypertension, heart failure, infectious endocarditis, hemodynamic disorders, pulmonary bleeding, renal failure, which can lead to an unfavorable outcome.

Postnatal adaptation in children with an open ductus arteriosus is complicated by damage to other organs and systems: necrotic enterocolitis, renal insufficiency, sensory system disorders, mental retardation, bronchopulmonary dysplasia [1].

Given the severe concomitant pathology with an open ductus arteriosus, the study of the causes of this defect is an urgent problem.

In total, 108 cases of children with an open ductus arteriosus were recorded in the city of Minsk during the period 2016–2020. In 2016, 29 cases of open ductus arteriosus were registered, which accounted for 0.13 % of the total number of children born, in 2017 – 25 (0.13 %), in 2018 – 21 (0.12 %), in 2019 – 21 (0.12 %), in 2020 – 12 (0.08 %). Of these, multiple heart defects in combination with an open ductus arteriosus occurred in 89.8 % of cases; isolated open ductus arteriosus – in 10.19 % of cases.

The frequency of occurrence of an open ductus arteriosus in the structure of multiple congenital heart defects is 7 %; in the structure of decompensated congenital heart defects, the frequency of an open ductus arteriosus is 4 %.

BIBLIOGRAPHY

1. *Козлов, Ю. А.* Хирургические болезни детей. Национальное руководство / Ю. А. Козлов, В. А. Новожилов, А. Ю. Разумовский. – Москва: ГЭОТАР-Медиа, 2019. – С. 203–205.

2. *Калашникова, Е. А.* Открытый артериальный проток: особенности ранней неонатальной, постнатальной диагностики, клинической манифестации, лечение и прогноз / Е. А. Калашникова, Н. А. Никитина // Здоровье ребёнка. – 2017.

3. *Deshpande, P.* Patent ductus arteriosus: The physiology of transition / P. Deshpande [et al.] / Semin Fetal Neonatal Med. – 2018, Aug. – N. 4. – P. 225–231.

ANALYSIS OF PANCREAS CANCER INCIDENCE IN MINSK AND THE REPUBLIC OF BELARUS IN THE PERIOD FROM 2000 TO 2018

L. Zhuk[1,2], Y. Malinovskaya[1], Y. Zhuk[3]

[1]*Belarusian State University, ISEI BSU*

[2]*Minsk City Clinical Oncologic Center*

[3]*Academy of Public Administration under the aegis of the President of the Republic of Belarus*

Minsk, Republic of Belarus

liudmila.zhk84@gmail.com

The paper presents the incidence rates of patients with pancreatic cancer for 2000–2017, taking into account the age, as well as the prevalence of the process: local stages; the presence of regional or distant metastasis. The analysis of the incidence of pancreatic cancer in the Republic of Belarus for 2006–2018 was carried out.

Keywords: pancreatic cancer, morbidity analysis.

Malignant tumors of the gastrointestinal tract, including neoplasms of the hepatopancreatobiliary zone, are a complex, urgent and unsolved problem of modern oncology [2]. Malignant tumors of the pancreas are the fourth leading cause of cancer death, and the incidence of these tumors continues to rise. The immediate cause of pancreatic cancer has not yet been established, and in 40 % of cases the disease is sporadic [1]. The survival rate for patients with these tumors is extremely low, with an overall 5-year survival rate of less than 5%. Most patients, over 90%, die within a year of diagnosis. This circumstance is due to the fact that pancreatic cancer is diagnosed after the appearance of clinical signs in the advanced (III-IV) stage.

Materials and research methods. The material of the study was the data on all cases of pancreatic cancer in Minsk based on the materials of the Cancer Register of the Republic of Belarus, confirmed by the cytological method and covers the period from 2000 to 2017 (18 years). For the analysis of the incidence of pancreatic cancer in the Republic of Belarus, information was obtained from the annual specialized collection "Statistics of oncological diseases in the Republic of Belarus" for the specified period.

Research results. The analyzed cohort of patients with pancreatic cancer (PCa) in Minsk for 2000–2017 is 1292 patients (691 men and 601 women). For a detailed study, the sample size of patients with pancreatic cancer is based on a confirmed cytological method (the main method for confirming the diagnosis) and amounted to 393 cases (203 men and 190 women).

In our study, an analysis of the age factor was carried out: the patients in the study were divided into 4 age groups (age up to 30 years old, 30–49 years old, 50–69 years old and over 70 years old) according to the prevalence of the process (TNM classification). The results are shown in Figure 1.

When studying patients with pancreatic cancer according to the prevalence of the process, it turned out that the overwhelming majority of patients were first registered with already advanced forms of the disease – with stages III and IV (more than 77 % of cases). According to the study, localized stages were diagnosed in 22.9 %, regional metastases – in 17.6 %, distant metastases – in 59.5 %.

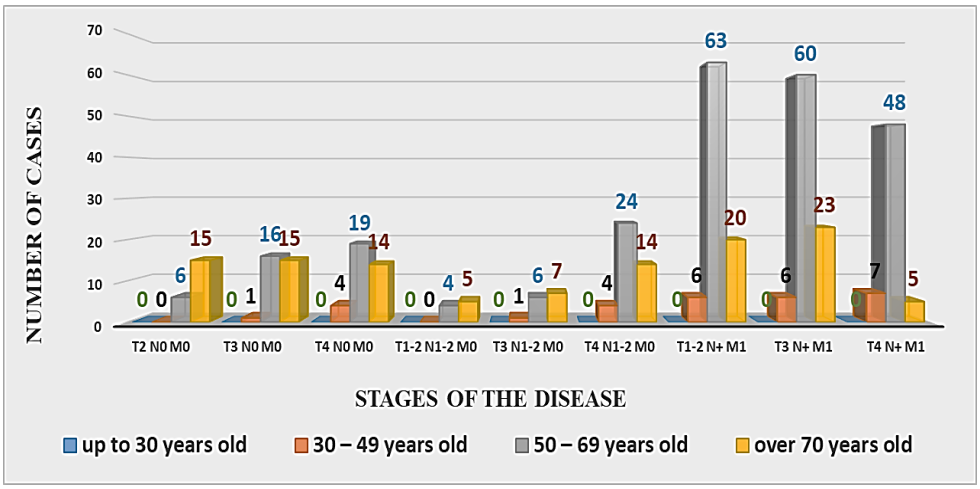


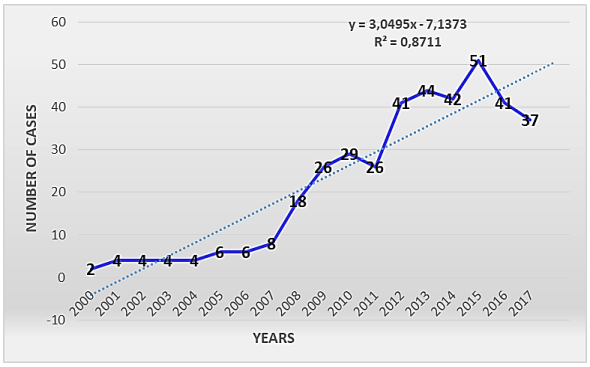
Fig. 1 – Distribution of patients according to the age category and the established stage of the disease (n = 393)

The presented data indicate that the peak incidence of pancreatic cancer occurs at the age of 50–70 years and $T_{1\text{-}4}N_{+}M_1$ stage, according to the TNM system, especially in the $T_4N_{+}M_1$ group.

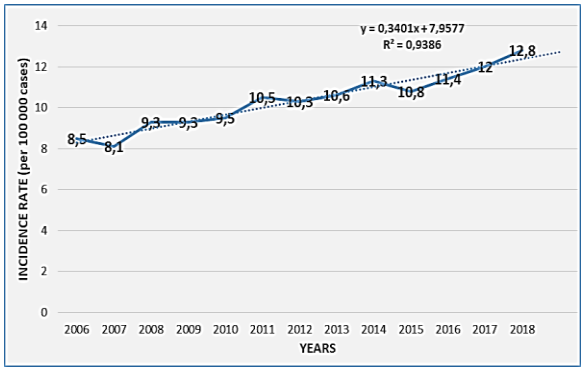
The incidence increased more than 4.3 times in Minsk over the period 2000–2017, and more than 1.5 times in Belarus for 2006–2018 (Figure 2). Reliability level (95.0 %) = 0.8262.

This is due to the demographic aging of the nation, which is manifested by an increase in the proportion of older people, i.e. those age groups most at risk of cancer.

Despite the development of modern technologies, the diagnosis of malignant tumors of the pancreas is a difficult and unsolved problem, which is confirmed by the low proportion of stages I and II: 5.3 % and 17.5 %, respectively.



(A)



(B)

Fig. 2 – Dynamics of the incidence of pancreatic cancer:
in Minsk for 2000-2017 (A); in the Republic of Belarus for 2006–2018 (B)

Conclusion. In recent decades, significant advances have been made in the diagnosis and treatment of pancreatic cancer. Aspiration biopsy of the lesion of the pancreas has become the standard approach for diagnosis in many healthcare settings.

In the period from 2000 to 2017 in Minsk there was a significant increase in morbidity, more than 4.3 times. An increase in the incidence of pancreatic cancer can be traced not only in the territory of Minsk, but also throughout the territory of the Republic of Belarus as a whole (according to the results of our study, the incidence increased by 1.5 times over in the period from 2006 to 2018).

BIBLIOGRAPHY

1. *Borazanci Erkut and Haag Susan*. Hereditary Pancreatic Cancer / Erkut Borazanci and Susan Haag // Intech / 2017. – P. 121–140

2. *Шмак, А. И.* Эпидемиологические особенности злокачественных новообразований гепатопанкреатобилиарной зоны в мире и в Республике Беларусь / Шмак А. И., Ерзинкян Ф. В., Мартынов Е. П., Котов А. А., Ерошенко А. В. // Вестник ВГМУ. – 2018. – Том 17, № 3. – С. 67–75.

SECTION 3

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY (BIOMONITORING, BIOINDICATION, BIOREMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGEMENT AND AUDIT. INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

LAND DEGRADATION IS A SERIOUS ECONOMIC AND ENVIRONMENTAL PROBLEM

M. Abdurakhmanova

National University of Uzbekistan named after Mirzo Ulugbek (NUUz)
Tashkent, Republic of Uzbekistan
muqaddas_01@mail.ru

Soil erosion, desertification and water scarcity cause many problems. Therefore, land degradation, which is currently a global problem, should be considered a risk factor, especially when the ability of people to use land to store food and water is gradually decreasing or other vital ecosystem services are negatively impacted.

Keywords: Land resources, land degradation, soil erosion, efficiency in the agricultural sector, agriculture.

Land degradation is a complex phenomenon, usually associated with partial or complete loss of fertility of land, soil, vegetation, biomass, biodiversity, ecosystem services and environmental sustainability. There are interrelated factors that lead to land degradation. These are biophysical factors that determine land use systems, institutional factors that govern land use policies, and socio-economic factors that affect demand and land management.

Soil degradation is especially common in eastern Sahara, which accounts for 20–50 percent of the land. [7] Soil degradation is common in Asia and Latin America, as well as in other parts of the world. [6]

The annual economic damage caused by the degradation of irrigated lands in Uzbekistan is $ 252 million, pastures – $ 91 million, transportation of irrational irrigation water – $ 118.5 million. The components of this damage are insufficient nitrogen enrichment of the soil, insufficient productivity as a result of the removal of poor quality soils from the economic circulation and a decrease in the nutritional potential of rangelands. A serious negative factor in land use is the increase in the area of irrigation and collector networks, along with a decrease in the efficiency of the use of irrigated lands.

The importance of the degradation of irrigated land is a real threat to agricultural growth and the well-being of the population. According to the World Bank and the Global Environment Facility (GEF WEMP), the total cost of rehabilitating the national irrigation and drainage infrastructure is between $ 23 billion and $ 31 billion. The determinants of the primary land use system usually include climate, vegetation, topography and water availability. As an economic factor, it affects the timing and methods of making changes, including management decisions.

Institutional factors are often historically determined by perennial cultural norms as well as political and economic decisions. Ownership and property rights play an important role in understanding the influence of institutional factors [4].

In general, land use that leads to land degradation and loss of land-related functions is influenced by interacting elements at many local and global levels [5].

An estimated 2.6 billion people are affected by land degradation and desertification in over 100 countries, affecting more than 33 percent of the earth's surface. Currently, about 73 percent of arid pastures are degraded. Reaches Africa. At the same time, the efficiency of land use in Uzbekistan is still low. According to A.K. Bazarov's estimates, the annual economic losses due to irrational land use amount to $ 1.6 billion.

This means that increasing agricultural production in recent years, especially increasing yields per hectare of land, is an important challenge. Until recent years, there has been an inextricable link between land reclamation, the ecological state and the level of soil fertility, especially the irrigated soils of the republic, and the yield obtained. It can be seen from the above data that it is impossible to obtain high-quality agricultural crops on degraded soils with unhealthy reclamation and ecological conditions.

However, due to the lack of differentiated farming systems that take into account soil and climatic conditions, types of crops, as well as due to the lack of application of agrotechnical measures, in the coming years, there is a decrease in soil fertility and crop quality due to negative degradation processes.

Output Based on the foregoing, we can single out the following economic aspects as the most important, priority aspects of land use: firstly, in the process of efficient use of land, an economic product is produced that is necessary for the sustainable existence of society; secondly, the economic product produced in the process of economic aspects of land use is the material basis for the processing of land resources (soil fertility);

thirdly, the priority of the economic aspect of land use requires taking into account when developing programs for the socio-economic development of countries and regions, the distribution of land by sectors of society, sectors of the economy, especially when improving the composition of rural lands. fourth, the introduction of a differentiated system of farming, fully taking into account soil and climatic conditions, types of crops grown; fifth, it requires the introduction of biofertilizers and resource-saving technologies in order to prevent its negative impact on degraded irrigated arable land.

BIBLIOGRAPHY

1. Decree of the President of the Republic of Uzbekistan dated April 19, 2013 "On measures to improve the reclamation of irrigated lands and rational use of water resources for 2013–2017".

2. Strategy of actions for further development of the Republic of Uzbekistan // [Electronic resource]. Achievement mode // www.lex.uz

3. UZRTMD, National Report for 2017. pp. 56–63.

4. Committee of the Department of Economics, National Report 2020.6-8 pages). Land resources: World overview First edition of the UNCCD, 2017 Secretariat of the United Nations Convention to Combat Desertification National Unity Square 1 53113 Bonn, Germany www.unccd.int [8].

5. *Гейст, Х. Дж. и Ламбин, Э. Ф.* 2002. Непосредственные причины и основные движущие силы вырубки тропических лесов. Биологические науки: 143–150 [9].

6. Report of the Secretary-General on the chapter "Land resources" of the Agenda for the 21st century of the Commission on Sustainable Development (CSD8, UN, New York, 2000), Agenda of UNSED21, Rio de Janeiro, 1992 and the UNCCD, Paris, 1994. [11].

7. *K. Ya. Ji.* Degradation of land resources in Central Asia. January 2008 8–9 [13].

EFFECTS OF DRYING PROCESS ON BIOLOGICAL PROPERTIES OF SOILS

T. Abdurakhmonov, M. Karimboeva

National University Uzbekistan (NUUz)
Tashkent, Republic of Uzbekistan
karimboyevamaftuna2@gmail.com

Environmental change has caused many problems. For example, drought, desertification, salinization, pollution and other problems are now a serious threat to agriculture and human health. As a result of global warming, the rate of evaporation on the Earth's surface has increased. Lack of moisture has become a limiting factor in plant growth. This is accelerating desertification.

Keywords: Soil microbiome, desertification, desert rehabilitation, industrial revolution, rhizosphere organisms, biological crust, plantation, industrial revolution, microbial community.

The region’s increasing drought is a global threat that has a direct impact on agriculture and crop production. Drought and semi-arid zones cover about 30 % of the Earth's surface. (Schlaepfer et al., 2017; Canter, 2018). Deserts cover about 19 % of the Earth’s surface, and their microbial ecology has not been fully studied. Climate change, decrease in precipitation, increase in temperature and the process of drying are one of the main factors affecting the composition of soil microbial communities, as well as crop and crop quality. The study and forecasting of the impact of climate change on soil microbiomas and the ecosystem processes they represent has become one of the most pressing issues facing the planet[2].

The industrial revolution and the acceleration of fuel production have led to an increase in CO^2 in the atmosphere and, as a result, global warming and a decrease in precipitation (Interstate Panel on Climate Change, 2014). Increases in CO^2 have a significant impact on terrestrial ecosystems, changing the dynamics of organic carbon by stimulating the carbon cycle and photosynthesis in the atmosphere (Schimel et al. 2000). High CO^2 concentrations slow down the decomposition rate of microorganisms (Gougoulias et al. 2014; Cha et al. 2017). In addition, a number of other biotic and abiotic factors also have a direct or indirect effect of CO^2 on soil microorganisms.

Rising temperatures reduce the amount of moisture in the soil and limit the spread of microorganisms in it (Carson et al. 2010). Rising ambient temperatures lead to soil warming and changes in the rhizosphere microbiome (White et al. 2010). Climate change models predict a large increase in temperature and atmospheric vapor pressure deficits in the Mediterranean region, accompanied by a decrease in the amount and frequency of precipitation (Guiot and Cramer, 2016). Planned climate drought trends increase heat and drought stress for plants and their symbiotic mycorrhizal fungi on many continents, leading to reduced plant survival and surface productivity, which also disrupts underground processes. 'may change (León-Sánchez et al., 2018, 2020)[1].

Drought areas are growing from year to year, but its microbiological diversity is not yet well defined. Soil microbiome regulates the biogeochemical cycle of macronutrients, micronutrients and other elements necessary for plant and animal life. The soil microbiome includes a community of interacting bacteria, fungi, viruses, protozoa, archaea (Jansson and Hofmockel 2020). The microbiome is an important component of the soil ecosystem because soil microorganisms are more involved in providing a source of nutrients in total biomass production than plants and animals (Bar-On et al., 2018). The interacting microbial communities of the soil microbiome regulate the circulation of micro- and macronutrients[3].

The development and changes in the properties of the soil layer are primarily associated with the recovery of plants and the permanence of plants. Restoration of plants promotes the development of the soil layer. The biological crust, in turn, develops with the age of the plantation. With the development of the biological crust, the properties of the soil improve. As the depth of the soil increases, the change in the properties of the topsoil decreases. Reforestation is one of the most successful measures to rehabilitate arid lands and improve the ecological environment in the sandy desert. The establishment of plantations promotes the development of the biological crust of the soil and improves the properties of the soil at a height of 0–5 cm under the crust in the sand dunes[3].

Rhizosphere organisms have a unique way of life because many factors can affect the shape of the microbiome. We all know that the use of interactions between soil microbes and plants is crucial for sustainable agriculture and ecosystems. Cross-linked microorganisms in communities of plant-associated microorganisms contribute to their plant species in a variety of ways. Numerous studies have shown that soil microbiome can provide significant benefits to the plant. However, different soil conditions (pH, temperature, oxygen, physicochemical and moisture), soil environment (drought, swampiness, toxicity and salinity of metals), plant species, genotype and agriculture operations can lead to different microbial composition and properties[4].

It has been found that the diversity of adapted microorganisms in arid and desert areas is very large and consists of microorganisms that can withstand severe environmental conditions. It is important to study and reproduce a microbiome community that is resistant to long-term abiotic influences, such as arid lands or water restriction and salt accumulation. By multiplying the identified microorganisms, it is possible to expand plant plantations in difficult sandy desert soils, to stop the migration of salt and sand.

BIBLIOGRAPHY

1. *Jose Ignacio Querejeta, Klaus Schlaeppi, Alvaro Lopez-Garcia et al.* “Lower relative abundance of ectomycorrhizal fungi under a warmer and drier climate is linked to enhanced soil organic matter decomposition”. Received: 23 April 2021. doi: 10.1111/nph.1766.

2. *Shu An, Cécile Couteau, Fan Luo, Julie Neveu, Michael S. Du Bow*. “Bacterial Diversity of Surface Sand Samples from the Gobi and Taklamaken Deserts”. : 22 August 2013. DOI 10.1007/s00248-013-0276-2.

3. *Wager Islam, Ali Noman, Hassan Naveed, Zhigun Huang Han Y.H. Chen*. “Role of environmental factors in shaping the soil microbiome”. Environmental Science and Pollution Research. 23 August 2020. DOI: 10.1007/s11356-020-10471-2.

4. *Ha-LinZhao, Yi-RuiGuo, Rui-Lian Zhou, Sam Drake*. The effects of plantation development on biological soil crust and topsoil properties in a desert in northern China. Geoderma.15 January 2011. https://doi.org/10.1016/j.geoderma.2010.10.005.

ECOLOGICAL, PHARMACOLOGICAL AND BIOCHEMICAL ASSESSMENT OF THE FRUITS OF CLOUDBERRY SQUAT (RUBUS CHAMAEMORUS L.) OF NORTHERN BELARUS

E. Akshevskaya, A. Kozorez

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
ewa.akshewska@gmail.com

The ecological, pharmaceutical and biochemical significance of cloudberry fruits are considered, and the reasons for the disappearance of the species from the territory of Belarus are explained. The study of the biochemical composition of the fruits of the cloudberry in its new habitats was carried out and all aspects of the significance of the species were revealed.

Keywords: low cloudberry, cloudberry fruit, climatic factors, biochemical composition of cloudberry, ecological and pharmacological significance of cloudberry.

The ecological, pharmaceutical and biochemical significance of cloudberry fruits, as well as the reasons for the disappearance of the species from the territory of our country, determine the relevance of this study. To solve this problem, a study of the biochemical composition of the fruits of the cloudberry in its new habitats was carried out and all the positive aspects of the significance of the species under study were revealed.

The object of the study was the cloudberry (*Rubus chamaemorus L.*) – one of the economically valuable rare relict species with a number of medicinal properties. The specified representative of the flora of our country is listed in the Red Book of Belarus as a species in need of protection (III category) in 1981.

Cloudberry fruits have a wide range of useful substances: they contain 3–6 % sugars (glucose and fructose), organic acids – citric and malic (0.8 %), vitamin C (30–200 mg), vitamin B (0.025 mg), PP (0.15 mg) and high content of carotene (provitamin A), in the content of which cloudberries are superior to carrots. In addition, cloudberry fruits contain anthocyanins, tannins and pectin substances, macro- and microelements (Mg, P, Fe, Co, etc.).

The biochemical composition of the species has been studied in detail in its natural habitat. It was found that the content of neutral lipids, ascorbic acid, vitamin K1 and pectin substances in cloudberry fruits in southern habitats is higher than in northern ones [1–4].

The roots and leaves of cloudberries are known to be used as a diuretic; infusion of cloudberry leaves – as an astringent, anti-inflammatory, hemostatic, blood-purifying and wound-healing agent. Cloudberries have antimicrobial, antispasmodic, diaphoretic, diuretic and antiscorbutic properties. Cloudberry juice has a strong bactericidal effect.

The reasons for the disappearance of this representative of the flora in our country are the violation of the sexual structure of the populations of the species (the predominance of males over females and their spatial division), as well as the influence of geoclimatic (damage to flowers by late spring frosts), biological (lack of the required number of pollinating insects) and phytocenotic factors. The natural habitat of the studied plant species is raised and transitional bogs, sphagnum pine forests adjacent to raised bogs, as well as open habitats with wild rosemary and blueberries.

The table shows the qualitative and quantitative characteristics of the cloudberry squat in its natural habitat – in the northern climatic zone of Russia, which can be interpreted for the territory of Belarus in connection with similar geoclimatic conditions.

Table

The chemical composition of the fruits of the cloudberry squat [4]

Sample number	Humidity, %	Neutral lipids *,%		Ascorbic acid, mg /%		Vitamin K1 *, mg/%		Pectin substances *,%	
		x	S(x)	x	S(x)	x	S(x)	x	S(x)
1	82	3,68	0,010	144,82	0,07	0,0751	0,0005	2,63	0,01
2	80	3,22	0,010	72,51	0,05	0,0703	0,0003	2,61	0,01
3	80	3,12	0,010	68,81	0,03	0,0738	0,0003	2,29	0,01
4	78	2,11	0,005	57,39	0,05	0,0645	0,0003	2,20	0,02
5	84	2,10	0,005	50,70	0,02	0,0631	0,0005	2,13	0,01

Note. * – content calculated on dry matter; S (x) – is the laboratory confidence standard deviation.

Therefore, based on the listed problems of the growth of the studied plant species, we can conclude that the most effective method for restoring cloudberries is to transplant its blocks (monoliths) outside its natural range in early spring, before the emergence of seedlings (introduction). Encouraging results in this direction were obtained by employees of the Institute of Forestry of the National Academy of Sciences of Belarus using cuttings of underground shoots (rhizomes) of cloudberries as planting material. Today, the most relevant, economically profitable and, most importantly, ecological method of preserving and spreading this species is precisely introduction.

Thus, passive forms of protection and targeted economic measures will help preserve the specified ecological and pharmaceutical significant species of the plant world of Belarus - squat cloudberry.

BIBLIOGRAPHY

1. *Suttie, J. W., Vitamin K,* In: Handbook of Lipid research: The fat-soluble vitamins (HF DeLuca, ed.), Plenum Press, 1978.

2. *Баранова, И. И., Смирнова, Л. М., Ершова, Г. Ф*. Биологически активные вещества дикорастущих ягод Южной Карелии // Тезисы докладов на Всесоюзном совещании «Изучение, заготовка и охрана лесных дикорастущих ягодников на территории европейской части СССР в связи с задачами освоения природных ресурсов нечерноземной зоны СССР». Петрозаводск, 1980. С. 15–16.

3. *Валуйских, О. Е, Тетерюк, Л. В*. Особенности структуры ценопопуляций Rubus chamaemorus L. в зонах тайги и тундры европейского Северо-Востока России // Известия Самарского научного центра Российской академии наук. 2010. Т.12. № 1(3). С. 652–656.

4. *Матистов, Н. В., Валуйских, О. Е., Ширшова, Т. И.* Химический состав и содержание микронутриентов в плодах морошки (*Rubus chamaemorus* L.) на европейском Северо-Востоке России // Известия Коми научного центра УРО РАН (биол. науки) – Сыктывкар – 2012 – с. 41–45.

ENVIRONMENTAL DIRECTION OF THE "A1" ENTERPRISE

M. Artemchuk[1], **V. Krasovsky**[1], **P. Krishchanovich**[2]

[1]*Belarusian State University, ISEI BSU*

[2]*A1 Main Office*

Minsk, Republic of Belarus

[1]*mikhail.artemchuk2002@list.ru, vikras@iseu.by;*

[2]*p.kryshchanovich@a1.by*

During training practice in 2021 on the Unitary Enterprise A1, was received information about ecological state of the enterprise and and its evolutionary development in this direction.

Keywords: A1, ESG principles, Energy Efficiency and Energy Saving, Waste Reduction.

A1 (Unitary Enterprise A1) is a telecommunications, ICT and content services provider in the Republic of Belarus. The company began its commercial activities on April 16, 1999, becoming the first mobile operator of the GSM standard in the country. Since November 2007, the company is part of A1 Telekom Austria Group, the European subsidiary of the multinational holding América Móvil, one of the world's largest wireless service providers. Until August 2019, the company conducted operations under the brand name ‘Velcom’.

A1 customers in in the Republic of Belarus are more than 4.9 million people, over 1.1 million households have accessibility to a fixed communication network using GPON and Ethernet technologies in regional cities and the largest district centers. In addition, A1 provides IPTV digital television services under the brand name VOKA, as well as data storage and cloud services based on its own data center, one of the largest in the country. The company employs about 2,700 people, and branded sales and service centers are located in all major cities of the country.

In the end of 2020 A1 has approved its environmental policy for 2021 – 2025. The company has developed and adopted an official document outlining its basic principles and obligations in the field of environmental protection and environmental safety. The new policy will affect all aspects of A1's activities as since 2020 the environment protection has become one of the company's priorities in the field of corporate social responsibility.

To minimize the impact on the environment, A1 within the Environmental. Social. Governance (ESG) direction has identified specific goals and objectives that the company plans to achieve from 2021 to 2025 in three main areas: energy efficiency, reducing carbon dioxide emissions and reducing the waste.

The aim of the given Policy is the increase the level of environmental safety and the introduction of an integrated approach to the rational use of energy and natural resources, minimizing the environmental damage caused

by activities of A1, preserving a favorable environment for future generations, and A1's public positioning as an environmentally cautious company.

Policy defines the priority activity streams:

- Energy Efficiency and Energy Saving;
- Reduction of Carbon Dioxide Emissions into the Atmosphere;
- Waste Reduction.

Within the first direction it's planned:

- Increase the share of renewable energy sources in the structure of energy consumption;
- Implement of energy-saving and resource-saving technologies at the facilities of A1;
- Technological re-equipment and gradual decommissioning of obsolete equipment with its replacing for equipment with lower power consumption;
- Reduction of specific energy consumption in the process of rendering services. Decreasing the share of auxiliary processes in the total energy balance of A1.

Within the second direction it's planned:

- Increase the share of electric vehicles in the company's vehicle fleet;
- Reduction of the company's own vehicle fleet;
- Use a more economical high-speed style of driving on the highway;
- Reduce the number of business trips (by plane and by car);
- Increase in the number of bicycle parking near offices and other facilities of the company.

To decrease waste reduction, company will:

- Reduce waste volumes;
- Ensure safe handling with them;
- Ensure separate collection of household waste (in case of technical possibility in a particular region and economic feasibility);
- Reduce the consumption of paper and ink for printers within the company and when working with customers through the promotion of electronic document circulation;
- Increase the level of sorting and decreasing the volume of waste by informing and stimulation employees.

Conclusions: company can serve as an example of scientific approach in ecologic questions and can be recommended for conducting educational practice by students of the specialty "Energy efficient technologies and energy management".

Bibliography

1. A1 Environmental Policy., 2020 – 14 p.

THE PROBLEMS OF ECOLOGICAL SAFITY IN REPUBLIC OF ARMENIA IN RECENT DISTILLATES AND THEIR IMPACT ON CHILD MORBIDITY

T. M. Astabatsyan

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus;
Armenian Medical Institute,
Yerevan, Armenia
tigran.astabacyan@bk.ru

The relevance of our research is associated with the violation of the ecological situation in connection with the active development of the mining industry, which leads to a change in the natural landscape, and the environment is polluted. The ecological situation in the Republic of Armenia (RA), over the past decades has led to a change in the morbidity structure of the country's population, including the child population. In some regions of Armenia, there are clear signs of an environmentally unfavorable situation associated with the mine industry in these regions, increased levels of lead and arsenic in the children's blood living there, which also causes an increase in the morbidity of children.

Keywords: industry, morbidity, children, regions, mines, heavy metals, lead, arsenic, ecology.

Conducted analysis of the prevalence of diseases in the pediatric population of RA 1990–2019, as well as the prevalence of the incidence of the disease from 0 to 14 years per entire region of RA. Reported morbidity and mortality were calculated per 100,000 population. Analysis of industrial performance in areas with the highest in-

cidence of child morbidity, analysis of polluting indicators, based on data from the AUA School of Public Health, selected studies published in journals (see sources). Of particular interest are the studies carried out by the Institute of Chemical Physics named after A.B. Nalbandyan of the National Academy of Sciences of the Republic of Armenia, in particular in the collected and analyzed materials of the candidate of chemical sciences S. Minasyan.

There are clear signs and evidence of an environmentally unfavorable environment in some regions [1], an increase in the level of heavy metals (arsenic, lead) in the blood of children, a pronounced steady increase in the incidence of children. In particular, Lori has the highest level of infectious diseases, diseases of the blood and hematopoietic system with immune mechanisms, asthma. That is, there are clear signs of the effects of lead and arsenic on the immune system. There is also evidence of an increase in the latter in plots of land and in the blood of children living near the mining sites in Lori.

The most unfavorable situation with the newly diagnosed incidence of asthma. Unfavorable areas – Lori, Syunik, Gegharkunik, Aragatsotn and Armavir, Noteworthy is the incidence of the child population in Gegharkunik (diseases of the blood and hematopoietic system with immune mechanisms, neoplasms and asthma) and Syunik (diseases of the blood and hematopoietic system with immune mechanisms and asthma).

It is necessary to expand the research sector and take samples from problem regions. It seems to be quite important to implement measures to control the concentration of harmful elements in soil, water and air, control the technical safety of operating mines and monitor the state of the mothballed mines. Biological monitoring is required based on the analysis of the content of heavy metals in the urine and blood of children. Further research needs to take into account the effects of mercury used for processing raw materials and other chemicals.

BIBLIOGRAPHY

l. *Grigoryan R.* The situation in the city of Akhtala, Armenia, Environmental and health consequences of the mining industry / R. Grigoryan// Yerevan, Armenia 2015, P. 1–12.

2. *Petrosyan V.* Lead in the soil of populated areas and dust in the mining-copper smelting region in the north of Armenia. pilot study. Environmental research / V. Petrosyan [et al.] // Yerevan, Armenia (2004): P. 94 (3), 297–308.

ANALYSIS OF THE HANDLING OF CONTAMINATED TEXTILES IN THE REPUBLIC OF BELARUS

E. Baeva, V. Misiuchenka

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
evabaevaa@inbox.ru

The handling of contaminated textile waste for the period 2011 - 2020 was analyzed. Based on the analysis of statistics, it is determined that the bulk of the resulting wastes of contaminated textiles are represented by wiping material contaminated with oils, worn-out cotton and other workwear and rags contaminated with paint materials. The most used types of contaminated textiles are currently worn-out working clothes cotton and other, wiping material contaminated with oils, rags contaminated with paint materials, fabrics and fabric filters contaminated with petroleum products.

Keywords: waste management, contaminated textiles, formation, use, neutralization, recyclables, statistics.

Currently, textiles are one of the most common materials that people use constantly both in everyday life and for economic and other activities. The advantages of textiles are longevity and resistance to damage, versatility in use. Various home decorations, clothes, shoes are created from textiles. In production it is used as workwear, filter fabrics, and also polishing and wiping materials. After retirement from use it becomes a contaminated textile.

Textile is suitable for recycling. The volume of contaminated textile waste is the aggregate of wool, cotton, linen, and chemical fiber waste – the main sources of secondary raw materials for the production of secondary textile materials, suitable for the production of nonwoven fabrics.

According to the conducted researches based on statistical data of the Republic of Belarus on the formation of contaminated textiles in recent decades has tended to increase (5406,15 tons for 2011 и 6790 tons for 2020). A large share of contaminated textile are wiping material contaminated with oils, if we consider 2011 and 2020, the amount of its formation remained almost unchanged (3375 tons for 2011 и 3323 tons for 2020). But some types of contaminated textiles, for example worn-out working clothes cotton and other and rags contaminated with paint materials are increased by about 2,5 times (669 tons for 2011 and 1583 tons for 2020, 336 tons and 793 tons respectively).

In 2020 the share of wiping material contaminated with oils is 49 percent of the total amount of contaminated textile waste generated over the year. Second place is taken by worn-out cotton and other workwear (23%), then follows rags contaminated with paint materials (12%). If we compare it with 2015, then formation of wiping material contaminated with oils is increased by 1,2 times ((2695 tons for 2015 and 3323 tons for 2020), worn-out cotton and other workwear – 1,3 times (1191,6 tons for 2015 and 1583 tons for 2020), rags contaminated with paint materials – 1,5 times (517,23 tons for 2015 and 793 tons for 2020). In 2020 the least amount of contaminated textile waste that was generated include textile packaging material with harmful contaminants, mostly inorganic, perchlorovinyl tissue contaminated with beryllium oxide, used filter fabrics for oil cleaning, contaminated spinneret tear, wiping material contaminated with arsenic, beryllium oxide, ceramic paste, fabrics contaminated with antimony, ceramic paste, lead, salt solutions, capron filters contaminated with LMB, rags used in cleaning pours of PCB-containing liquids. The share of formation this types of contaminated textile waste is less than 0,1% of the total formation.

In view of the increasing number of contaminated textiles data on its use, neutralization and disposal were analyzed. Some types are temporarily stored on the territory of the enterprise. We can see an ambiguous trend in the use of all types of contaminated textile and increase in disposal.

So, in the period from 2011 to 2015 use of textile waste increased by 68% for the year (735,01 tons for 2011 and 2271,93 tons for 2015). Further, in the period from 2015 to 2017 the amount of used textile waste decreased by 8% (2271,93 tons in the period for 2015 and 2087,7 tons for 2017). In the period from 2017 to 2019 there is a tendency to decreasing of use contaminated textile waste (for 2019, the use of waste decreased to 1473,2 tons and, by extension, 29,5%). And finally, in the period from 2019 to 2020 amount of used textile decreased by 61% (in 2020 their number amounted to about 570 tons). The most used types are wiping material contaminated with oils and worn-out cotton and other workwear. 271 tons contaminated textile received for neutralization in 2011, 140 tons in 2020. These are such types of textiles as used Cuno filters, wiping material contaminated with oils, and also fabrics and filter bags with harmful contaminants, mostly organic. For burial in 2011 were received 4255,21 tons of waste, 5400 tons for 2020, and it was basically wiping material contaminated with oils, rags contaminated with paint materials and worn-out cotton and other workwear.

In general, the conclusions on the handling of contaminated textiles in our country are following:

1) The total formation of contaminated textiles of various types during the analyzed period increased by 1,3 times.

2) Over the decade formation of wiping material contaminated with oils decreased by 52 tons, but stably has the largest amount of formation compared to other types.

3) In 2020, as well as in 2011, the leading position in formation have wiping material contaminated with oils, worn-out cotton and other workwear and rags contaminated with paint materials.

4) Invariably the lowest volumes of formation in 2020, as well as in 2011 has textile packaging material with harmful contaminants, mainly inorganic.

5) In spite of available technologies of recycling contaminated textile has become less used, so its use from 2011 to 2020 decreased by almost 1,3 times.

6) In 2011, the most used waste was worn-out cotton and other workwear, currently, the leaders are also worn-out cotton and other workwear, and also wiping material contaminated with oils, the number of uses of which has increased significantly in recent years.

7) Volumes of burial increased by 21 % during the period under review. The most active for burial are wiping material contaminated with oils, rags contaminated with paint materials worn-out cotton and other workwear, and also fabrics and bags are filtered with harmful contaminants, mainly organic ones.

Often used methods of recycling contaminated textiles were revealed – this is the production of nonwoven materials, as well as the production of nonwoven needle-punching fabric.

CURRENT TRENDS IN THE GENERATION OF INDUSTRIAL WASTE AND WASTE MANAGEMENT AT THE ENTERPRISE «TREPLAST»

K. Baradynich[1], **A. Fralou**[2]

[1]*Minsk State Linguistic University*

[2]*University of Civil Defense of the Ministry of Emergency Situations of the Republic of Belarus, Minsk, Republic of Belarus*

proshedshiymig@gmail.com

The analysis of the dynamic of industrial waste at the enterprise “Treplast” in Brest has shown that the development of production is accompanied by the risk of exacerbating the problem of the most hazardous waste.

Key words: Environmental safety, production waste, hazard class, waste decontamination, waste disposal.

Nowadays, an increase in waste generation is a growing threat for environmental safety [4]. We have analyzed the trend of waste generation and waste management in the activity of "Treplast" enterprise, which is one of leading enterprises producing energy efficient lamps in Belarus [3]. We have used the data on annual waste of the enterprise for the period 2017–2020 for it.

The data analysis shows that waste generation rose for several years. For example, its total weight in 2019 rose by 12 % in comparison with the total weight in 2018. However, the total waste generation had fallen by 10 % by the end of 2020.

The analysis of the structure of generated waste has shown that the largest share of its total weight at the enterprise, as a rule, is the waste which, according to the national classifier [4], is similar to human waste. It belongs to the class of non-hazardous waste [2]. Both this kind of waste and waste of the fourth hazard class are low hazard. At the enterprise, their share in the total waste registered by weight, , has been from 80 % to 90 % over the years. At the same time, the total weight of non-hazard and low-hazard waste has not changed significantly over the years. Waste of the fist hazard class generated by the enterprise is mainly spent luminescent tubes. In 2019, spent lead accumulators, which belong to the same hazard class, were registered as waste as well. These types are registered by the piece and that impedes the identification of its share in the total waste weight.

Data, which we have studied, shows that the list of generated waste had been expanding up to 2019. However, the number of industrial waste types at the enterprise fell by four types from 15 to 11 in 2020.

Also, we have found out that the majority of the third and fourth hazard class waste, as a rule, has been neutralized by the enterprise. But some of it is still used. The share of the buried waste has varied between 14 % and 16% of the total waste weight over recent years. However, based on the data we have, we can make a conclusion that the enterprise probably has had problems with the neutralization of the most hazardous waste, that's why the waste has been accumulating.

The analysis of the generated waste trend done using the example of "Treplast" enterprise, in our opinion, confirms that the development of production, including the expansion of product range, in general, raises the issue of industrial waste, which, as the experience at the enterprise shows, can be solved. However, there might appear difficulties with neutralization of the most hazardous waste, if its range expands and its quantity increases.

BIBLIOGRAPHY

1. Классификатор отходов, образующихся в Республике Беларусь [Электронный ресурс] / Национальный правовой интернет-портал – Режим доступа: http://www.pravo.by/upload/docs/op/W21934631p_1569531600.pdf. Доступ: 22.09.2021.

2. О порядке установления степени опасности отходов производства и степени опасности опасных отходов производства : постановление Минстерства природных ресурсов и охраны окружающей среды Республики Беларусь и Министерства по чрезвычайным ситуациям Республики Беларусь 29.11.2019 № 41/108/65 [Электронный ресурс] / Национальный правовой интернет-портал – Режим доступа: http://www.pravo.by/upload/docs/op/W21934870_1576270800.pdf. Доступ: 22.09.2021.

3. ООО «Трепласт» : Официальный сайт [Электронный ресурс]. – Режим доступа: http://www.treplast.by/. Доступ: 22.09.2021.

4. *Фролов, А. В.* Угрозы экологической безопасности Республики Беларусь в контексте обновлённой национальной стратегии устойчивого социально-экономического развития / А. В. Фролов // Проблемы экологии и экологичекой безопасности : сб. мат-ов конф. – Минск : УГЗ, 2017. – С. 23–25.

VARIABILITY OF CERTAIN TRAITS UNDER THE INFLUENCE OF ELECTROMAGNETIC IMPULSES TO THE VEGETATIVE ORGAN OF CULTIVARS AND LINE PLANTS DEVELOPED IN CONDITIONS OF WATER SCARCITY

A. Bekmukhamedov, A. Khasanova, N. Khusanov

National University of Uzbekistan named after Mirzo Ulugbek
Tashkent, Republic of Uzbekistan

Unfavorable conditions negatively affect the growth and productivity of cotton. It is important to study the physiological, biochemical and genetic processes occurring in plants under such conditions, and on the basis of their study, it is possible to create plant varieties adapted to adverse conditions, disease resistant and productive. Accordingly, in order to increase the yield of cotton and not lose its quality, scientifically based approaches are needed, according to which it is important to find the appropriate genotypes adapted to stressful conditions, or to solve the problems associated with improving the properties of resistance through the use of additional methods.

Keywords: Cotton, electromagnetic impulse, water scarcity.

Significant differences in the length of the main stem of plants during the flowering period were observed under standard conditions in the Ibrat variety (N-57.5 ± 2.11 cm; T-67.4 ± 1.91 cm; F-9.9) and L-452 (N-71.2 ± 1.96 cm; T-73.3 ± 1.87 cm; F-2.1), L-4112 (N-80.3 ± 2.19 cm; T-81.3 ± 2.14 cm; F-1.0) occurred in line plants, while Sultan (N-56.3 ± 1.86 cm .; T-62.6 ± 2.15 cm; F-6) developed in water-scarce conditions., 3) type and L-4112 (N-55.1 ± 2.05 cm; T-65.2 ± 1.96 cm; F-10.1), L-452 (N-54.1 ± 1, 91 cm; T-57.0 ± 2.04 cm; F-2.9)

The predominance of experimental variant plants was observed in line plants compared to control variant plants. According to the number of joints in the main stem, under normal conditions the Sultan variety N-18.6 ± 0.29; T-19.1 ± 0.33, L-4112 line N-18.1 ± 0.34; N-17.1 ± 0.30 on the T-18.6 ± 0.31 and L-452 lines; T-17.8 ± 0.29 values were observed, while in water-scarce conditions N-17.3 ± 0.27 in the Sultan variety; T-17.8 ± 0.29, N-15.2 ± 0.33 on line L-4112; N-14.7 ± 0.31 on the T-15.9 ± 0.32 and L-452 lines; T-14.8 ± 0.34 values were observed. According to the study, the predominance of control variant plants over experimental variant plants was not observed in the Ibrat variety in both conditions (normative and water scarcity).

According to the number of joints and yield horns in the main stem, the superiority of the experiment over the control was solved at the expense of the Sultan variety, L-4112 and L-452 lines, while the opposite was observed in the Ibrat variety.

According to the number of cocoons, large differences between control and experimental variant plants occurred in the Ibrat variety and L-4112 line under normal conditions, and in the Sultan and Ibrat varieties, as well as in the L-4112 line under water shortage conditions. Different responses of cultivars and line plants to adverse conditions and to low-frequency electromagnetic waves before planting indicate that they belong to heterogeneous and homogeneous populations or depend on their genotypic conditions.

BIBLIOGRAPHY

1. *Kusharenko M. D.* Exogenous regulation of water exchange, drought and frost resistance of plants. – Kishinev: Shtiinsa, 1990, – 123 p. Krupnov V. A. Zasuxa i selektsiya pshenitsy: sistemnyy podkhod // S.-x. biology. 2011. № 1. S. 12–24.

2. *Lukyanova S. V., Tonkix A. K., Bekmuxamedov A. A., Ibragimxadjaev S. U.* The action of electromagnetic poles with different characteristics on the semen xlopchatnika. UzMU news №3 / 1 2016 p. 82–85.

INHERITANCE OF FIBER OUTPUT IN COTTON HYBRIDS

S. Boboyev, M. Mirakhmedov, G. Narkizilova, J. Ruziev

National University of Uzbekistan named after Mirzo Ulugbek
Tashkent, Republic of Uzbekistan

In recent years, Uzbekistan has been optimizing the area under cotton and creating cotton-textile clusters that will be able to fully cover all stages of cotton growing and processing. This has led to an increase in demand for cotton fiber, leading to an increase in demand for varieties with high fiber consumption and quality. For this reason, genetic-selection scientists pay special attention to the creation of varieties with high fiber yield and quality.

It has been proven that the use of different hybridization methods in cotton can create high-fiber varieties by involving high-fiber forms in hybridization. In particular, the research of I.G.Amanturdiev confirmed that it is possible to distinguish transgressive forms with a fiber consumption of more than 40 % by hybridizing ecologically and geographically long forms and involving high-yield fiber samples in the mix [1]. It has been found that large-scale variability in fiber yield and length can be achieved in cotton on the basis of complex interspecific hybridization, and that high-performance forms can be distinguished from them [2].

The study examined the inheritance of fiber yield traits in F_1 hybrids of cotton with different genotypes, i.e., sharply different varieties, ridges, and families.

Varieties used as parents in hybridization ranged from 36.2 % to 37.5 % in terms of fiber consumption of the ridge and families. Fiber consumption was relatively high in the T-1380, O-107-12, O-87-91 families, with a rate of 37–37,5 %.

In the first generation, the mean value of the fiber yield trait, depending on the hybrid combinations, ranged from 35.8–38 % and was found to be inherited in intermediate, fully dominant, and heterosis cases. While a negative heterosis phenomenon was observed in the F_1SP-1303 x T-282-85 combination studied, it was found that in all other hybrid combinations the trait was inherited in a positive fully dominant and heterozygous state. In combinations F_1O-107-12 x T-282-85 (hp = 3.0) and F_1O-87-91 x Generosity (hp = 2,25), the average fiber yield was

37,2 % and 38%, respectively, provided that it was 2–3 % higher than the parent forms, and a case of heterosis was observed.

There is an inverse correlation between fiber yield and 1000 seed weight, which was also confirmed in the hybrid combination, i.e. fiber yield was observed when 1000 seed weight was high.

In the next F_2 generation of the studied hybrids, a wide-range separation process on fiber yield occurred, and an improvement in the mean was observed in some combinations due to the manifestation of positive transgressive forms. In the combinations of F_2O-107-12 x T-282-85 and F_2O-87-91 x Sakhovot hybrids, a lateral shift in the variational row was observed, and the emergence of forms with a fiber yield of 40–42 %, which is superior to the parent forms, was detected. This also had a positive effect on the average performance of hybrids, ensuring that the average was 38,7–39,0 %.

Of the 8 F_2 hybrid combinations studied, 3 improved over F_1, while the remaining combinations remained at F_1. However, the presence of high-performance forms among hybrid combinations was identified, and it was confirmed that it is possible to create varieties with high fiber consumption by carrying out selection work on them.

Based on our results and analyzes, it was found that the fiber output trait is inherited in cases of intermediate, complete dominant, negative and positive heterosis depending on the parental genotype involved in the hybridization. Among the F_2 hybrid plants, it was found that there are forms with a fiber yield of more than 40 %, and targeted selection work on them allows to create new varieties of cotton with high fiber yield.

BIBLIOGRAPHY

1. *T. H. Khamidullaev, I .G. Amanturdiyev, Sh. E. Namazov.* Inheritance traits of fiber output and length оп Geographically-Distant Fз Hybrids of Cotton. ERPA lnternotional Journal of multidisciplinary Research (lJMR) V.5., Issue-11, November 2019.

2. *Sayfulla Boboyev, Gulnoza Toshpulatova, Ikrom Amanturdiev, Mirvakhob Mirakhmedov*. Variability and inheritance of fiber length and wilt resistance in a complex 4–5 specific and backcross hybridization of cotton. Journal of Biological Research 2021; volume 94:9243.

SUMMER POPULATION OF VRANOVY BIRDS IN BORISOV

M. Bogachova, A. Khandohiy, Y. Kisialiova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
masha7749@gmail.com

Do corvids have preferred foraging spots in urbanized landscapes?

Keywords: ecology, corvids, urbanization, synanthropes.

The study of corvids as model species makes a significant contribution to solving the problem of animal adaptation in urban areas. But due to the created problems in urban cenoses, corvids are not always desirable birds in urban landscapes. For this reason, our efforts were mainly focused on studying the life of birds of this family in Borisov, while special studies on their extra-nesting ecology were not carried out here.

The aim of the work was to identify the features of the extra-nesting ecology of corvids in Borisov.

The objects of research were corvids, most of which are typical synanthropes.

The species composition and number of birds were determined by taking them into account on permanent routes. The population density of corvids was calculated according to the standard method [1].

We have established that the hooded crow, rook and jackdaw live in the urban landscapes of Borisov. In the course of the study, it was revealed that in the summer period for corvids is characterized by a decline in active life during the heat and active solar radiation. At this time of day, birds prefer to escape from the heat in the shade, while cloudy weather and light rain do not disturb their activity.

From corvids – jackdaw and rook are the most widespread species of the regional center. In all model territories of Borisov, the daw is the dominant species of corvids. In this city, favorable conditions have developed for the jackdaw to live: convenient places for its nesting, good food supply. The attractiveness of a relatively small town for jackdaws and the proximity of the main summer feeding places – fields, meadows, floodplains of the river. Berezina.

A high population density of jackdaws was noted in the area of highways – from 100.1 to 212.7 ind/km^2 (n =11), Which, apparently, is associated with the proximity of forest belts, fields and the presence of an abundance of food on agricultural lands after harvesting grain, which is confirmed by the data of other researchers [2].

The lowest population density of jackdaws in summer was noted on the central streets of the city and amounts to 34.9 ind/km^2 (n =11). Which serve as a place of accumulation of flocks of corvids post-nesting migrations.

The population density of rook, the second most important corvid species, living together with flocks of jackdaws, ranges from – 24.4 to 98.8 ind/km^2 (n =11). This species prefers the marginal areas of the city, since its food preferences during this period of the life cycle are aimed at finding open areas that abound not only with the remaining grain after harvesting grain crops in the fields, but also with other food – mice, voles, plant rhizomes, etc.

In Borisov there is a relatively small sedentary population of the hooded crow, not exceeding 14.1 ind / km^2.

In the city of Borisov, in the summer, there were isolated cases of meeting of magpies, jays and crows.

Thus, the highest population density of corvids at this time of the year is concentrated in the marginal areas of the city. The formation of large crowds of corvids in the city in August is associated with the beginning of autumn migrations, the formation of wintering flocks and an increase in trophic competition, which leads to an increase in the number of jackdaws at all large feeding grounds.

BIBLIOGRAPHY

1. *Новиков, Г. А*. Полевые исследования по экологии наземных позвоночных / Г. А. Новиков. – М. : Наука, 1953. 502 с.

2. *Хандогий, А. В.* Галка (*Corvus monedula*) – самый массовый вид семейства врановых (*Corvidae*) в городе Минске / А. В. Хандогий, К. О. Зоричев // 21-ая междунар. научн. конф. «Сахаровские чтения – 2021 года» (г. Минск, 20–21 мая 2021 г.). Мн. : МГЭИ, 2021. С. 129–131.

MODERN PROBLEMS OF MORPHOMETRIC ANALYSIS

N. Bushkevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
bushkevich.tasha@yandex.ru

Morphometric analysis (in medicine) is a branch of biometrics that studies morphological elements of a person and their connections using mathematical research methods. The study of the basics of biology is an important link in the knowledge of the human body, since tissues represent one of the levels of organization of living matter, the basis for the formation of organs.

Keywords: morphometric analysis, morphometry, biometrics, pathology, histology, cytology, cytohistological analysis.

The issues of studying both living organisms and plant objects, as well as the processes occurring at different levels of the organization of biological systems, are becoming more and more relevant day by day. The study of the basics of histology is an important link in the knowledge of the human body, since tissues represent one of the levels of organization of living matter, the basis for the formation of organs. In clinical practice, cytohistological analysis is used for the objective diagnosis of various tumors, diseases of the blood, immune system, etc. The study of spatial connections between cells, their contents and ways of interacting with each other and with the extracellular matrix is possible only with the help of microscopic methods [1].

The assessment of structural changes in cells and tissues is largely based on a qualitative description, which often is subject to serious errors, since it is essentially subjective. Morphometric methods, which rely less on qualitative observation and thereby reduce such subjectivity, are currently used in pathology diagnostics, as well as in histological and cell-biological studies. Morphometry includes methods that have advantages in terms of increasing objectivity, improving reproducibility and, in addition, they allow detecting previously unsuspected changes [3].

Morphometry is one of the methods of biometrics. Morphometry is defined as a quantitative description of the structure. This structure can be both macroscopic and microscopic in size. Morphometric analysis (in medicine) is a branch of biometrics that studies morphological elements of a person and their connections using mathematical research methods [2].

The main task of morphometry is the search and development of the latest methods for measuring different structures of the body, as well as the meta-nalysis of various characteristics of a sick and healthy organ, in order to identify their functional state [4].

The widespread use of morphometric analysis in morphological studies has allowed us to establish a number of important patterns that have not been revealed by methods of descriptive morphology. The development of the

morphometric method makes it possible to streamline some issues of classification and differential diagnosis of a number of diseases. Objective data obtained on the basis of morphometry make it possible to select the most reliable information, clarify some issues of pathogenesis and morphogenesis of diseases, and are the basis for the development of quantitative pathological morphology of a person [1].

The introduction of computer modeling during tissue morphometry has given many opportunities for faster and better scientific work. In the future, the construction and improvement of computer models will make it possible to create unified models that will allow describing the functioning of the organism at different levels of its organization simultaneously from different positions.

In recent decades, there has been an accumulation of cytological material in archives, an increase in its variability within a single diagnosis, as well as the creation of databases in which the results obtained from the morphometric analysis of micropreparations are entered. In this regard, the first attempts to model the introduction of artificial intelligence into the analysis process have appeared, which mean the complete absence of human intervention in the formulation of a pathological diagnosis. It is assumed that artificial intelligence itself will be able to make a diagnosis based on a comparison of the studied micro-preparation with the average results already available in the database, accumulated during targeted studies. If this becomes possible, in the future it will be permissible to increase the number of positive outcomes in the treatment of patients, due to a sharp acceleration of diagnosis.

BIBLIOGRAPHY

1. *Автандилов Г. Г.*, Введение в количественную патологическую морфологию / Г.Г. Автандилов. М.:Медицина, 1980.

2. *Автандилов Г. Г.*, Медицинская морфометрия / Г.Г. Автандилов. М.:Медицина, 1990. – 384 с.

3. *Baak J. P. A., Oart J.*, A Manual of Morphometry in Diagnostic Pathology / J. P.A. Baak, J. Oart // Springer-Verlag. 1983.

4. *Weibel E. R.*, Stereological Methods. Vol. 1: Practical Methods for Biological Morphometry / E. R. Weibel // Academic Press, London. 1979.

LICHENOINDICATION OF AIR POLLUTION OF M. YA. PAVLOV'S PARK

S. Chadovich, I. Lapshevich, A. Titov, A. Lunovich, Y. Zhyltsova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
cadovicsnezana3@gmail.com

As a result of the investigations M. Ya. Pavlov's park (Minsk), the index of relative air purity has been determinated with the help of epiphytic lichens. It was found that the number of lichen species detected is typical for the outskirts of large industrial cities. It has been established that the atmospheric air in the depths of the park and near Beletsky Street is characterized as polluted, and near Lubimov Avenue as very polluted.

Keywords: lichenoindication, bioindication, index of relative air purity, epiphytic lichens.

Air quality control in a large industrial city is one of the primary tasks of environmental monitoring. Lichenoindication occupies a special place among all currently existing methods of environmental quality control. So, lichens meet all the parameters required for bioindicators: they have a long life cycle, they are widespread and able to respond to salvo and short-term emissions of toxic substances, at the same time, they not being very sensitive or very resistant to them [1]. In addition, a distinctive feature of lichens is that prolonged exposure to low concentrations of toxicants leads to long-lasting damage to them. Epiphytic lichens among ecological and substrate groups are one of the most sensitive organisms to changes in the concentration of toxicants in the atmospheric air [2].

The aim of our work was to assess the ecological state of M.Ya. Pavlov's park of Minsk using the lichens. To achieve this goal, the following tasks were solved: 1) to lay test sites on the territory of the park; 2) determine the life form of epiphytic lichens depending on the shape of the thallus; 3) estimate air pollution by the method of linear intersections.

On the territory of the park, 3 test sites were laid: 1 site was located in the depths of the park, 2 sites were located near the roads bordering the territory of the park along Lyubimov Avenue and Beletsky Street. At each test site, at least 10 *Tilia cordata* Mill. were examined for the presence of epiphytic lichens. Eight species of epiphytic lichens were found on the territory of the park that is typical for the outskirts of large industrial cities: *Parmelia sulcata* Tayl., *Physcia stellaris* (L.) Nyl., *Physcia aipolia* (Ehrh. Ex Humb.) Furnr., *Physcia adscendens* (Fr.)

H. Olivier, *Hypogymnia physodes* (L.) Nyl., *Phaeophyscia orbicularis* (Neck.) Moberg, *Phaeophyscia nigricans* (Flk.) Moberg, *Xanthoria parietina* (L.) Th. Fr. The projective coverage of the scale lichens varied from 0 to 12% and the projective coverage of the leafy lichens varied from 6 % to 39 %. The bushy lichens did not occur. Calculated indexes of relative air purity on sites in the depth of the park and near Beletsky Street did not differ significantly (p=0.95) and had an average value of 0.22±0.02 that characterized atmospheric air as polluted with SO_2 concentration 0.057-0.086 mg/m^3. Index of relative air purity at the site near Lyubimov Avenue differed significantly and had a value of 0.18±0.02 that characterized the atmospheric air in this area as very polluted with a SO_2 concentration of more than 0.086 mg/m^3.

BIBLIOGRAPHY

1. *Жукова, А. А.* Биоиндикация качества природной среды / А. А. Жукова, С. Э. Мастицкий. Минск : БГУ, 2014. – 112 с.

2. *Кузнецова, В. Ф.* Эпифитные лишайники как индикаторы загрязнения атмосферного воздуха газообразными поллютантами, тяжелыми металлами и радионуклидами: дис. … канд. биол. наук: 03.00.16 / В. Ф. Кузнецова. – Нижний Новгород, 2004. 208 с.

THE IMPACT OF FOOD WASTE ON THE ENVIRONMENT

D. Churakova, L. Kuzina

Belarussian State University, ISEU of BSU
Minsk, Republic of Belarus
chukarova2112@gmail.com

Resume: this article provides data on food losses at the stages of production, trade and consumption. Food waste negatively affects the climatic conditions of our planet. The article indicates the reasons leading to the growth of food waste, suggests methods to improve the situation with food losses and waste.

Keywords: waste, environment, food, losses.

Every year, a third or all food produced in the world ends up in losses or waste. In developing countries, a considerable proportion of food (40 %) is lost at the stage of harvesting or processing. This is celled food losses. In developed countries, the same percentage (40 %) is lost at the stage of consumption or retail sale, when food products that are not bought in stores or not eaten at home, in restaurants or cafes go to waste. This is called food waste. Today, the average European throws about 250 kilograms of household waste into the trash, half of them food waste. According to the UN World Production Program, every year 1.3 billion tons of products produced in the world are sent to landfills, so many could wrap the Earth 7 times. At the same time, according to data for 2019, 690 million people were malnourished, and 3 billion could not afford a healthy diet human. [2] Food waste is the cause of all kinds of environmental impacts of food production. According to the Food and Agriculture Organization (FAO), food waste accounts for 8 % of global greenhouse gas emissions in the world. FAO concludes that almost 30 % of all available agricultural land in the world - 1.4 billion hectares - is used for the production of uneaten food. Reducing food waste at the retail, catering and household levels can bring huge benefits to people and the planet. Today there are many opportunities to improve the situation with food losses and waste, which remained mostly unused and underused. For example, American scientists have developed a technology that allows you to get heat from cheese product ion waste, they are processed to produce methane. There are many cheese factories located in Wisconsin. As a result of washing the factory equipment, whey and regular milk waste is regularly generated here. The use of 900 thousand liters of cheese production waste, which the processing enterprise receives from local factories, made it possible to synthesize so much methane that it was enough to heat three thousand private homes. And the remaining waste can be dried md further used for the production of fertilizers. In addition, culinary fat has also been used, which is formed daily after draining the oil from the fryers of fast food restaurants. Scientists from Washington State University have developed a technology that can turn it into asphalt. [1] As noted above, the problem of food waste entails not only the waste of resources – land, water, energy, labor and finance, but also stimulates the emission of greenhouse gases and global climate change. Scientists are sure that if everyone pays attention to this problem, then it will become much easier to solve it on a global scale. For example, we have acquired habits that damage the environment and create an additional burden on natural resources. Here are a few simple things you can do right now to become a zero-hunger hero and turn thrift into a way of life. [3] You need to stan small - reduce portions at home or in a restaurant with friends; do not leave anything on the plate; buy only what you need; buy "ugly" or irregularly shaped fruits and

vegetables: they are just as delicious, just look a little different; give the surplus to those in need; shares products with others, etc.

BIBLIOGHRAPHY

1. Decree of the President of the Republic of Belarus to. 313 dated July 11, 2012 «On some issues of consumer waste management".

2. *Efiinova, E. V.* No food waste / E. V. Efimova // Solid household waste. – 2017. – No. 3 – p. 61.

3. Resolution of the Council of Ministers of the itepublic of Delarus of July 28, 2017 on the approval of the "National Strategy for the Management of Solifi Municipal Waste and Secondary Material Resources in the Republic of Belarus for the period up to 2035".

ANALYSIS OF THE SPECTRAL REFLECTIVITY OF AGRICULTURAL VEGETATION

Y. Davidovich

Belarusian State University, The Faculty of Geography and Geoinformatics
Minsk, Republic of Belarus
seg98001@gmail.com

The scientific work presents the results of in-situ studies of the spectral reflectivity (SR) of agricultural vegetation on the example of winter barley in the phenological phase of the appearance of 2 – 3 leaves. The measurements were carried out on the territory of the test site «Ščomyslica» in the autumn period on a clear, cloudless day. The research results indicate a close relationship between the SR of crops and the properties of the underlying soils.

Keywords: Spectral reflectivity, winter barley, spectral brightness coefficient.

The object of study in this work is the crops of winter barley in the phenological phase of the appearance of 2–3 leaves, as well as the soil on which they grow, and the spectral brightness coefficients (SBC) are the subjects.

The SR of agricultural vegetation is influenced by the following properties: pigmentation, the content of various chemical elements, phenological phase, mineral deficiency, air temperature, mechanical stress, diseases, etc.

The soils of the test site are presented formed on homogeneous parent rocks (loess-like loams). The predominant type of soil is dry Albeluwisols (70.39 % of the site), the second-largest are slightly-moist Albeluwisols (20.01 %). The smallest area is occupied by medium-moist (5.98 %) and moist Albeluwisols (3.62 %).

The study of the SR of barley was carried out in the in-situ measurements using an FSR-02 spectroradiometer with a spectral range of 400–900 nm and a resolution of 4.3 nm. Milk glass MG-20 was used as a reference surface for the preparation of SBC.

The values of the SBC of barley in the phenological phase of the formation of 2–3 leaves closely correlate with the degree of soil moisture. From the SBC (table 1) it is obvious that barley growing on dry Albeluwisols has a spectral reflectivity higher than barley growing on slightly-moist Albeluwisols.

Table 1

Spectral brightness coefficients of winter barley in the phenological phase of formation of 2–3 leaves, in%

Soils	Spectral range, nm						
	0,40–0,45	0,45–0,48	0,48–0,50	0,50–0,56	0,56–0,59	0,59–0,62	0,62–0,75
Dry Albeluwisols	7,5	9,4	10,4	19,8	23,7	20,5	33,7
Slightly-moist Albeluwisols	4,5	4,8	5,2	7,7	9,0	8,7	11,8

On moist and medium-moist Albeluwisols the survey of barley was not carried out because of the soak and insignificant projective cover. The greatest differences in the SBC of barley in this growing phase are observed in the wavelength ranges from 522 to 596 nm (green and yellow color zone) and from 693 to 750 nm (red zone).

In-situ spectrometric measurements of winter barley are consistent with previous studies. The SBC values of winter barley closely correlate with the degree of soil moisture.

The change in the spectral reflectivity of crops and their image tone in different phenophases makes it possible to interpretant the soil depending on the degree of moisture.

ASSESSMENT OF THE ECOLOGICAL STATE OF TREE PLANTS OF PAVLOV PARK

U. Dubatoyka, E. Zhuk

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
vlad.db2@gmail.com

An ecological assessment of the state of the forest stand of the Mikhail Pavlov Park in Minsk was carried out.

Keywords: ecological state, tree state coefficient.

Parks perform a recreational function in urban ecosystems, creating conditions for a comfortable pastime [1]. Nowadays, due to the growth of cities and the increase in urban population, the role of parks is increasing. The presence of green spaces in the city affects the air quality, partially cleaning it from transport and industrial waste, plants reduce the level of noise, prevent the occurrence of undesirable wind regimes [2].

Pavlov Park was founded in the first half of the 1990s and is a recreation area for residents of the Moskovsky district. The tree plantations of the park include a number of tree species left over from the settlements located here. In general, there are twenty-one species of tree plantations registered on the territory of the park, among which there are native and introduced species. The most common species are: *Ácer platanoídes, Fráxinus excélsior, Tília cordáta, Sálix fragílis, Populus suaveolens, Bétula péndula*. Introduced species include: *Quércus rúbra, Quer. velutina, Ácer saccháriпum, Picea pungens, P. glauca, Arónia melanocárpa, Júglans mandshúrica.*

The analysis of the ecological state of the park's woody vegetation was carried out on sites that differ in the degree of anthropogenic impact. The assessment of the state of trees was carried out according to external signs (from 1 to 5 points), the coefficients of the ecological state of the stand of each species and site were calculated.

The species composition of trees in the selected sites is different. The largest number of species (12 species) was noted on the site, the least visited by visitors to the park. The dominant species are *Fr. excélsior and Ác. platanoídes*, accounting for 22.9 % and 17.4 % of the total number of trees. The indicator of the state of the stand (1.29) indicates the healthy state of the trees in this area.

Assessment of the condition of trees at the sites of the most frequently visited indicates a weakened forest stand. Indicators range from 1.89 points to 2.39 points. The species composition of trees at the sites is diverse. At the first site with a high level of anthropogenic impact, ten species of tree plantations were described, among which are dominated: *T. cordáta, Fr. excélsior*, (make up 30.3 %, 23.2 %.). At the second site with a moderate anthropogenic impact, six tree species were recorded. The predominant species are *B. péndula and Ác. platanoídes* (respectively 75.0 % and 14.2 % of the total growing stock).

In general, the coefficient of the state of the forest stand of the Mikhail Pavlov Park is equal to K = 1.86, which makes it possible to classify it as a weakened one.

Trees affected by pests were noted. On *Ác. Saccháriпum*, a disease caused by a capitate mite from the *Eriophyidae* family has been noted. *S. babylónica* has a disease - scab caused by the fungus *Pollaccia saliciperda*. A disease has been observed on *Pýrus commúnis* - rust caused by a fungus from the *Pucciniaceae* family.

The ecological state of tree plantations in Pavlov Park needs monitoring studies and measures to improve and protect tree plantations.

BIBLIOGRAPHY

1. *Нагибина, И. Ю.* Значение парковых зон для жителей городской среды / И. Ю. Нагибина, Е. Ю. Жукова. – // Молодой ученый. – 2014. – № 20 (79). – С. 84–85.

2. Студенческая библиотека онлайн [Электронный ресурс]. – Режим доступа: https://studbooks.net/1974871/nedvizhimost/parki. – Дата доступа: 02.04.2013.

IMPLEMENTATION OF THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS IN THE REPUBLIC OF BELARUS

V. Duzinchuk, S. Golovatyi

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
sscience@yandex.ru

Environmental pollution is one of the global ecological problems of our planet. The problem of implementation of Belarus obligations on persistent organic pollutants is urgent because presently there is still a certain

amount of these substances in our country. Adopted and implemented program documents on the reduction and complete cessation of usage of these substances attest that all stocks of polychlorinated biphenyls (PCBs) and obsolete pesticides have to be destroyed in the republic by the end of this decade.

Keywords: Stockholm Convention, persistent organic pollutants (POPs), polychlorinated biphenyls (PCBs), obsolete pesticides, background values, maximum permissible concentration, differentiated regulation.

Persistent organic pollutants (POPs) are chemicals that do not degrade or slowly degrade naturally. POPs are a global environmental problem due to their persistence, their ability to migrate over long distances and accumulate in the tissues of living organisms and in the environment, poisoning people, animals and plants. POPs include a group of synthetic compounds used in industry, in agriculture as pesticides, or that are spontaneously formed as by-products of combustion or industrial processes.

The main types of waste containing POPs in Belarus are decommissioned equipment (power capacitors, transformers, etc.) containing polychlorinated biphenyls (PCBs), seized soils, contaminated (PCBs) and obsolete pesticides, both identified and in the form of unidentified mixtures, and contaminated containers resulting from repackaging of such pesticides.

Persistent organic pollutants are toxic even in extremely low concentrations; due to their ability to occupy intercellular spaces, they cause many pathological conditions and processes. The initial Stockholm Convention list of banned persistent organic pollutants (entered into force in 2004) included 12 chlorine-containing organic substances: pesticides (aldrin, dieldrin, chlordane, endrin, mirex, heptachlor, hexachlorobenzene, toxaphene, dichloro-diphenyl-trichloromethylmethane); industrial chemicals (polychlorinated biphenyls) and by-products (polychlorodibenzodioxins and polychlorodibenzofurans).

Presently, the total volume of polychlorinated biphenyls (hereinafter – PCBs) in electrical equipment (transformers and capacitors, including small-sized ones), taking into account containers with sovtol, is estimated at 1.2-1.3 thousand tons. The total mass of PCB-containing equipment is 3.7 thousand tons. Currently, there are many stocks of obsolete pesticides belonging to agricultural enterprises in Belarus, and 5 underground storages constracted during the Soviet period. About 1200 tons of obsolete pesticides are stored at 32 agricultural stocks in Vitebsk, Grodno and Minsk regions, of which: in the Vitebsk region – 543 tons (stored at 20 stocks located in 17 districts); in the Grodno region – 144 tons (stored at the stock in the Novogrudok region); in the Minsk region about 506 tons (stored in 11 stocks located in 11 districts).

To implement the obligations stipulated by the Stockholm Convention on persistent organic pollutants, the Republic of Belarus adopted and implemented benchmarks of the program of socio-economic development of the Republic of Belarus for 2016–2020, subprogram "Management of persistent organic pollutants" of the State Program "Environmental Protection and sustainable use of natural resources "for 2016–2020 and State Program "Environmental Protection and Sustainable Use of Natural Resources" for 2021–2025, according to which the republic is obliged to decommission all equipment containing polychlorinated biphenyls by 2025, and by 2028 the territory of the republic must be completely cleared of PCBs and stocks of obsolete pesticides.

Within the framework of the international technical assistance project "Sustainable Management of Persistent Organic Pollutants and Chemicals in the Republic of Belarus, GEF-6", which is implemented by the Ministry of Natural Resources and environmental protection, by 2023 the environmentally friendly disposal of more than 2,000 tons of PCB-containing waste and 1,900 tons of obsolete pesticides is envisage. According to this project, nowadays the construction of an enterprise for the environmentally safe destruction of POPs and other hazardous wastes in the amount of up to 2 thousand tons per year is currently being completed on the base of the Municipal Unitary Enterprise “Complex for the processing and disposal of toxic industrial waste in the Gomel region”.

ANALYSIS OF THE POSSIBILITIES OF RECYCLING DISUSED FURNITURE IN THE REPUBLIC OF BELARUS

P. Dzelianko, V. Misiuchenka

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
dzelpolina@gmail.com

The analysis of waste management of out-of-use furniture is carried out. This type of waste is presented in the Waste Classifier under the title «Products from plywood that have lost their consumer properties, containing binder resins in an amount from 0.2% to 2.5%». Based on statistical data for the period from 2011 to 2020, a comparative analysis of waste received for reuse and disposal was carried out. The results of the analysis showed that the major part of this type of waste gets to the disposal facilities, and only a small fraction (up to

1 %) is removed or reused. Currently, the main technologies for the processing of disused furniture are incineration, and the production of compost, fuel briquettes and pellets.

Keywords: furniture, formaldehyde, reuse, disposal, recycling technologies.

This type of waste is the waste of the furniture industry, which at different stages of production has a negative impact on the environment. The waste that is presented in the Classifier of waste of the Republic of Belarus under the code 1720300 «Plywood products that have lost their consumer properties, containing binding resins in an amount of 0.2 % from 2011 to 2020» were analyzed. Cabinet furniture, which after the end of its service life falls into landfills, pollutes the soil and wastewater, which is associated with the leaching of wood-processing materials.

Based on statistical data for the period from 2011 to 2020, a comparative analysis of waste received for reuse, removal and disposal was carried out. The analysis of the generation of this type of waste showed that from 2011 to 2017 there was a tendency to reduce the formation of waste of disused furniture: 2011 – 4.1 thousand tons, 2015 – 3.4 thousand tons, 2017 – 1.73 thousand tons. However, after 2017, the indicator of the formation of this type of waste began to grow again: 2019 – 2, 14 thousand tons, 2020 – 2.7 thousand tons.

A comparative analysis of the volumes of recycling and disposal of this type of waste over the same period showed that in 2011, 0.15 % was recycled, while 102.4 % (taking into account the early accumulation at the sites of enterprises) ended up at landfill sites. In 2015, 0.05 % was recycled, 111.7 % was disposed of. In 2017, the volume of recycling amounted to 0.42 %, 96.4 % was disposed of. In 2019, 0.8 % was recycled, and the amount of waste received for disposal was 63.08 % of the formation. In 2020, the volume of waste re was 0.7 %, for landfills – 77.77 %. The result of the analysis showed that the main part of the waste falls on the disposal facilities, and the amount of waste sent for recycling is insignificant.

As a result of the patent search, several ways of processing plywood products that have lost their consumer properties were found:

1)The technology of producing fertilizers by recycling waste from the woodworking industry. [1]

Waste from the wood processing industry is crushed, mixed with ash, sawdust and dust with glue-containing effluents. Waste (sawdust, glue-containing effluents) is small in percentage, which does not allow waste to be disposed of in the required amount. The method is expensive, energy-intensive, requiring preparation for storage and transportation of fertilizers, taking a lot of time during production.

2) Wood waste incineration technology (device with combustion chamber and lining methods) [2]

This method of burning wood waste with heat recovery and a device for its realization with a combustion chamber allow:

– to dispose of woodworking waste with high efficiency, including wet, without their preliminary preparation (drying, grinding, etc.);

– simplify operation due to the spontaneous supply of loaded fuel to the burning zone during fuel burnout;

– to increase the efficiency of wood waste disposal by regulating the flow of air entering the burning zone;

– reduce the content of solid burning products in flue gases due to the low flow rate in the expansion chamber;

– reduce the cost of the heat exchanger construction, working at temperatures above 800 ºC, through the use of mass-produced finned pipes made of cast iron of conventional grades;

– reduce the time and expenses for installation and repair of lining in the combustion zone.

3) Technology for producing compost, fuel briquettes, pellets by recycling wood-containing waste (recycling of solid household waste of plant content) [3]

The patent relates to the field of processing municipal solid waste (MSW) containing organic components. Waste is sorted, various inclusions are removed and humidity measurements are carried out. The waste is crushed and dried to the required moisture index, and then compost, fuel briquettes and pellets are produced from the resulting material. The disadvantage of the known method is the relatively low efficiency of the technological recycling process, as well as the production of products with low quality.

Based on the work done, several conclusions can be made:

1) At the moment, there is a dynamic increase in the volume of generation of disused furniture.

2) Of the total volume of waste generated, only a small part is reused, the main volume of waste ends up at landfill sites.

3) There are no technologies for processing these wastes in the Republic of Belarus. Analysis of international patents has shown that the main ways of processing are compost production, thermal methods.

BIBLIOGRAPHY

1. Патент РФ № 2005120826/12, 04.07.2005. Способ получения удобрений путем утилизации отходов деревообрабатывающей промышленности // RU 2300511 C2, 10.06.2007 Бюл. № 16 / Сибримов Н. И., Барарайкин В. П., Надежкин С. М., Барашкин В. А.

2. Патент РФ № 2001127212/06, 08.10.2001. Способ сжигания древесных отходов и устройство для его осуществления с камерой сгорания и способом футеровки // RU 2189526 C1, 08.10.2001 / Кузнецов В. Б., Широков В. К.

3. Патент РФ № 2012146613/13, 01.11.2012. Способ переработки твердых бытовых отходов растительного содержания // RU 2537199 C2, 01.11.2012 / Панченко В. Ю.

ANALYSIS OF THE TREATMENT OF CULLET IN THE REPUBLIC OF BELARUS

M. Evsievich, V. Misyuchenko

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
evsievich.mari@gmail.com

The formation of cullet waste for the period 2007–2020 is analyzed. Based on the analysis of statistical data, it was determined that most of all different container cullet is formed: green, colorless, semi-white. The most used types of cullet are currently colorless container cullet and semi-white container cullet. The highest volumes of burial are characterized by the cullet of non-reinforced colored glass, cullet from kinescopes, Triplex glass waste and cullet from the processing of mercury lamps. Currently, the main technologies for processing cullet in our country are the production of light-reflecting glass balls, granulate, glass containers, ceramic tiles, glass wool.

Keywords: waste management, cullet, recycling, recyclables, statistical data.

Nowadays, glass is one of the most common materials that people use in their activities. The main advantages of glass are high strength, transparency, hardness, resistance to chemicals, low cost of production in comparison with other materials. So, bottle glass, sheet glass, showcase glass, ampoule glass are created from glass. After going out of use, all these products become nothing more than cullet. [1]

Glass is 100 % recyclable and can be recycled indefinitely without loss of quality or purity. Cullet is defined as recyclable broken or used glass used in the production of glass, but it is also the most difficult to dispose of waste, causing, if released into the natural environment, serious damage to the environment for centuries. At the same time, it is a valuable material, for which not only natural raw materials have already been spent, but also significant energy resources. In the last two decades, there has been an increase in the volume of cullet formation in the CIS countries, and the number of cullet in our country has also increased.[2]

According to the research conducted on the basis of statistical data of the Republic of Belarus on the formation of cullet in recent decades, there has been an increasing trend (52 thousand tons in 2010 and 149.7 thousand tons in 2020). A large share of cullet falls on container cullet, if we consider 2010 and 2020, the formation of container cullet has increased almost 3 times (41 thousand tons in 2010 and 118.9 thousand tons in 2020). This is due to the growth in the production of beverages and other food products using glass containers. But some types of cullet, for example, other cullet has increased significantly, namely by 7 times (2.6 thousand tons in 2010 and 18.5 thousand tons in 2020).

In 2020, most of the cullet falls on polluted cullet (22 % of the total volume of education) and on colorless container cullet (21 %), semi-white container cullet moved to third place in terms of education and accounted for 19 % of the total amount of waste generation. If we compare with 2015, the formation of polluted cullet increased 39 times (in 2015 – 2 thousand tons, in 2020 – 92 thousand tons), colorless container cullet 5 times (in 2015 – 17 thousand tons, in 2020 – 87.6 thousand tons) and semi-white container cullet 3 times (in 2015 – 24 thousand tons, in 2020 – 77.4 thousand tons). The least amount of chemically resistant glass was formed in 2020, its volume of formation was 100 tons, and in 2015 it was 165 tons, that is, the volume of formation decreased by 1.6 times.

Taking into account the increasing amount of cullet, data on its use and disposal were analyzed. The cullet does not arrive for neutralization, but it is actively used, some types go to burial and are stored temporarily on the territory of the enterprise. There is a positive trend in the use of all types of cullet and a significant decrease in burial.

In particular, in 2020, 250 thousand tons of cullet were used, if compared with the same 2007, it is almost 100 times more, because in 2007 only 22 thousand tons were used. The most used types are colorless container cullet and semi-white container cullet. In 2020, 100 tons of cullet were received for burial in the republic as a whole, and these are mainly cullet from kinescopes, cullet of non-reinforced colored glass, Triplex glass waste and cullet from the processing of mercury lamps. In 2007, about 3 thousand tons of waste were received for disposal, and these were such types of cullet as polluted cullet, flat glass cullet, cullet with metal inclusions, waste from the production of mirrors, glass from the processing of mercury lamps.

In general, the conclusions on the treatment of cullet in our country are as follows:

1) The total formation of container cullet of different types increased 6 times during the analyzed period.

2) Over the decade, the formation of bottled cullet decreased by 1.7 times.

3) In 2007, lead-free optical glass cullet was formed in the largest quantities, and in 2020, semi-white sheet glass cullet, polluted glass cullet and other glass cullet became the leader, polluted glass cullet is characterized by the largest volume of formation.

4) During the analyzed period, a consistently large formation of semi-white container cullet is monitored.

5) The smallest volumes of formation are characterized in 2020 by the cullet of chemically resistant glass, which is 7 times less than in 2010.

6) Thanks to recycling technologies, cullet began to be used in larger quantities than before, so its use increased almost 100 times from 2007 to 2020.

7) In 2007, the most used waste was cullet when packing various beverages (bottle cullet), currently the leaders are colorless container cullet and semi-white container cullet.

8) The volume of burial during the period under review decreased by almost 100 %. In 2007, polluted cullet, flat glass cullet, cullet with metal inclusions, mirror production waste, glass from mercury lamp recycling were actively buried, now in small quantities – cullet from kinescopes and colorless container cullet.

The most frequently used methods of cullet processing were identified – this is the production of light-reflecting glass balls, granules, glass containers, ceramic tiles, glass wool, preparation and use of waste for the reclamation of unused (disturbed) lands.

BIBLIOGRAPHY

1) *Dubovets, D. L.* Export of glass waste / D. L. Dubovets // Ecology at the enterprise. 2020. №. 8. S. 108–109.

2) *Misyuchenko, V. M.* Processing of industrial waste and development of documents for the enterprise : an educational and methodological manual / V. M. Misyuchenko. Minsk, IVC of the Ministry of Finance, 2018. – 99 p.

EFFECT OF BIOSOLVENT DRUGS ON THE WASHING EFFECTIVENESS OF SALTS IN ALLUVIAL SOILS WITH DIFFERENT SALT

M. Fakhrutdinova, O. Imomov

National University of Uzbekistan (NUUz)
Tashkent,Republic of Uzbekistan
murod.imomov2019@gmail.com

It is important to study ionic polymers, which effectively wash away salts in saline soils, ion exchange properties, first of all, to study their effect on soil structure, to develop methods of application and their introduction into saline soils. This suggests the need to not only manage saline soils, but also to adopt advanced technologies and share accumulated experience in saline soil management to make them more widely used to prevent soil salinization.

Keywords: Salt movement, biosolvent, polymer composition, effective washing of salts ,saline soils, soil structure.

According to official documents, the area of irrigated lands in the country is 53 % or 2 million hectares. 286,000 hectares are saline to varying degrees. Weakly saline soils cover 1 million hectares. 125 thousand hectares or 58 %. The area of moderately saline lands is 650,000 hectares or 33 %, and the area of highly saline lands is about 250,000 hectares, which is 14 % of the total saline lands.

Subsequent scientific studies have shown that in low-salinity soils, crop yields are reduced by 20–25 %. This means that 1/4 less is harvested than non-saline land. In moderately saline soils, yields are reduced by 30–40 %, and in some cases up to 50 %. In heavily saline soils, yields can be as low as 80 % or even extinct. [1]

As a result of non-compliance with scientifically based agro-technical rules of irrigated lands, soil salinity is increasing year by year. Currently, many ditches are not cleaned or buried, and closed drains do not work, leading to rising groundwater levels. In addition, over-irrigation is intensifying the processes of salinization, salinization and salt movement in many places. In areas with secondary salinization, magnesium and sodium cations are increasing instead of calcium cations. It leads to a decrease in the porosity of the soil, compaction, and, consequently, the deterioration of the filtration coefficient of the soil structure. In Kyzyltepa, Navbahor, Karmana, Khatirchi districts of Navoi region, there is an increase in salinity.

This geochemical chain connection in the oases must be thoroughly studied and taken into account when developing reclamation measures against salinization. It can be seen that there are two types of connections in the

oases: 1) between the components; 2) between geosystems. Due to these two bonds, chemical processes in the soil result in different salinization processes in the soil [2].

The Ministry of Innovation Development of the Institute of Bioorganic Chemistry of the Academy of Sciences of the Republic of Uzbekistan has developed a drug "Biosolvent" for effective washing of salts in saline soils, which was used in experiments for washing salts in saline soils and achieved effective results. [3]

It is important to study ionic polymers, which effectively wash away salts in saline soils, ion exchange properties, first of all, to study their effect on soil structure, to develop methods of application and their introduction into saline soils.

The polymer composition consists of its polyacid and copolymer 25–30 % anionic type active surfactant 1.2–4.5 % amino alcohol type buffer and neutralizing additive 04–13 % and the rest is neutral-inert substance and water. The effectiveness of the Biosolvent composition is explained by the fact that the total amount of insoluble salts is washed away by 35–40 % compared to the control, depending on the soil properties, and the soil porosity increases by 20–30 %. [4]

Grassland of Khatirchi district under study leads to an increase in alluvial soils, soil microflora, quantitative number of microorganisms and an increase in the number of nitrifiers. [5]

This suggests the need to not only manage saline soils, but also to adopt advanced technologies and share accumulated experience in saline soil management to make them more widely used to prevent soil salinization.

BIBLIOGRAPHY

1. Ministry of Higher and Secondary Special Education of the Republic of Uzbekistan Fergana State University Isagaliev MT Text of lectures on Soil Bonting Fergana – 2019 Page 14.

2. *Joniyev Otabek Tokhirovich*, Master's dissertation "Environmental problems of Navoi region and the ongoing natural geographical processes" pages 43–44.

3. https://mininnovation.uz/oz/news/29-08-2019-biosolvent-preparati

4. *Khudoynazarov I. A., Normaxamatov N. S., Turaev A. S*. Materials of the 7th Republican Conference of Young Chemists “Problems of Bioorganic Chemistry”, Namangan, November 25–26, 2011.

5. Composition for processing of soil. Zaya patents of the Republic of Uzbekistan; Turaev A. S., Normaxamatov N. S., Khudoynazarov I. A., Filatova A. V. IAP 20150262 dated 29.06.2015.

6. Melioratsiya pochv, Zasolennые pochvы: ucheb, posobie O. G. Lopatovskaya, A. A. Sugachenko-Irkutsk: Izd-vo Irkut, gos, un-ta, 2010. – 101 p.

INFLUENCE OF MOLD FUNGI OF THE GENUS *ASPERGILLUS* ON A NATURAL CELLULOSE POLYMER IN MACROVISUAL OBSERVATION

L. Gavriluyk, N. Ikonnikova

Belarusian State University, ISEI BSU

Minsk, Belarus

massl2001@yandex.by, rett14301@gmail.com

The influence of substrate and biodegradation of molds on the polymer of natural origin was evaluated. The relationship between speed of propagation of the samples and the density of the polymer samples is indicated.

Keywords: mycology, cellulose, biodegradation, mold.

Fungi of the genus *Aspergillus* are of great interest to mycologists and microbiologists due to the ubiquitous distribution of representatives of this genus, the development cycle, and the biodegradability of polymers of various kinds.

The genus *Aspergillus* has a huge enzymatic capacity for a wide range of polymers, characterized by active biochemistry of processes, which can lead to significant regulation and stimulation of the natural biodegradation of various materials and their introduction into the global and local circulation of substances.

It was revealed that the mold of the genus Aspergillus showed antagonistic activity of varying severity in relation to the studied samples. The results were taken into account 24 hours after populating the samples into the environment.

The enzymatic activity of cellulase was determined according to the degree of hydrolysis of the filter paper. To assess the cellulase activity of glucosidase, the method of visual characterization of the destruction of cellulose samples was used

The highest cellulolytic activity was observed on the 10th day of growth of the fungus on Czapek's agar with samples of low density filter paper. On a nutrient medium supplemented with samples of medium and high densi-

ty, the enzymatic activity of cellulase of the A. niger fungus was lower. Cultivation of the fungus on a nutrient medium for 20 days without adding additional sources of cellulose showed a low level of enzyme activity.

Table 1

Duration of biodegradation of low density filter paper samples.

Culture	Duration of cultivation	Start of biodegradation of cellulosic polymer samples		
		Low density	Medium density	High density
Aspergillus sp. LG 1	20 days	3 days	6 days	10 days
Aspergillus sp. LG 2	20 days	2 days	7 days	12 days
Aspergillus sp. LG 3	20 days	3 days	7 days	11 days
Aspergillus sp. LG 4	20 days	4 days	5 days	14 days
Standard	–	–	–	–

The effect of *A. niger* on the cellulosic substrate showed an accelerated degradation (biodegradation) in comparison with the standard, and, accordingly, a change in the degradation time of the samples. The main participants in the biodegradation of cellulose were catalase and cellulase. A wide area of distribution and a flexible adaptive apparatus, coupled with a highly active enzymatic system, make *A. niger* a quality model for further research in the field of industrial biodegradation of biopolymers that linger in the circulation of substances in the long term.

BIBLIOGRAPHY

1. *Клесов, А. А.* Ферментативный гидролиз целлюлозы / А. А. Клесов [и др.] // Биоорганическая химия. - 1980. – № 6. – С. 1225–1241.

2. *Грачева, И. М.* Лабораторный практикум по технологии ферментных препаратов: учеб. пособие / И. М. Грачева. – М.: Легкая и пищевая промышленность, 1982. – 240 с.

IFFERENCES IN THE VERBAL DEFINITION OF THE CHARACTERISTICS OF THE ECOLOGICAL QUALITY OF PRODUCTS IN SOME LANGUAGES AS A BASIS FOR THE UNIFICATION OF THEIR ENVIRONMENTAL LABELING

V. Gudovich[1], **A. Fralou**[2]

[1]*Minsk State Linguistic University*

[2]*University of Civil Defense of the Ministry of Emergency Situations of the Republic of Belarus*

Minsk, Republic of Belarus

valeriagudovich@list.ru

The differences found in modern languages in the expression of the characteristic of such environmental characteristic of products as the absence of potentially hazardous chemicals in them make it expedient to unify their environmental labeling in a wide international practice.

Keywords: ecology, chemicals, environmentally friendly product, environmental labeling.

Currently, in various countries, but primarily in industrialized countries, consumers are increasingly interested in such environmental quality of food products as the absence of chemical ingredients in them that may not be safe for health. Prevention of food contamination with potentially dangerous chemicals is provided by so-called environmentally friendly technologies that exclude or minimize the use of chemicals for agricultural production. Practice shows that such technologies are able to cause a higher production cost and, accordingly, the price of the product. Nevertheless, many consumers today are ready to give preference to such products and, if possible, purchase them. However, it is found that in different languages there are differences in the expression of such an ecological quality of the product as obtaining it using the so-called environmentally friendly technology. And this can create difficulties in choosing such a product for a person who finds himself in another country and is in an unusual language environment for him.

So, in our country, both in Belarusian and in Russian, as well as in Ukrainian, people are accustomed to the verbal meaning of this product literally as "environmentally pure". Which in meaning implies that there are no substances in the product that are dangerous to both humans and the environment. Similarly, such a product is defined in French – "produits ecologiquement purs". However, in Germany and other German-speaking countries,

a different construction is used to formulate the same term. In German, such a product is called "umweltfreundliches Produkt". Which in Belarusian and Russian literally means a product friendly to the environment. A similar verbal meaning is also used in English: "environmentally friendly product". Meanwhile, in Italian, the adjective "biologica" is used. So, Italians call it "biological product".

From the examples given, it follows that, once in another country, a person, due to differences in the language constructs, may have difficulty in understanding the information about the environmental quality of the product being selected and purchased, not fully understanding the meaning of the labels on its packaging or in the store.

Unification in different languages with their historically established traditions of the product designation produced by clean technology without the use of chemicals seems to be hardly possible. Therefore, in our opinion, in this situation it would be useful and expedient to solve the problem of unification in the broad international practice of ecolabelling of products. By introducing for the designation of a product produced by clean technology without the use of chemicals a single common label for a variety of countries and, therefore, everywhere recognizable. Just as it has been done so far in the practice of the Scandinavian countries and the European Union.

NATURAL ANALOGUES IN PHYSICS AND MECHANICS

D. Ignatovskiy, V. Krasovskiy

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
skentdimaskent@gmail.com

The natural mechanisms and systems of living beings that are used or can be used by man are considered: in artificial mechanisms, structures, devices. Questions about possible borrowings in the future, methods of borrowing mechanical and physical systems from wildlife in order to improve the quality of human life and the scientific ecological approach in the design of technical solutions are described.

Keywords: nature, physics, man, systems, mechanisms.

According to research by astrophysicists from Cornell University [1], life on planet Earth is at least 3.7 billion years old. During this time, through evolution, nature has created a huge variety of different systems that help living organisms survive in this world, develop and increase the number of their populations. Man, possessing high intelligence relative to other creatures on Earth, repeatedly noticed the perfection of the systems created by nature and began to borrow them. The concept of a tool for transferring these devices to real practical tasks will allow a person to continue to improve the quality of his life, observing the environmental principles of development.

The simplest heat exchanger is a household heating battery in the house. Hot water passes through pipes with a small outer surface, which, according to the Newton-Richman law, is responsible for correspondingly small heat losses. Next, the main pipe passes into many small pipes located in the battery itself. This battery has a large outer surface, as a result of which heat loss increases, and the room heats up. Similarly, the system of maintaining body temperature in warm-blooded people works. Organs such as the brain and liver have high temperature, and they can suffer from overheating. As a coolant in the body is not water, but blood, the role of the main pipe – large vessels, the role of the radiator is performed by the capillary mesh of the skin. Blood, when it enters this grid, is cooled by the external environment and already cooled enters the heart and other organs that require cooling.

In 1934, the Englishman Percy Shaw patented his invention – the "cat's eye". By cat's eye, Percy meant a reflector, which is still used all over the world to separate stripes, as well as to mark the roadsides. It is obvious that the idea to create such a retroreflector came to the Englishman after he noticed the reflection of light in the eyes of a cat. Tapetum lucidum is responsible for the reflection of light – a special layer of vascular shell of the eye. This layer is behind the retina. Tapetum directs retinal photons that have not interacted with retinal receptors back to increase the number of photons absorbed. Therefore, the eyes of cats and glow.

Analogues of the generator and electric motor are presented in adenosine triphosphate synthase (ATP synthase). The stator analogue (stationary part) is fixed inside the mitochondrial membrane or chloroplast, and inside there is a rotor – a rotating part. This rotor uses the potential difference in the membrane, because during cellular respiration, positively charged hydrogen ions are pushed out of the mitochondria. Next, they tend to get back inside, where the charge is negative, and their path lies through the molecular rotor of ATP synthase. By turning this rotor, the protons cause the protein to synthesize the ATP molecule, the intracellular fuel. However, ATP synthase can also work in the mode of an electric motor: when ATP is a lot, and the voltage on the membrane is

insufficient, the enzyme can use its fuel and begin to pump protons in the other direction, thereby increasing the potential difference.

As we can see, nature has long invented everything for us, and we just need to learn from her and take her inventions. A person should learn to notice and understand natural mechanisms, to master the tool of borrowing these systems. This will significantly improve the quality of human life, is likely to elevate the environmental component, and will also contribute to the simplification of the scientific and inventive process.

BIBLIOGRAPHY

1. *Ben K. D.* Pearce Constraining the Time Interval for the Origin of Life on Earth / A. Tupper / R. E. Pudritz / P. G. Higgs // Astrobiology, 2018.

ADVANTAGES OF PHITOREMEDATION CLEANSING SOILS CONTAMINATED WITH HEAVY METALS

Z. Jabbarov, N. Sultonova

National University of Uzbekistan named after Mirzo Ulugbek (NUUz)
Tashkent, Republic of Uzbekistan
sultonovanim@gmail.com

Due to natural processes and anthropogenic activities, the accumulation of heavy metals in the soil has increased rapidly. Heavy metals are biologically indestructible elements that join the food chain and cause various diseases in the human body, so it is important to remove heavy metals from the soil. Phytoremedia is an environmentally friendly and cost-effective method. It is important to get acquainted with the advantages and mechanisms of action of phytoremedia. The following is a description of the types of phytoremedia, the mechanisms by which plants absorb, transfer, and neutralize heavy metals.

Keywords: phytoremediation, bioavailability, xylem loading, sequestration, cellular compartmentation, phytostabilization, phytoextraction, phytovolatilization, phytofiltration.

Plants have the abilities to absorb ionic compounds in the soil even at low concentrations through their root system. Plants extend their root system into the soil matrix and establish rhizosphere ecosystem to accumulate heavy metals and modulate their bioavailability, thereby reclaiming the polluted soil and stabilizing soil fertility [1].

There are advantages of using phytoremediation, which include:

– economically feasible-phytoremediation is an autotrophic system powered by solar energy, therefore, simple to manage, and the cost of installation and maintenance is low;

– environment and eco-friendly it can reduce exposure of the pollutants to the environment and ecosystem,

– applicability it can be applied over a large-scale field and can easily be disposed;

– it prevents erosion and metal leaching through stabilizing heavy metals, reducing the risk of spreading of contaminants;

– it can also improve soil fertility by releasing various organic matters to the soil [2].

There are series of processes involved in accumulation of heavy metal in plants, including heavy metal mobilization, root uptake, xylem loading, root-to-shoot transport, cellular compartmentation, and sequestration. Heavy metal mostly exists as insoluble form in soil, which is not bioavailable to plants. Plants can increase their bioavailability by releasing a variety of root exudates, which can change rhizosphere pH and increase heavy metal solubility [3]. After entering into root cells, heavy metal ions can form complexes with various chelators, such as organic acids. These formed complexes including carbonate, sulfate, and phosphate precipitate, are then immobilized in the extracellular space (apoplastic cellular walls) or intracellular spaces (symplastic compartments, such as vacuoles) [1]. The bioavailable metal is sorbed at the root surface and moves across the cellular membrane into the root cells. The uptake of heavy metals into roots occurs mainly through two pathways, apoplastic pathway (passive diffusion) and symplastic pathway (active transport against electrochemical potential gradients and concentration across the plasma membrane). The common uptake of heavy metals via symplastic pathway is an energy-dependent process mediated by metal ion carriers or complexing agents [4] There are a number of phytoremediation strategies that are applicable for the remediation of heavy metal-contaminated soils, including (I) phytostabilization – using plants to reduce heavy metal bioavailability in soil, (II) phytoextraction – using plants to extract and remove heavy metals from soil, (III) phytovolatilization – using plants to absorb heavy metal from soil and release into the atmosphere as volatile compounds, and (IV) phytofiltration – using hydroponically cultured plants to absorb or adsorb heavy metal ions from groundwater and aqueous waste [5]. The metal ions se-

questered inside the vacuoles may transport into the stele and enter into the xylem stream via the root symplasm [6] and subsequently are translocated to the shoots through xylem vessels. Through apoplast or symplast, they are transported and distributed in leaves, where the ions are sequestered in extracellular compartments (cell walls) or plant vacuole, thereby preventing accumulation of free metal ions in cytosol [7].

BIBLIOGRAPHY

1. *Ali, H., Khan, E., and Sajad, M. A.* (2013). Phytoremediation of heavy metals-concepts and applications. Chemosphere 91, 869–881. doi: 10.1016/j.chemosphere.2013.01.075

2. *Aken, B. V., Correa, P. A., and Schnoor, J. L*. (2009). Phytoremediation of polychlorinated biphenyls: new trends and promises. Environ. Sci. Technol. 44, 2767–2776. doi: 10.1021/es902514d

3. *Dalvi, A. A., and Bhalerao, S. A.* (2013). Response of plants towards heavy metal toxicity: an overview of avoidance, tolerance and uptake mechanism. Ann. Plant Sci. 2, 362–368.

4. *Peer, W. A., Baxter, I. R., Richards, E. L., Freeman, J. L., and Murphy, A. S*. (2005). "Phytoremediation and hyperaccumulator plants," in Molecular Biology of Metal Homeostasis and Detoxification, eds M. J. Tamas and E. Martinoia (Berlin: Springer), 299–340. doi: 10.1007/4735_100.

5. *Marques, A. P., Rangel, A. O., and Castro, P. M*. (2009). Remediation of heavy metal contaminated soils: phytoremediation as a potentially promising clean-up technology. Crit. Rev. Env. Sci. Technol. 39, 622–654. doi: 10.1080/10643380701798272.

6. *Thakur, S., Singh, L., Wahid, Z. A., Siddiqui, M. F., Atnaw, S. M., and Din, M. F. M*. (2016). Plant-driven removal of heavy metals from soil: uptake, translocation, tolerance mechanism, challenges, and future perspectives. Environ. Monit. Assess. 188:206. doi: 10.1007/s10661-016-5211-9.

7. *Tong, Y.-P., Kneer, R., and Zhu, Y.-G*. (2004). Vacuolar compartmentalization: a second-generation approach to engineering plants for phytoremediation. Trends Plant Sci. 9, 7–9. doi: 10.1016/j.tplants.2003.11.009.

FEATURES OF RADIAL DISTRIBUTION OF NICKEL IN FOREST SOILS IN ZONES OF INFLUENCE OF ELECTRICAL PRODUCTION

P. Kachanovich

The Polesie Agrarian Ecological Institute of the NAS of Belarus
Brest, Republic of Belarus
tyres810@gmail.com

The radial distribution of nickel in three types of biogeocenoses subjected to aero-technogenic chemical pollution is considered. A high migratory ability of nickel was revealed, especially evident under the black alder forests. The sorption capacity of the forest floor did not significantly affect the intensity of the downward migration of nickel.

Keywords: heavy metals, soil pollution, nickel, lead-acid car battery production, radial migration in soils, forest floor.

The study of the radial distribution of nickel in three types of biogeocenoses was carried out - sorrel spruce forest (A) and herb-runny birch forest (B) located at a distance of 35 m and marsh-fern-nettle black alder forest (C) located at a distance of 70 m from the waste storage site (lead ash) for the production of storage acid batteries (ACB). To assess the distribution of TM in the profile, the radial contrast ratio (Kc) was used.

The highest nickel content was recorded in the surface layer (0–2 cm) of the A1 horizon of the spruce forest and amounted to 7.81 mg/kg (table 1), which is 3.2 times higher than the local background (for Ni – 2.41 mg/kg). The upper layer of litter and the underlying layer of soils (at a depth of 2–4 cm) also have a high level of nickel contamination and contain, respectively, 6.2 and 6.55 mg / kg of nickel, which in both cases exceeds the local background by more than 2, Five times. A decrease in the Ni content and the transition of Kc through 1 is observed at a depth of 6 cm, which is significant (4–6 cm deeper than for Zn and Cd, which we considered earlier [1]).

The gross content of nickel in the soil profile of birch forests, spruce forests, black alder forests of the impact zone of pollution "Zeleny Bor"

Table 1

Показатель		Опад	Подстилка	0–2 cm	2–4 cm	4–6 cm	6–8 cm	8–10 cm	10–12 cm	12–14 cm	14–16 cm
A	mg/kg	1,3	4,77-6,2*	7,81*	6,55*	3,67*	2,6*	<1,3	<1,3	<1,3	<1,3
	Kc	–	1,30-1,68	2,12	1,78	1	0,71	<0,35	<0,35	<0,35	<0,35
B	mg/kg	1,46	3,17*	3,31*	2,55*	1,98	2,02	1,94	1,73	<1,3	1,53
	Kc	–	1,46	1,53	1,18	0,91	0,93	0,89	0,8	<0,6	0,71
C	mg/kg	1,53	5,49*	4,69*	5,25*	5,42*	5,32*	5,16*	5,63*	5,02*	5,18*
	Kc	–	1,05	0,9	1	1,03	1,02	0,98	1,07	0,96	0,99

* – exceeds local background
Kc – the radial contrast ratio

The highest migratory activity of Ni along the soil profile was detected under black alder forest. Despite the position of this test site at almost twice the distance from the emission source, it was not detected through 1 even at a depth of 16 cm. At the same time, the soil profile and litter under the alder stands contain an amount that exceeds the local background by 1.8–2.3 times.

The lowest average Ni content is taken under the birch forest, and no increase in the local background was recorded at this site. The transition of Kc through 1 occurs at a depth of 4 cm, which is also 2–4 cm deeper than for Zn and Cd [1].

BIBLIOGRAPHY

1. *Качанович, П. В.* Особенности радиального распределения в лесных почвах цинка и кадмия в зонах влияния электротехнических производств / П. В. Качанович // Молодежь в науке – 2021 : тез. Докл. XVIII Междунар. науч. конф. Молодых ученых, Минск, 27-30 сент. 2021 г. : в 2 ч. / Нац. Академ. Наук Беларуси, Совет молодых ученых ; редкол : В. Г. Гусаков (гл. ред.) [и др.]. – Минск : Беларусская наука, 2021. – Ч. 2. – С. 431–435.

AGRICULTURAL CROPS IN THE STRUCTURE OF THE DIET OF RESOURCE ANIMAL SPECIES IN BELARUS

A. Kapskaya, Yu. Lyakh, M. Lezhdey

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
Yury_Liakh.61@mail.ru

Crop production in the structure of agriculture in Belarus occupies a leading role, being the basis for all branches of agricultural production. The high level of obtaining crop products allows us to talk about the use of modern and effective technologies when performing agrotechnical methods. However, at every stage from sowing to harvesting, due to various reasons, there is a loss of part of the crop. These residues of plant growing are used to replenish their diet with resource species of animals of Belarus.

Keywords: agricultural production, crop production, resource species of animals, hunting.

Losses in crop production, which mainly arise due to violation of technological regulations at all stages of production, cause significant economic damage to the national economy. The natural factor also makes its own adjustments to the quantitative and qualitative indicators of losses of all types of fodder plants. In some cases, they can reach 10-20% of the grain yield. However, that part of the crop production that remained in the fields becomes available for wild animals and is included in the structure of their diet.

Research on this topic is of certain relevance, since special attention is paid to the conservation of biological resources in Belarus. And the preservation of the diversity and number of populations of resource species of animals is a priority task.

In the process of research, in determining the level and value of agricultural crops in the structure of the diet of hunting species of animals (autumn-winter period), we conducted field studies of agricultural lands visited by wild animals living on the territory of the hunting farm of the Molodechno district of the Minsk region.

In recent years, Belarus has clearly seen the dynamics of an increase in the number of ungulate species of game animals, with the exception of wild boar, the population of which, due to the threat of African swine fever, was reduced from 80.4 thousand in 2013 to 2.5 thousand in 2020. [1, 2].

The increase in the number of other species of animals was the result of the adoption of timely laws in the field of protection and conservation of species diversity of animals and their habitats. In the last decade, the number of hunting species of ungulates in Belarus has continued to grow. So the moose population increased from 25.27 thousand in 2010 to 43.5 thousand in 2020. Reindeer - from 7 thousand in 2010 to 34.27 thousand in 2020, and roe deer – from 70.61 thousand in 2010 to 120.0 thousand in 2020. The main task of the hunting industry in Belarus is to achieve the optimal number of populations of resource species of animals in order to effectively manage this industry.

The optimal number is the number of hunting animals that can live in hunting grounds for a long time, reproduce naturally, effectively use forage resources, which ensures the highest yield of high-quality hunting products without significant harm to the components of the natural environment [3, 4].

And, nevertheless, an increase in the density of wild animals predisposes the risks of a decrease in the forage capacity of hunting grounds. In this situation, agricultural crops and that part of the crop that remains in the fields after harvest is an additional source of food for forest dwellers.

BIBLIOGRAPHY

1. *Лях, Ю. Г.* Популяция дикого кабана в условиях неблагополучия Республики Беларусь по африканской чуме свиней / Ю. Г. Лях, А. В. Морозов., С. Г. Нестерович // Международная научно-практическая конференция «Перспективы сохранения и рационального использования природных комплексов особо охраняемых природных территорий». п. Домжерицы, 26–29 августа, 2015. – С. 281–284.

2. *Лях, Ю. Г.* Научно-практические рекомендации по проведению комплекса охотохозяйственных и биотехнических мероприятий в охотничьем хозяйстве ОАО «Газпром трансгаз Беларусь» // Минск: «Право и экономика» , 2014. 47–48 с.

3. *Морозов, А. В.* Роль сельскохозяйственных культур в структуре рациона охотничьих животных на фоне Осиповичской субпопуляции зубров / А. В. Морозов, Ю. Г. Лях, Е. К. Востоков // Животноводство и ветеринарная медицина, Горки, №3 (18) 2015. С. 20–25.

4. *Востоков, Е. К.* Кабан в биоценозах Беларуси (исторические аспекты, современное состояние, перспективы и патологии) / Е. К. Востоков, Ю. Г. Лях // – Минск 6 ИВЦ Минфина, 2020. – 280 с.

COMPREHENSIVE EVALUATION AND OPTIMIZATION OF ECOLOGICAL TRANSFORMATION OF COAL MINING SUBSIDENCE LAND – A CASE STUDY OF PAN'AN LAKE URBAN WETLAND PARK IN XUZHOU

Ju. Kechun

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus

Coal resources play an important role in the process of human production and development, but after large-scale coal mining, coal mining subsidence has caused a large waste of land resources and brought great harm to the environment and people's production and life. With the deepening of the research on the ecological transformation of coal mining subsidence land, the current situation of subsidence land after ecological transformation has attracted more and more attention.

Keywords: coal mining subsidence area; Ecological environment; Governance and restoration.

Coal has played a vital role in promoting China's economic development, but its mining has led to surface subsidence to a certain extent, damaged the ecological environment, and even threatened people's life and property safety. The treatment and restoration of the collapsed area has a serious impact on the economy and stability of the mining area, which is a problem that needs to be seriously solved. We should innovate and build the subsidence area as a whole and constantly strengthen the intensity of protecting the ecological environment. Therefore, this governance work has become a key topic for in-depth research.

Most of the subsidence areas generally choose farmland and farmland in the suburbs, which directly damages the farmland and even cannot be cultivated effectively. Comprehensive management should protect agricultural planting. Generally, drainage method, local soil taking method, solid waste filling method, etc. are adopted. Specifically, the backfilling operation is carried out through gangue, fly ash or other solid wastes, and the planting operation is comprehensively promoted after the land is leveled.

First, combine the scientific development concept and strictly address the root causes. In the process of restoration, scientific means of restoration should be formulated in combination with the actual situation to further achieve the goal of scientific restoration. For example, in shallow areas, planting land can effectively improve the

environment; In the deep and shallow complex areas, the methods of mixed culture of fish and ducks are selected; For large-scale areas, we can choose to build wetland parks.

Second, actively carry out base experiments and demonstrations. In order to restore and control in time, we should understand the local geological characteristics and ecological environment as a whole, select the basic improvement principle according to local conditions, break through the specified demonstration area, further develop comprehensive restoration and control, and achieve the goal of restoring the ecological environment in the group.

Third, establish an industrial system with ecological characteristics. Before the specific restoration, we should emphasize the sustainable development of ecology, vigorously develop agricultural circular economy by adjusting the production mode within the region, implement cleaner production, and summarize a new industrial development mode with high scientific and technological quantity and minimum resource consumption.

For example, a wetland restoration, specifically an important sub project to repair the ecological environment of exhausted coal mines, is initially constructed in the abandoned old mining areas. After restoration, the north and South regions were gradually connected. In the process of economic planning and development, closely focusing on the goal of ecological construction, with the help of other mining companies in close cooperation, scientifically integrate water system and vegetation, establish natural environment and effectively expand highway network, so as to further build the collapsed area into a living area with various functions of tourism, ecology and residence. This has become the most representative example of restoring the collapsed ecological environment. At the same time, according to the geographical environment and the real situation of the city, the ecological area has been preliminarily constructed, and as a coal culture scenic spot with unique style, it has initially developed into a tourism and cultural place. In view of other impacts brought by the subsidence area, the local government has taken relevant measures, given certain policy subsidies, and selected the corresponding recovery mode according to the specific situation. The wetland is constructed on the gangue hill, including two parts: the gangue hill and the leaching buffer zone. It can be designed as shrub land in the direction of repairing collapse. Specifically, a layer of black soil is laid on the gangue hill through non filling repair. Because the shower runoff in the depression reflects the acid characteristics, the plants adopted also show acid resistance. The corresponding way is to plant deciduous forest land, and lay the mixed soil on the gangue hill. At least half of the clay must be mixed.

Pan'an Lake Wetland Park is not only an ordinary Wetland Park, but also represents a spirit of exploration and explores a new mode of waste utilization in many similar wastelands. I sincerely wish Pan'an lake a better tomorrow.

COMPARATIVE ANALYSIS OF METHODS FOR CALCULATING STATIONARY RADIATION PROTECTION APPLIED TO PREMISES FOR RADIATION THERAPY

E. Kemesh, E. Preobrazhenskaya, M. Piatkevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
kemesh.jenya@gmail.com

The conclusions of the analysis of two different methods for calculating stationary radiation protection applied to the premises for radiation therapy are presented: the method used for calculating radiation protection in the Republic of Belarus and described in the NCRP recommendation No. 151 “Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities »

Keywords: radiation safety, radiation control, dose rate, calculation of protection, equivalent dose, equivalent dose rate.

In the course of the work, two methods of performing the calculation of stationary radiation protection for the premises of radiation therapy were considered. One technique is used to calculate radiation protection in the Republic of Belarus. Another - describes the NCRP recommendation No 151 "Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities" [1].

To analyze the techniques, a plan of the radiation therapy room was designed in accordance with the recommendations of the NCRP, sanitary rules and regulations [2] and the designer's desktop reference from Varian [3]. It was also decided to switch to the equivalent dose rate in the calculations, in contrast to the NCRP recommendation to use the equivalent dose.

When calculating the stationary radiation protection of the radiation therapy room, taking into account the sanitary rules and norms used in the Republic of Belarus, it was obtained that in the same planned room, the

equivalent dose rate on the door to the labyrinth is $2{,}7\times10^3$ times higher at using the methodology used in the Republic of Belarus. This is due to the use of a more conservative approach to assessing dosimetry characteristics in the Republic of Belarus.

Based on the calculations performed, it can be concluded that both methods globally differ only in the initially laid down principles. With a detailed examination of all the formulas used, it is possible to track the general physical approach in the calculations. It can also be noted that the methodology written in this work according to the recommendations of NCRP No. 151 is more optimized, due to the typical design of the premises for radiation therapy. However, this is one of the key constraints to the widespread use of this technique. Since it is not always necessary to design a room from scratch, it may not be feasible to use this technique in calculating radiation protection for existing rooms with a different layout.

The above-described disadvantage is devoid of the methodology adopted for calculating radiation protection in the Republic of Belarus. Due to its versatility, it is ideal for calculating protection with complex labyrinth designs.

BIBLIOGRAPHY

1. Structural Shielding Design and Evaluation for Megavoltage X- and Gamma-Ray Radiotherapy Facilities / NCRP № 151. – 2005. – 257 p.

2. Санитарные правила и нормы 2.6.12-34-2006 «Гигиенические требования к размещению и эксплуатации ускорителей электронов с энергией до 100 МэВ».

3. Designers' Desk Reference High Energy Clinac Edition / Varian Medical Systems. – California, 2015. – 15 p.

STUDY OF THE PROPAGATION OF CILIATE BANANA-EATEN GECKOS IN THE MINSK ZOO

N. Kovalchuk, I. Khandohiy

Belarusian State University, ISEI BSU

Minsk, Republic of Belarus

natalia2000kovalchuk@gmail.com

The difficult ecological situation in the world today worries everyone. Human activities, climatic factors without taking into account environmental laws have led to catastrophic consequences for animals. In particular, a great influence was exerted on the ciliated bananoed geckos. At the moment, breeders of the Minsk Zoo are trying to find optimal conditions for life and breeding of ciliated bananoed geckos to increase the population.

Keywords: gecko, banana eater, reptile, reproduction, lizard.

The aim of the work was to identify the features of the reproduction of ciliated bananoed geckos in the Minsk Zoo.

The banana-eating ciliate gecko is listed as an endangered species and is under protection. Agriculture and the proximity of civilization, as well as the capture of geckos for sale and the merciless hunt for geckos by red fire ants, have contributed to the rapid decline of this species in nature [1]. Part of the territory inhabited by the ciliated bananoed gecko is protected, but no other measures are taken to protect this species. Therefore, all over the world, zoologists are actively raising banana eaters in a terrarium to restore their population [2]. The Minsk Zoo is no exception.

We have studied the peculiarities of the reproduction of bananoed geckos in the Minsk Zoo. Lizards become sexually mature in the second year of life. Males are ready to breed much earlier. A pregnant female must be seated separately. The female lays two eggs in a clutch, which she buries in the ground. Middle-aged ciliated banana eaters lay only one egg. There can be three or four such clutches per season. The clutch is incubated at a temperature of 22–27 °C for a period of 55–75 days [3].

As a result of the study, it was found that from the moment the first imported banana-eating gecko appeared in the Minsk Zoo until now, 11 individuals of this species have been bred: 2 females, 3 males and 6 individuals of an indeterminate sex.

It was also noticed that of all hatched individuals, 1 individual hatched on June 16, 2019, died on May 29, 2020. Cause of death: natural / non-euthanasia.

We found that the incubation temperature affects only the hatching rate of individuals. In this case, hatching also occurs when the eggs are kept at a temperature of 21–24 °C. In this case, it was noted that individuals emerge later than from eggs in the incubator, but the viability of eggs outside the incubator is much higher.

At the moment, special attention is paid to such a factor as the presence of ultraviolet radiation, since the opinion of breeders in the Minsk Zoo differs from the opinion of other zootechnicians. Without ultraviolet light, reptiles cannot absorb calcium from the food they receive, which leads to various serious diseases. To assimilate calcium, it is not the ultraviolet itself that is required, but the vitamin "D3" produced by the skin under its influence.

Summarizing all the accumulated knowledge about the ciliated bananoed gecko, we offer recommendations on the rules for their maintenance and breeding, which boil down to the following conditions: the need for a suitable vertical terrarium, with appropriate dimensions; the presence of ultraviolet radiation, soil (coconut, sphagnum, gravel), humidity (from 50 %) and optimal background temperature (21–24 °C).

Thus, at present, the conditions created in the zoo are almost completely consistent with the natural habitat of ciliated bananoed geckos. Over the entire period of breeding in the zoo, the mortality of hatched individuals in artificially created living conditions was less than 10 %, which indicates satisfactory living conditions. In this direction, work is underway to reduce this indicator to zero.

BIBLIOGRAPHY

1. Ресничный геккон-бананоед [Электронный ресурс]. – Режим доступа : http://myreptile.ru/. – Дата доступа : 20.09.2021.

2. *Team Ben.* Crested Gecko Owners Guide. Crested Gecko care, diet, health, behavior, interacting and costs. Crested Gecko care/Ben Team. − IMB Publishing crested gecko, 2017. 13 c.

3. *Дунаев, Е. А.* Рептилии и амфибии. Самые красивые и знаменитые / Е. А. Дунаев, И. Л. Кауров, К. Е. Михайлов. М. : Аванта+, 2010. 15 с.

COMMITMENT TO THE ALARA CONCEPT AT THE BELARUSIAN NUCLEAR POWER PLANT AS ONE OF THE KEY FACTORS IN PROVIDING THE RADIATION SAFETY OF PERSONNEL

V. Kutas

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
vladislavkutas@mail.ru

This work summarizes the essence of one of the fundamental principles of radiation safety - the principle of optimizing of radiation protection. The need to observe optimization approaches in the radiation protection system of the Belarusian nuclear power plant is indicated, due to the successful experience of optimizing the dose loads of personnel of foreign nuclear power plants.

Keywords: radiation safety, nuclear power plant, optimization of radiation protection.

The main objective of radiation safety, according to the approaches of leading organizations in the field of radiation safety and protection is to protect people and the environment from harmful effects of ionizing radiation without undue restriction of human activity [1,2].

In accordance with the recommendations of the International Commission on Radiological Protection (ICRP) and the requirements of the International Atomic Energy Agency (IAEA), in order to achieve radiation safety goals for all existing exposure situations (existing, emergency and planned), a single set of principles for ensuring radiation safety has been formulated [1,2]. The main principle is the source-oriented principle of optimizing of radiation protection, or as it is still commonly called ALARA (acronym As Low As Reasonably Achievable). The objective of optimizing radiation protection is to ensure the efficient allocation of resources spent on protection in order to reduce doses as low as possible, taking into account social and economic factors.

Optimization of radiation protection in practice is carried out using the ALARA procedure – a simple formed list of steps that determines the structure of the approach and solution of any radiation protection problem. The ALARA procedure aims to solve the problem in such a way that when determining the main radiological protection options, all available dose reduction means are considered, along with the associated costs and any other relevant factors [3].

Implementation of optimization approaches at Dukovany (Czech Republic), Cernavoda (Romania) and Beloyarskaya (Russian Federation) nuclear power plants (NPP's) has resulted in significant reduction of personnel exposure, as demonstrated in works [4-8]. In general, the approaches used at these nuclear power plants are similar, however the management of each of the stations acts within the framework of their financial capabilities and their own preferences in choosing optimization measures.

The Belarusian NPP design combines a number of solutions aimed at minimizing the doses received by the NPP personnel [9]. However, over time, when there is enough information necessary to analyze the exposure levels of NPP personnel, it will be necessary to introduce radiation protection options related not only to design solutions, but also to the organization and management of work at NPP.

In view of the fact that a project of such complexity and scale is being implemented in the Republic of Belarus for the first time, taking into account the experience and recommendations of other countries operating nuclear power plants is necessary when ensuring the proper level of radiation safety and radiation protection of the personnel of the Belarusian nuclear power plant. The Government, supervisory and regulatory bodies of the Republic of Belarus as well as the management of the Belarusian NPP should be guided by and exchange experience in the operation and optimization of dose loads of NPP personnel of other countries in order to ensure a high level of safety culture and to comply as much as possible with the requirements of world norms and standards established by leading organizations in the field of nuclear energy and radiation safety.

BIBLIOGRAPHY

1. Публикация № 103 МКРЗ: Рекомендации 2007 года Международной Комиссии по Радиологической Защите. – МКРЗ, 2007. – 344 с.

2. Серия норм МАГАТЭ по безопасности, № SF-1. Основополагающие принципы безопасности. – МАГАТЭ, 2007. – 34 с.

3. Серия докладов по безопасности МАГАТЭ, доклад № 21. Оптимизация радиационной защиты при контроле облучения персонала. – МАГАТЭ, 2003. – 92 с.

4. Petrova, K. Factors Contributing to the Reduction of Occupational Exposures at Dukovany NPP / K. Petrova, L. Urbancik, V. Kulich, D. Fuchsova. – Czech Republic. – 10 p.

5. Dragos Ionel HAU. ALARA and radiation protection optimization status of Cernavoda NPP / Health physics department. – Romania, 2000. – 3 p.

6. Occupational exposures at nuclear power plants. Twenty-fifth annual report of the ISOE programme. – NEA/ISOE OECD, 2017. – 120 p.

7. Ташлыков, О. Л. О проблеме снижения дозовых затрат персонала АЭС / О. Л. Ташлыков [и др.] // Известия вузов. – 2011. – № 1. – С. 55-60.

8. Ташлыков, О. Л. Атомные электростанции с реакторами на быстрых нейтронах с натриевым теплоносителем: учебное пособие. В 2 ч. Ч. 2 / О. Л. Ташлыков [и др.]. – Екатеринбург: УрФУ, 2013. – 420 с.

9. Информационные материалы по Белорусской АЭС: Раздел 3 «Концепция обеспечения безопасности» // Департамент по ядерной и радиационной безопасности Министерства по чрезвычайным ситуациям Республики Беларусь [Электронный ресурс]. – 2021. Режим доступа : https://gosatomnadzor.mchs.gov.by/upload/iblock/c82/razdel-3-kontseptsiya-obespecheniya-bezopasnosti.pdf. – Дата доступа : 08.09.2021.

TROPHIC STRUCTURE IN THE HYDROGEN SULFIDE LAKE BARKOVSHCHINA

I. Lapuka

Scientific and Practical Centre of the National Academy of Sciences of Belarus on Bioresources
Minsk, Republic of Belarus
ilya.lapua@yandex.ru

Data is presented about trohical structure in the Barkovshchina lake, characterized by the absence of oxygen after a depth of 3 meters, and the presence of hydrogen sulfide at these depths, are presented. Throughout the reservoir, predatory forms dominated, which were common at all depths. The trophic structure of the lake, to a greater extent, depends on abiotic factors.

Keywords: trophical structure, zoobenthos, hydrogen sulphide.

The trophic factor is one of the most important, which, when combined with other conditions of existence of populations of benthic invertebrates, quantitatively determines the level of productivity of the community. The ratio of different components of the food stream is displayed in the trophic structure of the zoobenthos, which it is advisable to represent in the form of the participation of various functionally related groups of species in the transformation of organic matter [1].

Lake Barkovschina is located in Ushachsky district, Vitebsk region of the Republic of Belarus. Belongs to the basin of the Ushacha river, located 8 km south of the town of Ushachi, near the village of Vashkova, among the forest. The area is 0.16 km2, with a length of 0.76 and a maximum width of 0.3 km. The maximum depth is

21.8 m. The highest aquatic vegetation occupies shallow water and forms a strip with a width of 10 to 250 meters [2]. There are four spring, two of which are radon, one is rich in iron, and another is hydrogen sulfide. [3]. This indicates that the hydrogen sulfide zone in this reservoir is formed not only to the processes of internal transformation of organic matter, but is also replenished from the source, which is indirectly confirmed by the relatively high transparency of water - 3.5 meters, characteristic of mesotrophic reservoirs.

Due to such conditions in the reservoir, the distribution of zoobenthos is extremely uneven and depends on the concentration of oxygen and the presence of hydrogen sulfide in the deep layers of water. The main part of this community is located in the coastal and epilimnion, where more favorable conditions for life are created [4].

In the trophic structure of the Barkovshchina Lake, more than half of the bottom animals are represented by predatory forms (Figure 1).

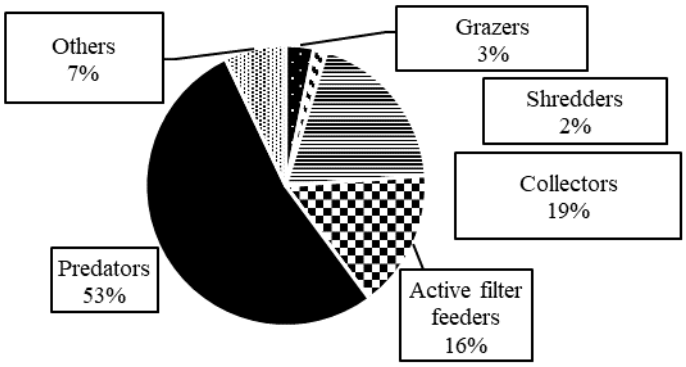


Fig. 1 – Trophic structure of the Barkovshchina Lake

The high relative numerosity of predators in the entire reservoir is explained by the fact that after a depth of 3 meters there is completely no oxygen and the hydrogen sulfide zone begins. It is known that the content of hydrogen sulfide in water, even in the smallest concentrations, is fatal for many aquatic organisms , but according to haoborid larvae have adapted to survival in such conditions, have daily migrations in the water column, moving to the surface at night, and during the day the larvae "rest" in anoxic mud. Therefore, starting from a depth of 4 meters and up to the maximum, representatives of haoborids dominate in bottom samples in the absence of other representatives of zoobenthos.

Other trophic groups were represented only in the littoral zone by widespread species, the most numerous of which were active filtrators – Dreissena polymorpha (Pallas, 1771) and collectors – representatives of the family Chironomidae.

Thus, the peculiarity of the trophic structure of Lake Barkovshchina with the prevalence of predators is determined by abiotic factors – the distribution of oxygen and hydrogen sulfide in the water column.

BIBLIOGRAPHY

1. *Беляков, В. П.* Изменения продукционных характеристик и трофической структуры зообентоса озера Красного в зависимости от природных и антропогенных факторов / В. П. Беляков, А. И. Бажора // Российский журнал прикладной экологии. – 2018. – № 4 (16). – С. 11–15.

2. Блакітная кніга Беларусі: Энцыклапедыя. Рэдкал. Н.Ф. Дзісько і інш. – Минск: БелЭн, 1994. – 415 с.

3. Planeta Belarus [Электронный ресурс]. – Режим доступа: https://planetabelarus.by/ – Дата доступа: 26.01.2021

4. *Вежновец В. В., Лапука И. И.* Пространственное распределение зоопланктона и зообентоса в озере Барковщина Ушачского района Беларуси / В. В. Вежновец, И. И. Лапука // Природные ресурсы. – 2021. – № 1. – С. 76–83.

MONITORING OF SARCOCYSTOSIS AMONG HUNTING SPECIES OF WATERING BIRDS OF MINSK REGION

S. Latushko, Yu. Lyakh

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
Yury_Liakh.61@mail.ru

In Belarus, about 40 thousand people are engaged in hunting for waterfowl. This is a rather fascinating type of recreation, which implies a direct stay in the natural habitat of a large number of birds. In the process of conducting seasonal hunting for waterfowl, the hunter obtains trophies in the form of carcasses of a dead bird. The use of game for food is part of the ancient tradition of all mankind. However, a number of infectious and invasive diseases that are present among birds can cause pathological processes in humans. This happens as a result of contact with them or as a result of the use of game for food without a preliminary veterinary and sanitary examination.

Keywords: hunting species of waterfowl, infectious and invasive diseases, sarcocystosis, laboratory diagnostics, veterinary and sanitary examination.

In the Republic of Belarus, great attention is paid to animal husbandry. The epizootic situation is constantly monitored for the main infectious and parasitic diseases, which cause the greatest economic damage to the national economy of our country. The veterinary and medical services are quite successful in dealing with the issues of preventing epizootics in livestock and poultry farms, however, infectious and invasive pathology among representatives of resource animal species in Belarus is practically not dealt with. The only exceptions are such especially dangerous diseases as rabies, African swine fever. For the first disease, they are limited to the periodic use of anti-rabies blister baits and the removal of sick animals from the natural environment, followed by laboratory confirmation of rabies. In the second case, they limited themselves to measures to depopulate wild pigs in the republic, which does not bring the desired result [1].

Parasitic diseases of wild animals and birds are almost completely out of sight of veterinary and medical workers, with the exception of isolated cases of trichinosis.

In this regard, we are conducting research on monitoring sarcocystosis among hunting species of waterfowl living in the reservoirs of the Minsk region. A total of 134 individuals of domestic and 204 wild waterfowl were subjected to diagnostics. At the same time, in hunting species of waterfowl, isolated cases of detection of sarcocysts in muscle tissue and internal organs have been established, which allows us to talk about the circulation of this parasite among wild birds.

In our country, little attention is paid to sarcocystosis. In the available literature there are isolated materials on this topic. It should be noted that sarcocystosis is a serious protozoal disease of mammals and birds and can be dangerous to humans.

Sarcocystosis – protozoal diseases of domestic and wild animals, which are characterized by an asymptomatic course. The acute form is recorded quite rarely, mainly in young animals and in the case of a high degree of invasiveness.

Sarcocysts go through two phases of development: asexual and sexual. The asexual phase proceeds with the use of intermediate cyst hosts. Artiodactyls and birds are such hosts. Single-celled parasites enter the animal's esophagus with food and raw water. Sporozoites through the gastrointestinal tract penetrate into the blood, cells and tissues of the internal organs of the animal. In his body, asexual reproduction of sporozoites takes place - merogony.

The second phase begins after eating raw or poorly cooked meat or using contaminated water. Domestic pets – dogs, cats, or wild carnivores (in some cases humans) are the final hosts of cysts. In the intestinal tract, the maturation of the adult parasite takes place. Unicellular organisms, entering the body, parasitize the intestines or muscle tissue. Entering the epithelium of the small intestine, merozoites parasitize in cells, free themselves from their membranes, grow and develop. After their fertilization, a zygote is formed, then it develops into an oocyst (size 9-20 by 12-15 microns), in which 2 sporocysts develop (12–17 microns in diameter). Each of them contains 4 sporozoites. The oocyst membrane is very delicate, so some of them die in the intestine. Over time, the oocyst bursts, releasing sporocysts, which exit the intestinal tract with feces. They have a denser shell and can survive for a long time in the environment while waiting for a new host.

BIBLIOGRAPHY

1. *Лях, Ю. Г.* Роль мониторинга эндопаразитов охотничьих водоплавающих птиц Беларуси в сохранении эпизоотического благополучия / Ю. Г. Лях // Сборник научных трудов УО «БГСХА» «Актуальные проблемы интенсивного развития животноводства». Выпуск 23, ч.2. г. Горки, 2020. – С. 222–231.

ANALYSIS OF THE INITIAL MATERIALS FOR THE "ENVIRONMENTAL PROTECTION" SECTION OF THE FLAX FIBER BLEACHING WORKSHOP RECONSTRUCTION PROJECT

V. Lesik, V. Misyuchenko

Belarusian State University, ISEI BSU
Minsk, the Republic of Belarus
horektut20@gmail.com

Technical documentation data of the Orsha flax mill is analysed. The study is focused on the flax fiber bleaching workshop. It is determined that the installation of new equipment will not have a significant impact on the ambient air pollution in the area of the mill. The analysis of the results of pollutants dispersion in the "Ecolog" program shows that the concentration of pollutants corresponds to the normative values.

Key words: design documentation, flax fiber, processing, short flax fiber, bleaching.

In the process of designing, reconstruction or modernization of buildings and complexes of civil, industrial, municipal and other purposes and constructions in the Republic of Belarus it is obligatory to develop the "Environment protection" section of project documentation. It is based on such documents as: design specifications, design documentation from related departments of the organization, data on background concentrations and estimated meteorological characteristics. These data are used to analyse the technological process of short flax fiber bleaching at the Orsha flax mill in the course of the project documentation development of the "Protection of atmospheric air from pollution" subsection of the "Environmental Protection" (EP) section to identify sources of emissions of pollutants into the ambient air.

The analysis is performed in accordance with HB3-02 to BRB 1.03.02-96 "Composition and development procedure of the "Environmental protection" section in design documentation" handbook [1]. The technology implies that during the bleaching process, the flax fiber is initially transferred in bales to the bale opener for opening and partial cleaning of the fiber for further watering and pressing. The next step is the bleaching of the incoming prepared fiber at 95˚C. The bleaching cycle consists of the following processes: souring, scouring, oxygen bleaching and four step post-bleaching scouring. The duration of the bleaching process is about 4.5-5.8 hours. The bleaching, scouring and centrifuging operations are carried out sequentially. Thus, the tanks holding chemicals for bleaching operations are the sources of contaminant emissions. The flax fiber bleaching equipment is also the source of air pollutant emissions.

The analysis of physical and geographical characteristics of the site shows that there is a residential area to the north and north-east of the site; a recreation and cultural park is to the east; the Dnieper River is to the south-east. The Orsha TPS, a Belorusneft oil depot, the Orsha prefabricated reinforced concrete products and structures plant can be found to the south-west; while Orsha meat packing plant is situated to the north-west. The size of the Sanitary Protection Zone (SPZ) already established by the sanitary norms, rules and hygienic standards by type of activity may be affected by the residential buildings located near the production facilities or the facilities on the territory of the enterprise that pose an increased hazard. That is, the flax mill is located in the industrial zone of Orsha and SPZ is not limited to residential buildings. All emission sources of the designed workshop are located within the production site, the site in question is not a high-hazard facility, which will not affect the overall SPZ of the flax mill its size is determined only by sanitary norms, rules and hygienic standards stated in "Requirements for Sanitary Protection Zones of Organizations, Structures and Other Objects Affecting Human Health and the Environment" [2].

When the pollutant emission assessment and the determination of the emission source locations have been done, pollutant dispersion patterns are determined in the “Ecolog” software. The most unfavorable period for dispersion turned out to be winter. During this period, at the boundary of the sanitary protection zone a caustic soda exceedance at two sources is detected. In this case, abatement measures are applied to reduce the impact on ambient air such as, in particular, the heightening of the sodium hydroxide emission flue as well as the reduction of the chemical injection pump capacity in the tanks. After the application of the measures mentioned, the permissible level of caustic soda at the boundary of the Sanitary Protection Zone has been achieved.

For full impact assessment of the object on ambient air, the category of object impact on ambient air is determined according to the resolution of the Ministry of Natural Resources and Environmental Protection of Belarus dated 29.05.2009 № 30 (Instruction on the order of assigning categories to objects) [3]. According to the Instruction, it is concluded that the flax fiber bleaching workshop belongs to Category 5.

The data for the development of "Protection of surface and underground water against pollution and exhaustion", "Protection of environment against pollution by industrial wastes, municipal and solid domestic wastes" subsections of the EP section in the project documentation are deliberately not considered, since during the technological process wastewater and industrial wastes are not generated. "Protection and rational use of land resources", "Protection of vegetation", "Protection of fauna" subsections are not taken into account as well as, since all the equipment is located and the technological process is taken place indoors.

The following conclusions are drawn:

1. The Orsha flax mill is located within the Orsha industrial zone and its SPZ is not limited by residential buildings, which allows larger scale modernization of the enterprise and the development of additional trends in flax fiber processing and usage.

2. The most unfavorable period of the year for dispersion of pollutant emissions from the flax fiber bleaching workshop is winter. Emission reduction measures are designed based on the worst dispersion conditions.

3. The boundary of the Sanitary Protection Zone will not change because of the commissioning of the bleaching workshop, as it has a category 5 impact on ambient air, and the concentration of pollutants will remain within the norm at the boundary of the SPZ.

BIBLIOGRAPHY

1. *Петрова, Л. Н.* ПЗ-02 к СНБ 1.03.02-96 «Состав и порядок разработки раздела «Охрана окружающей среды» в проектной документации» / Л. Н. Петрова : Минск, 2002.

2. Санитарные нормы и правила «Требования к санитарно-защитным зонам организаций, сооружений и иных объектов, оказывающих воздействие на здоровье человека и окружающую среду» постановления Министерства Здравоохранения Республики Беларусь №91 от 11 октября 2017 года.

3. Постановление Министерства природных ресурсов и охраны окружающей среды Республики Беларусь, от 29.05.2009 № 30 (Инструкция о порядке отнесения объектов к категориям).

ECONOMIC POTENTIAL OF WIND POWER INDUSTRY IN BELARUS

L. Lipnitski, M. Treyvas, E. Cherevan

Belarusian State University ISEI BSU
Minsk, Republic of Belarus
gloomyhit@gmail.com

Global goal: to provide the population with clean and affordable electricity, reduce the impact on the climate, reduce the level of greenhouse gases.

Keywords: electrical energy, renewable energy sources, wind energy.

The increase in global consumption of electrical energy and the limited use of fossil energy resources, which are decreasing faster than they are formed, lead to an urgent need to find alternative solutions.

Another global problem is that when fossil energy resources are burned, carbon dioxide and a number of harmful compounds are released, which is one of the main causes of climate change around the world. Pollution of the atmosphere and soil is also associated with the extraction of fossil energy resources.

The total capacity of all wind power plants on the planet has increased by 50 GW since 2001-2006, and now it is about 1000 GW and continues to grow. At the same time, over the past decade, the cost of electricity generated by wind power plants has fallen by three times and has become competitive with the cost of electricity generated by traditional power plants.

The efficiency of wind energy development depends on the average wind speed during each season, the price of fuel, the electricity tariff, and the unit cost of the wind generator itself.

Climatic and natural conditions in relation to Belarus make it possible to create up to two thousand sites for the operation of wind turbines. Of interest are sites for the construction of single installations and full-fledged stations with a potential of over 200 MW/h. They are mainly located in Minsk, Vitebsk and Grodno. Optimum for wind turbines is a height of 20 to 80 m at a constant wind speed of 6 m/s.

At the moment, there are 500 MW of renewable energy capacities in Belarus, which include photovoltaic power plants, wood-fired thermal power plants, hydroelectric power plants, biogas complexes and electric power

plants. According to the plan, by the end of 2025, this value will approach the capacity indicator of 630 MW, which will be 8% in the share of electricity produced in the country. Today, renewable energy sources account for 5.5% of the energy balance of Belarus. The implementation of the measures applied will reduce the standardized cost of wind energy from 0.32 to 0.23 BYN/kWh, which is equivalent to the cost of gas-fired power plants for generating electricity. In case of attracting $ 807 million of investments, savings on the purchase of gas, reaching $ 650 million, are possible. After the payback period is over, the operating costs of maintaining wind turbines are much lower than those of plants using solid, gaseous or nuclear fuel and needing supply. With this approach, carbon dioxide emissions can be reduced by 12 million tons by 2040.

The analysis of the prospects for the use of wind power plants in the Republic of Belarus shows that this method of generating electricity in the near future will become comparable in cost to traditional methods of generating energy and will allow replacing some of them (for example, gas). This will significantly reduce the cost of importing energy resources, improve the environmental situation and develop energy at the local level.

BIBLIOGRAPHY

1. Ветроэнергетика Беларуси: состояние и перспективы развития [Электронный ресурс]. – Режим доступа: https://energobelarus.by/articles/alternativnaya_energetika/vetroenergetika_belarusi_sostoyanie_i_perspektivy_razvitiya/ – Дата доступа: 23.09.2021.

2. Knowledge Expander Энергии [Электронный ресурс]. – Режим доступа: https://nxplorers.com/ru/nexus/knowledge-expanders/enegry – Дата доступа: 23.09.2021.

3. Мощности установок возобновляемых источников энергии в Беларуси с 2010 года увеличились в 19 раз [Электронный ресурс]. – Режим доступа: https://www.belta.by/economics/view/moschnosti-ustanovok-vozobnovljaemyh-istochnikov-energii-v-belarusi-s-2010-goda-uvelichilis-v-19-raz-449610-2021/ – Дата доступа: 23.09.2021.

4. Госстандарт: мощность установок ВИЭ в Беларуси к 2025 году достигнет 630 МВт [Электронный ресурс]. – Режим доступа: https://www.belta.by/economics/view/gosstandart-moschnost-ustanovok-vie-v-belarusi-k-2025-godu-dostignet-630-mvt-449620-2021/– Дата доступа: 23.09.2021.

5. Экономический потенциал ветроэнергетики [Электронный ресурс]. – Режим доступа: http://www.spwr.by/stati/ekonomicheskiy-potentsial-vetroenergetiki.html – Дата доступа: 23.09.2021.

THE NEED TO DEVELOP MEASURES FOR ENERGY SAVING AND IMPROVING ENERGY EFFICIENCY IN HEALTHCARE INSTITUTIONS

L. Lipnitski, A. Kutas, K. Solenok

Belarusian State University, ISEI BSU,
Minsk, Republic of Belarus
alenakutas@mail.ru

The article discusses ways to ensure energy efficiency and energy saving in health care institutions.

Keywords: energy efficiency, energy saving, health care, electricity.

Energy saving is an urgent task all over the world. For Belarus, this problem is also important because the Republic is limited in fossil energy resources and is forced to import them.

Medical institutions are major energy consumers and are tasked with developing measures to reduce energy consumption. The most energy-consuming group consists of electrothermal installations for disinfection and sterilization from 10 % to 40 % of electricity consumption, refrigeration equipment – 5–10%, lighting – 30–60%, ventilation and air conditioning – 10–20 % [1].

Lighting systems. Taking into account the trends in the development of lighting technology, the most promising direction for modernizing lighting systems is the phased replacement of lamps with LED ones. Energy savings in buildings can be achieved by installing integrated automated control and management of electric lighting systems using motion and presence sensors.

Ventilation systems. The introduction of devices for automatic regulation and control of ventilation units, depending on the outside air temperature, allows you to reduce energy costs. Other measures to save energy in ventilation systems are replacing old fans with new, more economical ones; shutdown of ventilation units during the absence of people at work; elimination of operational defects and deviations from the project [2].

Heating systems. The need for thermal renovation of buildings is due to the high energy consumption in cold climates. Reducing the consumption of thermal energy for heating buildings can be achieved through the

development and implementation of energy-efficient design and engineering solutions into the practice of modern construction. Reducing the level of energy consumption is achieved by increasing the resistance to heat transfer of the enclosing structures, the introduction of energy-efficient window designs, reducing the air permeability of the shell while maintaining the ventilation rate [3].

Rational use of medical devices. Power reduction of large-sized devices (computer tomographs, cyclotrons, magnetic resonance tomographs) can be realized by automatically putting the equipment into standby mode, as well as turning it off during non-working hours. So in MRI, electromagnets are used, which require energy-intensive water cooling. In addition, tomographs themselves consume a large amount of electricity, and in order to save it, they should be turned off during breaks between examinations.

Alternative energy. Switching to renewable energy sources will help reduce energy costs over time. According to the IDAE (Instituto para la Diversificación y Ahorro de la Energía), solar thermal energy can meet 80 % of the domestic hot water needs of a hospital and 60 % of the electricity needed to heat this building [4]. In addition, the use of renewable energy sources in medical institutions will ensure the backup of electrical energy and ensure its uninterrupted supply of the life support systems of seriously ill and operated patients.

The introduction of energy-saving measures and the search for solutions in the field of clean energy allow medical institutions to reduce energy consumption and contribute to an improvement in the environmental situation. The introduction of automatic control systems for energy consumption processes in hospitals and other medical institutions will simplify the management of facilities and contribute to significant energy savings.

BIBLIOGRAPHY

1. Разработка мероприятий по энергосбережению и повышению энергетической эффективности в учреждениях здравоохранения (прикладной проект) / КГБУЗ «Рубцовская ЦРБ». – Рубцовск : [б. и.], 2014. – 22 с.

2. Системы вентиляции и кондиционирования [Электронный ресурс]. – Режим доступа : https://helpiks.org/5-1769.html. – Дата доступа : 03.10.2021.

3. Строительная теплотехника. Строительные нормы проектирования: ТКП 45-2.04-43-2006(02250). – Введ. 29.12.2006 (с отменой СНБ 2.04.01-97). – Минск : Министерство архитектуры и строительства Республики Беларусь, 2007. – 32 с.

4. Paneles solares pueden abastecer hospitales de energía [Электронный ресурс]. – Режим доступа : https://www.renovablesverdes.com/paneles-solares-pueden-abastecer-hospitales-de-energia/. – Дата доступа : 03.10.2021.

URBAN AIR POLLUTION AND ITS COUNTERMEASURES IN HEBEI, CHINA

Liu Jiu 'an[1], **V. Lemiasheuski**[1], **Mehmet Musa Özcan**[2]

[1]*Belarusian State University, ISEI BSU*

Minsk, Republic of Belarus

[2]*Department of Food Engineering, Faculty of Agriculture, Selcuk University*

Konya, Turkey

lem@iseu.by

From the end of the 20th century to the beginning of the 21st century, China has entered the process of large-scale urbanization and industrialization, accompanied by this process, environmental pollution problems also appeared, among which the air pollution problem in Hebei province is particularly serious. This paper analyzes the causes of urban air pollution in Hebei province, expounds the harm of air pollution, and Take measures to control air pollution in Hebei province based on the experience of other areas.

Key words: air pollution control, Hebei province, industrialization.

Hebei province is the most serious pollution provinces in China, Air pollution there is even serious. In the air quality ranking list of 74 major cities in China, most of the 10 cities with the worst air pollution are in Hebei province. The study of air pollution in Hebei province is of typical significance for understanding air pollution in China [1].

The purpose of this study is to provide the methods to improve the air quality of Hebei province by analyzing the causes of pollution in Hebei province and drawing on the good experience of other regions.

Analysis of reason of air pollution. The air pollution in Hebei province is mainly soot pollution caused by coal for industry and heating. The main reasons are as follows:

Industrial structure overly dependent on steel industry and other heavy industries. The industrial structure of Hebei province is a heavy chemical industry system dominated by the secondary industry and led by the steel industry. There are 110 iron and steel production enterprises and 348 blast furnaces in the province, with an annual capacity of 269 million tons of iron. There are 305 bessaries and electric furnaces, with an annual capacity of 261 million tons.

Natural factors make the Beijing-Tianjin-Hebei region easy to accumulate pollutants. In terms of topography, yanshan Mountain in the north and Taihang Mountain in the west encircle the area. The terrain is high in the northwest and low in the southeast, making it easy for pollutants to gather. The prevailing southeasterly wind in summer diffused the pollutants in tangshan, Langfang and other places to the whole region, and locked the pollutants in the Yanshan-Taihang Mountain range. Therefore, the interaction between topographic and climatic conditions is an important reason for the difficult diffusion of pollutants in this area.

Countermeasures against air pollution. In order to improve the environment, We can learn from Beijing's experience in air improvement. Beijing adheres to the strategy of clean energy, vigorously promotes the reduction of coal burning in industry and daily life, and strives to build a clean energy system dominated by electricity and natural gas, supplemented by geothermal energy and solar energy. Through the adjustment of energy structure, Beijing's air quality and air pollutant emissions have been significantly reduced.

Drawing on the successful experience of Beijing, Hebei should adopt the following measures to achieve the goal of achieving the emission of air pollutants from the standard to ultra-low emission and then to the overall ultra-low emission.

First of all, in the construction of urban industrialization, the use of advanced industrial technology, can effectively control the emission of industrial waste gas, reduce the pollution of waste gas to the environment. While continuing efforts to desulphurize, sell off coal and remove dust from key industrial enterprises and pollution sources, we will also introduce these measures into non-key areas so as to reduce overall emissions and intensity of air pollutants. Secondly, the emission standards of air pollutants in different industries will be improved so that all industrial sectors will comply with the emission standards, non-industrial production sectors will gradually comply with the emission standards, and key industrial enterprises will implement ultra-low emission of air pollutants.

Second, the implementation of regional collaborative governance in Hebei Province. Because air pollution can flow and spread, only coordinated governance, to achieve effective prevention and control. In implementing coordinated regional prevention and control, we should not only fully respect each region's right to development, but also respect each region's contribution to air pollution prevention and control. We can set up air pollution prevention and control organizations in prefecture-level cities to eliminate the estrangement between various departments, and set up multi-department consultation mechanism to realize multi-department collaborative governance, and bring the contribution of departments to air pollution prevention and control into the assessment system of urban development.

Hebei province, due to the serious emission of industrial exhaust gas, lead to a serious decline in ambient air quality, to people's health posed a threat. If you want to improve our air quality, we should start from now, reduce industrial gases emissions, development of more advanced technology to promote improvement of environmental air quality achieve the better effect of environmental air quality control.

BIBLIOGRAPHY

1. *Jia Shibin, Yin Chengyuan.* Green Finance Countermeasures of Air Pollution Control in Hebei Province from the perspective of Industrial Structure Adjustment, Hebei Finance, October, 2020

STORMWATER RUNOFF POLLUTION CONTROL – THE COMPREHENSIVE IMPROVEMENT PROJECT OF WATER ENVIRONMENT IN ZHANGJIAKOU CITY, HEBEI PROVINCE

Liu Zhi gang, V. Lemiasheuski

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
lem@iseu.by, niu5151@126.com

Refer to the technical means of water quality management at home and abroad; use the concept of maximum daily load (TMDL) to govern the river water environment in Zhangjiakou City, Hebei Province; use total phosphorus as a representative indicator of river eutrophication as a water quality evaluation factor; sort out the drainage network, Current status of discharge and non-point source pollution; use Zhangjiakou river environment

model coupling calculation method; scientifically formulate total phosphorus emission control plan; simulation calculation.

Keywords: water environment governance; total maximum daily load; water quality evaluation index; rivers in Zhangjiakou City, Hebei Province.

Main urban water system: The rivers in Zhangjiakou City belong to three basins, namely: inland river basin, Luan he river basin and Hai he river basin. There are mainly five water systems, namely: inland river system, Luan River system, Yong ding River system, Chao bai River system and Daqing River system.

The purpose of the study is to use the concept of maximum daily load (TMDL) to control the river water environment in Zhangjiakou City, Hebei Province, Based on the construction and application of the TMDL model system, fully considering meeting the needs of residents' life and recreation, according to site conditions investigation, determine the plots and control rates in the drainage area where the source low-impact development measures can be implemented, and determine the source control plan. Construct a drainage network system and couple it with the two-dimensional surface to form a drainage model. Determine the specific location, waterlogging situation and waterlogging risk analysis of the waterlogging area in the region, and formulate a process gray pipe network restoration project plan. It mainly solves the problem of non-point source pollution of rainwater discharged into the river in the urban area of Zhangjiakou.

Source governance: 1) Roof runoff control

Rain down tube disconnection. Most of the rain downpipes in the old community are old and damaged, and many places are connected to the balcony sewage. During the renovation, the old rain down pipes will be connected to the sewage pipe network, and the newly built rain down pipes will be disconnected and drained to biological retention facilities such as transmission-type grass ditch and rain water garden for infiltration and purification treatment. According to different site characteristics and rainwater control requirements, the combination of disconnection measures and rainwater treatment facilities can adopt different forms.

Green roof. Set up green roofs in roof areas where conditions permit, and build roof rainwater collection and infiltration systems. In the water system organization form of green roof (square)-rainwater garden-rainwater storage pond-river course, rainwater is purified and then penetrated to ensure the water quality of supplementary groundwater sources and reduce the load of soil removal of pollutants.

Surface runoff control. Sponge facilities are set up on the green space and paving around the building to mainly treat the roadway, roof and own rainwater. Roof rainwater is introduced into the rainwater garden through rain downpipes. By adding small rainwater storage facilities, the rainwater is collected and stored at the same time for water replenishment and water exchange, as well as nearby greening and road sprinkling.

Remediation effect: (1) Social benefits

The renovation of Zhangjiakou's urban area has improved the living environment of residents, and improved the green landscape between buildings through greening and sketches; parking spaces have been increased and standardized to make parking more convenient for residents. At the same time, the waterlogging area and time of waterlogging at the intersection and the east area of Xing cun have been greatly reduced, reducing the risk of waterlogging in the urban area of Zhangjiakou and reducing the loss caused by urban waterlogging.

(2) Ecological benefits

On the basis of rain and sewage diversion, Zhangjiakou District has adopted various measures including LID and initial rainwater storage tanks to achieve urban non-point source pollution control. According to the volumetric method, the runoff pollution control rate of urban water is 82.68 %, which meets the target requirements and plays a better role in protecting downstream water quality.

Therefore, through the TMDL method and roof runoff control, green roof, surface runoff control. The area and time of waterlogging at the intersection of Xing cun Village and the East District have been greatly reduced, the risk of waterlogging in the urban area of Zhangjiakou has been reduced, and the loss caused by urban waterlogging has been reduced. The urban water runoff pollution control rate was 82.68 %, which met the target requirements and played a good role in protecting downstream water quality.

PARASITIC NEMATODES LOCALIZED UNDER THE CUTICLE OF THE MUSCULAR STOMACH OF WILD AND DOMESTIC WATER BIRDS AND THEIR DIAGNOSTICS

Yu. Lyakh, A. Bormotov

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
Yury_Liakh.61@mail.ru

Various types of nematodes parasitize in all organs and tissues of wild animals and birds, exerting a negative influence on them. At the same time, in animals suffering from nematodes, resistance decreases, anemic and inflammatory phenomena occur. Sometimes in severe cases of nematodes, animals die. Diagnostics of parasitic diseases in wild and domestic waterfowl in Belarus will make it possible to study the extent of the spread of these diseases and develop measures for their prevention.

Keywords: parasitoses, wild and domestic waterfowl, nematodes, gastrointestinal tract, gizzard, cuticle, inflammatory reactions.

A feature of the developmental biology of parasites localized under the cuticle of the muscular stomach of wild and domestic waterfowl is the introduction of nematode larvae into the mucous and cornea of the stomach, their further movement under the cuticle and in the upper part of the mucous membrane. Such migration almost always causes a violation of the integrity of tissues, hemorrhagic and inflammatory phenomena, necrosis and, in the case of the penetration of pathogenic and putrefactive bacteria, the death of the animal [1, 2].

To establish the presence of nematode lesions of the cushion zone of the muscular stomach in domestic and wild waterfowl, we performed an autopsy of animal carcasses and a postmortem examination of their gastrointestinal tract.

The bird was represented by two meat breeds of ducks – (Peking, gray Ukrainian) and musky duck (Cairina moschata). Pekin (Pekin duck) – 52 individuals, gray Ukrainian – 60 individuals and musk duck – 22 individuals and was in the private household of residents of the Minsk region. In the hunting grounds of Belarus, a waterfowl was caught, of which: a witch (Anas penelope) – 2 individuals, a teal-whistle (Anas sressa) – 84 individuals, an ordinary mallard (Anas platyrhynchos) – 71 individuals, a gray duck (Mareca strepera) – 25 individuals and the wide-beaked duck (Spatula clypeata) – 22 individuals.

According to the research results, we did not find nematode invasion, which allows us to speak about the well-being of these animal species in relation to nematodes affecting the glandular and muscular stomachs of domestic and wild waterfowl.

Nevertheless, histrichosis, namely this disease, is caused by the nematodes Hystrichis tricolor from the family Dioctophymidae parasitizing in the glandular stomach of domestic and wild ducks and very rarely in geese and chickens, can occur among populations of waterfowl. Hystrichosis is characterized by focal spread. The foci of this helminthiasis are registered in the southern and western regions of Ukraine and other regions of the CIS [3, 4].

Scientific research on this problem will continue, since the mass migration of birds of these species does not exclude their contacts with various representatives of the avifauna, as a result of which re-infection by nematodes of the Dioctophymidae family may occur.

BIBLIOGRAPHY

1. *Лях, Ю. Г.* Диагностика инвазий у охотничьих водоплавающих птиц, обитающих на водоемах Беларуси / Ю. Г. Лях, С.С. Латушко, А.С. Бормотов // Международная научно-практическая конф. «Зоологические чтения - 2021», 24-25 марта 2021 года, Гродно. С. 138-140.

2. *Лях, Ю. Г.* Мониторинг нематодозной инвазии охотничьих водоплавающих птиц Беларуси / Ю. Г. Лях // Сборник научных трудов УО «БГСХА» «Актуальные проблемы интенсивного развития животноводства». Выпуск 24, ч.1. г. Горки, 2021. - С. 253-261.

3. *Лях, Ю. Г.* Мониторинг распространения возбудителей инвазий паразитирующих под кутикулой мышечного желудка диких водоплавающих птиц / Ю. Г. Лях, А. С. Бормотов, А. А. Корнакова, С. С. Латушко // Международная научно-практическая конф. «Зоологические чтения - 2021», 24–25 марта 2021 года, Гродно. С. 135-137.

4. *Лях, Ю. Г.* Проблемы снижения популяций охотничьих водоплавающих птиц Беларуси / Ю. Г. Лях // Материалы Республиканской научно-практической он-лайн конференции «Современные проблемы естествознания в науке и образовательном процессе», 25 февраля 2021 года, Минск. С. 61.

IXODIC TICKS IN THE RECREATIONAL ZONE OF MINSK AND THE ROLE OF HUMANS IN ENHANCING THEIR NEGATIVE INFLUENCE

Yu. Lyakh, L. Isachenko

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
Yury_Liakh.61@mail.ru

Annotation: In the historical aspect, ixodids, (family Ixodidae) are mostly forest and pasture parasites that lie in wait for host animals in open nature. They are found in various climatic zones of our planet. The lifestyle that nature has prepared for them predetermines a small percentage of the likelihood of the parasite meeting with the host. In this regard, the evolutionary process provided ixodid ticks with a whole set of specific adaptations and schemes for their preservation as a species.

Key words: ixodid ticks, systemic tick-borne borreliosis, Lyme disease, recreational areas, carriers of pathogens, urban areas, biological means of defense.

In isolation, a tick bite is not dangerous to humans. Human health is threatened by pathogenic microorganisms, for which ixodids are lifelong carriers.

For the first time reports of systemic tick-borne borreliosis appeared in 1975 in the United States, where in the fall, in the state of Connecticut, in the small town of Lyme, the first cases of this disease were recorded.

The causative agent, the spirochete *Borrelia burgdorferi*, resembles a corkscrew-like coiled spiral in shape, consisting of an axial filament around which the cytoplasm is located, its length is from 11 to 25 μm and a width of 0.18–0.25 μm, the size may vary slightly. It is ticks that serve as the main reservoir of *Borrelia burgdorferi*, since their carriage lasts all their life, and ticks of this family can transmit it, transovarially, to their offspring [1, 2].

In nature, ixodid ticks exist for millions of years, how long they will live on earth is not known. However, the danger that they, indirectly, carry to humans, obliges people to take appropriate measures to reduce the number of contacts with these blood-sucking parasites. A person, since he is not able, and there is no need for this, to completely get rid of the presence of ixodid ticks in the natural environment must at least ensure minimal contact with them. This problem is especially acute in the recreational areas of urbanized areas. And oddly enough, the person himself is guilty of this.

Pollution of urbanized areas with household waste, unauthorized landfills, a large number of homeless animals, uncontrolled walking of domestic animals - this is not a complete list of factors for creating favorable living conditions and increasing the number of ixodid hosts. In the city of Minsk, this problem is well traced [3, 4].

As a rule, wastelands, landfills for solid household and food waste, construction waste in long-term construction sites - immediately become a refuge for mouse-like rodents and stray animals. And they, in turn, contribute to an increase in the number of ixodid ticks. The human factor is obvious here. Climate change in the direction of increasing the temperature regime significantly aggravates the situation with infectious diseases, the main link of transmission, which is ixodid ticks.

BIBLIOGRAPHY

1. *Лях, Ю. Г.* Биологические методы регуляции численности иксодовых клещей и роль рыжих лесных муравьёв в этом процессе / Ю. Г. Лях, Л. И. Исаченко // VIII Международная научно-практическая конф. «Эколого-биологические аспекты состояния и развития Полесского региона». г. Мозырь, 26 октября 2018. – С. 61–64.

2. *Исаченко, Л. И.* Особенности распределения иксодовых клещей в населенных пунктах с различной степенью урбанизации, влияние климатических характеристик на иксодид / Л. И. Исаченко, Ю. Г. Лях // Сахаровские чтения 2019 года, г. Минск, – Ч.2. – С. 157–160.

3. *Исаченко, Л. И.* Рыжие лесные муравьи, биологические регуляторы численности иксодовых клещей на урбанизированных территориях / Л.И. Исаченко, Ю.Г. Лях // XV Международная научно-практическая конференция «Актуальные проблемы экологии - 2020». г. Гродно, 22–24 сентября 2020. – С. 35–37.

4. *Исаченко, Л. И.* Биологические регуляторы численности иксодовых клещей / Л. И. Исаченко, Ю. Г. Лях // Материалы Республиканской научно-практической он-лайн конференции «Современные проблемы естествознания в науке и образовательном процессе», 25 февраля 2021 года, Минск. С. 58.

NATURAL RECREATIONAL POTENTIAL OF GOMEL REGION OF REPUBLIC OF BELARUS

A. Makarenko

Belarusian State University, Faculty of Geography and Geoinformatics
Minsk, Republic of Belarus
anntomakarwork@mail.ru

The article describes the main natural recreational resources in Gomel region. The author highlight positive and negative aspects of development tourism in the each recreational resource, according to basic knowledges of recreational tourism.

Keywords: natural recreational resources, tourism in Gomel region, recreational potential of Gomel region.

Natural recreational resources are subdivided into climatic, orographic, water, hydro-mineral, mud and forest.

The climatic conditions of the Gomel region: the annual regime of comfortable weather is not stable, which interferes with the organization of treatment and prophylactic activities [1]. The average annual air temperature in the region is higher than in the central and northern regions of the republic. Annual precipitation ranges from 510 to 670 mm. Orographic conditions: most of the Gomel region is lowlands and only 5 % of the territory has heights of more than 200. The general character of the relief is low-lying. The river network belongs to the Black Sea basin. The main river system of the region is the r. Dnieper (more than 400 km long within the region. The main tributaries are the Berezina, Pripyat, Ptich, Ubort, Sozh, Drut '. Within the region, there are 29 rivers with a length of more than 50 km. The average water temperature in the warm period is 16 C, from June to August – 21 C. The region has many small lakes (about 90 of it has an area of more than 0.1 km^2), the largest are Chervone, Beloe, Velikoye and others, most of the lakes are of ancient origin. The lake area of the region is 0.2 %. There are 22 reservoirs with a total volume of 138 million m^3. Water resources are used for fishery, recreational purposes, as well as for irrigation [1].

Phytotherapeutic resources are represented by forests, which occupy about 44 % of the regions. Oak, birch and pine forests are the most favorable for organizing medical activities for tourists. Plots with certain types of forest extend their medicinal properties to open spaces adjacent to woodlands. The limiting factor of their use is the degree of soil moisture. Even though pine forests are somewhat inferior to birch and oak forests, their role increases in winter. Pine forests have a positive effect on lung diseases.

The region is distinguished by a significant potential of mineral waters; in terms of their reserves and diversity, it is significantly ahead of other regions of the country. Several types of mineral waters are in studied region:

a) Chloride-hydrocarbonate and hydrocarbonate-chloride (sanatoriums "Sosny", "Polesie" of the Mozyr region, "Polesie" of the Narovlya region);

b) Sulfate, chloride-sulfate and sulfate-chloride waters, among which the most common are sodium;

c) Bromine waters and iodine-bromine brines (found within the Pripyat trough);

d) Sulfide and hydrogen sulphide mineral waters and brines were found in the village of Tsuper, Zhlobin district (sanatorium-preventorium "Praleska"), in the city of Yelsk [1].

In the development of the natural resource recreational potential of the Gomel region, nature protection territories should be considered. In total, there are 126 specially protected natural areas in the region, such as: a national park, a nature reserve, reserves of republican and local significance, natural monuments of republican and local significance. The most remarkable for tourists and excursionists are the Pripyatsky National Park, republican landscape reserves "Vydritsa", "Smychok", "Mozyr ravines", "Middle Pripyat", as well as republican wetland reserves "Stary Zhaden" and "Floodplain of the river Sozh" [2]. The total area of specially protected natural areas in the region is 1676 thousand hectares – about 7.4 % of the total area of the region.

Currently, the republican reserves "Smychok", "Vydritsa" and "Dnepro-Sozhsky" are developing ecotourism as a type of recreational activity. The territory of "Smychok" is equipped with places for rest, placing tents. Among the types of services provided there is a tourist water route along the river Lower Olba and ecological trail "Barvinka". The “Vydritsa” nature reserve carries out a tourist ecological route and an ecological trail along the lake Belogorskoe. Biological reserve "Dnepro-Sozhsky" is attractive to tourists for its inhabitants listed in the Red Book of the Republic of Belarus, the organization of fishing and 4 tourist routes [2].

In this way, among the natural recreational potential, ecological and aquatic species stand out, as well as a medical and health-improving type of tourism (mainly health improvement for children) is in great demand throughout the republic and among neighboring countries.

BIBLIOGRAPHY

1. *Гайдукевич, Л. М.* Туризм в Беларуси. Пособие для студентов факультета международных отношений. / Л.М. Гайдукевич [и др]. Бел. гос. Ун-т. – Минск : БГУ, 2001. – 348 с.

2. *Решетников, Д. Г.* География туризма Республики Беларусь / Д. Г. Решетников. Минск : Четыре четверти, 2011. – 248 с.

THE IMPACT OF THE THERMAL TREATMENT OF THE SUBSTRATE ON THE BIOLOGICAL EFFICIANCE OF GILLED MUSHROOMS (PLEUROTUS OSTREATUS)

A. Makas, G. Krusir

[1]*Odessa National Academy of Food Technology*
Odessa, Ukraine
antonina.makas@gmail.com

This study explores the dynamics of the biological efficiency of oyster fungi stain in various conditionsof the thermal substrate treatment to determine the optimal method of substrate heat treatment.

Keywords: substrate, common fungus, sterilization, pasteurization, biological efficiency

Pleurotus is a genus of gilled mushrooms which includes one of the most common cultivated edible oyster mushrooms in the world that has high nutritional value and medicinal healing properties. Its content is low in lipids and high in proteins, fiber, carbohydrates, minerals, and vitamins. Mushroom extract has anti-inflammatory, anti-bacterial, anti-tumour properties, reduce heart disease risk factors like high blood pressure and cholesterol. Mushrooms have quick mycelium growth, don't need special compost and suitable for growing in the artificial environment. The production process is wasteless and multipurpose as the growth substrate can be used as cattle food supplement, fertilizer, soil, and water purification.Mushrooms need substrate dense in woody, fibrous materials like lignin, cellulose, hemicellulose for growth. A wide range of materials is used for substrate base: agricultural by-products (cereal straw, sunflower husk, sawdust, corn cobs) or unconventional materials based on coffee grounds, tea production waste, coconut shavings, fig palm leaves, etc. Substrate quality assurance is critical for successful cultivation and consistent high crop yield. Substrate nutritional value and favourable environmental conditions promote mushrooms' growth. This research determines the optimal substrate thermal treatment to promote oyster mushroom cultivation (Pleurotus ostreatus).

The biological effectiveness (BE KPI) of mushrooms is the key performance indicator of mushroom efficiency estimation. It is defined as the ratio of the raw weight of mushroom fruits to the dry mass of the substrate. The change of dynamics of biological efficiency was observed during research within various conditions of substrate heat treatment. The object of study is a gilled mushroom (Pleurotus ostreatus), the substrate materials had the same technical parameters. Thermal treatment was delivered by two methods: hot water pasteurization and sterilization in an autoclave. The hydrothermal treatment was implemented in two stages: hydration and hot water pasteurization (t 80–900C) within 4 hours; water drainage and substrate cooling to 450C within 12 hours and to temp. 260 within the next hour; substrate inoculation. Autoclave sterilization process steps: sterilization with the high-pressure steam of 15 psi and 121–125C within 90 minutes, offload and substrate cooling to 260C; substrate inoculation.

Table 1

Change dynamic of BE KPI of gilled mushroom within various substate heat treatment methods

№ o/p	Substrate heat treatment method	BE, %
1	Hot water pasteurisation	56,3
2	Autoclave sterilisation	67,5

Conclusions. From the derived research data, we can conclude that autoclave sterilisation is the optimal method that yields higher crops. Pasteurization process has longer duration and higher risk of competing fungi species occurrence which could lead to substrate block wastage, which leads to BE decline.

BIBLIOGRAPHY

1. Окончательная обработка субстратов для вешенки. Стерилизация. Часть 3. Выращивание грибов: всё для успешного производства: веб-сайт URL: http://micoprom.ru/?p=1486

2. Технология выращивания вешенки [Електронний ресурс]. – Режим доступу: http://www.universalinternetlibrary.ru/book/20193/ogl.shtml

ANALYSIS OF BIOCHEMICAL PROPERTIES OF *BACILLUS CEREUS* PURE CULTURES UNDER PROLONGED EXPOSURE TO IONIZING RADIATION

S. Maltsava, A. Yakubovich, E. Gritskevitch

Belarussian State University, ISEI BSU
Minsk, Republic of Belarus
sveta.malceva28@mail.ru

One of the largest groups of soil microorganisms are aerobic spore-forming bacteries. Of particular interest is the study of bacteria of the genus *Bacillus*, as key ammonium bacteria, as well as sanitary microorganisms of soils in many regions. *Bacillus cereus* (*B. cereus*) is one of the brightest representatives of this genus. This bacterium is ubiquitous (soil, water, hay, food) [1]. *B. cereus* is a conditionally pathogenic microorganism potentially dangerous to humans which is capable of causing food toxic infections [3]. It is also known that radiation pollution can lead to significant environmental changes.

Keywords: Bacillus cereus, amylolytic activity, proteolytic activity, catalase activity, ionizing radiation.

It is well known that bacteria of the genus *Bacillus* play an important role in the formation of soil microgroups. The study examined the effect of prolonged exposure to ionizing radiation on key biochemical properties of *B. cereus* test microorganism.

The study used the following research methods: the isolation and cultivation of test cultures was carried out using a differential diagnostic nutrient medium (*MYP-agar*); microscopic methods for analyzing the morphological features of test cultures, biochemical research methods: amylolytic activity (starch hydrolysis, Carovey method), proteolytic activity (casein hydrolysis), as well as catalase activity. I served as material for a research the strains of a bacterium of *B. cereus* allocated from tests of the soils which are under long impact of ionizing radiation (of Dronki, Hoyniksky the area, the territory of the Polesia radiation and ecological reserve) and also soils of the green space of the agrotown of Cheretyanka of the Gomel district, the Gomel region with natural conditions of impact of ionizing radiation. The change in biochemical properties was judged by: the starch hydrolysis zone around the colony of the test culture, as well as the amount of the amylase enzyme contained in 1 ml of the biological solution under study, which cleaves amylodextrin (in μg) in 1 minute at 37 ° C (amylolytic activity), the zone of enlightenment around the colony of the test culture in mm (proteolytic activity), gas bubble release intensity (catalase activity) [2.4]

Based on studies conducted to study the physiological and biochemical properties of B. cereus bacteria, it was shown that bacteria isolated from the soils of the forest park zone (hereinafter referred to as Control) have a higher ability to enzymatic hydrolysis of starch (starch hydrolysis zone 8 ± 0.2 mm) compared to bacteria that were exposed to long-term ionizing radiation (starch hydrolysis zone 6 ± 0.2 mm). Similar results were confirmed by the Karovey's method. There was also a decrease in proteolytic activity (by 23 %) and catalase activity in B. cereus bacteria, which were under prolonged exposure to ionizing radiation compared to the Control.

Based on the data obtained, it can be assumed that the action of this stress factor (ionizing radiation) can lead to a decrease in the biochemical activity of a bacterium of the genus *Bacillus.*

BIBLIOGRAPHY

1. *Алтон, Л. В.* Развитие и выживаемость бактерий рода Bacillus / Л. В. Алтон // Микробиология. 1998. №9. 34 – 35 с.

2. *Васильев, Д. А.* Идентификация бактерий Bacillus cereus на основе их фенотипической характеристики / Д. А. Васильев, Н. А. Феоктистова, А. В. Алешкин. Ульяновск, ООО «Колор-Принт», 2013. – 98 с.

3. *Rasko, D. A.* Genomics of the Bacillus cereus group of organisms / D.A. Rasko, M.R. Altherr, C.S. Han// FEMS Microbiol Rev. 2005. V. 29. P.303-329.

4. *Wang X.* In vitro utilization of amylopectin and high-amylose maize (amylomaize) starch granules by human colonic bacteria / X. Wang [et al.] // Appl. Env. Microbiol. 1999. V. 65, №. 11. P. 4848–4854.

INFLUENCE OF LOW-INTENSITY LASER RADIATION ON THE GROWTH OF PURE *BACILLUS SUBTILIS* CROPS ISOLATED FROM THE SOILS OF THE POLESYE STATE RADIATION AND ECOLOGICAL RESERVE

E. Maslyukov, L. Gavriluyk, E. Gritskevich, A. Vabishschevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
massl2001@yandex.by

The effect of combined laser radiation in the dose range of 3–12 J on the rate and nature of *Bacillus Subtilis* colonies growth has been evaluated. Significant growth inhibition was noted at a load of 12 J, colony growth dissociation and a decrease in their size.

Keywords: laser radiation, colonies morphology, dose load, biometric analysis.

Bacillus Subtilis are facultatively aerobic soil bacteria characterized by biochemical and genetic variability. The main area of use is probiotics creation for the treatment of gastrointestinal diseases. The ability to synthesize cyclic lipopeptides, polypeptides, proteins and non-peptide compounds acting as hormones and signaling molecules plays an important role.

In the course of the work, the culture resistance to combined laser radiation was assessed to further determinatino of the stimulating and depressing doses. The planting culture, diluted in physiological solution 1:100, was carried out on a nutrient medium GM-F-AGAR (RF), immediately after planting the experimental groups were irradiated with doses of 3, 6 and 12 J, respectively; the control group was not exposed to radiation. For irradiation, a "Vityaz" (RB) quantum therapy apparatus with red (λ = 620–700 nm) and infrared pulse-simulated irradiation (12500 Hz) was used. Subsequent germination was carried out in a thermostat at t = 36º (Pol-Eko-Aparatura ST1 Basic, Poland).

With an interval of two days, microscopic examination (Micromed 3 ver. 2 Led M, China) and survey of colonies (Sony IMX486, Japan) were carried out. The contamination of the nutrient medium was analyzed (ImageJ, NIH, USA). Table 1 shows the indices of contamination during the observation period.

Table 1

Indicators of contamination of the nutrient medium in the experimental groups

Nutrient medium contamination, %					
group	day 2	day 4	day 6	day 8	day 10
control	82.149	82.427	82.750	83.110	83.385
3 J	78.730	79.255	79.812	80.079	81.074
6 J	58.280	59.491	60.085	61.569	62.359
12 J	52.443	54.289	55.866	56.008	56.128

As follows from the table, with an increase in the dose load, the area occupied by bacteria decreases. It is characteristically, that with an increase in the dose, the scattered growth of colonies intensifies: if in the control group the bacteria grow in a continuous «lawn», then in the group irradiated with 12 J, the structure of the colony is coarse-grained. This is probably due to the malfunction of the adhesive proteins and changes in the cultural properties. With an increase in the dose, the shape of the colonies gradually changes, among the rhizoid colonies there are round, irregularly shaped and with a scalloped edge, but the pasty consistency of the colonies and the color index remain. When the experimental groups were irradiated on the second day with the same doses, no changes in the nature of the population of the nutrient medium and morphological parameters were observed.

Thus, the effect of combined laser radiation on the *Bacillus Subtilis* monoculture was revealed, the main changes in the pattern of growth and formation of colonies were noted, and the relationship between the radiation dose and the degree of contamination of the nutrient medium was considered.

BIBLIOGRAPHY

1. *Шабурова Л. Н.* Влияние низкоинтенсивного лазерного излучения на различные формы микроорганизмов / Л. Н. Шабурова, А. Н. Данилова, Г. А. Цыганова // Передовые пищевые технологии: состояние, тренды, точки роста: Материалы конференции, Москва: МГУПП, 2018. – С. 508–512.

2. *Климков, Ю. М.* Взаимодействие лазерного излучения с веществом: учеб. пособие / Ю. М. Климков, В. С. Майоров, М. В. Хорошев. – М.: МИИГАиК, 2014. – 108 С.

ON A NATIONAL GLOSSARY OF NUCLEAR AND RADIATION SAFETY AS AN INSTRUMENT OF TERMINOLOGY HARMONIZATION

K. Mazanik, T. Artsemyeva, N. Tushin, M. Michalevic

Belarusian State University, ISEI BSU
Minsk, the Republic of Belarus
kosmv@list.ru

The creation of a special national glossary can serve as a solution to the problem of harmonizing regulatory documents in the field of nuclear and radiation safety and ensuring the accuracy of translation. The article substantiates the necessity of developing such a document, taking into account the specifics of the application of harmonization mechanisms.

Keywords: Glossary, nuclear and radiation safety, information problems, competent translation, the IAEA, the Belarusian language, terminology harmonization, harmonization of documents, codification of terminology.

The IAEA has been developing, establishing and updating safety standards in the field of atomic energy use for many years – being itself guided by these standards as well as recommending them for use by member countries as a basis for the creation or modernization of national safety regulatory systems. The IAEA's standards development activities are conducted in English, followed by translation into other official languages (Spanish, Chinese, French and Russian). These translations must conform to the original text [1], fully matching the document in English. The development of standards is preceded by rigorous research, the level of which is achievable only by combining the efforts of the member states, and their implementation is directly related to ensuring the safety of the population. Considering the specifics of nuclear and radiation safety, reaching mutual understanding among specialists and officials is impossible without thorough preparation of quality translations of these documents. Therefore, the harmonization and codification of terminology is at the core of mutual understanding in ensuring compliance with standards.

There is an ongoing challenge involving harmonization of special texts on nuclear and radiation safety with regard to the professional, cultural and linguistic aspects of the English, Russian and Belarusian languages. Applying harmonization mechanisms to such texts is characterized by certain specific features due to the following reasons: the professional sphere of application of the norms for ensuring nuclear and radiation safety, difference in arrangement and the established practice of using special English vocabulary regarding nuclear and radiation safety in a particular country, difference in wording and definitions adopted in national concepts, discrepancy in the volume of concepts behind the lexemes in English and Russian (sometimes up to lacunization of certain terms), discrepancy or misinterpretation of information transmitted by texts, a well-established tradition of using grammatical and syntactic forms in arranging the content of the translation [2, p. 104].

Therefore, the creation of a national glossary of nuclear and radiation safety is intended to solve a range of interrelated problems, including the following: 1) the problem of the time lag (which at present could embrace over a decade) between the publication of IAEA documents in English and their respective translations into Russian; 2) the problem of harmonizing the terminology used in the legal acts of the Republic of Belarus (in two state languages) and in the international regulatory documents; 3) the problem of codification and standardization of terminology in the field of radiation and nuclear safety (at the moment there is no single official glossary of the nuclear and radiation safety profile, which would include a translation into Belarusian). The IAEA Safety Glossary 2018 [3] is supposed to be used as the main source of terms and definitions.

To recapitulate, developing a special glossary of terms necessary to formulate the basic principles of ensuring radiation and nuclear safety in English, Russian and Belarusian can be considered essential to solving the problem of text and terminology harmonization in the field of nuclear and radiation safety in the Republic of Belarus.

BIBLIOGRAPHY

1. *Букринский, А. М.* О качестве переводов на русский язык стандартов МАГАТЭ по безопасности / А. М. Букринский // Ядерная и радиационная безопасность. 2006. №6. С. 8–10.

2. *Москалева, А. С.* Гармонизация переводов специальных текстов по тематике обеспечения ядерной и радиационной безопасности / А. С. Москалева // Таможенная политика России на Дальнем Востоке. 2013. № 3 (64). С. 98–105.

3. IAEA Safety Glossary: Terminology Used in Nuclear Safety and Radiation Protection. 2018 ed. Vienna : IAEA, 2019. 278 p.

NANOSCALE PHOTOCATALYSTS BASED ON ZINC OXIDE (ZnO) FOR THE REMOVAL OF PHARMACOLOGICAL WASTE IN AQUEOUS MEDIA UNDER THE INFLUENCE OF ULTRAVIOLET RADIATION

A. Miadzvetski, A. Shcherbovich, V. Plakhodzka,
N. Savastenko, I. Filatova, V. Lushkevich, S. Maskevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
aleksander.medvedskiy@gmail.com

The kinetics of caffeine photodegradation is investigated in the presence of catalysts based on the titanium dioxide nanoparticles.

Keywords: pharmaceuticak waste, plasma, photocatalyst, ZnO, photodegradation, methyl orange, radio-frequency discharge, plasma treatment.

Pharmacological waste can have a negative impact on human health [1]. Heterogeneous photocatalysis using ZnO-based nanocatalysts is an effective way to decompose this kind of waste contained in aqueous media. But for the use of existing materials on an industrial scale, it is necessary to increase their photocatalytic activity. Promising methods for modifying catalysts based on ZnO are its impregnation with silver nanoparticles, as well as plasma treatment during synthesis [3].

For the preparation of ZnO and Ag-ZnO followed the procedure described in [3]. ZnO was obtained by drip addition of 25 ml NaOH 0.4 mol/l in 25 ml $ZnSO_4$ 0.2 mol /l with an approximate addition rate of 5 ml / min. After stirring on a magnetic stirrer (IKA, Germany) at a speed of 150 rpm for 60 minutes, the solution was kept for 2 hours at a temperature of 60 ° C.

Composite Ag-ZnO nanoparticles were obtained by adding 6 ml 0.01 mol/l ascorbic acid and 13 ml $AgNO_3$ 0.01 mol / l to a solution of NaOH and $ZnSO_4$, while stirring under the same conditions as in the first experiment, then the solution was kept at 70 ° C for 2 hours. At the last stage, the synthesized products were centrifuged and washed several times with distilled water and dried for 24 hours [2]. The samples ZnO-DBD-4_15 and Ag-ZnO-DBD-4_15 were processed in a plasma of a dielectric barrier discharge created in air at normal pressure [3].

The photocatalytic activity was studied in a model decomposition reaction of caffeine sodium benzoate simulating pharmacological waste under the action of ultraviolet radiation in aqueous suspensions of synthesized samples. As a quantitative characteristic of the activity of the samples, the reaction rate constant was used, determined by the slope of the graph of the dependence of the logarithm of the concentration of the decomposed substance on time. The relative concentration of the model substance C_r was determined from optical density measurements at the absorption maximum:

$$C_r = \frac{C(t)}{C_0} \cdot 100\% = \frac{A_t}{A_0} \cdot 100\%, \quad (1)$$

where C_0 is the initial concentration of the model substance, C(t) is the concentration of the model substance after irradiation with UV radiation at time t, A_0 and A_t are the optical density of the solution of the model substance at the absorption maximum (λ=272 nm) before irradiation and at time t after irradiation of the sample, respectively.

This work was partially financially supported by the State Research Program “Convergence 2025. 2.2.02. Scientific basis of plasma-activated interaction of nanoparticles with the surface of functional materials in order to develop new methods for aimed synthesis and modification of nanostructured catalytic materials” and grant of the Ministry of Education of the Republic of Belarus No. 20211534 "plasma modification of catalysts doped with plasmon nanoparticles for photodegradation of pharmacological waste"

BIBLIOGRAPHY

1. *World Health Organization*, electronic resource, accessed 25 January 2021, <https://www.who.int/news-room/fact-sheets/detail/health-care waste>.

2. *Savastenko, N., et. al*. Effect of silver nanoparticles impregnation on efficiency of plasma treated ZnO-based photocatalysts // High Temperature Material Processes: An International Quarterly of High-Technology Plasma Processes. 24. 10.1615/HighTempMatProc.2020033434.

3. *Viet Ha Tran Thi, et. al*. Synergistic Adsorption and Photocatalytic Activity under Visible Irradiation Using Ag-ZnO/GO Nanoparticles Derived at Low Temperature // *Journal of Chemistry*, vol. 2019, Article ID 2979517.

EVALUATION OF BY-PRODUCTS THAT CAUSE ENVIRONMENTAL PROBLEMS IN OLIVE OIL PRODUCTION

Mehmet Musa Özcan[1], **V. Lemiasheuski**[2]

[1]*Selcuk University*
Konya, Turkey
[2]*Belarusian State University, ISEI BSU*
Minsk, Republic of Belarus
mozcan@selcuk.edu.tr

In olive production, which has a very important place in the country's economy, in addition to main products such as olive oil and table olives and olive oil, solid and liquid by-products such as "Pirina" and "Blackwater" are formed in olive oil factories. Against pomace, which can be evaluated economically, black water is left indiscriminately to the environment. Most of the wastes that occur on average as 200 billion tons each year are either left to nature as garbage or used as fuel, animal feed or fertilizer with a little processing. Environmental pollution that appears with increasing industrialization and population, and the economic consumption used to eliminate pollution cause wastes to become a biomass problem.

Keywords: olive, processing, olive by-products, waste, blackwater, prina (pomace).

It is obtained by mechanical means from the fruits of the evergreen tree *Olea europaea*. The food industry has a wide working area and high production capacity in terms of raw material sources used. As a result of production, high amounts and various types of waste are generated. Creating a waste awareness for this sector will also contribute to our country economically. Waste biomass, which can be considered as a renewable energy source, has become an increasingly important field of scientific study and industrial application in terms of environmental and economic reasons, as well as the recovery of waste, useful, cheap, new, high value-added and natural products. Olive black water; contains sugars, organic acids, polyalcohols, pectins, colloids, tannins and lipids. Valuable products can be produced by biotechnological transformation from solid and liquid wastes from the olive oil industry. In order to determine the wastes of the olive and olive oil processing industry and alternative evaluation methods, first of all, olive, olive oil and its compositions should be examined, and then the wastes generated in the production technology should be investigated in detail.

a. Fleshy part (Mesocarp): It makes up 65–83 % of the grain. It contains water, oil, sugar, polysaccharides, protein, pectin, organic acid, tannin, oleuropein, color and mineral substances. The fleshy part contains 50–60 % water, 15–30 % oil, 2–5 % nitrogenous substances, 3–7.5 % sugar, 3–6 % cellulose, 1–2 % minerals, 2–2.25 % phenols.

b. Seed: In this part of the grain, there are 30 % water, 27.3 % oil, 10.2% nitrogenous substances, 26.9 % sugar, 1.9 % cellulose, 1.5 % minerals, 0.5 % polyphenols.

c. Core (Endocarp): It makes up 13–30 % of the grain. The kernel consists of the kernel shell and the seed inside. In the core part, there are 9.3 % water, 0.7 % oil, 3.4 % nitrogenous substances, 41 % sugar, 38 % cellulose, 4.1 % minerals, 0.1 % polyphenols.

In the composition of the olive fruit, besides phosphorus, potassium, calcium and magnesium elements, there are vitamins A (retinol), which plays an important role in vision, E (tocopherol), which is one of the natural antioxidants, K (naphtaquinone), which is a coagulation factor, and D (cholecalciferol), which prevents rickets.

Alternative Uses of Wastes from Olive Oil Production. When we classify the studies carried out to evaluate the waste products generated in olive oil production in the world, according to their fields; alternative energy production (biodiesel, biogas, bioethanol, biohydrogen, pellet), livestock (feed) and agricultural applications (soil conditioner), food (gelling, functional foods), pharmaceuticals, nutraceuticals, cosmetics (preservatives, natural humectants) applications, and we encounter biotechnological applications such as bioplastic/biopolymer, biological surfactant and lipase production.

Phenolic substances (1–3 % by weight) are at the top of the bioactive substances in olives. More than 36 phenolic compounds have been identified in olive oil. The antimicrobial, antioxidant and anti-inflammatory effects of olive oil phenolic compounds have been demonstrated in many studies.

The use of olive black water in animal nutrition. At the end of olive oil production, a serious level of olive waste water (black water) is formed. It can be used in blackwater animals by concentrating or drying.

The use of pomace in animal feeding. Factors such as the method used in olive oil production, the geographical condition of the region where the olives are obtained, the harvest period and the separation of the seed from the olive pomace affect the chemical composition of the olive pomace. These situations affect its use in animal nutrition. In order to produce animal feed additives from raw pomace, the very high acidity of the pomace

must be adjusted and its oil must be removed. The main reason why it is preferred as animal feed is that it is cheap. However, the biggest disadvantage is that it is poor in protein and contains a high amount of cellulose.

Use of pomace for fertilization purposes. The most important benefit of this method is to bring the high amount of nutritive components carried by the waste to the soil naturally. Raw pomace (50 % moisture) contains nitrogen (0.96 %), phosphorus (0.56 %) and total organic carbon (60.45 %). These components are added to the soil with the humus-like product obtained from the enrichment of pomace by fermentation in an airless environment.

Use of olive black water for fertilization. When olive oil waste water is used directly as organic fertilizer, it has negative effects on plants and soil properties. Treatment of these wastes is necessary to produce a stable and easily manageable end product. Composting is a widely used treatment for the treatment of organic waste. To dispose of olive oil waste water, composting olive oil waste water is an economically and ecologically accepted method. In this way, black water can be used as organic fertilizer without any phytotoxic effect.

The use of pomace in the production of phenolic compounds. Pomace; It is very rich in oleuropein, hydroxytyrosol, tyrosol, phenolic acid and flavonoid content. Approximately 0.27–0.29 g of polyphenols (oleuropein, hydroxytyrosol, tyrosol and tocopherol) and flavonoids (apigenin, quercetin, luteolin etc.) 70.0–79.3 g of cellulose; 3.54–4.75 g of ash; There are 107,1–195.4 mg of polyalcohol (mannitol). It is also very important that it is a natural and cheap resource.

Production of pectin and polyphenol from black water and olive pomace. The oil and water contained in the waste are separated by the pre-treatments carried out by centrifugation and evaporation.

Production of tyrosol and hydroxytyrosol from Blackwater. Microfiltration (MF), ultrafiltration (UF), nanofiltration (NF) in addition to column chromatography for the production of tyrosol and hydroxytyrosol from black water in a 2009 patented study for use in dermocosmetic products (milk, gel, cream), nutraceuticals and beverage-based diet mixtures. Purification was made with reverse osmosis (RO) membrane systems, and water was recycled by spray drying.

ELECTRIC CARS IN THE CONTEXT OF ENVIRONMENTAL IMPROVEMENT

V. Pleskanev, E. Yablonsky, D. Mishlakov, P. Shalkevich

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
pavel.shalkevich@gmail.com

The ecological aspects of replacing gasoline and diesel cars with electric cars are considered. The conditions of solving the environmental problems associated with CO_2 emissions due to this replacement are formulated.

Keywords: electric vehicle, electricity, energy ecology.

On July 14, 2021, the European Commission presented the EU Green Deal plan to reduce harmful emissions into the atmosphere [1]. This plan envisages a 55 % reduction in harmful emissions into the atmosphere by 2030 compared to 1990. In order to achieve this goal, it is planned to reduce CO_2 emissions from cars. To do this, it is planned to reduce the number of cars, the operation of which implies CO_2 emissions, by 2025 - by 15%, by 2030 – by 55 %. Moreover, under the EU Green Deal, it is planned to phase out the production of vehicles with harmful emissions by 2035. For these purposes, the European Union plans to build 1 million charging stations for electric vehicles by 2025, and by 2035 – to build 3 million such stations. At first glance, it may seem that such a policy will help humanity to take an important step towards solving global environmental problems, but this statement is controversial.

In order to give a correct assessment of the scale of the influence of CO_2 emissions from cars on the total number of CO_2 emissions from the industrial environment, it is necessary to consider the characteristics of energy production. Today 85 % of energy produced in the world is obtained from the combustion of hydrocarbons [2]. According to the same studies, 63.3 % of total electricity is generated by burning fossil fuels, mainly coal. At the same time, in 2000, this number was 64.8 %. Considering the relatively low rates of reduction in the consumption of fossil fuels (≈1.5 % over 20 years) in the electricity production, as well as the described trend towards the popularization of electric vehicles, the question of what kind of energy resources will provide energy for electric vehicles becomes especially important. In addition, along with the environmental aspects of the energy features of the introduction of electric vehicles, it is fair to ask a question about the ecology of the production, use and disposal of various types [3] of batteries used for electric vehicles. After all, the development of infrastructure for electric vehicles, despite its technical advantages [4], has problems associated with its negative impact on the environment [5, 6].

Thus, it is possible to talk about solving environmental problems associated with CO_2 emissions by replacing cars with diesel engines and internal combustion engines with electric vehicles only if the following conditions are met:

– energy for electric vehicles is provided by renewable energy sources (the design and construction of which take on special significance in the considered context [7]);

– the negative impact of the production, operation and disposal of electric vehicle batteries on the environmental situation does not exceed the its positive impact.

BIBLIOGRAPHY

1. Delivering the European Green Deal | European Commission. [Электронный ресурс]. – URL: https://ec.europa.eu/info/publications/delivering-european-green-deal_en. – Date: 06.10.2021.

2. *Smil, V.* Energy Transitions: Global and National Perspectives / V. Smil. – Praeger, 2017 – 297 p.

3. *Kocherov, A. V.* Vybor tipa elektrohimicheskoj sistemy akkumulyatora elektromobilya LCV-segmenta / A. V. Kocherov[i dr.] // Trudy NGTU im. R. E. Alekseeva. 2018. №2 (121).

4. *Fatyhov, R. R.* Perspektivy primeneniya litij-ionnyh akkumulyatorov v kachestve rezervnyh is-tochnikov pitaniya na elektricheskih stanciyah / R. R. Fatyhov, S. M. Hantimerov, N. M. Sulejmanov // Vestnik KGEU. 2017. №4 (36).

5. *Ol'shanskaya, L. N.* Ekologicheskie aspekty utilizacii litievyh himicheskih istochnikov toka / L. N. Ol'shanskaya, E. N. Lazareva, A. P. Klepikov // Vestnik SGTU. 2005. №1 (6).

6. *Plahotnik, V. N.* Ekologicheskie aspekty utilizacii litievyh batarej sistemy FUL / V. N. Pla-hotnik[i dr.] // Fundamental'nye problemy preobrazovaniya energii v litievyh elektrohimicheskih sistemah: Materialy VII Mezhdunar. konf. Saratov, 2002. S. 134-135.

7. *Baran, A. N.* Proektirovanie ob"ektov vozobnovlyaemoj energetiki : uchebnoe posobie / A. N. Baran [i dr.]. – Minsk : RIVSH, 2020. – 440 s.

IMPROVEMENT OF TECHNOLOGY OF WASTE PROCESSING OF MILK PROCESSING ENTERPRISES

V. Prilutskiy, G. Krusir, O. Sagdeeva, I. Kuznetsova

Odessa National Technological University;
Odessa, Ukraine

Wastewater from the food industry is highly concentrated, so the most appropriate method of treatment is anaerobic fermentation (methane fermentation). Methane fermentation is one of the most environmentally friendly methods of cleaning the environment and is of great importance in industry as a source of methane. The level of pollution by winter consumption of wastewater from dairies of different productivity is in the range of 3000 mg / l, which indicates the feasibility of using methane fermentation.

Keywords: ecological biotechnology, methane fermentation, dairy waste, biotechnology of environmental protection.

Wastewater from the food industry by pollution is highly concentrated. They contain a significant amount of organic matter that gets into them during the processing of plant and animal raw materials.

These substances are generally well soluble in water, available for consumption by microorganisms, which causes a high degree of biological contamination of water bodies where these wastewater enters.

Wastewater from the alcohol, meat and sugar industries is the most polluted. Wastewater from yeast, milk and brewing is no less harmful to water bodies.

The urgency of introducing the process of methane fermentation in wastewater treatment technology coincided with the increase of the energy crisis, ie with the need to find new, unconventional energy sources. Methane fermentation is of great importance in industry not only and not so much in the technology of wastewater treatment, but as a cheap and promising source of energy: biogas - methane.

Abroad, methane fermentation of waste has become a significant additional source of energy in many industries. Research in this direction continues in our country. Published works on wastewater indicate the possibility and feasibility of processing into biogas of liquid and solid waste from almost all food industries. The dairy industry is no exception.

Little research has been done on wastewater treatment in this industry. Traditional technology is not suitable in this case. The level of contamination by HSC wastewater of dairy plants of different productivity is within 3000 mg / l, which indicates the feasibility of using methane fermentation.

Dairies have other environmental problems, such as whey. This is a secondary raw material that should be used according to the long-known technology of obtaining various food products. However, this is not done by all companies. Many plants do not use all or no whey to produce by-products.

The paper provides a scientific explanation for the fact that a further increase in the concentration of activated sludge does not improve the quality of treatment due to lack of nutrients compared to the number of cells of microorganisms. It is an inhibitory factor of metabolism that causes autolysis and secondary contamination of the culture fluid. As a result of maintaining the optimal concentration of activated sludge, a high degree of pretreatment and the maximum amount of biogas was achieved.

Part of the serum for one reason or another gets into the sewer from wastewater. This creates additional environmental problems. There is a question about the influence of serum on the technological parameters of biochemical wastewater treatment and the dependence of these parameters on the amount of serum in wastewater. In addition, preliminary studies show that methane fermentation of serum allows to obtain 15 times the volume of methane relative to the volume of fermenting serum. This wastewater indicates the feasibility of work in this direction.

PASSIVE IMMUNITY DEFENSE SYSTEM OF PLANTS AGAINST PHYTOPATHOGENIC FUNGI

D. Pristavkina, A. Chernetskaya

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
d.pristavkina03@mail.ru, chealval@gmail.com

The article considers the problem of plant immunity to infectious diseases, which is the main phytopathological problem, as its task is to eliminate mass plant diseases - epiphytoties. In our work, special attention was paid to the study of protective barriers. The protective barrier functions are performed by lignin, cutin and suberin and some specific structures (halos, papillae, collose plugs and others), aimed at limiting the introduction, spread and exchange of the parasite with plant tissues.

Keywords: protective barriers, passive immunity, fungal pathogens, phytoprotection complex, epidermis, cuticle, wax, pubescence.

A huge number of pathogens are unable to overcome passive immunity mechanisms due to anatomical and morphological features of plants and their chemical composition. Factors that increase resistance to diseases include: the general external condition of the plant, the surface structure, the structure of the covering tissues, the rhythm of the stomata, and the anatomical features of plants. The entire endogenous phytoprotection complex can be divided into three components: protective substances, protective reactions, and protective barriers [1].

In the pathway of fungal pathogen penetration, there are a number of organs adapted for protection. The first one is leaves with exogenous flavonoid glycosides localized on their surface, whose antibiotic action reduces the infection load. The second such organ is epidermis or stomata closing cells with high content of flavonoid glycosides. The third adaptive protective organ is the intercellular or so called free space with localized in it flavonoid glycosides, phenolcarboxylic acids and their esters. Finally, the last obstacle in the way of the fungus is the cell membrane, which contains high levels of phenolic compounds [2].

Wax on the surface of leaves and fruits (fruits) forms a water-repellent surface, which promotes the rolling away of water droplets and prevents the formation of a water film in which fungal spores accumulate and germinate or bacteria multiply. The dense pubescence on the surface of the plants can have a similar water repellent effect, thus reducing plant infestation. A thick cuticle can increase resistance to pathogens that penetrate directly through the surface.

The thick and rigid wall of epidermal cells protects plants from micro-injuries and makes it difficult or impossible for pathogens to penetrate through the undamaged surface. Stomatal structure (narrow stomatal slit, high walls, or shape features of closing cells) plays an important role in resistance against some bacterial pathogens.

The described factors statistically reduce the probability of pathogen penetration inside the plant or prevent penetration mechanically.

The thickness and area of the outer wall of epidermal cells, features of wax and cuticle covering them, structure, rhythm, number and density of stomata are considered to be important factors of resistance to wound pathogens [3].

One of the important properties of mechanical immunity is its heritability. Carriers of resistance are varieties with delayed type of defeat. It is important to combine complex disease resistance in one variety. It is promising to select initially disease-resistant forms.

The phenomena of structural immunity and morpho-anatomical factors, being a mechanical obstacle, act passively on the parasite, i.e. the processes of mechanical protection go without relation to fungi and are not a reaction to the introduction of parasites [2].

BIBLIOGRAPHY

1. Биология, систематика и экология грибов и лишайников в природных экосистемах и агрофитоценозах, НАН Беларуси /ред. А.В.Пугачевский [и др.]. – Минск: Колорград, 2016. – 324 с.

2. *Дьяков, Ю. Т.* Инвазии фитопатогенных грибов / Ю. Т.Дьяков, М. М. Левитин. – Москва: Ленанд, 2018. – 251 с.

3. Фундаментальная фитопатология / С. Ф.Багирова [и др.]; ред. Ю. Т. Дьяков. – стереотип. – Москва, 2017. – 509 с.

PROBLEMS OF POLLUTION BY SOLID AND HOUSEHOLD WASTE IN THE REPUBLIC OF BELARUS

I. Reich

Belarusian State University, ISEI BSU
Minsk, Belarus
123-goga@inbox.ru

Garbage pollution has a significant impact on human health and the population as a whole. This paper describes the problems caused by pollution by solid and household waste and how to solve them.

Keywords: garbage, garbage pollution, solid and household waste, garbage disposal.

Annually about 33-34 million tons of household waste are generated on the territory of the republic. In total, more than 800 varieties of waste with a wide range of morphological and chemical properties are formed in the republic. Industrial municipal waste occupies huge territories: over the past 10 years in Belarus, about 25 hectares of land were seized only for industrial waste. Most of the household waste disposal facilities have been in operation for more than 25 years.

The composition and volume of solid household waste varies depending on the degree of development of the city, the geographical location of the territory, the time of year and many other factors. The main share of solid household waste in Russia and the Republic of Belarus is paper and cardboard (about 35 %). The second category is organic waste, including food (about 30 %). A smaller part of solid household waste is metal, plastic, glass, wood, textiles, rubber, etc. [2]

In the last decade, there has been a steady increase in the amount of solid household waste generated on the territory of the Republic of Belarus. The amount of garbage per capita during this period increased from 0.485 kg to 0.877 per day, which means that this figure has almost doubled and approached the EU indicator (0.85–1.7 kg per capita per day) [4].

In fact, the consequences are many and they are all serious: soil pollution with household garbage and groundwater poisoning in the process of decomposition, destruction of the ozone layer, poisoning of the population and animals with toxic smoke due to the burning of landfills, landfills serve as a halo for the habitat of insects, birds and rodents that are carriers of various infections, toxic substances, getting into the atmosphere, fall to the ground in the form of acid rain, landfills within the city are sources of unpleasant odors and attract homeless animals [1].

Disposal of consumption waste in Belarus is almost completely produced at landfills of solid municipal waste. 30–35 % of production waste, similar to household industrial household garbage, etc.) is also exported there [3].

Thus, the landfill of solid domestic waste in Gomel is located 2 km from the regional center (the right bank of the Sozh River) and has been operated since 1969. The area occupied by waste is more than 12 hectares. It contains more than 1 million tons of waste. In addition, littered with garbage and adjacent to the landfill area.

The solution of issues of processing of solid and domestic waste has recently become important for the Republic of Belarus. One of the solutions to this is the formation of the competence of the population in matters of environmental pollution through awareness of the population and the need for everyone's participation in solving this problem.

BIBLIOGRAPHY

1. *Konstantinov V. M.* Nature Protection. M.: Publishing Center "Academy", 2000. – 108 p.

2. *Bezzubtseva M. M.* Program "Energy Management and Engineering of Energy Systems" / International Journal of Experimental Education. – 2015. – No. 1. – P. 44–46.

3. Environmental protection in the Republic of Belarus: statistical sb. / M-vo statistics and analysis Of the Republic of Belarus. – Minsk : Informstat, 2007 — 206 s.Bezzubtseva M.M. Program "Energy management and engineering of power systems" / International Journal of Experimental Education. – 2015. – No1. – P. 44–46

4. Industrial ecology: schoolbook / M. G. Yasoveev, N. S. Shevtsova, O. V. Shershnev et al. edited by M. G. Yasoveev. – Minsk: BSPU named after M. Tank, 2010. – 308 p.

EXPRESS METHODS FOR WATER POLLUTION IDENTIFICATION

D. Samokhina, A. Zhukova, U. Kapitsa

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
dianna.samo@mail.ru

The purpose and main types of express tests for determining the pollution of natural waters are described. The principles of chemical determination of contamination are given. Methods of physicochemical determination of contamination in the field are described. A list of devices used to perform rapid tests of water pollution is given.

Keywords: water pollution, identification of water pollution, rapid tests, chemical methods, test strips, physicochemical methods, spectral methods, conductometer, thermometer, pH-meter.

Express-tests are used for a very simple, fast and reasonably accurate water analysis outside the laboratory. Express-tests - signaling means for monitoring the quality of water: drinking, natural, waste, technical. Express-tests are used to determine the most important standardized indicators of the aquatic environment. The basic principle of operation of Express-tests is based on analytical reactions that provide a visual indication effect. Express analysis takes only a few minutes and is much cheaper than laboratory analysis. Express-tests can either immediately determine a specific parameter of water quality, or determine the qualitative presence of a pollutant, and carry out a quantitative determination in a laboratory. In the second case, it appears to significantly reduce the number of samples taken and reduce the labor intensity of the work.

There are chemical and physicochemical principles for performing express-tests in the field conditions.

To perform chemical express-tests, either special reagent kits or paper strips impregnated with reagents have been developed. The set of express tests has everything you need. Often, when using such kits, the analysis can be done without any special knowledge and skills, simply by reading the instructions supplied with the kit.

Express-tests are tissue or paper test strips with immobilized reagents to determine the target component in water or aqueous solution. A plastic film that protects the test strip from washing out the reagents protects the fabric strips. Instructions for testing and a control scale, samples of which reproduce the color of the test strip when interacting with the target component of standard aqueous solutions, accompany each set of test strips. Some ETs have a dry reagent in the kit, which, when added to the analyzed water, stabilizes the indicator effect.

The principle of operation of tissue test strips is based on the absorption of a strip of analyzed water or an aqueous solution by a strip. The polymer film provides the required dosage of the analyzed solution and the stable course of the chemical reaction, as a result of which the color of the section of the indicator strip changes when the analyte is present in the aqueous solution.

The principle of paper test strips' action is similar, but differs in the way of contact with the analyzed solution.

The physicochemical method is based on the use of portable devices capable of detecting selected pollutants, determining the temperature, acidity, and degree of water ionization. In this case, electronic thermometers, conductometers, pH meters, or compact devices with spectral measurement principles (photometers, spectrometers, lidars) are used to conduct express tests.

BIBLIOGRAPHY

1. https://www.vee-ekspert.com/products/express-tests. Дата доступа 01.10.2021

2. Методы лабораторных и полевых исследований: Учебно-методическое пособие / Горшкова О. М., Горецкая А. Г., Корешкова Т. Н., Краснушкин А. В., Марголина И. Л., Потапов А. А., Пращикина Е. М., Шкиль А. Н.; под ред. М. В. Слипенчука. 3-е изд., испр. и доп. М.: Географический факультет МГУ, 2015. 220 с.

ENVIRONMENTAL CRISIS IN CHINA

H. Siqin, O. Nilova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
olga.n.1978@mail.ru

The article discusses the main issues and causes of the poor environmental situation in China. In the context of intensive industrial development, the country in recent decades has been experiencing significant environmental consequences of technogenic activities.

Keywords: China, environmental threats, atmosphere, soil erosion, acid precipitation.

The deterioration of the environmental situation as a result of economic activity is a phenomenon accompanying the development of human society over a long historical period. The current situation is different in that environmental problems have taken on a global character, which gives reason to talk about the emergence of a planetary ecological crisis.

The People's Republic of China (CNR) is one of the most intensively developing countries in East Asia, with significant environmental impacts. For this reason, as well as in connection with the continued high population of the country and the limited natural resources per capita, the analysis of the ecological situation in China is an urgent and very modern problem.

Currently, China is facing such global environmental problems as air pollution, soil and water pollution, climate change. The CNR is one of the “world leaders” that generates the largest share of carbon dioxide (CO_2) emissions on the planet. Exhaust gases make up about 79 % of air pollution, which have a strong tendency to increase [1].

Coal ranks second in terms of carbon dioxide emissions in the country; its share in the country's energy balance is 70%. When burned, much more CO_2 is emitted into the atmosphere than when burning oil products and gas. Chinese cities are considered the most polluted, as of the 20 dirtiest cities in the world, 16 are in the CNR. Mortality in China from unfavorable ecology is 4 times higher than in developed countries [2].

The high concentration of nitrogen oxides and sulfur in the atmosphere is the cause of acid precipitation, which has become commonplace in China, regularly polluting a third of its territory.

The area of land subject to erosion in China has begun to decline in the last decade, but it still remains very high – 3,56 million km^2 (37.1 % of the total area of the CNR). More than 4 billion tons of fertile soil layers are lost annually due to water and wind erosion. This is primarily due to the irrational use of the land fund of mountainous areas, excessive plowing, and deforestation.

The water problem, namely the lack of clean fresh water, is one of the most important problems affecting the economic growth and well-being of the population of the republic. More than 75 % of surface waters flowing through cities in China are considered unfit for drinking and fishing, 90 % of groundwater in cities is polluted, 50% of river waters are unsuitable for use in agriculture or industry. The main pollutants are organic substances, sulfates, ammonium and nitrite nitrogen, chlorides, heavy metals, which are present in wastewater in significant and constantly growing quantities [3-4].

An important step towards the stabilization of the economy and industrial development was the awareness of the Chinese leadership of the existing problems and the need to make decisions that can change the situation. Thus, environmental pollution control measures have become tougher, and interest in environmentally safe, efficient and profitable activities has increased

An example of this is the "zero tolerance" policy pursued by China, which consists in introducing criminal liability for environmental violations, as well as granting the state the right to close any enterprise that does not eliminate environmental pollution [5].

In the near future, environmental protection will remain an important issue in the domestic and foreign policy of the People's Republic of China.

BIBLIOGRAPHY

1. *Zhenhua S.* It is necessary to achieve carbon neutrality by 2060/ S. Zhenhua // China. 2020. №. 12. P. 4–5.

2. *Badian B.* China: economic boom and environmental threat / B. Badian// Bulletin of the RUDN. 2009. № 2. P. 24–32.

3. *Tolokonnikova E.V.* Ecological problems of China / E. V. Tolokonnikova// Bulletin of the Moscow University. 2014. №.1. P. 60-63.

4. *Agarwal A.* The role of NGOs in environmental protection / A. Agarwal // Journal of Environmental Research and Development. 2018. V. 2. №.4.P.933–938.

5. China intends to become an ecofriendly country by 2020. [Electronic resource]/ Access mode: https://tass.ru/plus-one/4085171 / – Accessed: 25.09.2021

ATMOSPHERIC AIR POLLUTION AND POSSIBLE EFFECTS FOR HUMAN HEALTH IN THE REPUBLIC OF BELARUS

V. Sivukha, A. Rodzkin

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
sivuxa.2001@mail.ru

In the modern world, polluted air plays an important role in the morbidity and mortality of the world's population. Emissions from mobile and stationary sources have an adverse effect on human physical health.

Keywords: air pollution, emissions, bronchial asthma, lung cancer, green zone.

Air pollution is considered one of the biggest health threats today, causing 7 million deaths worldwide every year. Air pollution contributes to and exacerbates many diseases: asthma, cancer, lung disease and heart disease. The International Agency for Research on Cancer lists factors such as carcinogenic outdoor air pollution and particulate matter as one of the main components of oncology.

Based on the results of long-term studies, scientists have come to the conclusion that polluted air can cause a variety of diseases: 43% of cases of COPD (chronic obstructive pulmonary disease) are caused by polluted air; lung cancer in 29% of all cases; diseases of the cardiovascular system (it is known that people living in regions with high levels of pollution are more at risk of dying from a stroke or heart attack). Thus, polluted air is one of the main pathogens of environmental factors [1].

The main causes of air pollution in developed countries are: nitrogen dioxide (from burning fossil fuels); ozone (from exposure to sunlight on nitrogen dioxide and hydrocarbons); suspended solid or liquid particles; sulfur oxides.

Ozone, which makes up a large proportion of smog, is a strong irritant and oxidizing agent. In summer, late morning and afternoon, ozone levels are highest. Short-term effects of ozone on the human body cause shortness of breath, chest pain and increased airway sensitivity. Long-term exposure to ozone results in a slight long-term deterioration in lung function.

Sulfur oxides from the combustion of high sulfur fossil fuels produce highly soluble acid aerosols that are deposited in the upper respiratory tract. Sulfur oxides can also cause airway inflammation, increasing the risk of developing chronic bronchitis and causing bronchoconstriction.

Particulate air pollution is a complex mixture produced by the combustion of fossil fuels, especially diesel. The particles cause local and systemic inflammatory reactions, which explains their effect on the state of the respiratory and cardiovascular systems [2].

All of the above indicators of air pollution cause airway hyperresponsiveness. Long-term exposure increases the number of respiratory infections and symptoms in the population, especially in children, and may cause decreased lung function.

When considering the situation with atmospheric air pollution in the Republic of Belarus for the period 2017–2019, the following picture emerges: with a general trend towards a decrease in emissions in the Republic of Belarus, in some regions, Brest and Vitebsk, their increase is observed. Also, according to the statistical yearbook of the Republic of Belarus, an increase in mortality from respiratory diseases is observed in these regions. The increase in mortality in these areas, albeit indirectly, indicates the negative impact of polluted air on human health. That is why emissions from transport and enterprises are strictly regulated by the Law of the Republic of Belarus dated November 26, 1992, No. 2–З "On the protection of atmospheric air" and the National Strategy for Sustainable Development of the Republic of Belarus for the period up to 2035.

Another solution to this problem is the creation of "green zones". A green zone is a naturally natural strip that quite tightly encloses a city or urban area. They are created with the aim of providing a healthy environment for citizens [4].

BIBLIOGRAPHY

1. World health organization [Электронный ресурс]: Air pollution/URL: https://unece.org/ru/air-pollution-and-health (дата обращения: 16.04.2021)

2. AbigailR. Lara. Заболевания, связанные с загрязнением воздуха [Электронный ресурс]//Справочник MSD. URL: https://www.msdmanuals.com/ru/профессиональный/легочные-нарушения/экологические-заболевания-легких/заболевания-связанные-с-загрязнением-воздуха (дата обращения: 15.04.2021)

3. Статистический ежегодник Республики Беларусь. Минск. 2020. 436 с.

4. *Selmanovich O., Luchina V.* Some peculiarities of the realization of green zones policy in the Republic of Korea//Actual environmental problems: proceedings of the VII International Scientific Conference of young scientists, graduates, master and PhD students. 2017. P.14.

ENERGY EFFICIENT TECHNOLOGIES OF PRE-SOWING PREPARATION OF SALAD SEEDS

V. Sivukha, V. Pashynski

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
sivuxa.2001@mail.ru

An overview of information on the possibility of preparing seeds for sowing, in order to increase germination and yield, by exposing them to an alternating inhomogeneous electric field of high intensity.

Keywords: seeds, electric field, polarization, charge.

Seed production includes a number of technological measures: post-harvest storage, pre-sowing treatment, disinfection, sowing. At each stage of production and storage, seeds may be negatively affected by climatic and economic factors that reduce their quality. Under unsatisfactory storage or growing conditions, seeds lose their natural germination, become infected with diseases, are damaged by insect pests or by mechanical processing. Agricultural production specialists and scientists are constantly looking for ways and means to improve the sowing qualities of seeds. Currently, various methods of pre-sowing preparation of seeds have been developed, which are conditionally divided into three classes: mechanical, physical and chemical.

The greatest interest in obtaining environmentally friendly products is represented by physical factors of the electromagnetic field, such as gamma radiation, X-rays, ultraviolet, visible optical, infrared, magnetic and electric fields, irradiation with alpha and beta particles, ions of various elements, etc. The use of gamma and X-ray irradiation is dangerous for human life, and therefore unsuitable for use in agriculture. The study of the effects of electromagnetic fields in the cultivation of cereals, nightshade, oilseeds, legumes, melons and root crops is relevant [1].

The electric field (both constant and variable) is a fairly well-known influence factor on various biological environments and objects, including seeds. Some researchers have established the influence of electrical treatment on individual characteristics of grains (germination, etc.), certain results have been obtained and their mathematical description has been performed. However, the authors often consider only one or several parameters of the electric field and evaluate their quantitative influence, without explaining the nature and mechanism of the changes obtained.

This approach is incorrect, since the electric field is a form of matter that has a complex effect on biological objects at both the macro and micro levels. At the same time, the course of a number of intracellular processes changes, which further causes larger-scale effects (changes in grain characteristics). Thus, it is possible to talk to a certain extent about informational, controlling influence, which, at very low energy costs, can provide a significant effect.

When seeds are introduced into an electric field, complex electrical processes occur in them and in the working area that creates this field, which are interconnected and mutually conditioned. Grain has a powerful enzymatic system, the activity of which depends on the state of the environment. By changing the temperature of the grain and the intensity of the electric field, it is possible to regulate the activity of enzymes, and, consequently, to control the biochemical and technological properties of the grain.

It is established that when grain is placed in an electric field, currents arise due to polarization, redistribution of the electric induction flow, due to the layered structure and heterogeneity of the chemical composition. For pretreatment of seeds, dry material should be taken, since using wet, currents will pass over the surface of the grain without affecting the inner layers, respectively, tensions will not be created inside the grain and the effect will be ineffective.

Thus, the grain has a powerful enzymatic system, the activity of which depends on the state of the environment. By changing the temperature of the grain and the intensity of the electric field, it is possible to regulate the activity of enzymes, and, consequently, to control the biochemical and technological properties of the grain.

BIBLIOGRAPHY

1. *Басов А. М.* Электротехнология / А.М.Басов и др. – М.: Агропромиздат, 1985. – 256 с.
2. *Прищеп Л. Г.* Эффективная электрификация защитного грунта. – М.: Колос, 1980. – 208 с.

INFLUENCE OF HUMIDITY ON THE BIOLOGICAL EFFICIENCY OF RAIN WORM (EISENIA FETIDA) IN THE COMPOSTING OF FOOD WASTE

T. Sokolova, G. Krusir, V. Sokolova O. Sagdeeva

Odesa National Academy of Food Technologies, ONAFT
Odesa, Ukraine
taiasokolowa041@gmail.com

Humidity is one of the factors taken into account in the composting process of food waste. The level of humidity affects a number of indicators such as: raw material yield and growth rate of vermiculture.

Keywords: biological activity, composting, vermicomposting, substrate humidity, worms, compost.

The method for environmentally safe and at the same time efficient disposal of various wastes is the method of verma-composting, ie the use of earthworms. Composting is an exothermic dynamic process of biological oxidation, in which the organic substrate (waste) in conditions of elevated temperature and humidity is subject mainly to aerobic biodegradation with the participation of various living organisms. [1].

One of the important factors that determines the growth and development of vermiculture is the humidity of the substrate, the directed regulation of which in artificial cultivation is the key to rapid growth of vermiculture [2]. It is advisable to take into account the moisture content of the raw material, which was determined by the gravimetric method in accordance with GOST 16483.7-7 [3].

The results of the research revealed a direct dependence of the growth rate of vermiculture on the humidity of the medium at a constant temperature of 25 °C. Studies have shown that the most rational humidity, at which the highest yield of vermiculture biomass was observed, is 80%, ie is close to the water content in the body of the worm.

Decreased humidity to 60 % slowed the development of worms in all variants, and humidity below 60% led to a sharp decrease in biomass. Increasing the humidity to 90 % delayed the access of oxygen to the substrate, which led to the development of anaerobic processes of decomposition of the substrate, the growth and development of worms slowed down. The study was performed for 25 days. The dynamics of growth in the number of individuals is shown in Fig. 1.

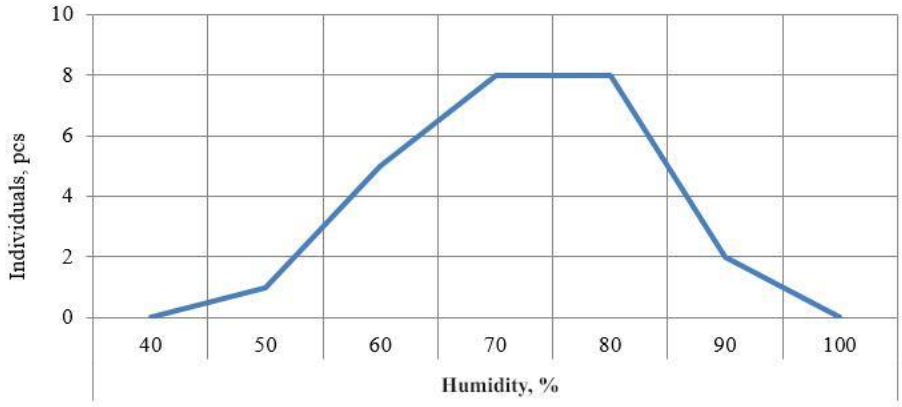


Fig. 1 – Influence of humidity on the number of individuals of Eisenia foetida

When growing earthworms in the laboratory, the maximum weight and production of compost are achieved at a substrate humidity ranging from 70 to 80 %, ie close to the water content in the body of the worm.

BIBLIOGRAPHY

1. Біотехнології в екології: навч. посібник/А.І. Горова, С.М. Лисицька, Б 63 А. В. Павличенко, Т.В. Скворцова. – Д.:Національний гірничий університет, 2012. – 184 с.
2. *Чміль А. І.* Дослідження і розробка замкнених еколого-біотехнічних систем у тваринництві [Електронний ресурс] / А. І. Чміль // Науковий вісник Національного університету біоресурсів

і природокористування України. Серія : Техніка та енергетика АПК. – 2016. – Вип. 242. – С. 63–69. – Режим доступу: http://nbuv.gov.ua/UJRN/nvnau_tech_2016_242_12

3. ДСТУ 4922:2008 Лісоматеріали та пилопродукція. Методи визначення вологості. [Чинний від 2009-07-01]. Вид. офіц. Київ, Національний університет біоресурсів і природокористування (НУБіП), 2009.

INFOSPHERE AND FUNDAMENTAL VALUES IN THE AGE OF HYBRID WARS

A. Sokolova, S. Sokolova

University of Civil Protection of the Ministry of Emergency Situations of the Republic of Belarus
Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
sokolovacn@mail.ru

International relations in the world of civilization testify to the fact that neoterrorism is gaining strength, as a result of which fundamental values are losing their paramount importance. The infosphere today is dominated by a value vacuum, which is not automatically filled and, in the context of paradigmatic and semantic plurality, leads to axiological deformation and value deactivation of the modern personality.

Keywords: hybrid wars; information and telecommunication technologies; neoterrorism; fundamental values.

Geopolitical paradoxes occurring in the infosphere testify to the special relevance of information and telecommunication technologies. Hybrid wars in the world of civilization synthesize various methods of traditional warfare: open armed invasion of the territory of another state, subversive activities of special services, financial, economic, socio-political and diplomatic pressure, ideological confrontation, multi-vector use of information and telecommunication technologies. In the era of hybrid wars, national economies and social institutions are destroyed, and fundamental values are transformed in the infosphere, changing the adaptive potential of any social system [1].

Note that neoterrorism as a purposeful expansion, proving the fact that in the epicenter of the conflict is the traditional marginal opposition ("protestors", "criminal elite"), destroying the national economy and fundamental values. As a rule, the sources of destructive influence are not only armed formations, analytical units, but also information and telecommunication technologies initiated by public organizations, engaged elites and social groups [2].

Neoterrorism, according to the authors of the article, implements modern achievements of scientific and technological progress and all the latest types of weapons, attracting paramilitaries, terrorists, specially trained marginals (traditional marginal opposition) to use destructive techniques in the implementation of "color revolutions" on the territory of various states. The ongoing international events and regional confrontation, initiating an ideological confrontation between different states, the ultimate goal of which is to reformat public consciousness with the help of a "war of controlled chaos", "multivariate war", "complex military actions" and full-scale information and humanistic deactivation of the individual, which affects both rational and emotional perception by the subject of military-political reality.

Neoterrorism, which is accompanied by crises (migration, political, energy, anthropological), information violence, provoking large-scale changes in the infosphere and destroying the national economies of various states, while transforming social institutions, which makes the dialogue between elites ineffective, which "... goes not so much at the table negotiations, how many in hot spots" [3, p. 8]. As a result, it can be argued that in the era of hybrid wars, it is necessary to implement promising directions that would make it possible to minimize the multi-format hybrid aggression in the infosphere, carried out by latent forces in the form of a "war of controlled chaos", "complex military actions", "multivariate war". In the era of hybrid wars, it is important to focus on a more tolerant attitude of political elites and politically correct international cooperation (military-strategic, financial-economic, political-legal cooperation), which minimizes the degree of mistrust between states, reduces the risks associated with military conflicts. It is necessary to initiate more effective international control and scientific support of scientific developments related to innovative tactical systems, strategic programs, modern types of weapons, which is often a catalyst for the ongoing destructive transformations in the infosphere. Thirdly, it is necessary to optimize tolerant social relations based on morality and trust in order to improve the ways of multi-format socio-cultural cooperation in the process of strengthening the international security system (information security), qualitatively changing the direction of activity of various structures of the infosphere. In the infosphere today, semantic eclecticism, manipulative information technologies, information violence are practiced, initiating

a conflict of interpretations and value deactivation of the modern personality, which especially actualizes the culture of security.

Thus firstly, neoterrorism, as the most destructive element of the strategy of hybrid wars and the basic resource of international terrorism, synthesizes all existing types of modern war, actively initiating a policy of "double standards systemic media aggression is carried out in the infosphere for the emergence (deployment) of the political phase of the conflict in the absence of a legal field in a multipolar world. The negative media agenda and the “rocking” of international relations by European bureaucrats harms the multidimensional and polycivilizational world, and also provokes an economic blockade of independent states, practicing neoterrorism, cyberattacks, extremism, and various crises (migration, energy, political, anthropological, coronaryetc) [4].

BIBLIOGRAPHY

1. *Соколова А. А., Соколова С. Н.* Культура безопасности в эпоху гибридных войн / Язык и межкультурная коммуникация: современные векторы развития: сборник научных статей по материалам II Международной научно-практической конференции, УО ”Полесский государственный университет“, г. Пинск, март 2021 г. / Министерство образования Республики Беларусь [и др.]; редкол.: В. И. Дунай [и др.]. – Пинск : ПолесГУ, 2021. – С. 19–26.

2. Угрозы гибридных войн в современном обществе / Гибридные войны XXI столетия: происхождение, сущность и место в цивилизационном процессе: Монография / А. С. Брычков, С. Н. Соколова [и др.]. – Смоленск: ВА ВПВО ВС РФ, 2019. – 306 с.

3. *Лукашенко А. Г.* Наша общая цель – построение сильного и безопасного государства / А. Г. Лукашенко // Белорусская думка. 2017. – № 5. – Май. – С. 4–12.

4. *Соколова А. А., Соколова С. Н.* The age of hybrid wars and neoterrorism in the information society // Вестник Полесского государственного университета. Серия общественных и гуманитарных наук. – 2021. – № 1. – С. 26–34.

ANALYSIS OF RADIATION EFFECT ON INDIVIDUAL BIOTA COMPONENTS BY THE LEVEL OF CONTAMINATION BY RADIONUCLIDES ^{90}Sr И ^{137}Cs OF LAKES IN THE BELARUSIAN SECTOR OF THE CHERNOBYL EXCLUSION ZONE

E. Sologub, E. Busko

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
jade_west@list.ru

The level of radiation exposure to the most representative components of biota in the Belarusian sector of the Chernobyl exclusion zone was estimated by calculating the radiation dose based on generalized data from monitoring the radiation situation in the studied region.

Keywords: biota, radioactive contamination, radiation monitoring.

In recent decades, technogenic impacts (chemical, physical, and radiation) on individual components of the environment, including humans, have increased during the construction and operation of nuclear power plants. After the first reactors appeared and up to the present day, about 300 radiation accidents occurred in the world. The most dangerous is the spread of radioactive substances in the environment. Water objects are currently affected by a number of anthropogenic factors, but the factor of radioactive contamination is the most significant [1].

Regular measurements of radiation contamination of a particular water body and assessment of radionuclide removal to other water ecosystems during normal operation of the enterprise not only maintain the monitoring system in constant emergency readiness, but also serve as a means of monitoring the stability of the radiation situation in the vicinity of the enterprise during normal operation.

In the Belarusian sector of the Chernobyl accident, the highest concentrations of radionuclides are observed in the reservoirs of the exclusion zone. First of all, these are closed and weak flowing reservoirs.

The ionizing radiation fields on the territory of the Chernobyl accident trace are characterized by a significant heterogeneity of distribution in space and time [2].

Radionuclides can migrate from bottom sediments along the food chain and enter the human body. In this regard, fish are of considerable interest in studying the accumulation of radionuclides by aquatic organisms, since they occupy the upper trophic levels in biohydrocenoses.

The general trend in changing the content of radionuclides in the water of almost all the water bodies of the exclusion zone studied by us since the early 1990s is a continuing decrease in the specific activity of ^{90}Sr and ^{137}Cs, the dynamics of which is primarily related to the intensity of water exchange processes.

Analysis of data on the radiation situation of the surveyed area and the level of accumulation of ^{137}Cs and ^{90}Sr by various fish species in the lakes Svyatsky, Revuchy, Perstok, Masanovsky Starik and Borshchevsky flooding showed that the radiation dose values continued to be determined mainly by ^{137}Cs and ^{90}Sr. Therefore, it was decided to take these radionuclides as the main radionuclides when calculating the radiation dose rate.

It is established that the intensity of migration of ^{90}Sr from the catchment area is determined by the amount of precipitation, the annual water content of rivers, and, as a consequence, the nature of flooding of their banks, which causes significant fluctuations in the annual removal of ^{90}Sr. No such dependence has been established for ^{137}Cs, since ^{137}Cs is fixed in the crystal lattice and is mainly in a non-exchangeable form.

The measurement of radiation pollution in water bodies and biota makes it possible to record the emissions of an enterprise (NPP) during its normal operation. Such emissions can be so insignificant that it is almost impossible to fix them at the level of the global radiation background. Since ^{137}Cs and ^{90}Sr are analogs of potassium and calcium, respectively, they are actively accumulated by biota, especially by some species of algae and fish. Fish is an important and valuable human food, and for certain categories of the population, for example, fishermen, its share in the diet can be determined. In this regard, the V Committee of the International Commission on Radiation Protection included predatory and peaceful fish among the reference organisms for radiological environmental protection, for calculating internal radiation doses, which also need to predict the content of radionuclides in individual organs and the body of fish [3, 4].

BIBLIOGRAPHY

1. *Носов, А. В*. Моделирование миграции радионуклидов в поверхностных водах / А. В. Носов, А. Л. Крылов, В. П. Киселев, С.В. Казаков, Р. В. Арутюняна // Институт проблем безопасного развития атомной энергетики РАН; Наука. – Москва, 2010. – 253 с

2. Научное решение чернобыльских проблем (основные итоги 2001 года) / Комитет по проблемам последствий катастрофы на Чернобыльской АЭС при Совете Министров Республики Беларусь, Респ. науч.-исслед. Унитарное предприятие “Институт радиоэкологии”. – Минск, 2002. – 44 с

3. ICRP – International Commission on Radiological Protection / Protection of the Environment under Different Exposure Situations // Publication 124. Annals of the ICRP. – 2014. – P. 59.

4. ICRP – International Commission on Radiological Protection / Environmental Protection: the Concept and Use of Reference Animals and Plants ICRP // Publication 108. Annals of the ICRP. – 2009. – P. 251.

BIOINDICATION ASSESSMENT OF SOILS ANTHROPOGENIC LOAD OF THE M. Ya. PAVLOV'S PARK

A. Strakh, V. Shashkova, A. Tuz, O. Pisarenko, Yu. Zhyltsova

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
alenastrakh2003@gmail.com

As a result of the investigations the M. Ya. Pavlov's park (Minsk), soil acidity has been determinated with the help of bioindicator plants. It was revealed that the number of plant species along the highway is significantly lower in comparison with the territories in the depths of the park. It was found that acidophilic species dominate in most of the surveyed sites. It is concluded that it is necessary to take measurements to improve the condition of soil in the park alongside the highway Dzerzhinsky Avenue.

Keywords: soil acidity, nitrogen and sulfur oxides, bioindication, indicator plants.

City parks can perform a number of ecological functions: participating in reducing air pollution, being a natural habitat for living organisms, and taking part in maintaining the biodiversity of the environment. Under conditions of constant increased anthropogenic pressure, it is important to monitor the state of the parks soil in order to identify violations in the state of the soil cover in a timely manner, and take measures for its remediation.

The soil acidity is one of the indicators to be monitored when determining anthropogenic load. Soil acidity is the ability of the soil to exhibit the properties of acids. A change in the acid-base properties of soil can be caused both by natural soil-forming processes (dissociation of carbonic and organic acids), intensive use of soils in agriculture, and by the influx of pollutants as a result of anthropogenic impact (acid atmospheric fallout, emissions of N and S oxides by black and non-ferrous metallurgy, chemical industry, thermal power plants, as well as vehi-

cles) [2, p. 7-16]. Currently, there are many methods for determining the quality of the environment: methods of quantitative chemical analysis, physicochemical analysis, space analysis, GIS technology. However, the bioindication is one of the simplest method that proposed by nature itself for determining the quality of the environment.

The purpose of our work was to assess the anthropogenic load on the soil of the M. Ya. Pavlov's park using the indicator of soil acidity and the method of bioindication. To achieve this goal, the following *tasks* were solved undertaken: 1) to lay test sites on the territory of the park; 2) identify the plants growing on the test sites; 3) determine the acidity of the soil on the test sites using indicator plants.

In the territory of the park, 6 test sites were laid: 4 sites were located in the depths of the park and, 2 – near the highways bordering the territory of the park along Dzerzhinsky Avenue and Kosmonavtov Street. On the test plots, 23 plant species were found: *Trifolium pratense* L., *Taraxacum officinale* F.H.Wigg, *Lotus uliginosus* Schkuhr., *Medicago sativa* L., *Achillea millefolium* L., *Plantago lanceolata* L., *Veronica chamaedrys* L., *Veronica officinalis* L., *Plantago major* L., *Tussilágo fárfara* L., *Medicago lupulina* L., *Convolvulus arvensis* L., *Urtica dioica* L., *Potentilla anserina* L., *Glechoma hederacea* L., *Rumex confertus* L., *Fraxinus excelsior* L., *Dactylis glomerata* L, *Stellaria media* L Vill., *Pimpinella major* L. Huds., *Agrostis gigantea* Roth, *Achillea millefolium* L., *Alliaria petiolata* (M. Bieb.) Cavara & Grande. On sites located far from highways, there were on average ($p = 0.95$) 7 ± 2 plant species (from 5 to 10 species). The number of species (3 species each) on the sites near the road was significantly less ($p = 0.95$).

The acidophiles dominated in most of the surveyed sites. The acidity of the soil did not differ significantly on sites in the depths of the park and was 6.00 ± 0.05. The acidity of the soil at the site near Dzerzhinsky Avenue significantly differed from the same indicator in the depths of the park and was 4.68, which indicates the existence of anthropogenic pressure and the need to take measures to improve the condition of the soil in the park along the highway.

BIBLIOGRAPHY

1. *Соколова, Т. А.* Почвенная кислотность. Кислотно-основная буферность почв. Соединения алюминия в твердой фазе почвы и в почвенном растворе / Т.А. Соколова, И.И. Толпешта, С.Я. Трофимов. Тула : Гриф и К, 2012. – 124 с.

SEASONAL CHANGES IN THE COMPOSITION OF THE AVIFAUNA OF PARKS IN MINSK

E. Svistun, A. Khandohiy, N. Anishchanka

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
svistyn.alena@yandex.by

The article presents data on the seasonal dynamics of the ornithological community of park complexes in Minsk. Wintering and migratory bird species have been identified. The feed ration of birds in different periods of the year is determined. According to the results of the study, the structure of the avifauna population in urban parks is formed to a greater extent due to migratory bird species.

Keywords: birds, avifauna, seasonal dynamics.

Among the main environmental problems of our time, the reduction of biological diversity occupies a special place. The most numerous representatives of wildlife in the city are birds. Birds react quickly to changes in the environment, which increases the efficiency of assessing possible changes in ecosystems [1]. The study of urban birds has become one of the priorities of modern ornithological research, as well as an effective indicator for the overall assessment of environmental situations within urbanized territories [2].

Ornithological studies were carried out on the territory of the following parks in Minsk: Chelyuskintsev Park and the Central Botanical Garden (I), the park named after the 50th Anniversary of the Great October (II), Drozdy Park (III), Loshitsky Manor and Park Complex (IV), Medvezhino Forest Park (V), the monument of nature «Dubra-va» (VI).

The species composition of the avifauna of the parks varies according to the seasons of the year. In winter, there is not a large biological diversity of the ornithological population. The largest number of species in winter is registered in the territories of Chelyuskintsev Park and Botanical Garden, Loshitsky Manor and Park Complex - 14 species each (Fig.1). This suggests that in these parks there are places for feeding birds (feeders, a large number of people). In the spring (April) and autumn (October) periods, the species richness is approximately at the same level. In spring, biodiversity increases in comparison with winter. This is due to the replenishment of the avifauna of the park due to migratory birds, as well as an increase in the food supply and the melting of ice on the

pond, which is a place for drinking. In the summer, species diversity reaches its peak. In total, 66 species of birds live on the territory of the park complexes of the city of Minsk in the summer. In the autumn period, there is a decrease in the number of species again, as most of them fly south. Therefore, biodiversity is greater than in winter, but less than in summer.

Entomophage species play the greatest role in the bird population of the park territories of Minsk. Their share in the population in the summer season is 46 %. A diverse group of phytophages (Columba livia, Carduelis cannabina, Carduelis flammea, etc.). Depending on the location of the nests, birds are classified as crown-nesting, hollow-nesting, ground-nesting, shrubby and burrowing. They arrange nests on trees of 19 species (28.8 %), in hollows – 16 species (24.2 %), in shrubs – 12 species (18.2 %), on cliffs, human structures, burrows – 8 species (12.1 %). Ground-nesting – 11 species, 16.7 % of all nesting birds.

From all of the above, it can be concluded that the structure of the avifauna population in urban parks is formed to a greater extent due to migratory bird species. This is evidenced by a significant decrease in species diversity in winter compared to summer (more than 3 times). In the spring, summer and autumn periods, the structure of the bird population is more diverse, there are species with different ecological groups (by nutrition, habitat). In winter, the structure is formed mainly due to synanthropic species that feed on a variety of foods (euryphage species).

BIBLIOGRAPHY

1. *Быков, Е. В*. Антропогенное воздействие на лесные экосистемы и гнездящихся птиц / Е. В. Быков // Известия Самарского научного центра Российской академии наук, 2015. С.614–621.

2. *Чайковский, А. И*. Многолетняя динамика плотности гнездования врановых птиц в Минске / А. И. Чайковский // Сахаровские чтения 2016 года : экологические проблемы XXI века. Минск : МГЭУ им. А. Д. Сахарова, 2016. С. 191.

ANALYSIS OF THE POSSIBILITIES OF PROCESSING OIL SLUDGE IN THE REPUBLIC OF BELARUS

O. Targovich, V. Misiuchenka

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
xollooma@gmail.com

The analysis of statistical data on the use, neutralization and disposal of oil sludge at enterprises of the Republic of Belarus is carried out. The results showed that the formation of oil sludge for the period from 2007 to 2020 increased significantly, the use of waste oil sludge also increased by 91.7 %, neutralization was 35.60 %, and disposal was 11.49 %. A patent search was carried out on methods for processing oil sludge, as well as an analysis of technologies for the neutralization of these wastes on the basis of the Register of Waste Disposal Objects.

Key words: sludge of oil products, fuel, use, neutralization, burial, oil waste.

Oil and petroleum products are a sought-after natural resource. However, today, work on the use and disposal of oil sludge is called an equally important problem.

Based on statistical data for the period from 2007 to 2020, a comparative analysis of waste received for use, neutralization and disposal was carried out. In 2007, 11.9 thousand tons were formed. while in 2020 109.2 thousand tons were formed. The number of waste has increased for almost all types of oil sludge, but at the same time, such types of sludge as: sand trap sludge, spent emulsion regeneration sludge, oil trap sludge and pipeline cleaning sludge have completely disappeared. The percentage of use in relation to education increased 9 times by 2020. The highest percentage of use by 2020 is oil-contaminated soil. By 2020, the volume of use of this waste was already 44.6 % in relation to the 2007 data.

On the basis of the Register of Waste Utilization Facilities, it is determined: on the territory of the Republic of Belarus, more than 15 organizations carry out work on the neutralization of oil sludge. The main technologies are the production of solid fuels using oil sludge, the production of oil products, the restoration of contaminated soils, and the production of modifiers. A number of the presented enterprises are mainly located within the Minsk and Brest regions, but there are also enterprises on the territory of the Gomel region.

The analysis of the results of the patent search showed the following methods of processing oil sludge into marketable products:

1. Method for cleaning bottom sediments of oil sludge accumulators. [1] Invention of the Russian Federation. A known line for processing oil sludge and bottom sediments of oil traps, flotators and sludge ponds in which the oil sludge and bottom sediment are separated at a temperature of 45 °C, the bottom sediment is subjected to heat treatment with steam at a temperature of 80 °C in the presence of a demulsifier and the formed three layers are separated: refined oil, purified water and mechanical impurities.

2. Method for processing oil sludge. [2] Invention of the Russian Federation. It is based on the processing and filtration of oil sludge, then centrifugation, separation to obtain purified oil and water.

3. Method for processing oil waste. [3] Also an invention of the Russian Federation. Includes heating of oil waste, mixing with a liquid heat carrier – technical toluene, separation of a solid sediment in a centrifuge and subsequent separation of products into water, light oil products and heavy residue. In this case, before separation, the liquid part of the mixing products is preheated to 180–200 °C.

BIBLIOGRAPHY

1. RF Patent No. 2006105815/15, 2006.02.26. Method for cleaning bottom sediments of oil sludge tanks // RU 2 309 128 C1 2006.02.26 / Khalilov V. Sh., Gilmanov Kh. G.

2. RF Patent No. 94012433/26, 1994.04.08 Method of processing oil sludge // RU 2 078 740 C1 1997.05.10 / Zorkin V. A., Bushueva N. N., Pobedinsky N. A., Beznosov V. N. , Chevardova N.P., Aisin E.Kh., Moiseev P. A., Chalchenko V. P.

3. RF Patent No. 2000111586/04, 2000.05.10 Method for processing oil waste // RU 2 176 660 C1 2000.05.10 / Khairudinov I. R.

STREAMING SERVICE AS MUSIC THERAPY

A. Tsikhonchyk, U. Ivaniukovich

Belarusian State University, ISEI BSU

Minsk, Republic of Belarus

Creation of a streaming web service for organizing music therapy sessions based on cloud storage technologies are proposed.

Keywords: Mental health, music therapy, music library, streaming data technologies, server, client application, mobile devices.

Humanity has faced coronavirus infection and long isolation in recent years. This greatly affected the mental health of people who were forced to stay at home for months. As a result, the problem of mental health of the population in the context of the pandemic has increased. Self-isolation and quarantine affect the economic situation and affect the usual activities of the population, so this leads to serious psychological problems. The media report that in many countries (China, Denmark, USA, etc.) anxiety background and self-isolation regime have caused a surge in mental disorders among the population.

Music therapy is one of the ways to increase the psychological stability of the population. Music therapy is a psychotherapeutic method based on the healing effect of music on the psychological state of a person. The human nervous system and muscles are able to sense the rhythm. Musical rhythmic pattern acts as an irritant, stimulating physiological processes in the body. Music can harmonize the rhythms of individual human organs, producing a kind of tuning of their frequencies.

Music therapy allows for self-healing, unlike most other methods of healing. There are even special music collections: they combine melodies that contribute to the treatment of a certain disease.

Of course, music therapy can’t replace classical medical procedures, but it can create a favorable background for treatment, reduce the required doses of drugs taken, and enhance the effect of pain relief. Considering that music therapy allows self-healing, it’s possible to create a service for everyone, because it won’t cause any negative consequences.

For this, it’s proposed to create a web service based on streaming data transmission technology, which should help in the fight against various disorders with the help of specially selected melodies. The service will also provide collections of music for sports, massage, meditation. In addition, it will provide licensed music to various establishments, and will also allow musicians and DJs to share their music and make money from it.

Streaming services operate on the principle of transferring content from provider to user. All content will be stored on a cloud server, the user doesn’t need to download anything to view or listen to. The client application will provide the possibility of music therapy, choosing from a library of compositions various categories of music that will contribute to relaxation and healing. Content is broadcasted in real time. The upload speed directly depends on the user's Internet speed. Access to the service will be provided through a mobile application.

The Swift language and frameworks such as Docker (for creating a backend, databases), Kitura (a web framework for creating Swift applications) will be used to create an application on the iOS platform. The Java language and a number of frameworks will be used to build on the Android platform. The Spark framework is the best choice for developing a web application in Java. It allows you to quickly and effortlessly build backend sites. Spark supports almost all Java 8 features and has an expressive API. JBehave is one of the best Java testing frameworks. Adobe Photoshop and Figma will be used to implement the design of the application.

A group of specialists, including, in addition to programmers, a psychologist and a music worker, will also participate in the development of the service.

USAGE OF MIXED WASTE OIL IN THE MIXTURE WITH ETHANOL FOR MICROBIAL EXOPOLYSACCHARIDE ETHAPOLAN BIOSYNTHESIS

A. Voronenko, T. Pirog

National University of Food Technologies,
Kyiv, Ukraine
voronenkoandr@gmail.com

One of the most attractive methods of waste oil disposal is using it in biotechnology as a substrate for the microbial synthesis of practically valuable products. In our previous studies, we demonstrated the possibility of microbial exopolysaccharide ethapolan synthesis by *Acinetobacter* sp. IMV B-7005 on a mixture of refined sunflower oil and ethanol. Therefore, the purpose of this work is to investigate the possibility of replacing the refined oil on a waste one during ethapolan synthesis on the mixture of ethanol and sunflower oil.

Keywords: *Acinetobacter* sp. IMV B-7005, microbial exopolysaccharide ethapolan, mixed substrates, the mixture of waste sunflower oil and ethanol.

In case of replacing classical expensive carbohydrate substrates (glucose, sucrose, sugar syrups, starch), which may constitute a significant part of the final product cost, with cheaper analogues the particular attention is paid to the use of different agro-industrial waste (molasses, whey, etc.). Among them the most attractive is using harmful and toxic compounds, such as waste sunflower oil, which cannot be further used in the food (production of dietary supplements) or agricultural (animal feed) industries.

Despite the fact that waste oils are collected and processed into biodiesel the most of it, especially oils used in households, are uncontrollably drained to the sewerage or disposed in landfill, resulting in a number of economic and environmental problems [1]. Another promising method of waste oil processing is its biotreatment or use as a carbon and energy source in biotechnology processes.

In our previous work [2] the effective technology of the microbial exopolysaccharide (EPS) ethapolan synthesis (produced by *Acinetobacter* sp. IMV B-7005) on the mixture of ethanol and sunflower oil has been established. Note than in this study expensive refined oil was used.

Taking into account the above information, the purpose of this work was to investigate the possibility of replacing the refined oil on waste one in the mixture with ethanol.

The IMV B-7005 strain was grown in a liquid mineral medium with the addition of yeast autolysate (0.5 %, v/v) and the multivitamin complex "Complevit" (0.00095 %, w/w by pantothenate). Ethanol (4.0 %, v/v) in the mixture with refined sunflower oil (1.2 %, v/v) was used as a carbon source. The initial concentration of ethanol and oil in the medium was 0.8–1.0 % and 0.24–0.3 %, respectively. During cultivation after 24 h these substrates were fractionally applied in portions of 0.8–1.0 % (ethanol) and 0.24–0.3 % (oil). Inoculum was grown on ethanol (0.5 %).

While frying refined sunflower oil undergoes considerable physical-chemical transformations, thus during its replacement for mixed waste oil, additional increase of Mg^{2+} cations concentration in the medium was carried out. It is known that these cations are able to influence enzymatic activity of systems responsible for catabolism of fatty acids.

Experiments have shown that an increase of the Mg^{2+} concentration up to 5 mM in a medium with waste oil and ethanol regardless of the mode of fractional addition of substrates (4 or 5 portions), an increase in the amount of the synthesized EPS to 15.5–16 g/l was observed, which was higher than the synthesis indicators on the basic medium with ethanol and refined oil (10–13.5 g/l).

Noteworthy, that addition of Mg^{2+} into the medium with mixture of refined oil and ethanol resulted in a slight decrease in the synthesis of EPS. It is possible, that was related to the different influence of magnesium cations on enzymatic systems, which are responsible for catabolism of fatty acids and other accompanying com-

ponents, which are part of sunflower oil. Thus, for example, in *Lactococcus lactis* ssp. *lactis* concentration of Mg^{2+} for maximum enzymatic activity is different for the different enzymes of the beta-oxidizing system [3].

As a result of the conducted studies, it was shown the possibility of replacement the refined oil in the mixture with ethanol on a waste one and determined conditions for cultivating the producer, providing the maximum values of the synthesis of the ethapolan on this mixed substrate.

BIBLIOGRAPHY

1. *Mannu, A.* Innovative applications of waste cooking oil as raw material / A. Mannu, M. Ferro, M. E. D. Pietro, A. Mele // Science Progress. 2019. V. 102, № 2. P. 153-160.

2. *Ярош, М. Б. Вороненко А.А., Пирог Т.П.* Интенсификация микробного экзополисахарида этаполана на смеси этанола и подсолнечного масла / М. Б. Ярош, А. А. Вороненко, Т. П. Пирог // Республиканская научная конференция «Современные проблемы генетики, геномики и биотехнологии»: Сборник тезисов, 2020. С. 286–288.

3. *Li, L.* Effects of metal ions on growth, β-oxidation system, and thioesterase activity of Lactococcus lactis / L. Li, Y. Ma // J. Dairy Sci. 2014. V. 97, № 10. P. 5975–5982.

THE PROSPECT OF GARBAGE RECYCLING IN NANTONG, JIANGSU PROVINCE, CHINA

Li Xiaolong, V. Lemiasheuski

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
lem@iseu.by

The composition and harm of rubbish from Nantong, Jiangsu Province, China, summarized the nantong traditional processing method of garbage and industrial power generation method and its related technology, combined with actual examples in nantong implements classified collection, garbage disposal and recycling, so as to realize the reduction and recycling of waste treatment.

Keywords: Nantong municipal garbage, recycling, utilization, resources, pollution.

The purpose of the research. Nantong's garbage is of great value and provides many jobs. Due to the lack of industrial policies for garbage recycling in Nantong city, garbage disposal has not formed an industrial scale. Therefore, according to the economic strength of Nantong city, it is necessary to carry out classified collection, harmless treatment and recycling of garbage, turn waste into treasure, and realize the reduction and recycling of garbage treatment. From the original mechanism and management system to seek a breakthrough, let the garbage treatment into the market operation mode. Attract and support private enterprises and capital to participate in urban waste treatment from the perspective of industrial policy, taxation and finance.

Field investigation was used research results: according to the field investigation in nantong, waste composition and harm of mainly includes the following 3 kinds:

1.1 the living garbage, including waste paper, plastic, glass, metal and organic waste, including packaging and occupied the main part of food waste in the kitchen.

1.2 construction waste and clean up garbage, including soil, stones and concrete blocks, the blocks, waste wood, waste such as pipelines, sweepings public bins in the waste, public places and pavement damage after waste, etc.

1.3 electronic waste and medical waste, including waste electrical appliances, electrical waste, batteries, fluorescent tubes, such as thermometer, hospital contain viruses, bacteria or chemicals of medical waste, inflammable and explosive items and special industry waste containing radioactive substances. This kind of garbage generally cannot be mixed with ordinary garbage.

The garbage investigated above mainly refers to the solid wastes generated by urban residents, excluding the solid wastes generated in industrial and agricultural production activities.

In fact, people are throwing away a lot of recyclables every day. According to the statistics of Nantong Environmental Protection Foundation, there are 362,000 tons of waste plastic in nantong city's annual garbage, and 1 ton of waste plastic can produce 0.37 to 0.73 tons of oil, and every 1 ton of plastic recycled beverage bottles can gain 8 000 yuan of profit. There are 388,000 tons of waste paper, every 1 ton of waste paper can be recycled, 0.85 tons of good paper, save 3 m^3 of wood, It can save 300 kg of alkali and reduce 74 % of pollution compared with the production of good paper. There are 150 thousand tons of waste glass. It can save 10–30 % of energy by reproducing glass from broken glass, reduce 20 % of air pollution and 80 % of abandoned slag from mining.

There are 237 million waste batteries, using waste batteries can recover cadmium, nickel, manganese, zinc and other precious heavy metals, while reducing the pollution of heavy metals to the environment and harm to human health. There are 35 thousand tons of scrap metal. For every 1 ton of scrap steel recovered, 0.9 tons of steel can be refined, which can reduce 75 % air pollution, 9.7 % water pollution and solid waste, and save 47% smelting cost compared with making steel with ore. There are 1.23 million tons of waste food and vegetation. Every 1 ton of waste can produce 0.6 tons of organic fertilizer and waste fuel for power generation and heating.

The traditional garbage treatment methods in Nantong city mainly include landfill, composting and incineration. The three methods are relatively simple in technology, low resource recovery rate and secondary contamination:

At present, there are three main industrial methods of garbage recycling, namely landfill composition! Biogas field electricity, waste incineration recycling heat power generation and through biological engineering technology.

Biogas field power generation, is the current technology mature, less investment, low cost, easy to use and management, favored by developed countries a way of urban waste treatment. By the end of the 20th century, there were more than 140 around the world! The waste gas field power station is in operation. The UK has a capacity to generate 18 MW of electricity from waste biogas fields. The landfill biogas plant in Illinois, USA, covers 61 hm^2, fills 1.8 million tons of waste, and has a generating capacity of 1 600 kW, equivalent to using 28 thousand barrels of oil per year.

The establishment of waste incineration plant, in the incineration process to recover its heat energy, and used for power generation, can realize waste incineration energy. Germany and the United States were the first countries to generate electricity by recycling heat from burning waste. In the 1960s, incinerators were established in the former West Germany, benefiting 2.45 million people. By the 1980s, electricity had been provided to 21.2 million people, accounting for 34.4% of the total beneficiaries. The United States had invested in incineration plants since the 1980s, with an annual capacity of 30 million tons of waste. In the 1990s incineration accounted for 18% of America's total waste disposal. The city of Detroit in the United States has the world's largest garbage processing power plant of 4 000 tons per day. Japan's largest waste thermal power plant has a maximum capacity of 22 MW.

To sum up, the landfill and incineration compost treatment of nantong municipal solid waste have their own advantages, but also have unavoidable disadvantages. The solution is to use mineral processing technology and equipment to recycle most of the useful substances (50–80 %) after the household waste is classified and collected, and then send the remaining parts that cannot be recycled (50–20 %) to landfill, incineration or composting. In this way, the municipal solid waste can be harmless, reduced and re – resource, and save a lot of money.

HYDROGEN ENERGY

M. Yakauleva, V. Timchenko

Belarusian State University, ISEI BSU

Minsk, Republic of Belarus

mariamariam2000@mail.ru, violettapolyanskaya@gmail.com

The article analyses the development outlook for the development of hydrogen energy as an alternative energy source.

Keywords: hydrogen, fuel cell, processing, consumption, energy.

Nowadays electricity generation, industry and transport are the sources of emissions that contribute to climate warming. Based on this, there is a need to search for alternative energy sources. Hydrogen is the most energy-intensive and light substance of all types of fuel. Today, hydrogen has found its application in the food industry, the production of nitrogen fertilizers, improving the quality of steel, improving the quality of gasoline.

The first hydrogen fuel cell was designed by the scientist William Grove in the 30s of the 19th century. Thanks to Grove, in collaboration with Christian Schoenbein, was demonstrated the possibility of energy production in a hydrogen-oxygen fuel cell using an acid electrolyte. [2]

The prospect of switching to hydrogen energy received the green light as soon as were solved the main problems related to storage for further use as automobile fuel and the possibility of obtaining hydrogen at the place of use.

According to the Hydrogen Council (an association of large international companies, which includes Total, Toyota, BP, Shell and other, mainly European and Japanese, corporations), the share of hydrogen in energy consumption will be 17–19 % in 2050. [1]

It is worth considering that hydrogen is extracted from other compounds using various chemical methods, because it is practically not found on earth in its pure form. Hydrogen is divided into color gradations according to the methods of production. The production of green hydrogen by water electrolysis is based on the use of revolving energy sources. Blue hydrogen is produced from natural gas. Atomic energy is used to produce red (pink) hydrogen. Gray hydrogen is produced by the conversion of methane. Brown hydrogen is obtained as a result of coal gasification. 18 % of hydrogen production is accounted for coal processing, 4 % is provided by green hydrogen and 78 % by processing natural gas and oil. [2]

Production methods based on the use of fossil fuels, generate 830 million tons of carbon dioxide emissions each year, which is equal to the emissions of the UK and Indonesia combined. Nevertheless, hydrogen is a cleaner alternative to traditional fuel.

According to the report of the IEA (International Energy Agency), by 2050 the global demand for hydrogen should reach 528 million tons – against 87 million in current 2021 – and its share in world consumption will be 18 %, of which 10 % will be green hydrogen, obtained by water electrolysis. The IEA plans to reduce the cost of producing this type of fuel to 2 dollars per kilogram by 2050, which is significantly lower than the current 10 dollars. This will happen thanks to the development of renewable ("green") energy technologies and cheaper production of wind and solar energy. [3]

Currently, hydrogen is produced by 3 companies: Air Products, Linde, Cummins. These companies are global giants with great experience in the field of industrial gas. Their main focus is on the production of gray hydrogen, but they do not deny the transition to cleaner production methods. The shares of these companies are actively growing jointly with the market.

In conclusion, it should be noted that for investing in hydrogen, it is important to have a good base for choice based on activities, assessments, partners and management.

BIBLIOGRAPHY

1. *Новак, А. А.* Водород: энергия «чистого» будущего / А. А. Новак // Энергетическая политика. 2021. №4 (158). С. 6–11.

2. *Рогова С. М.* Переход на водород / С.М. Рогова // Коммерсантъ Наука. 2021. №23. С. 21.

3. *Choi Ch.* Floating Solar Rig Produces Hydrogen Fuel / Charles Q. Choi // Scientific American. 2017. № 3. P. 24–26.

INVASIVE PROPERTIES OF *ROBINIA PSEUDOACACIA* IN BELARUSIAN PALESSE

M. Yakhnovets[1], **E. Yurchenko**[2]

[1]*Belarusian State University*
Minsk, Republic of Belarus
[2]*Polessky State University*
Pinsk, Republic of Belarus
[1]*maksim.yakhnovets@gmail.com;* [2]*eugene.o.yurchenko@gmail.com*

The status of *Robinia pseudoacacia* as an invasive species in the conditions of Belarusian Palesse is considered, taking into account the known biological characteristics of the plant and the author's own field observations. The positive and negative sides of this species spreading are discussed.

Keywords: black locust, Black Book of the flora of Belarus, Brest region, plant spreading.

The invasion of certain plant species is one of the most common environmental problems of our time, which is also typical for the territory of Belarus. In the Republic of Belarus, there is a Resolution [1], according to which the woody legume plant black locust (*Robinia pseudoacacia* L.) is included in the list of species prohibited for introduction and (or) acclimatization. In addition, the species is included in the "Black Book of the flora of Belarus" [2]. On the basis of the need to take measures for population management, the species has the status A-3, where A is a category of species for which measures to restrict the spread, etc. are necessary, and 3 is the degree of severity of the hazard [2].

Black locust is currently found in 105 administrative districts of the country, where 1681 of its location have been identified on an area of 495 hectares [2, 3, 4]. In particular, *R. pseudoacacia* was widely planted as an introduced plant on the territory of the Belarusian Palesse – in the landscaping of settlements and along the roads in the Brest and Gomel regions, in some places as forest cultures. It became widespread in pine and mixed forests due to its unpretentiousness to soil and ground conditions [3, 4].

Black locust, in comparison with other invasive plant species, has comparatively high economic value. Thus, as a result of the assessment of 54 invasive species of vascular plants of the Belarusian Palesse [5], the total score for *R. pseudoacacia* was +3. At the same time, the species poses risks due to increased competitiveness (because of a powerful root system with a nitrogen fixation apparatus), the production of a large number of seeds, the viability of which lasts up to 50 years, rapid growth and high ecological plasticity. The phenolic compounds that it synthesizes have high allelopathic activity, and through the soil they are able to inhibit some plant species. The deterioration of the soil under black locust is noted due to toxic substances formed in its roots [2, 4].

In June–August 2021 we carried out the field studies of the populations of black locust in Pinsk district of the Brest region. We have described in details 10 places of growth of black locust as solitary trees and 10 as plants in tree groups. Young black locust shoots, looking as separate plants, but having the features of root offshoots, within the crown projection area of older *Robinia*, were observed only under 3 of 10 solitary trees and under 4 of 10 trees growing in groups. Similar studies were carried out for the ash-leaved maple (*Acer negundo* L.) with the following results: juvenile plants were observed under 7 of 10 solitary older trees and under 9 out of 10 trees growing in groups. A smaller number of young plants of *Robinia* indicates a less intense spreading process. Thus, there are prerequisites for a possible decrease in the invasive status of the species in the flora of Belarus. Further monitoring of the impact of black locust on natural plant communities and surrounding biodiversity is needed.

BIBLIOGRAPHY

1. О внесении изменений в постановление Министерства природных ресурсов и охраны окружающей среды Республики Беларусь от 28 ноября 2008 г. № 106 [Электронный ресурс]: Постановление Минприроды РБ №35 от 28.10.2016 // Законодательство Республики Беларусь. Режим доступа: https://kodeksy-by.com/norm_akt/source. Дата доступа: 01.10.2021.

2. *Дубовик, Д. В.* Черная книга флоры Беларуси: чужеродные вредоносные растения / Д. В. Дубовик [и др.]. Минск: Беларуская навука, 2020. 407 с.

3. *Бордок, И. В.* Мониторинг растительного мира в Республике Беларусь: результаты и перспективы / И. В. Бордок [и др.] // Мониторинг инвазионных видов растений. Минск: Беларуская навука, 2019. С. 177–216.

4. *Соколов, А. С.* Распространение инвазивных видов как глобальная и региональная экологическая проблема / А. С. Соколов, Н. С. Шпилевская // Геаграфія. 2020. № 6. С. 26–38.

5. *Мялик, А. Н.* Хозяйственное значение инвазионных видов растений Белорусского Полесья / А. Н. Мялик, О. А. Галуц // Прыроднае асяроддзе Палесся: асаблівасці і перспектывы развіцця. 2016. Вып. 9. С. 24–28.

ANALYSIS OF THE PHYSIOLOGICAL AND BIOCHEMICAL PROPERTIES OF SANITARY-INDICATIVE MICROORGANISMS ISOLATED FROM SOILS EXPOSED TO LONG-TERM EXPOSURE TO IONIZING RADIATION

H. Yakubovich, S. Maltsava, E. Gritskevitch

Belarusian State University, ISEU BSU
Minsk, Republik of Belarus
anya.yakubovich.00@inbox.ru

The soil is the main reservoir, characterized by the natural habitat of various microorganisms. It is favorable for the development of pathogens of the most dangerous infectious human diseases of a bacterial and viral nature. It is through the soil that environmental objects are polluted, and raw materials, food products and feed are seeding with pathogenic microorganisms. Sanitary protection of soil, as one of the most important objects of the environment, is currently of great importance. This is primarily due to the fact that, despite the preventive measures carried out in our country and abroad, the incidence of intestinal infections of bacterial and viral nature remains at a high level, which is largely due to the circulation of pathogenic enterobacteria in the environment.

Keywords: colymorphic bacteria, sanitary indicative microorganisms, ionizing radiation.

It is generally known that colymorphic bacteria play an important role in assessing the health of water and soil. The study examined the effect of long-term exposure to ionizing radiation on key biochemical properties of colymorphic bacteria.

During the study, the following research methods were used: isolation and cultivation of test cultures was carried out using a differential diagnostic nutrient medium (Endo medium, McConkey medium); microscopic

methods for the analysis of morphological signs of test cultures, biochemical research methods: amylolytic activity (starch hydrolysis, Karovey's method), proteolytic activity (casein hydrolysis), as well as catalase activity. The material for the study was the strains of colymorphic bacteria isolated from soil samples under prolonged exposure to ionizing radiation (Dronki village, Khoiniki district, the territory of the Polesie radiation-ecological reserve), as well as the soils of the forest park zone of the agro-town Cheretyanka, Gomel district, Gomel region with natural conditions exposure to ionizing radiation. The change in biochemical properties was judged by: the zone of starch hydrolysis around the colony of the test culture, as well as the amount of the amylase enzyme contained in 1 ml of the test biological solution, which breaks down amylodextrin (in μg) for 1 min at 37 °C (amylolytic activity) [1]; the area of clearing around the colony of the test culture in mm (proteolytic activity); the intensity of the release of gas bubbles (catalase activity).

Based on the studies carried out to study the physiological and biochemical properties of colymorphic bacteria, it was shown that microorganisms isolated from the soils of the forest park zone (hereinafter referred to as the Control) have a higher capacity for enzymatic hydrolysis of starch (starch hydrolysis zone 12 ± 0.4 mm) compared to bacteria that have been under conditions of prolonged exposure to ionizing radiation (starch hydrolysis zone 7 ± 0.3 mm). Similar results were confirmed by Karovey's method. There was also a decrease in proteolytic activity (by 13 %) and catalase activity in B. cereus bacteria that were exposed to prolonged exposure to ionizing radiation compared to the Control.

Based on the data obtained, it can be assumed that the action of this stress factor (ionizing radiation) can lead to a decrease in the biochemical activity of colymorphic bacteria.

BIBLIOGRAPHY

1. *Wang X.* In vitro utilization of amylopectin and high-amylose maize (amylomaize) starch granules by human colonic bacteria / X.Wang [et al.] // Appl. Env. Microbiol. 1999. V. 65, № 11. P. 4848–4854.

SYNTHESIS OF PLANT GROWTH STIMULANTS BY *NOCARDIA VACCINII* IMV B-7405 STRAIN IN THE PRESENCE OF ERYTHRITOL

V. Zhdaniuk, D. Piatetska, T. Pirog

National University of Food Technologies
Kyiv, Ukraine
zhdanuk2907@gmail.com

It was found that the introduction of erythritol into the culture medium of the strain *Nocardia vaccinii* IMV B-7405 was accompanied by an increase in the amount of synthesized gibberellins by 2-2,5 times.

Keywords: phytohormones, erythritol, surfactants, intensification.

It is known that pesticides negatively affect the biosphere in general. Now methods to reduce the need for pesticides are studied at the national and international levels (such as organic farming and biological methods of plant protection) [1]. An alternative can be the use of non-toxic, biodegradable complex microbial preparations that do not cause resistant forms of microorganisms based on surfactants, which have antimicrobial properties. In the previous studies [2] the ability of surfactant, producer *Nocardia vaccinii* IMV B-7405 to synthesize substances which have phytohormonal nature (auxinis, cytokinins, gibberellins) was established. But concentrations of synthesized substances were relatively low (for example gibberellins GA_3 and GA_4 40,5 and 6,3 μg/l, respectively), which allow to use them in crop production. It is known that the biosynthesis of gibberellins in most of bacteria is occurs in the methylerythritol-4-phosphate pathway; therefore, erythritol can be a synthesis precursor of these phytohormones [3].

The aim of this work was to establish the optimal concentrations of erythritol in the cultivation medium of surfactant producer *N. vaccinii* IMV B-7405 to increase the synthesis of gibberellins.

The strain *N. vaccinii* IMV B-7405 was grown in a liquid mineral medium with 2 % (v/v) of the waste sunflower oil. Erythritol was added at concentrations of 100-500 mg/l at the beginning of cultivation or at the stationary growth phase. Extraction of gibberellins was carried out with ethyl acetate at pH 2,5. Preliminary purification and concentration of phytohormonal extracts were performed by thin layer chromatography.

It was found that the introduction of erythritol into the cultivation medium of *Nocardia vaccinii* IMV B-7405 was accompanied by an increase in the amount of synthesized phytohormones. When precursor was added at concentrationin 400 mg/l both at the lag phase and in the stationary growth phase surfactant producer's, the amount of biologically active gibberellins was rising up by 2–2,5 times (up to 53.2 and 48.04 μg/l, respectively) compared with that on a medium without erythritol (21.31 μg/l).

A further increase in the concentration of the precursor was accompanied by inhibition of the gibberellin synthesis. The results show the possibility of intensifying the synthesis of gibberellins in the presence of exogenous erythritol in the cultivation medium with waste oil, which allow to increase the efficiency of using a complex microbial preparation in crop production.

BIBLIOGRAPHY

1. *Рогозин М. Ю.* Экологические последствия применения пестицидов в сельском хозяйстве / Рогозин М. Ю., Бекетова Е. А. // Молодой ученый. 2018. Т. 211. № 25. Р. 39–43.

2. *Leonova N. O., Pirog T. P.* Synthesis of gibberellins by surfactant producers *Nocardia vaccinia* IMV B-7405, *Acinetobacter calcoaceticus* IMV B-7241 and *Rhodococcus erythropolis* IMV Ac-5017 / *N. Leonova et al*. // Sci. Study Res.: Chem. Chem. Eng. Biotechnol. Food Ind. 2020, V. 21. № 4. P. 497–509.

3. *Banerjee A., Sharkey T. D.* Methyl Erythritol 4-phosphate (MEP) Pathway Metabolic Regulation / A. Banerjee, T. D. Sharkey // Nat. Prod. Rep. 2014. V. 31. № 8. P. 1043–1055.

COMPARATIVE CHARACTERISTICS WATER MONITORING METHODS

A. Zhukova, I. Volodko, U. Kapitsa

Belarusian State University, ISEI BSU
Minsk, Republic of Belarus
anya.zhukova2001@mail.ru

Methods used in water monitoring are discussed in this work. The features of the organoleptic, chemical, physical, physicochemical methods and the Bioindication and their applicability in the analysis of water are described.

Keywords: water monitoring; water analysis; water quality; organoleptic methods; bioindication; chemical methods; physicochemical methods; physical methods.

Monitoring of water resources is one of the most important sections of the National Environmental Monitoring System (NSEM). A wide range of methods for assessing the quality of water is characterized by both the difference in the labor intensity of the work performed and the information content of the results obtained. Comparative characteristics of water monitoring methods allow to justify the choice of the most optimal methods and work to optimize the available ones.

The following groups of studies are distinguished in water monitoring:

– Organoleptic methods. Sensory organs are used to identify the quality characteristics of water. At the same time, smell (using the sense of smell), taste (taste buds), turbidity, transparency, color (visual perception) are determined. This group refers to express methods, performed at the site of sampling. The disadvantage is the subjectivity of the results obtained.

– Bioindication of fresh water - Method for determining water quality using aquatic organisms Bioindication is based on the study of the qualitative and quantitative composition of aquatic organisms that are sensitive and tolerant to pollution. The method makes it possible to assess the ecological state of the reservoir, including by parameters that cannot be normalized, but requires the presence of identifiers and the ability to determine them.

– Chemical methods (chemical analysis) are based on carrying out a chemical reaction between the studied sample and specially selected reagents. In chemical methods, the analytical signal resulting from a chemical reaction is observed primarily visually.

– Physicochemical methods of analysis are based on a quantitative study of the composition – physical property of an object. An analytical signal is the electric potential, current strength, resistance, etc., or any other parameter (temperature of phase transformations, hardness, density, viscosity, saturated vapor pressure, etc.) associated with a certain functional dependence with the composition and concentration of the research object. Physicochemical research methods usually require the use of highly sensitive equipment. The advantages of these methods are their objectivity, the possibility of automation and the speed of obtaining results. An example of a physicochemical method of analysis is the potentiometric determination of the pH of a solution using measuring instruments – potentiometers. This method makes it possible not only to measure, but also to continuously monitor the change in pH during the course of any processes in solutions.

– In physical methods of analysis, the analytical signal is usually obtained and recorded using special equipment. Physical methods, first of all, include optical spectroscopic methods of analysis based on the ability of atoms and molecules to emit, absorb and scatter electromagnetic radiation. By registering the emission, absorp-

tion or scattering of electromagnetic waves by the analyzed sample, a set of signals characterizing its qualitative and quantitative composition is obtained.

BIBLIOGRAPHY

1. *Пименова, Е. В.* Химические методы анализа в мониторинге водных объектов [Текст]: / Е. В. Пименова; М-во с.-х. РФ, ФГБОУ ВПО Пермская ГСХА. – Пермь: Изд-во ФГБОУ ВПО Пермская ГСХА, 2011. – 138 с.

2. Handbook of water analysis /Edited by Leo M. L. NolletLeen S . P. DeGelder - N.Y., Taylor & Francis Group, LLC, 2014 – 965 p.

3. *Иванов А. Р.* Физико-химические методы анализа в экологическом мониторинге воды и почвы: учебное пособие / ВШТЭ СПбГУПТД. - СПб., 2019.Часть 1. – 77 с.

CONTENT

SECTION 1
SOCIO-ECOLOGICAL, ETHICAL AND PEDAGOGICAL PROBLEMS OF OUR TIME

THE IMPACT OF PSYCHOLOGY AND BIOLOGY ON THE IDENTITY CRISIS OF ADOLESCENCE 3
E. Akshevskaya, A. Kozorez, I. Olevsknaya

POSTHUMANISM: ALTERNATIVE REALITIES AND ARTIFICIAL INTELLIGENCE IN GREG EGAN'S SCIENCE FICTION 4
I. Boyarkina

SCHOOL ENVIRONMENTAL EDUCATION IS THA BASIS OF ENVIRONMENTAL EDUCATION 5
G. Bunel, O. Davydova-Loiko

PROBLEMS OF INTRODUCTION OF CIRCULAR ECONOMY IN BELARUS 6
L. Chayka, L. Kuzina

THE IMPACT OF FOOD WASTE ON THE ENVIRONMENT 7
D. Chкurakova, L. Kuzina

IFFERENCES IN THE VERBAL DEFINITION OF THE CHARACTERISTICS OF THE ECOLOGICAL QUALITY OF PRODUCTS IN SOME LANGUAGES AS A BASIS FOR THE UNIFICATION OF THEIR ENVIRONMENTAL LABELING 8
V. Gudovich, A. Fralou

ROLE OF AN ACTIVE LIFESTYLE ON HUMAN PHYSICAL HEALTH 9
O. Hadasevic

INFLUENCE OF STRESS ON MENTAL AND PHYSICAL HEALTH OF THE HUMAN 10
I. Olevskaya, R. Kazakov

TECHNOLOGY OF MANUFACTURING ORGANIC CARDS IN SECONDARY EDUCATIONAL INSTITUTION 11
N. Kirchuk

ESG PRINCIPLES AS THE MAIN COMPONENT OF THE STRATEGY OF A MODERN COMPANY 12
M. Kirikovich, O. Moyseenok

ENVIRONMENTAL IDEAS OF THE PHILOSOPHY OF TAOISM 13
D. Kolesnikovich, N. Lepskaya

CONSUMING SOCIETY 13
A. Korotkevich, A. Budko

THE PROBLEM OF EXPIRED DRUGS 14
Y. Kuratnik, L. Kuzina

BRAIN CAPACITY OF YOUNG BASKETBALL PLAYERS IN TRAINING AND COMPETITIVE ACTIVITIES 15
M. O. Lashchevskaya, N. A. Buzlyakov, I. Z. Olevskaya

PSYCHOPHYSIOLOGICAL STATE OF HEALTH OF THE RESIDENTS OF MODERN MEGAPOLISES IN THE CONDITIONS OF URBANIZATION 16
V. Luchina, V. Sivukha

THE MAIN PROBLEMS OF INVASIVE ANIMAL SPECIES IN BELARUS 17
E. Makarevich, I. Khandohiy

FACTORS OF TOURISM DEVELOPMENT – DIVERSITY AND CLASSIFICATION 18
A. Makavitski

DEVIANT BEHAVIOR IN ADOLESCENTS 19
A. Melnichonok, S. Pekarskaya, I. Olevskaya

THE PSYCHOLOGY OF STRESS 20
D. Mozheiko, D. Zhukouskaya, I. Olevskaya

ECONOMIC ASPECTS OF THE IMPLEMENTATION OF ORGANIC AGRICULTURE IN THE REPUBLIC OF BELARUS 21
A. Nazarovich

INSTRUCTIONAL DESIGN: THE ESSENCE OF THE ISSUE 22
A. Osinovskaya

DEVELOPMENT OF A BICYCLE ROUTE PROJECT IN BARANOVICH DISTRICT AS A WAY TO IMPROVE TOURISTIC AND RECREATION POTENTIAL 23
A. E. Rasskazova

INFLUENCE OF HYPOTHYROIDISM ON HUMAN MENTAL HEALTH 24
D. Sikita, A. Derachits, I. Olevskaya

PSYCHOLOGICAL FEATURES OF PANIC DISORDER. 25
L. A. Sultanova , I. Z. Olevskaya

THE PROBLEM OF INFLATED EXPECTATIONS 26
V. Timchenko, M. Yakauleva

PROBLEMS OF ECOLOGICAL CONSCIOUSNESS AND BEHAVIOR OF STUDENTS 27
A. Vabishchevich, T. Kapustina

ENVIRONMENTAL EDUCATION OF SCHOOLCHILDREN WITHIN THE FRAMEWORK OF THE ACADEMIC SUBJECT "MAN AND THE WORLD" 28
S. Vergeichik, E. Zhuk

EXPERIENCE IN ORGANIZING DISTANCE LEARNING STUDENTS 29
A. Yatskovskaya, D. Churakova, T. Kapustina E. Zhuk

"GREEN ECONOMY" IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT 29
A. Yatskovskaya, L. Kuzina

SECTION 2
MEDICAL ECOLOGY

THE EFFECT OF SOME MONOSACCHARIDES ON INSULIN FIBRILLATION 31
V. Abakumets, R. Baranovskiy, N. Bogdanova, K. Bulanova

THE RARE MUTANTS OF BARLEY PRODUCED IN CONDITIONS OF MOUNTAINS 32
I. Abdulov, I. Amanturtiev

THE EFFECT OF ANTIMICROBIAL THERAPY OF ORAL MUCOSA IN NORMAL AND PATHOLOGICAL CONDITION 32
Abdulrazzak Mohammad Sabah Abdulrazzak, N. Ikonnikova

THE ANALYSIS OF THE POSSIBILITIES OF ACCUMULATION OF ALUMINUM IONS BY ERYTHROCYTES AND LYMPHOCYTES OF HUMAN PERIPHERAL BLOOD 33
P. Adashova, A. Skorobohatova, E. Slobozhanina, E. Smirnova

EFFECT OF HELMAR 1 POLYPHENOL EXTRACT ON GLUTATHIONE PEROXIDASE ENZYME ACTIVITY IN RAT LIVER MITOCHONDRIA IN TOXIC HEPATITIS 34
S. Ahmedova, M. Asrarov, S. Mirzakulov, M. Pozilov

IMPORTANCE OF MEDICAL ECOLOGY IN THE RECOVERY PERIOD FROM COVID-19 35
G. Akhmedova, B. Zaripov, B. Kakhorov

INTERACTION BETWEEN NANOTUBE (8,10) AND RESVERATROL 37
A. Augustinovich

DETERMINATION OF THE CONTENT OF ZINC IONS IN THE BLOOD IN PREECLAMPSIA 38
R. Baranovsky, A. Zhiv, K. Bulanova

ANALYSIS OF LONG-TERM DYNAMICS OF CAUSES OF MORTALITY OF THE POPULATION OF THE REPUBLIC OF BELARUS 39
A. Bobrova, N. Porada

INFLUENCE OF BONE MARROW – DERIVED MULTIPOTENT MESENCHYMAL STROMAL CELLS ON THE PROLIFERATIVE POTENTIAL OF LEUKEMIA K562 CELL LINE 40
V. Bondarenko, M. Yurkevich

RETROSPECTIVE ANALYSIS OF THE INCIDENCE OF CIRCULATORY SYSTEM DISEASES OF ADULT POPULATION OF CHASHNIKI REGION IN 2015–2019 41
E. Bulyno, A. Sysa

ASSESSMENT OF THE EFFECT OF CO_2 ON THE LEVEL OF SORPTION OF FURANOCOUMARINS 42
V. Cheplya, S. Shahab

CREATION OF A GENETIC CONSTRUCT CARRYING THE DNA POLYMERASE GENE OF THE BACTERIOPHAGE *PHI29*.....43
V. Chichina, A. Bulatovsky

MODERNIZATION OF THE EQUIPMENT OF THE RADIOLOGICAL DEPARTMENT OF THE STATE INSTITUTION «N. N. ALEXANDROV NATIONAL CANCER CENTRE OF BELARUS» 44
I. Chirkova, T. Chikova

MODERN HIGH-TECH EQUIPMENT OF THE RADIOLOGY DEPARTMENT OF THE STATE INSTITUTION «N. N. ALEXANDROV NATIONAL CANCER CENTRE OF BELARUS».....45
I. Chirkova, T. Chikova

CHANGES IN THE CONTENT OF LPO PRODUCTS IN A RAT LIVER MITOCHONDRIA OF THE "RAPID AGING" MODEL AND THE EFFECT OF SUPROMOLECULAR COMPOUNDS ON THEM 46
S. Dalimova, Sh. Kuziev, G. Umarova, G. Mukhammadjanova, M. Yunusova, N. Khamdamova, S. Khamroev, M. Mustafakulov, D. Azimova

STUDY OF CARDIOPROTECTIVE PROPERTIES SUPRAMOLECULAR COMPOUNDS WITH GLYCIRRIZIC ACID 46
S. Dalimova, M. Yunusova, G. Umarova, Sh. Kuziyev, G. Mukhamadjonova, N. Khamdamova, S. Khamroyev, M. Mukhamedova, M. Dadakhonova

SYNTHESIS OF TRIOL N-METHYLMORPHOLINO INOSINE.....47
E. Deusova, M. Khanchevskiy, V. Pashkovich, E. Kvasyuk

EPIDEMIOLOGICAL ANALYSIS OF THE INCIDENCE OF THE POPULATION OF THE KRUPSKY DISTRICT WITH RESPIRATORY DISEASES FOR 2014–2019 48
K. Dragun, A. Sysa

GENES OF SEROTONINEGIC SYSTEM AND ITS INFLUENCE ON HUMAN PSYCHOEMOTIONAL STATE.....49
I. Drozdov, I. Mosse

EXPLORING THE POSSIBILITIES OF CREATING A GENETIC CONSTRUCT FOR A DNA VACCINE AGAINST SARS-COV-2.....50
A. Dubinskaya, I. Kazlovsky, J. Venskaya

FUNCTIONAL ACTIVITY OF NEUTROPHILIS IN FUNGAL DISEASES OF NAILS, SKINHAND MUSCOUS MEMBRANES.....51
N. V. Emelianenko, T. R. Romanovskaya

ANTITUMOR ACTIVITY OF ZOLEDRONIC ACID 52
V. Gamenyuk, M. Khancheuski, M. Labai

ANALYSIS OF INCIDENCE AND TERRITORIAL DISTRIBUTION OF INFECTIOUS MONONUCLEOSIS IN BELARUS.....53
V. Garonina, Yu. Lyakh

THE IMMUNE SYSTEM DURING PHYSICAL ACTIVITY 54
B. Kakhorov, M. Khojamkulova

PHYSICAL SORPTION OF 6-THIO-2-DESOXYGUANOSINE AND 6-METHYL-2-ETHYL-PYRIDIN-3-OL WITH NANOTUBE CNT (10,10-8) 55
R. Kazakov, M. Khancheuski, S. Shahab, L. Filippovich

PREVALENCE OF CONGENITAL DEFECTS IN THE DEVELOPMENT OF THE MAXILLOFACIAL REGION 56
V. Kazyuchits, N. Kokorina, A. Ershova-Pavlova

PHYSIOLOGICAL ALTERATIONS OF MITOCHONDRIA UNDER DIABETES CONDITION AND ITS CORRECTION BY POLYPHENOL GOSSITAN 57
Sh. Khalilov, M. Pozilov, U. Gayibov, X. Ruziboyev, M. Asrarov, N. Abdulladjanova

ENZYMATIC SYNTHESIS OF 6-THIOGUANOSINE 58
M. Khancheuski, L. Birichevskaya, A. Bulatovski, A. Trifonova, A. Zinchenko

ELISA DIAGNOSTICS OF CORONAVIRUS INFECTION.....59
P. S. Khariton, E. E. Tarasova, N. S. Khariton

EFFECT OF INORGANIC POLYPHOSPHATES AND ADP ON THE ACTIVITY OF ENDOPLASMATIC RETICULUM CALCIUM ATPASE.....60
F. Khasanov, A. Baev, S. Dalimova

COMPARATIVE ANALYSIS OF THE ANOMALIES OF THE STRUCTURE OF THE ANNUAL SCOTS PINE LAYERS IN DIFFERENT FOREST TYPES 61
A. Khokh

VARIABILITY OF LATE AND EARLY WOOD CONTENT IN THE ANNUAL SCOTS PINE LAYER UNDER ANTHROPOGENIC LOAD 62
A. Khokh

STUDY OF THE INFLUENCE OF POLYCATION POLYELECTROLYTES ON THE STATE OF IMMUNOGLOBULIN IMMOBILIZED ON NANOSTRUCTURED SILVER FILMS 63
I. Koktysh, Ya. Melnikova, T. Pitsko (Kaluhina), O. Matusevich, S. Maskevich

ASSESSMENT OF BIOLOGICAL PROPERTIES OF SPECIES Achillea L. PERSPECTIVE FOR THE PRODUCTION OF DERMATOLOGICAL AND COSMETOLOGICAL PREPARATIONS 64
A. Kolos

NEUROPROTECTIVE EFFECTS OF METABOLIC ACTIVATED MITOPHAGY FOR THE PATIENT'S WITH HEREDITARY FORMS OF PARKINSON'S DISEASE..... 65
Nafisa R. Komilova[1], Zukhra Ya. Kuchkarova[2], Ulugbek Z. Mirkhodjaev

RELATION OF THE ACTIVITY OF THE COMPLEMENT SYSTEM AND THE LEVEL OF ANTICLEBSIELOUS ANTIBODIES IN ADULTS 66
A. Kostyuk, T. Romanovskaya

ANTIBIOTIC RESISTANCE IN LACTOBACILLUS, BIFIDOBACTERIUM AND BACILLUS..... 67
K. Kot

ANALYSIS OF THE INCIDENCE OF ALCOHOLISM AND ALCOHOLIC PSYCHOSES IN THE REPUBLIC OF BELARUS..... 67
E. Kozlova, N. Gerasimovich

THE EFFECT OF VITAMIN D ON THE DEVELOPMENT OF TYPE 2 DIABETES MELLITUS 68
D. Kozlovich, N. Bogdanova

ECOLOGICAL AND SOCIAL FACTORS AS A CAUSE OF MULTIPLE SCLEROSIS DEVELOPMENT..... 69
A. Kozorez, E. Akshevskaya

PROGNOSTIC SIGNIFICANCE OF INTEGRAL INDICATORS OF CELLULAR REACTIVITY OF HOMEOSTASIS IN CORONAVIRUS INFECTION COVID-19..... 70
E. Kozyreva, R. Smolyakova, N. Khokhlova, I. Antashkevich, E. Shpadaruk

ANTIOXIDANT PROPERTIES OF NATIVE, DEFATTED, FERMENTED AND HYDROLYZED BOVINE COLOSTRUM..... 72
P. Krasovskaya, E. Tarun, E. Staselovich, T. Halavach, R. Romanovich

ANALYSIS OF THE CELLULAR COMPOSITION OF PERIPHERAL BLOOD OF PATIENTS WITH STROKE 73
A. Krishtopenko, E. Shpadaruk, R. Smolyakova

ANALYSIS OF THE MORBIDITY OF THE POPULATION OF THE REPUBLIC OF BELARUS WITH SOCIALLY SIGNIFICANT INFECTIONS (2005–2019) 74
L. Kurilova, N. Porada

INTRAVENOUS LASER BLOOD IRRADIATION OF DIABETES MELLITUS PATIENTS..... 75
Y. Li, V. Lemiasheuski, K. Ostrenko, A. Ovcharova

FEATURES OF THROMBIN-INDUCED PLATELET AGGREGATION IN ARTERIAL HYPERTENSION.... 76
V. Linnik, A. Bakunovich

STUDY OF WATER AND ALCOHOL EXTRACTS OF PLANTS BY THIN-LAYER CHROMATOGRAPHY 77
Yu. Lozyuk, E. Tarasova

QUANTUM-CHEMICAL MODELING AND PHYSICO-CHEMICAL PROPERTIES OF CYCLOPYROX 78
M. Lubchenko, A. Yurlevich, D. Novik, S. Shahab

THE ROLE OF MICROBIOTA IN THE DEVELOPMENT OF METABOLIC DISEASES..... 79
A. Lukyanova, M. Statsi, M. Lobai

AGE AND GENDER STRUCTURE OF PATIENTSWHO COMPLETED RADICAL RADIOTHERAPY COURSE FORHEAD AND NECK CANCER AT THE BREST REGIONAL ONCOLOGICAL DISPENSARY FOR THE PERIOD 2016–2018 80
R. Lukyanovsky, P. Demeshko, A. Batyan, E. Hancharova

MATHEMATICAL MODELING OF THE DISTRIBUTION OF VIRAL INFECTIONS IN URBOECOSYSTEMS 81
M. Madani, O. Garkovich, M. Turetsky

THE ROLE OF HYDROGELS IN THE ECOLOGICALLY CLEAN CROP OF *CICER ARETINUM L.* IN ARID REGIONS OF UZBEKISTAN 82
S. Makhammadiev, Sh. Abdullaev

EFFECT OF GUANOSINE AND GUANOSINE TRIPHOSPHATE ON THE PROCESS OF FIBRIL FORMATION OF INSULIN MOLECULES 83
A. Makhnach, N. Bogdanova, J. Venskaya, V. Sagan, O. Sokolovich

EFFECT OF LOW-INTENSITY LASER RADIATION EXPOSURE TIME ON MICROORGANISMS 84
A. Mandrik, E. Tarasova

THE PROBLEM OF "SMALL DOSES" IN RADIOBIOLOGY 85
U. Martynenko, N. Gerasimovich

INFLUENCE OF γ-RADIATION ON DESTRUCTION AND CRYSTALLINE STARCH 86
E. Maslyukov, A. Bulavko, V. Litvyak, V. Kravchenko, A. Batyan, M. Atroshko

MEDICINAL PROPERTIES OF SALVIA OFFICINALIS L. 87
A. Matkarimova, G. Ergasheva

ESTIMATION OF THE DYNAMICS OF THE LEVEL OF ENDOGENIC INTOXICATION IN PATIENTS WITH TUBERCULOSIS DURING COMBINED THERAPY 87
A. Mazurova, K. Shpadaruk, R. Smolyakova

EFFECT OF POLY-L-LYSINE ON THE FLUORESCENCE INTENSITY OF IgG-FITC CONJUGATES IMMOBILIZED ON THE SURFACE OF SILVER NANOFILMS 88
Ya. Melnikova, I. Koktysh, T. Pitsko (Kaluhina), O. Matusevich, S. Maskevich

ESTABLISHING THE RELATIONSHIP BETWEEN THE CONCENTRATION OF SOLID PARTICLES IN THE ATMOSPHERIC AIR AND THE INCIDENCE OF ONCOLOGICAL DISEASES IN THE POPULATION OF THE REPUBLIC OF BELARUS 90
M. Mikulich, I. Pukhteeva

COMPARATIVE ANALYSIS OF ECOLOGICAL EDUCATION IN THE REPUBLIC OF BELARUS AND THE REPUBLIC OF POLAND 91
E. Misuno, E. Smirnova

BEHAVIORAL ACTIVITY AND BIOCHEMICAL PARAMETERS OF THE CENTRAL NERVOUS SYSTEM TISSUE ON THE MODEL OF THE NEURODEGENERATIVE STATE OF PARKINSON'S DISEASE 92
M. Mustafakulov, T. Ishankhodzhaev, B. Zainutdinov, T. Saatov, Sh. Kuziev, S. Hamroyev

IMMUNOCHEMICAL CHARACTERIZATION OF FRAGMENTS OF ANTIBODIES TO FERRITIN 92
B. Muzychenko, Y. Melnikova

BIOLOGICAL CHARACTERISTICS OF ADENOSINE MONOPHOSPHATE 93
D. Novik, A. Yurlevich, M. Lubchenko, S. Shahab

DETERMINATION OF ERCC1 EXPRESSION LEVEL IN PATIENTS WITH COLORECTAL CANCER 94
M. Oev, E. Shpadaruk, R. Smolyakova

SYNTHESIS OF 8-AZIDOFLUDARABINE 95
E. Osipova, E. Deusova, M. Khancheuski, E. Kvasyuk

RETROSPECTIVE ANALYSIS OF MORBIDITY ADULT POPULATION OF THE CITY OF BYKHOV (2007–2018) 96
V. Papruga, M. Dubina

INFLUENCE OF SOPHOROFLAVONOSIDE ON THE ACTIVITY OF THE CYTOCHROS-C-OXIDASE ENZYME IN RAT LIVER MITOCHONDRIA UNDER INTOXICATION WITH HALOXIFOP-R-METHYL PESTICIDE 97
M. Parpieva, H. Ruziboev, M. Pozilov, S. Nishanbaev

ION-EXCHANGE RESIN AS A REAGENT IN THE SYNTHESIS OF SECO-8-BROMOXANTHOSINE 98
V. Pashkovich, M. Khancheuski, Y. Gretskaya, V. Yaroshevich

COMBINED ANTIHYPERTENSIVE THERAPY 99
T. Piliushyna, A. Bakunovich

RELATIVE DOSIMETRY OF SMALL FIELDS 100
V. Piskunou, S. Siamionau, T. Chikova

ANALYSIS OF THE INCIDENCE OF ARVI IN THE POPULATION OF MOLODECHNO DISTRICT IN 2011–2020 101
V. Radzevich

ALZHEIMER'S DISEASE: BIOLOGICAL AND ECOLOGICAL PREREQUISITES, PROMISING DIAGNOSIS AND THERAPY METHODS 102
A. Rafalskaya, L. Major

MICROARTHROPODS IN THE SOIL LAYERS OF SOUTH UZBEKISTAN 103
M. Rakhimov, Z. Elmuratova, D. Majidova

RARE REPTILES OF THE KASHKADARYA REGION 104
M. Rakhimov, E. Yangiboyev

INFLUENCE OF SOIL SALINATION ON THE EXCHANGE OF PHOSPHOLIPIDS IN PLANTS 105
N. Rakhmonova, M. Abdullaeva

THYROID DISEASE IN ADOLESCENT GIRLS IN THE REPUBLIC OF BELARUS 106
Y. Reznik, N. Kokorina, A. Avetisova

THE COMPOSITION OF FRUIT BODIES OF MUSHROOMS WITH MEDICINAL SIGNIFICANCE 106
A. Rodzkin, N. Ikonnikova, M. Labai, E. Ateba

INDICATORS OF THE INFLAMMATORY SYNDROME IN ARVI AND INFLUENZA 107
E. Romantsevich, T. Romanovskaya

EPIDEMIOLOGICAL ANALYSIS OF THE MORBIDITY OF THE ADULT POPULATION OF THE MINSK REGION WITH DISEASES OF THE ENDOCRINE SYSTEM FOR 2015–2019 109
D. Rotova, V. Stelmakh

THE EFFECT OF ZINC IONS ON THE INSULIN MOLECULE 110
V. Sagan, N. Bogdanova, A. Makhnach, O. Sokolovich

QUANTITATIVE ASSESSMENT OF THE HEALTH STATUS OF THE POPULATION OF DYATLOVO, GRODNO REGION IN 2014–2020 111
J. Salash, N. Porada

FEATURES OF ADP- AND COLLAGEN-INDUCED PLATELET AGGREGATION IN ARTERIAL HYPERTENSION 112
A. Saley, A. Bakunovich

SYNTHESIS OF 8-METOXYADENOSINE-DIALDEHYDE 113
N. Serdjukova, M. Khancheuski, A. Trifonova, E. Kvasyuk

ANALYSIS OF THE PREVALENCE OF PANCREATIC CANCER MORPHOTYPES AND CLINICAL CHARACTERISTICS OF PATIENTS 114
E. Serenkova, E. Shpadaruk, R. Smolyakova

EPIDEMIOLOGICAL ASPECTS OF THE INCIDENCE OF COLORECTAL CANCER OF THE POPULATION OF THE REPUBLIC OF BELARUS 115
V. Sergeenko, A. Sysa

STUDY OF THE EFFECT OF MODIFICATIONS OF PYRIMIDINE NUCLEOTIDE ON THE ABILITY TO BIND TO HUMAN SERUM ALBUMIN BY FLUORESCENCE ANALYSIS 116
M. Serpitovskaya, T. Zhukovets

ANALYSIS OF ANTIBACTRIAL ACTIVITY OF CYTIDINE 3',5'-CYCLIC MONOPHOPHATE IN *PROTEUS MIRABILIS* 117
A. Shihad, A. Sysa, E. Gritskevitch

IN VITRO ANTIBACTERIAL ACTIVITY OF NELARABINE PHOSPHATE AGAINST SARCINA LUTEA STRAIN 118
A. Shihad, A. Sysa, E. Gritskevitch

CHANGES IN BLOOD BIOCHEMICAL INDICATORS IN PATIENTS WITH PREVIOUS CORONAVIRUS INFECTION 119
O. Shinkevich, E. Tarasova

PHOTON AND ELECTRON OUTPUT CONSTANCY 120
A. Shish, T. Chikova

RADIOCHROMIC FILM DOSIMETRY 121
A. Shish, T. Chikova

PHOTODYNAMIC THERAPY DOSIMETRY 122
A. Shish, T. Chikova

CONCEPT DEVELOPMENT OF A QUALITY GUARANTEE PROGRAM OF EXAMINATION IN THE DEPARTMENT OF RADIOISOTOPE DIAGNOSTICS OF MINSK CITY CLINICAL ONCOLOGY CENTER....123
D. Shpak, T. Chikova

STAGES OF IMPLEMENTATION OF THE QUALITY ASSURANCE PROGRAM OF EXAMINATION IN MINSK CITY CLINICAL ONCOLOGY CENTER....124
D. Shpak, T. Chikova

BIOLOGICAL ACTIVITY OF LOPINAVIR, RITONAVIR AND NELFINAVIR AS POTENTIAL INHIBITORS OF SARS-COV-2 MAIN PROTEASE M^{pro} 125
A. Sidorova, A. Bakunovich

INFLUENCE OF NUCLEOSIDES ON FIBRILL FORMATION OF INSULIN 126
O. Sokolovich, N. Bogdanova, V. Sagan, A. Mahnach

PHILLOSPHERE PATHOLOGIES OF DOMINANT PLANT SPECIES OF SMALL RECREATION ZONES IN MINSK ON THE EXAMPLE OF MIKHAILOVSKY SQUARE 127
Y. Sorgovitskaya, A. Chernetskaya

SOME REGIONAL FEATURES OF MODERN THYROID PATHOLOGIES OF THE URBAN POPULATION OF THE REPUBLIC OF BELARUS....128
A. Soropyatova

ANTIOXIDANT ACTIVITY OF WHEY AND COLOSTRUM HYDROLYZATES COMPLEXES WITH CYCLODEXTRIN....129
E. Staselovich, E. Tarun, P. Krasovskaya, T. Halavach, R. Romanovich

MODELING OF THE BIOLOGICAL ACTIVITY OF THE ESSENTIAL OILS COMPONENTS 130
A. Stasevich, A. Hryhoryeu, A. Bakunovich

FEATURES OF THE DIAGNOSIS OF FELINE VIRAL IMMUNODEFICIENCY AND FELINE VIRAL LEUKEMIA....131
M. Statsi, Y. Melnikova

ANALYSIS OF THE DYNAMICS OF RESPIRATORY DISEASES OF THE POPULATION OF LARGE CITIES OF THE MINSK REGION 132
O. Susha

COMPARATIVE ANALYSIS OF THE DYNAMICS OF THE INCIDENCE OF RESPIRATORY DISEASES OF THE POPULATION SERVED IN THE UZ "28TH CITY POLYCLINIC" OF PERVOMAISKY AND UZ "17TH CITY POLYCLINIC" OF THE ZAVODSKY DISTRICT OF MINSK...133
O. Susha

A RETROSPECTIVE ANALYSIS MORBIDITY OF THE POPULATION MIORY DISTRICT VARICELLA .133
K. Sushko, M. Dubina

THE PRODUCTION OF SUPEROXIDE DISMUTASE 3 AND VASCULAR ENDOTHELIAL GROWTH FACTOR RECEPTOR BY MULTIPOTENT MESENCHYMAL STROMAL CELLS UNDER HYPOXIA CONDITION....134
A. Svirskaya, M. Yakauleva, A. Dubko, D. Nizheharodava

MOLECULAR DOCKING OF 5-(2-HYDROXYBENZYLIDENE)PYRIMIDINE-2,4,6(1H,3H,5H)-TRIONE WITH A CRYSTAL STRUCTURE OF THE PROTEIN COMPLEX 7D2S....136
I. Syrytskii, S. Shahab, V. Linnik, A. Pyrko, L. Filippovich

ANTIOXIDANT ACTIVITIES OF THE 5-(2-HYDROXYBENZYLIDENE)PYRIMIDINE-2,4,6(1H,3H,5H)-TRIONE....137
I. Syrytskii, S. Shahab, A. Pyrko, L. Filippovich

ANTIOXIDANT ACTIVITY (Z)-4-(2-HYDROXYBENZILIDENE)-3-METHYLISOXAZOL-5 (4H)–ONE 138
I. Syrytskii, S. Shahab, A. Pyrko L. Filippovich

SYNTHESIS OF 8-BROMOISOGUANINE 139
A. Trifonova, M. Khanchevsky, E. Kvasyuk

ANALYSIS OF DISABILITY AND MORTALITY OF THE POPULATION OF THE REPUBLIC OF BELARUS DUE TO DIABETES MELLITUS FOR 2015–2019 140
V. Trosko, Yu. Lyakh

THE PHENOTYPE OF γδT-LYMPHOCYTES IN PATIENTS WITH INFLAMMATORY BOWEL DISEASES 141
D. Tsekhanovich, A. Starastsin, A. Dybau, D. Nizheharodava

EPIDEMIOLOGICAL ANALYSIS OF MORBIDITY OF MENTAL AND BEHAVIORAL DISORDERS IN 2010–2019 142
E. Tserlyukevich, N. Porada

MEDICAL REHABILITATION AFTER POSTED CORONAVIRAL COVID-19 INFECTION 143
A. Tsvetkova

ANALYSIS OF ANTIOXIDANT ACTIVITY OF GROOVE MUSHROOMS COLLECTED IN RUSSIA, BELARUS AND CHINA 144
A. Tuboleva, Y. Pavlovskaya, E. Tarun

PHYSICAL SORPTION BETWEEN NANOTUBE (8,10) AND RESVERATROL 145
A. Tushinskaya

ANTIOXIDANT ACTIVITY OF PYRIMIDINE DYES 146
A. Tushinskaya, A. Augustinovich, A. Hryhoryeu, D. Ustymchuk

FORMATION OF A COMPLEX IN A SYSTEM: NANOTUBE (8,10) AND RESVERATROL 147
D. Ustymchuk

LABORATORY DIAGNOSTICS OF CORONAVIRUS INFECTION SARS-COV-2 148
J. Venskaya, A. Makhnach, A. Dubinskaya

THE DIAGNOSTIC VALUE OF DETERMINING THE TITERS OF ANTIBODIES TO HEPATITIS B AND C IN SERUM SAMPLES 149
A. Voroshnina, E. Tarasova

DESIGN AND SYNTHESIS OF A BIOLUMINESCENT PROBE PRECURSOR (AMPPD) 150
Wanghui, S. Shahab

EFFECT OF MESENCHYMAL STROMAL CELLS ON IL-18 PRODUCTION IN CROHN'S DISEASE 151
M. Yakauleva, M. Zafranskaya, V. Timchenko

«ANALYSIS OF INCIDENCE WITH PRIMARY LOSS OF EMPLOYMENT DUE TO INJURY AT JSC « SKBZ «AlBERTIN» (2016–2020) 152
S. Yakovchik, V. Stelmakh

STUDY OF THE GENE EXPRESSION OF GHRELIN AND NESFATIN-1 GENES IN RAT ORGANS 153
I. Yakubov, A. Kuliboev

EFFECTS OF ANTHROPOGENIC FACTORS ON THE GEOLOGICAL ENVIRONMENT OF SHANDONG PROVINCE 154
Xu. Yanhui, V. Lemiasheuski

SYNTHESIS OF DISODIUM SALT OF DI-BISULFITADENOSINE 155
V. Yaroshevich, J. Gretzkaya, M. Khancheuski, E. Kvasyuk

SYNTHESIS OF SECO DERIVATIVES OF ADENOSINE AND URIDINE 156
V. Yaroshevich, J. Gretskaya, V. Pashkovich

THE INFLUENCE OF THE URBAN ENVIRONMENT ON THE DIAGNOSIS ON THE OF MALE AND FEMALE INFERTILITY IN THE POPULATION OF THE REPUBLIC OF BELARUS 157
M. Yaskevich, P. Kirvel

STATISTICAL ANALYSIS OF THE DATA OF REGISTRATION OF CONGENITAL DEVELOPMENTAL FAULTS 158
A. Yatskov, A. Ershova-Pavlova, N. Kokorina

DETERMINATION OF THE MOLECULAR BIOLOGICAL PROFILE AMONG PATIENTS WITH ESTABLISHED BREAST CANCER CARCINOMA AND HORMONE EXCRETION IMBALANCE 159
K. Yurchenkova, A. Prokopuk, E. Shpadaruk, R. Smolyakova

BIOLOGICAL CHARACTERISTICS OF FLUDARABINE 161
A. Yurlevich, D. Novik, M. Lubchenko, S. Shahab

FREQUENCY OF OCCURRENCE OF THE OPEN DUCTUS ARTERIOSUS IN NEWBORNS OF THE CITY OF MINSK 162
E. Zheleznaya, N. Kokorina, A. Ershova-Pavlova

ANALYSIS OF PANCREAS CANCER INCIDENCE IN MINSK AND THE REPUBLIC OF BELARUS IN THE PERIOD FROM 2000 TO 2018 163
L. Zhuk, Y. Malinovskaya, Y. Zhuk

SECTION 3

PROBLEMS OF MODERN ENVIRONMENTAL SAFETY (BIOMONITORING, BIOINDICATION, BIOREMEDIATION, RADIOECOLOGY AND RADIATION SAFETY, ENVIRONMENTAL MONITORING, MANAGEMENT AND AUDIT. INFORMATION SYSTEMS AND TECHNOLOGIES IN ECOLOGY)

LAND DEGRADATION IS A SERIOUS ECONOMIC AND ENVIRONMENTAL PROBLEM 165
M. Abdurakhmanova

EFFECTS OF DRYING PROCESS ON BIOLOGICAL PROPERTIES OF SOILS 166
T. Abdurakhmonov, M. Karimboeva

ECOLOGICAL, PHARMACOLOGICAL AND BIOCHEMICAL ASSESSMENT OF THE FRUITS OF CLOUDBERRY SQUAT (RUBUS CHAMAEMORUS L.) OF NORTHERN BELARUS 168
E. Akshevskaya, A. Kozorez

ENVIRONMENTAL DIRECTION OF THE "A1" ENTERPRISE....169
M. Artemchuk, V. Krasovsky, P. Krishchanovich

THE PROBLEMS OF ECOLOGICAL SAFITY IN REPUBLIC OF ARMENIA IN RECENT DISTILLATES AND THEIR IMPACT ON CHILD MORBIDITY 170
T. M. Astabatsyan

ANALYSIS OF THE HANDLING OF CONTAMINATED TEXTILES IN THE REPUBLIC OF BELARUS....171
E. Baeva, V. Misiuchenka

CURRENT TRENDS IN THE GENERATION OF INDUSTRIAL WASTE AND WASTE MANAGEMENT AT THE ENTERPRISE «TREPLAST» 172
K. Baradynich, A. Fralou

VARIABILITY OF CERTAIN TRAITS UNDER THE INFLUENCE OF ELECTROMAGNETIC IMPULSES TO THE VEGETATIVE ORGAN OF CULTIVARS AND LINE PLANTS DEVELOPED IN CONDITIONS OF WATER SCARCITY....173
A. Bekmukhamedov, A. Khasanova, N. Khusanov

INHERITANCE OF FIBER OUTPUT IN COTTON HYBRIDS....174
S. Boboyev, M. Mirakhmedov, G. Narkizilova, J. Ruziev

SUMMER POPULATION OF VRANOVY BIRDS IN BORISOV....175
M. Bogachova, A. Khandohiy, Y. Kisialiova

MODERN PROBLEMS OF MORPHOMETRIC ANALYSIS 176
N. Bushkevich

LICHENOINDICATION OF AIR POLLUTION OF M. Ya. PAVLOV'S PARK 177
S. Chadovich, I. Lapshevich, A. Titov, A. Lunovich, Y. Zhyltsova

THE IMPACT OF FOOD WASTE ON THE ENVIRONMENT 178
D. Churakova, L. Kuzina

ANALYSIS OF THE SPECTRAL REFLECTIVITY OF AGRICULTURAL VEGETATION 179
Y. Davidovich

ASSESSMENT OF THE ECOLOGICAL STATE OF TREE PLANTS OF PAVLOV PARK 180
U. Dubatoyka, E. Zhuk

IMPLEMENTATION OF THE STOCKHOLM CONVENTION ON PERSISTENT ORGANIC POLLUTANTS IN THE REPUBLIC OF BELARUS 180
V. Duzinchuk, S. Golovatyi

ANALYSIS OF THE POSSIBILITIES OF RECYCLING DISUSED FURNITURE IN THE REPUBLIC OF BELARUS 181
P. Dzelianko, V. Misiuchenka

ANALYSIS OF THE TREATMENT OF CULLET IN THE REPUBLIC OF BELARUS 183
M. Evsievich, V. Misyuchenko

EFFECT OF BIOSOLVENT DRUGS ON THE WASHING EFFECTIVENESS OF SALTS IN ALLUVIAL SOILS WITH DIFFERENT SALT 184
M. Fakhrutdinova, O. Imomov

INFLUENCE OF MOLD FUNGI OF THE GENUS *ASPERGILLUS* ON A NATURAL CELLULOSE POLYMER IN MACROVISUAL OBSERVATION 185
L. Gavriluyk, N. Ikonnikova

IFFERENCES IN THE VERBAL DEFINITION OF THE CHARACTERISTICS OF THE ECOLOGICAL QUALITY OF PRODUCTS IN SOME LANGUAGES AS A BASIS FOR THE UNIFICATION OF THEIR ENVIRONMENTAL LABELING 186
V. Gudovich, A. Fralou

Natural analogues in physics and mechanics 187
D. Ignatovskiy, V. Krasovskiy

ADVANTAGES OF PHITOREMEDATION CLEANSING SOILS CONTAMINATED WITH HEAVY METALS 188
Z. Jabbarov, N. Sultonova

FEATURES OF RADIAL DISTRIBUTION OF NICKEL IN FOREST SOILS IN ZONES OF INFLUENCE OF ELECTRICAL PRODUCTION 189
P. Kachanovich

AGRICULTURAL CROPS IN THE STRUCTURE OF THE DIET OF RESOURCE ANIMAL SPECIES IN BELARUS 190
A. Kapskaya, Yu. Lyakh, M. Lezhdey

COMPREHENSIVE EVALUATION AND OPTIMIZATION OF ECOLOGICAL TRANSFORMATION OF COAL MINING SUBSIDENCE LAND – A CASE STUDY OF PAN'AN LAKE URBAN WETLAND PARK IN XUZHOU 191
Ju. Kechun

COMPARATIVE ANALYSIS OF METHODS FOR CALCULATING STATIONARY RADIATION PROTECTION APPLIED TO PREMISES FOR RADIATION THERAPY 192
E. Kemesh, E. Preobrazhenskaya, M. Piatkevich

STUDY OF THE PROPAGATION OF CILIATE BANANA-EATEN GECKOS IN THE MINSK ZOO 193
N. Kovalchuk, I. Khandohiy

COMMITMENT TO THE ALARA CONCEPT AT THE BELARUSIAN NUCLEAR POWER PLANT AS ONE OF THE KEY FACTORS IN PROVIDING THE RADIATION SAFETY OF PERSONNEL 194
V. Kutas

TROPHIC STRUCTURE IN THE HYDROGEN SULFIDE LAKE BARKOVSHCHINA 195
I. Lapuka

MONITORING OF SARCOCYSTOSIS AMONG HUNTING SPECIES OF WATERING BIRDS OF MINSK REGION 197
S. Latushko, Yu. Lyakh

ANALYSIS OF THE INITIAL MATERIALS FOR THE "ENVIRONMENTAL PROTECTION" SECTION OF THE FLAX FIBER BLEACHING WORKSHOP RECONSTRUCTION PROJECT 198
V. Lesik, V. Misyuchenko

ECONOMIC POTENTIAL OF WIND POWER INDUSTRY IN BELARUS 199
L. Lipnitski, M. Treyvas, E. Cherevan

THE NEED TO DEVELOP MEASURES FOR ENERGY SAVING AND IMPROVING ENERGY EFFICIENCY IN HEALTHCARE INSTITUTIONS 200
L. Lipnitski, A. Kutas, K. Solenok

URBAN AIR POLLUTION AND ITS COUNTERMEASURES IN HEBEI, CHINA 201
Liu Jiu 'an, V. Lemiasheuski, Mehmet Musa Özcan

STORMWATER RUNOFF POLLUTION CONTROL – THE COMPREHENSIVE IMPROVEMENT PROJECT OF WATER ENVIRONMENT IN ZHANGJIAKOU CITY, HEBEI PROVINCE....202
Liu Zhi gang, V. Lemiasheuski

PARASITIC NEMATODES LOCALIZED UNDER THE CUTICLE OF THE MUSCULAR STOMACH OF WILD AND DOMESTIC WATER BIRDS AND THEIR DIAGNOSTICS....204
Yu. Lyakh, A. Bormotov

IXODIC TICKS IN THE RECREATIONAL ZONE OF MINSK AND THE ROLE OF HUMANS IN ENHANCING THEIR NEGATIVE INFLUENCE....205
Yu. Lyakh, L. Isachenko

NATURAL RECREATIONAL POTENTIAL OF GOMEL REGION OF REPUBLIC OF BELARUS....206
A. Makarenko

THE IMPACT OF THE THERMAL TREATMENT OF THE SUBSTRATE ON THE BIOLOGICAL EFFICIANCE OF GILLED MUSHROOMS (PLEUROTUS OSTREATUS)....207
A. Makas, G. Krusir

ANALYSIS OF BIOCHEMICAL PROPERTIES OF *BACILLUS CEREUS* PURE CULTURES UNDER PROLONGED EXPOSURE TO IONIZING RADIATION....208
S. Maltsava, A. Yakubovich, E. Gritskevitch

INFLUENCE OF LOW-INTENSITY LASER RADIATION ON THE GROWTH OF PURE *BACILLUS SUBTILIS* CROPS ISOLATED FROM THE SOILS OF THE POLESYE STATE RADIATION AND ECOLOGICAL RESERVE....209
E. Maslyukov, L. Gavriluyk, E. Gritskevich, A. Vabishschevich

ON A NATIONAL GLOSSARY OF NUCLEAR AND RADIATION SAFETY AS AN INSTRUMENT OF TERMINOLOGY HARMONIZATION....210
K. Mazanik, T. Artsemyeva, N. Tushin, M. Michalevic

NANOSCALE PHOTOCATALYSTS BASED ON ZINC OXIDE (ZnO) FOR THE REMOVAL OF PHARMACOLOGICAL WASTE IN AQUEOUS MEDIA UNDER THE INFLUENCE OF ULTRAVIOLET RADIATION....211
A. Miadzvetski, A. Shcherbovich, V. Plakhodzka, N. Savastenko, I. Filatova, V. Lushkevich, S. Maskevich

EVALUATION OF BY-PRODUCTS THAT CAUSE ENVIRONMENTAL PROBLEMS IN OLIVE OIL PRODUCTION....212
Mehmet Musa Özcan, V. Lemiasheuski

ELECTRIC CARS IN THE CONTEXT OF ENVIRONMENTAL IMPROVEMENT....213
V. Pleskanev, E. Yablonsky, D. Mishlakov, P. Shalkevich

IMPROVEMENT OF TECHNOLOGY OF WASTE PROCESSING OF MILK PROCESSING ENTERPRISES....214
V. Prilutskiy, G. Krusir, O. Sagdeeva, I. Kuznetsova

PASSIVE IMMUNITY DEFENSE SYSTEM OF PLANTS AGAINST PHYTOPATHOGENIC FUNGI....215
D. Pristavkina, A. Chernetskaya

PROBLEMS OF POLLUTION BY SOLID AND HOUSEHOLD WASTE IN THE REPUBLIC OF BELARUS....216
I. Reich

EXPRESS METHODS FOR WATER POLLUTION IDENTIFICATION....217
D. Samokhina, A. Zhukova, U. Kapitsa

ENVIRONMENTAL CRISIS IN CHINA....218
H. Siqin, O. Nilova

ATMOSPHERIC AIR POLLUTION AND POSSIBLE EFFECTS FOR HUMAN HEALTH IN THE REPUBLIC OF BELARUS....219
V. Sivukha, A. Rodzkin

ENERGY EFFICIENT TECHNOLOGIES OF PRE-SOWING PREPARATION OF SALAD SEEDS....220
V. Sivukha, V. Pashynski

INFLUENCE OF HUMIDITY ON THE BIOLOGICAL EFFICIENCY OF RAIN WORM (EISENIA FETIDA) IN THE COMPOSTING OF FOOD WASTE....221
T. Sokolova, G. Krusir, V. Sokolova O. Sagdeeva

INFOSPHERE AND FUNDAMENTAL VALUES IN THE AGE OF HYBRID WARS 222
A. Sokolova, S. Sokolova

ANALYSIS OF RADIATION EFFECT ON INDIVIDUAL BIOTA COMPONENTS BY THE LEVEL OF CONTAMINATION BY RADIONUCLIDES ^{90}Sr и ^{137}Cs OF LAKES IN THE BELARUSIAN SECTOR OF THE CHERNOBYL EXCLUSION ZONE 223
E. Sologub, E. Busko

BIOINDICATION ASSESSMENT OF SOILS ANTHROPOGENIC LOAD OF THE M. Ya. PAVLOV'S PARK 224
A. Strakh, V. Shashkova, A. Tuz, O. Pisarenko, Yu. Zhyltsova

SEASONAL CHANGES IN THE COMPOSITION OF THE AVIFAUNA OF PARKS IN MINSK 225
E. Svistun, A. Khandohiy, N. Anishchanka

ANALYSIS OF THE POSSIBILITIES OF PROCESSING OIL SLUDGE IN THE REPUBLIC OF BELARUS 226
O. Targovich, V. Misiuchenka

STREAMING SERVICE AS MUSIC THERAPY 227
A. Tsikhonchyk, U. Ivaniukovich

USAGE OF MIXED WASTE OIL IN THE MIXTURE WITH ETHANOL FOR MICROBIAL EXOPOLYSACCHARIDE ETHAPOLAN BIOSYNTHESIS 228
A. Voronenko, T. Pirog

THE PROSPECT OF GARBAGE RECYCLING IN NANTONG, JIANGSU PROVINCE, CHINA 229
Li Xiaolong, V. Lemiasheuski

HYDROGEN ENERGY 230
M. Yakauleva, V. Timchenko

INVASIVE PROPERTIES OF *ROBINIA PSEUDOACACIA* IN BELARUSIAN PALESSE 231
M. Yakhnovets, E. Yurchenko

ANALYSIS OF THE PHYSIOLOGICAL AND BIOCHEMICAL PROPERTIES OF SANITARY-INDICATIVE MICROORGANISMS ISOLATED FROM SOILS EXPOSED TO LONG-TERM EXPOSURE TO IONIZING RADIATION 232
H. Yakubovich, S. Maltsava, E. Gritskevitch

SYNTHESIS OF PLANT GROWTH STIMULANTS BY *NOCARDIA VACCINII* IMV B-7405 STRAIN IN THE PRESENCE OF ERYTHRITOL 233
V. Zhdaniuk, D. Piatetska, T. Pirog

COMPARATIVE CHARACTERISTICS WATER MONITORING METHODS 234
A. Zhukova, I. Volodko, U. Kapitsa

Научное издание

АКТУАЛЬНЫЕ ЭКОЛОГИЧЕСКИЕ ПРОБЛЕМЫ

ТЕЗИСЫ XI МЕЖДУНАРОДНОЙ НАУЧНОЙ КОНФЕРЕНЦИИ
МОЛОДЫХ УЧЕНЫХ, АСПИРАНТОВ, МАГИСТРАНТОВ, СТУДЕНТОВ
2–3 декабря 2021 г.
г. Минск, Республика Беларусь

На английском языке

Редакторы *Т. В. Беляева, Ю. И. Буткевич,*
Н. А. Грицай, Д. М. Громыко, Т. И. Жегало,
О. А. Климова, Н. М. Левданская, П. С. Литвинчук,
Л. Н. Никитина, Е. И. Суббота, Г. В. Третьяк, А. И. Тюрдеева
Компьютерная верстка *М. Ю. Мошкова*

Подписано в печать 22.11.2021.
Формат 60×90 $^{1}/_{8}$.
Бумага офсетная. Печать цифровая.
Усл. печ. л. 31,00. Уч.-изд. л. 25,29.
Тираж 100 экз. Заказ №

Республиканское унитарное предприятие «Информационно-
вычислительный центр Министерства финансов Республики Беларусь».
Свидетельство о государственной регистрации
издателя, изготовителя, распространителя печатных изданий
№ 1/161 от 27.01.2014, № 2/41 от 29.01.2014.
Ул. Кальварийская, 17, 220004, г. Минск.