SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Materials of the International Conference

Date: September 14

Beijing, China 2019

上合组织国家的科学研究：协同和一体化
国际会议

参与者的英文报告

International Conference
“Scientific research of the SCO countries: synergy and integration”

Part 2: Participants’ reports in English

2019年9月14日。中国北京
September 14, 2019. Beijing, PRC

Materials of the International Conference
“Scientific research of the SCO countries: synergy and integration” - Reports in English. Part 2

(September 14, 2019. Beijing, PRC)

ISBN 978-5-905695-58-2

这些会议文集结合了会议的材料 – 研究论文和科学工作者的论文报告。 它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。
作者对所引用的出版物，事实，数字，引用，统计数据，专有名称和其他信息的准确性负责

These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examines tecnical and sociological issues of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

Authors are responsible for the accuracy of cited publications, facts, figures, quotations, statistics, proper names and other information.

ISBN 978-5-905695-58-2

© Scientific publishing house Infinity, 2019
© Group of authors, 2019

CONTENT

VETERINARY SCIENCES

AGRICULTURAL SCIENCES

PHYSICS AND MATHEMATICS

TECHNICAL SCIENCE

Foreword

We thank all participants of our conference "Scientific research of the SCO countries: synergy and integration" for the interest shown, for your speeches and reports. Such a wide range of participants, representing all the countries that are members of the Shanghai Cooperation Organization, speaks about the necessity and importance of this event. The reports of the participants cover a wide range of topical scientific problems and our joint interaction will contribute to the further development of both theoretical and applied modern scientific research by scientists from different countries. The result of the conference was the participation of 69 authors from 7 countries (China, Russia, Uzbekistan, Kazakhstan, Azerbaijan, Tajikistan, Kyrgyzstan).

This conference was a result of the serious interest of the world academic community, the state authorities of China and the Chinese Communist Party to preserve and strengthen international cooperation in the field of science. We also thank our Russian partner Infinity Publishing House for assistance in organizing the conference, preparing and publishing the conference proceedings in Chinese Part and English Part.

I hope that the collection of this conference will be useful to a wide range of readers. It will help to consider issues, that would interest the public, under a new point of view. It will also allow to find contacts among scientists of common interests.

Fan Fukuan,
Chairman of the organizing committee of the conference
"Scientific research of the SCO countries: synergy and integration"
Full Professor, Doctor of Economic Sciences

前言

我们感谢所有参加本次会议的“上海合作组织国家的科学研究：协同作用和整合”，感谢您的演讲和报告。代表所有上海合作组织成员国的广泛参与者都谈到此次活动的必要性和重要性。参与者的报告涵盖了广泛的主题性科学问题，我们的联合互动将有助于不同国家的科学家进一步发展理论和应用的现代科学研究。会议结果是来自7个国家（中国，俄罗斯，乌兹别克斯坦，哈萨克斯坦，阿塞拜疆，塔吉克斯坦，吉尔吉斯斯坦）的83位作者的参与。

这次会议的召开，是学术界，中国国家权力机关和中国共产党对维护和加强科学领域国际合作的高度重视的结果。我们还要感谢我们的俄罗斯合作伙伴无限出版社协助组织会议，准备和发布中英文会议文集。

我希望会议的收集对广大读者有用，将有助于在新的观点下为读者提供有趣的问题，并且还将允许在共同利益的科学家中寻找联系。

范福宽，
教授，经济科学博士，中国科学院院士，会议组委会主席“上合组织国家科学研究：协同与融合”

能力方法作为管理国家公务员专业绩效的现代方法

COMPETENCE APPROACH AS A MODERN METHOD OF MANAGING THE EFFICIENCY OF STATE CIVIL SERVANTS PROFESSIONAL PERFORMANCE

Simutova Daria Viktorovna
postgraduate
Financial University under the Government of the Russian Federation

抽象。提高公务员绩效的效率和有效性是俄罗斯公共行政发展的主要方向之一。
国家管理在这方面的发展决定了新的现代国家机构人员管理方法的使用和改进。
因此，作为一种管理国家公务员专业绩效的现代方法，本文考虑了能力方法
本文描述了科学思想中“基于能力的方法”这一类别的概念和内容的主要方法，强调了在俄罗斯国家管理实践中使用这种方法的主要缺点。
作为学习的结果，“基于能力的方法”被定性为间接的
现代管理国家公务员职业绩效的方法。
基于这一结论，需要对使用这种方法对结果和员工专业绩效的有效性产生的影响进行定量评估，这是改进“基于能力的方法”方法的主要建议。
关键词：基于能力的方法，能力，管理方法，效率，国家公务员，专业能力，官方活动。

Abstract. *Improving the efficiency and effectiveness of the performance of public civil servants is one of the main directions of development of public administration in Russia.*

The development of state management in this direction determines the use and improvement of new modern methods of managing personnel of state bodies.

So, as a modern method of managing the efficiency of state civil servants professional performance, the article considers the competence approach

The paper describes the main approaches to the concept and content of the category "competency-based approach" in scientific thought, highlights the main disadvantages of using this method in the practice of Russian state management.

As a result of the learn, the "competency-based approach" is characterized as an indirect modern method of managing the efficiency of state civil servants professional performance.

Based on this conclusion, the need for developing a quantitative assessment of the impact of using this method on the results and the effectiveness of professional performance of employees is substantiated as the main recommendation for improving the “competency-based approach” method.

Keywords: *competency-based approach, competence, management method, efficiency, state civil servants, professional competence, official activity.*

Managing the efficiency and effectiveness of the professional performance of civil servants is one of the main tasks of state bodies of the Russian Federation.

The implementation of tasks in this direction determines the use of new personnel technologies, innovative methods for managing the effectiveness of professional performance of public civil servants.

A. Ya. Kibanov [4], O.L. Chulanova [14, 15], S.A. Shapiro [16], N.F. Altukhov [1], consider the competency-based approach as one of the modern methods of managing the effectiveness of professional performance.

At the same time, the idea of the relationship between the competence of workers and the effectiveness of their work was born in scientific thought a long time ago.

So, for the first time R. Boyatsis managed to connect competencies with the effectiveness of professional work. Competencies were defined by him as "a set of characteristics that separate effective work from unsatisfactory or ineffective" [3].

The competency-based approach was universally recognized in 1982, after 19 competences were formulated by R. Boyacis: 12 of them were defined as effectiveness competencies (differentiating) that affect efficiency, 7 as non-impacting effectiveness (threshold), but necessary for work competencies [3].

The ideas of R. Boyacis were continued in the works of Lyle M. Spencer Jr. and Saina M. Spencer. They defined competence as the basic quality of an individual, having a causal relationship to effective and (or) best performance based on the criteria in work or in other situations" [13].

Competence can be considered as a specialist's quality, which develops from a set of professional qualities of an initial level of education obtained in the system of higher professional education to a higher form of competence, namely skill and talent [12].

Today, according to some authors, the concept of "competence" in a broad sense includes such elements as: knowledge, skills, abilities, value attitudes and personal qualities of an individual (employee) [2, 6, 7, 9]. The combination of these elements is considered as a key prerequisite for the high-quality and effective implementation of official tasks by an employee [10, p. 181].

As N.M. Pestereva notes, "professional competence is a prerequisite for access to public service, the key to the successful implementation by officials of the competence of the relevant authority, based on the functions and powers legally established for the current position" [8, p. 18].

Ostashkin V.N. Suslova S.E. give the following definition of professional competence: "this is the ability of a particular employee in these areas to effectively and efficiently carry out activities in accordance with the requirements of his position" [5].

An important difference between the competency-based approach to personnel management in the state civil service is the reorientation of the goals of personnel management from solving operational personnel problems, such as the timeliness of training or staff rotation, to tasks of a higher strategic order. Simply enhancing the knowledge, skills, and competencies of civil servants is inadequate.

The result of this should be an increase in labor results and organizational changes that will increase the efficiency of the state body as a whole.

Therefore, in the context of the competency-based approach, the goals of personnel state management are formulated in such a way as to show that these processes will help improve the activities of the state body by achieving greater productivity, changing the behavior of employees and organizations [14, p. 2].

So, a number of authors refer to increasing the efficiency of labor activity and the effectiveness of the organization as a whole [5, 13].

In the practice of foreign experience today, the application of the idea of competencies is directly related both to assessing the effectiveness of public civil servants and to building an optimal compensation system, an effective motivation system [11, p. 176].

In Russia, only the first stages have been completed to introduce a competency-based approach to the civil service, the first models of professional competencies have been created, a number of key professional and personal qualities have been formulated, and development and implementation of innovative assessment methods are planned.

However, the complexity and laboriousness of the competency-based approach as a modern method of managing the effectiveness of the professional performance of civil servants in combination with the fragmented criteria and the advisory nature of existing methodologies do not allow the effective use of this method when working with civil servants [11, p. 175].

We can conclude that the method of "competency-based approach" indirectly affects the effectiveness of professional performance of public civil servants, and the quality of the results of applying this method is not always comparable with the costs.

The use of a competency-based approach as a method of managing the effectiveness of professional performance of civil servants is possible provided that a qualitative quantitative assessment of the impact of the use of this method on the final results (effectiveness) of the professional performance of civil servants is developed.

Thus, to improve the competency-based approach as a modern method of managing the effectiveness of the professional performance of public civil servants, it is necessary to develop a quantitative assessment of the impact of using this method on the results and effectiveness of the professional performance of employees.

The implementation of this direction will save resources, reduce time, improve the quality management of the effectiveness of professional performance of public civil servants.

References

1. Altukhova N.F., Vasilyeva E.V., Mirzoyan M.V. Competency-based approach to public service personnel management based on ontologies // Business Informatics. - 2018. - № 1 (43). - P. 17-27.

2. Annenkova N.V., Kamneva E.V., Shirvanov R.A. The specifics of the selection of young professionals // New pedagogical technologies. - 2014. - № XVI. - P. 98-101.

3. Vysochina M.V., Svyatoho N.V., Osmanova Z.O. A competency-based approach to enterprise personnel management // Issues and problems of economics and management in the modern world: collection of scientific papers based on the results of an international scientific and practical conference. Omsk, 2014. 207 P. [Electronic resource]. – URL: http://izron.ru/articles/voprosy-i-problemy-ekonomiki-i-menedzhmenta-v-sovremennom-mire-sbornik-nauchnykh-trudov-po-itogam-me/sektsiya-22-ekonomika-truda-i-upravlenie-personalom/kompetentnostnyy-podkhod-v-upravlenii-personalom-predpriyatiya/ (Date of appeal: 21.06.2019).

4. Kibanov A.Ya., Mitrofanova E.A., Konovalova V.G., Chulanova O.L. The concept of competency-based approach in personnel management. Monograph. - Moscow: INFRA-M, 2014. - 156 P.

5. Ostashkin V.N. Suslova S.E. Management culture and professional competence of state and municipal employees // Actual issues of social sciences: sociology, political science, philosophy, history. - 2017. - 3-4 (62). - P 22-31.

6. Pavlova V.V., Telennaya L.S. The role of professional staffing in the personnel management system, Current problems of economics and management: proceedings of an international scientific and practical conference. October 28, 2016 Voronezh: Voronezh State Pedagogical University. 2016. - P. 212-215.

7. Panova E.A., Barinov D.A. Competency-based approach in the public service personnel management system / Public Administration // Electronic Bulletin. - The electron. journal - 2014. - № 45. - P. 6-18. [Electronic resource]. – URL: http://e-journal.spa.msu.ru/uploads/vestnik/2014/vipusk__45._avgust_2014_g./prob lemi_upravlenija_teorija_i_praktika/panova_barinov.pdf (Date of appeal: 03.06.2019).

8. Pestereva N.M., Tsvetlyuk L.S., Nadeina O.S. Formation of professional competencies of civil servants: monograph / N.M. Pestereva, L.S. Tsvetlyuk, O.S. Nadeina - Moscow: Publishing House of the Moscow University for the Humanities, 2014. - 139 P.

9. Polevaya M.V. Some aspects of personnel training and the formation of professional competencies abroad // Scientific Herald of the Moscow State Institute of Informatics. - 2012. - № 4 (18). - P. 69-75.

10. Simutova D.V. Key competencies of state civil servants, Prospects for the development of social partnership: materials of the scientific and practical round table. March 29, 2017. - Moscow: SVIVT, 2017. - P. 180-185.

11. Simutova D.V. Competency-based approach in the state civil service // Formation of the general cultural and professional competencies of the financier: collection of articles Moscow, 2017. - Publishing house: SVIVT LLC (Reutov). - 2017. - P. 174-179.

12. Simutova D.V. The essence of the problems of managing the effectiveness of professional performance of civil servants at the stage of attraction and selection // University Herald. - 2019. - № 1. - P. 22-29.

13. Spencer Jr Lyle M., Spencer Sayn M. Competencies at Work: Models of Maximum Performance. - Moscow: GIPPO, 2010. - 371 P.

14. Chulanova O.L. The concept of competency-based approach in personnel management // Internet-journal "Naukovedenie". - № 5. - 2013. - P. 1-8.

15. Chulanova O.L. Methodology for the study of competencies of personnel of organizations: Monograph. - Moscow: INFRA-M, 2015. - 120 P.

16. Shapiro S.A. Improving professional competencies as a factor in increasing the labor efficiency of employees of commercial banks: monograph / S.A. Shapiro, E.A. Potapova. - Moscow - Berlin: Direct Media, 2015. - 153 P.

国家财政政策陷入衰退，并确定关键问题
STATE FISCAL POLICY IN RECESSION AND IDENTIFICATION OF KEY PROBLEMS

Mustafa Ali Ibrahim
Lecturer at the University of Technology
Iraq, city of Baghdad.
ALSaady Wesam
Postgraduate
Plekhanov Russian University of Economics

注解。 本文探讨了俄罗斯联邦财政政策的关键问题。 总的结论是，整体财政政策是公共支出和税收的监管者。 只有正确使用工具财政政策才能实现国家所有主体的稳定，平衡和繁荣的生活方式。

关键词：税收，税负，预算政策，财政政策，金融工具，俄罗斯。

Annotation. *The article examines the key problems of fiscal policy of the Russian Federation. General conclusion is that overall fiscal policy acts as a regulator of public spending and taxes. And only the proper use of tools fiscal policy leads to a stable, balanced and prosperous way of life of all subjects of the state.*

Keywords: *Tax revenues, tax burden, budget policy, fiscal policy, financial instruments, Russia.*

The state of tax legislation is still far from perfect. The problems of the formation and development of the tax system in the transitional economy of Russia are insufficiently studied and analyzed. The modern taxation system needs a clearly structured tax policy that meets the requirements of market relations, the interests of the state and taxpayers, as well as the resolution of contradictions between them. Thus, it can be argued that, in economic terms, the system of Russian taxes performs its functions unsatisfactorily, and the problem of improving and optimizing tax policy in Russia remains very relevant at present.

The problems of the implementation of fiscal policy in modern society are one of the key problems of economic practice. It should be emphasized that fiscal policy and its role in government regulation is very relevant, as it affects all the nuances of the formation of the national economy [1].

The problems of the implementation of fiscal policy in modern society are one of the key problems of economic practice. It should be emphasized that fiscal policy and its role in government regulation is very relevant, as it affects all the nuances of the formation of the national economy [1].

The main trends in fiscal policy, in accordance with an act of the Government of the Russian Federation, is considered to be "the development of a reliable and effective tax concept in order to reduce tax policy and provide a balanced government budget."

One of the main factors restraining the growth of production activity in modern conditions of development is irrational fiscal policy. The tax burden that the government has established is clearly redundant and does not at all allow production structures to conduct normal fiscal work.

The coordination of the directions and goals of fiscal policy is considered a relevant condition for increasing its effectiveness. Naturally, the ultimate goal of fiscal policy should not be price stability or the stability of the national currency [3].

When implementing fiscal policy, the following problems arise:

− increased municipal costs or tax cuts increase government budget deficits;

− public investment is crowding out private investment, i.e., it is a crowding-out effect.

Since Russia continues to be a commodity country, that is, a significant share of revenues comes from the oil and gas industries, one of the key estimates is the cost of oil in the world market.

Opinions on whether the adopted federal budget will lead to a shift in the country's economic development in a positive direction diverge. GDP growth in 2017 is expected to be no higher than 0.6 percent, which cannot be called economic growth. The main financial document of the country was created taking into account current external political and economic circumstances. But there is still hope for the settlement of interstate disagreements, the lifting of sanctions, the stabilization of oil prices at a level not lower than $ 50 per barrel.

In 2017, the Ministry of Finance refused to replenish reserves - A.G. Siluanov said that the Russian leadership supported the proposal to direct all additional oil and gas revenues not to new expenses, but to reduce the expenditure of reserves. According to the minister, with an average oil price of $ 50 per barrel in 2017, additional budget revenues will amount to a trillion rubles, and at 55 dollars per barrel, 1.4 trillion rubles. He also did not rule out that, given favorable conditions, the Ministry of Finance would not spend the Reserve Fund and the National Welfare Fund at all this year. Minister of Economic Development M.S. Oreshkin said that Russia has good chances to maintain the Reserve Fund in 2017 due to increased oil prices. [4]

The consequences of the decline in oil prices negatively affected the Russian budget, consumers and the activities of oil companies. However, the negative impact on the latter is not so much the result of an unfavorable situation as the desire of the state to raise money by the simplest and fastest "fiscal" method, without reforming and assessing the future prospects for the development of the oil industry.

In general, fiscal policy acts as a regulator of public spending and taxes. And only the correct use of fiscal policy instruments leads to a stable, balanced and prosperous lifestyle of all subjects of the state.

It seems that in modern conditions of the fiscal policy of the state there are certain problems with filling the revenue side of the budget system of Russia. One of the essential ways in which authorities help to carry out fiscal administration is through state coercion. In particular, failure to fulfill tax obligations provides for: tax, administrative and (or) criminal liability. Moreover, in addition to directly providing financial support for the performance of their duties.

As we can see, Russia has a very low efficiency of tax policy in general. Since Russia has a very large percentage of the shadow sector of the economy, namely 56%. With this indicator, we can safely say that the tax system of the state, which is present now, is absolutely ineffective. The country's government is only trying to come up with new tax fees, to replenish the tax base, instead of optimizing the areas that are currently available.

It's very harsh for Russian entrepreneurs of small and medium-sized businesses, because, instead of developing their organization, increasing profits and expanding the staff of workers, they have to fend off the tax office. The company still does not have time to develop, as it is already on the verge of ruin due to the large percentage of tax revenues (20% income tax) [2]. Therefore, the owners of organizations are forced to reduce staff and costs of new investment projects.

In order to somehow save the organization, they are forced to leave for the shadow sector. That is, the government itself provokes leaders to commit economic crimes: engage in cash out of cash through special organizations. This is due to the fact that the owner of the enterprise, paying the official salary to the employee, can lose about 40% of the payment fund, and through the cash withdrawal system only 7-8% for the commission, and then pays people "black" wages. Of course, such a system is more economical for the leader [5].

Certain taxes can regulate the country's economy, but this must be done effectively and in favor of the population. For example, the increase in the export tax on natural resources must definitely be increased, but for the processing industry, on the contrary, reduced. This is necessary in order for natural resources in raw form to be more expensive to export than in processed ones. Thus, we will increase the processing industry, jobs, and the tax base. We will also reduce the cost of fuel and, in general, the price of goods and services within our country.

In Russia, the main drawback of the tax policy is the financial and legal regulation and it is based on the reorientation of the tax system to direct taxes, as well as on increasing tax pressure on individuals, with an inadequate income tax system for working citizens. Indeed, under the current economy, a proportional tax system is not suitable for us, since in Russia most of the population receives up to 15,000 rubles, and some part of the population receives more than 100,000 rubles, but everyone pays the same tax rate (13%) [2]. People receiving up to 15,000 rubles are in poverty with current prices for goods and services, and they also have to pay taxes. In our opinion, this is not fair. Therefore, we urgently need to change the taxation system for individuals to a progressive one, then we can "unload" some segments of the population from tax fees. Moreover, we will only increase the federal budget by raising the interest rate for a wealthy part of the population.

In general, fiscal policy acts as a regulator of public spending and taxes. And only the correct use of fiscal policy instruments leads to a stable, balanced and prosperous lifestyle of all subjects of the state.

References

1. The Tax Code of the Russian Federation, part one of July 31, 1998 No. 146-ФЗ and part two of August 5, 2000 No. 117-ФЗ with amendments and additions from: December 28, 2016, March 7, 2017 [Electronic resource] // Access: GARANT system: URL: http://base.garant.ru/10900200/1/#ixzz4cdKzU85g (access date 20.09.2017)

2. Official website of the Ministry of Finance of the Russian Federation [Electronic resource]. - Access: http://www.minin.ru/ - (access date 12.09.2017).

3. The main directions of the tax policy of the Russian Federation for 2017 and for the planning period of 2018 and 2019. [Electronic resource] // URL:http://www.consultant.ru/document/cons_doc_LAW_183748/ (access date 20.09.2017)

4. RosBusinessConsulting [Electronic resource]. URL: http://www.rbc.ru/finances/19/01/2016/569e6d4c9a7947427aacab61

5. Ibrahim Mustafa Ali. Key problems of the fiscal policy of the state in the face of a falling level of the economy of the Russian Federation // "University Bulletin" (State University of Management). - 2018. - № 1. P. 127-131

在执行任务时对芬兰警察使用暴力
THE USE OF VIOLENCE AGAINST FINNISH POLICE OFFICERS IN THE LINE OF DUTY

Jilkine Vladimir Alekseevich
Doctor of law, MFA, law office
Helsinki

抽象。文章讨论了在执行职务时对警察使用暴力行为，并侵犯了他们的生命和健康。该条指出，打击犯罪和维持法律和秩序始终与警察的生命风险相关，特别是在拘留与严重毒品犯罪有关的武装犯罪团伙时。在长期研究刑事统计资料时，还确定了在国家和欧洲各级针对警察的暴力行为案件数量的增加。根据提交人提供的事实，可以得出结论，与其他国家相比，使用实际射击枪械杀害芬兰警察的情况非常少见。

根据统计数据和芬兰发表的实证研究结果和国际报告，已经确定了打击对警察使用暴力的优先方向，并提出了建议来对付这种消极现象。

法治原则意味着官方当局的行为应该在法律框架内正式和事实上进行。在使用致命武力，特别是用于杀戮的武器的情况下，这尤其合理，在这种情况下，权利，义务及其监管框架的定义应基于诉状的理论。

利用科学技术资源，结合计算机技术，人工智能和机器人技术的最新成果，提高了警用设备的水平，保证了公民和警察的安全。

关键词：对健康造成伤害，突然袭击，有组织犯罪，武装抵抗警察，暴力行为。

Abstract. *The article discusses the use of violence against police officers in the line of duty with an encroachment on their life and health. The article notes that the fight against crime and the maintenance of law and order are always associated with a risk to the lives of police officers, especially when detaining armed groups of criminals associated with serious drug crimes. When studying the materials of criminal statistics over a long period of time, an increase in the number of cases of violent acts against police officers at both the national and European levels was also established. Based on the facts presented by the author, it can be concluded that the use of firearms with actual shooting to kill police officers in Finland is quite rare in comparison with other countries.*

Based on statistical data and the results of empirical studies published in Finland and international reports, priority directions in the fight against the use of violence against police officers have been identified, and recommendations have been proposed to counter this negative phenomenon.

The principle of the rule of law implies that the actions of official authorities should be carried out both formally and in fact within the framework of the law. This is especially justified in the case of the use of lethal force, in particular weapons to kill, and the definition of rights, obligations and their regulatory framework in this situation should be based on the doctrine of jus positivum.

The use of scientific and technical resources, combined with the latest achievements of computer technology, new technologies of artificial intelligence and robotics, has increased the level of police equipment, which guarantees the safety of citizens and police officers.

Keywords: *causing harm to health, surprise attack, organized crime, armed resistance to police officers, violent actions.*

The use of violence against police officers or threats of violence against government officials in connection with the performance of their duties has increased in Finland and other Nordic countries. These crimes are associated with an encroachment on the life and health of government officials in the line of duty, which significantly increases their public danger.

The discussion of this topic became relevant after the attempt on the police in Porvoo on 08.25.2919, when two police officers did not have time to use weapons, when criminals opened fire on them and received gunshot wounds. Both suspects were detained and, by a decision of the county court on 29.8.2019, were arrested on suspicion of attempted murder of two people.

Of particular note, this attempted assassination of police officers was the second case of an armed attack on law enforcement officials in Finland during the two days of the end of August 2019.

Commenting on the incident, the Prime Minister of Finland Antti Rinne said that violence against the police indicates serious changes in society.

In law enforcement practice, an increase in the number of cases of violent acts against police officers at both the national and European levels is also noted.

In particular, the number of registered 833 cases of violence against police in Finland since 1999 has doubled compared to 2016 and reached 1,699[1]. In the Netherlands, violence towards police tripled between 1978 and 2008 [2], and in Sweden, violence against the police nearly doubled between 2002 and 2014. According to a police survey in Finland, two thirds (63%) experienced violence, and threats or insults at least once a month. At least every month, almost half (44%)

[1]Rikander Henri. Custos Publicus GladiuM frustra non fert. Empiirinen tutkimus poliisin voimankäytöstä ja poliisin kohtaamasta väkivallasta. 2019. P.101.

[2]Timmer – Pronk 2011, P. 188.

of the police were physically abused.[3] According to a Belgian police survey, four fifths (79.1%) of respondents experienced verbal aggression in their careers. More than half (51.7%) of respondents were physically abused [4].

Also, according to a survey conducted between 1.2 and 28.2.2018 among 539 private law enforcement officers in Finland, respondents reported the use of violence in 2017 almost 2,500 times[5].

A 2017 report by the Swedish National Criminal Investigation Service revealed details of attacks on police officers, including incidents of stoning masked police vehicles by stoning police cars. According to a police report published in June 2019 in Sweden, the number of "no-go zones" decreased from 61 to 60 (in 2015 there were 53), and the number of particularly vulnerable areas is 22[6].

Finnish police officers have a responsibility to protect the rights of citizens and ensure compliance with the rule of law in the state, based on democratic values, adherence to the rule of law, respect for human rights and a code of conduct for the police officer. Maintaining public order to carry out political processes in a constitutional order and on the basis of legality, police officers are more likely than others to become victims of crimes, as well as in the performance of duties of an immediate response or when patrolling.

It should be especially noted that the fight against crime and the maintenance of law and order are always fraught with a risk to the lives of police officers, especially when detaining armed groups of criminals associated with serious drug crimes.

One such example was the widespread operation to detain 18 senior members of Finland's largest criminal group, United Brotherhood and Bad Union, in 9 cities in Finland. In addition to the police forces, the operation was attended by the Central Criminal Police, the Police Department, customs, and the penitentiary department. Preparations for the police operation lasted 15 months, as a result of which 167 firearms, 20,000 rounds of ammunition, 55 kilograms of heavy drugs and 150,000 ecstasy tablets were confiscated. On September 9, 2019, the county court ruled to arrest members of the group on charges of serious drug crimes, money laundering, serious crimes of using firearms and organizing a criminal community. Searches also took place in four prisons in Finland; narcotic substances and drug

[3]Paasonen Juri. Kyselytutkimus yksityisen turvallisuusalan toimijoille alan lakiuudistuksesta. Edilex 2019/19, Published 13.5.2019, www.edilex.fi/artikkelit/19970, pp. 1–21. Paasonen, J., Aaltonen, M., Hamari, A. (2018) Yksityisen turvallisuusalan toimijoiden rikosoikeudellinen asema – empiirinen analyysi vartijoiden ja järjestyksenvalvojien kokemasta ja tekemästä väkivallasta. Edilex 2018/2. Published 8.2.2018.

[4]van Branteghem –Truyens –van Altert –Verwee 2015, P. 34.

[5]Paasonen Juri. Yksityisen turvallisuusalan toimijoiden kokema väkivalta. 31.5.2018. https://jyripaasonen.fi/yksityisen-turvallisuusalan-toimijoiden-kokema-vakivalta/..

[6]Here's the new police list of trouble suburbs in Sweden. 3 June 2019. https://www.thelocal.se/20190603/sweden-vulnerable-areas-decrease-positive-trends-police

marketing records were confiscated from nearly 100 prison cells. According to the Finnish Central Criminal Police, the United Brotherhood gang has a strong influence in prisons in which drug production, violence, pressure and blackmail for fictitious debts have increased due to the large number of members of UB gang convicted and serving sentences[7].

According to the list of deaths in the line of duty after the declaration of independence of Finland on December 6, 2017, 111 representatives of the Finnish authorities were killed during the performance of their official duties, including 31 police officers. According to the archives of the Museum of the History of Police, the figure is actually much larger, since there is no data on the deaths of police officers during the war.

So, the head of the Museum of the History of Police Tiina Tuulasvaara-Kaleva said that a particularly dangerous period was during the operation of the Prohibition of 1919-1932. During this period 1919-1932, more police officers were killed annually than in 19 years of the 21st century.

In the post-war period, there were no victims among the police until 1969. The tragic day was March 7, 1969, when 4 policemen died at the hands of an armed criminal. In the following decades, the number of victims of police officers decreased significantly due to the reorganization of the police and changes in legislation.

According to police commissioner, Doctor Juridical Sciences Henri Rikander, the number of Finnish policemen killed in the line of duty today is extremely small compared to one million emergency law enforcement and crime counteraction reports and more than 90,000 detentions and arrests each year. According to the Finnish police registry, 1,062,930 emergency reports were received in 2018 and 795,055 allegations of crime investigation were made. In total, in 2018 the police received 35,337 allegations of crimes against the person, of which 33,508 were beatings or other violent acts.[8].

In 2018, the Finnish police force was 9,810 employees, of which 7,201 were police officers, i.e. 129 police officers per 100,000 inhabitants. For comparison, in the EU countries this figure is from 360-360, in the USA 256, in China 120 and in India 128.

Based on a comparative analysis, we can conclude that internal security in Finland and the relatively low number of police officers killed during their duties are much lower than in the United States and European countries.

According to a report from the Police High School, from 2003 to 2013, 385 cases of the use of firearms were recorded in Finland, of which 122 shots were fired, on average from 26 to 44 per year. Between 2007-2017, seven people were killed as a result of the use of firearms by the police.

[7]Poliisi iski laajasti jengiä vastaan. Helsingin Sanomat 10.9.2019, A9.

[8]Poliisin tulostietojärjestelmä. PolStathttps://www.polamk.fi/instancedata/prime_product_julkaisu/intermin/embeds/polamkwwwstructure/77938_mediatilasto_tammi2019.pdf?325c5f68b7a0d688

It is also important to note the adoption of the 1967 Police Act, which was supplemented in 1995 and 2011, which contains the legal basis for the powers of the police to use force. According to the Police Act 7.4.1995 / 493, "the task of the police is to safeguard legal and public order, maintain public order and security, and prevent, investigate and prosecute crimes. Firearms can be used only in the event of imminent and great danger during the arrest of a person who poses a serious danger to life or health, if it is not possible to detain this person by other means. In addition, firearms can be used to perform an urgent and important task to eliminate the object, to neutralize the animal or other obstacles.

Firearms cannot be used to disperse a crowd using gas-powered cartridges or similar ammunition, with the exception of special orders.[9]

In 1980, the police received the right, with the assistance of the armed forces, to use military force to prevent or stop terrorist crimes, as provided for in the Law on Assistance to the Police[10].

It is also important to note the development of the legislative framework in the field of public order and public safety in Finland.

In 1999, the Firearms Act entered into force. In accordance with § 92 § 1, if there are reasonable grounds to suspect the unlawful use of firearms, weapon components, ammunition or especially dangerous ammunition, the police can immediately decide to temporarily seize them. Paragraph 2 of the same article obliges a police officer to seize such items from their owner if the danger of abuse is obvious. On the other hand, the enforcement of a temporary seizure order in accordance with Section 92 of the Firearms Act is not possible if the conditions of the section of chapter 2 6 § para. 1 of the Police Act or 2 § 8 of the chapter of the Law on Compulsory Measures are not met.

The Police Act obliges the policeman to intervene in an ongoing crime that is dangerous to human life and health. The principle of the rule of law implies that the actions of official authorities should be carried out both formally and in fact within the framework of the law. This is especially justified in the case of the use of lethal force, in particular weapons to kill, and the definition of rights, obligations and their regulatory framework in this situation should be based on the doctrine of jus positivum (natural law in force at the moment).

It should be emphasized that during the detention of dangerous criminals, the Finnish police makes every effort to save the lives of those suspected of crime during detention and arrests.

So, on August 18, 2017, at the Torgovaya Square in Turku, after stabbing eight women and two men, two of whom were killed, a terrorist from Morocco was detained by police after one shot in the thigh.

[9]Poliisilaki luku 2, § 19 mom. 1 ja 3.

[10]Laki puolustusvoimien virka-avusta poliisille (781/1980).

Jani Kellokumpu, suspected of killing and causing death by negligence in northern Sweden, was detained by a Finnish police officer in Orimattila in December 2018 according to a European warrant received in Sweden without a single shot.

Also, based on static data, it can be concluded that the use of firearms with firing to kill by police officers in Finland is quite rare in comparison with other countries. The exception is Iceland, where for the first time since 1943 the police used weapons to kill in 2013.

A police officer has the right to use weapons without warning only when repelling an attack using weapons, military and special equipment.

For example, in 2016, after numerous shots at police officers, an armed criminal was killed, mortally wounding a senior police constable and injuring a second police officer. The previous death case in Finland was recorded in 2009, when the police used firearms after repeated warnings to stop shooting at police officers. Prior to this, the police used weapons to defeat in 1997 when resisting shots at policemen from smooth-bore firearms.

The last death in Finland was recorded on 07/27/2019 in the city of Käpylä, when a criminal threatened the use of firearms by two women in the house.

On the other hand, in the United States, according to the report of the National Memory Fund in 2018, the number of police officers killed in the line of duty was 144, of which 134 were men and 10 were women[11]. In 2017, police deaths were 128, with more than 970 people killed by law enforcement officers in 2017. The total mortality rate from the use of firearms in the United States has reached its maximum level over the past 20 years and according to the "Gun Violence Archive" is more than 393 million units.

According to the non-profit organization "Gun Violence Archive" (GVA) on September 1, 2019, that is, in 244 days, 283 mass executions have already occurred in the United States. The GVA defines mass shooting as any incident in which at least four people were shot, excluding the shooter. The GVA reported that as of September 1, 2019, 37,662 shooting incidents were recorded, as a result of which 9 932 people were killed and 19 868 were injured. (As of September 1, 2019 which was the 244th day of the year, there have been 283 mass shootings in the US, according to data from the nonprofit Gun Violence Archive (GVA), which tracks every mass shooting in the country. The GVA defines a mass shooting as any incident in which at least four people were shot, excluding the shooter. The GVA said there have been 37,662 total shooting incidents, resulting in 9,932 gun deaths and 19,868 injuries, as of September 1)[12].

[11]144 police officers died in the line of duty in 2018, reversing a one-year decline. USA TODAY. Jan 1, 2019. https://eu.usatoday.com/story/news/2018/12/27/police-deaths-144-killed-line-duty-2018/2423797002/.

[12]There have been more mass shootings than days this year. September 1, 2019. https://www.cbsnews.com/news/mass-shootings-2019-more-mass-shootings-than-days-so-far-this-year/

The low crime rate in Finland is achieved by a high level of education, police training, technical equipment of the police and the assistance of the population in reporting and preventing the preparation of crimes.

Secondly, police training, tactics and defense tools are at a high modern level. It is difficult to overestimate the relevance for police officers of using tactics of defense methods in case of threat with a weapon in a critical situation. It should be noted the special training and equipment of the special police detachment Karhuryhmä, as well as the possible redistribution of police resources, for example, taking into account the growth of rape, sexual crimes and harm to health in refugee camps.

The lowest number of prisoners in Finland should also be noted. If in the countries of the European Union in 2016 there were an average of 124 prisoners per 100 thousand people, in Estonia 191, in Latvia 224, in Lithuania 254, in Russia 416, in Sweden 58, in Norway 73, in Finland this figure is 57.

And, as a result, according to The International Police Science Association, the World Internal Security and Police Index, a constitutionally-based system for ensuring a democratic nature, the activities of the Finnish police and the internal security of the country as a whole are among the best in the world, and in 2017 Finland was recognized as the most safe country.

The use of scientific and technical resources, combined with the latest achievements of computer technology, new technologies of artificial intelligence and robotics, has increased the level of police equipment, which guarantees the safety of citizens and police officers.

Among the priority areas in Finland are the normative establishment of general principles and approaches to the organization and content of the criminal law regulation of the problem under study, the solution of existing conflict issues of investigative and judicial practice, as well as the determination of common grounds for qualifying the relevant criminal assaults for all independent subjects of international law.

References

1. Christie, Nils: The ideal victim. Teoksessa: Fattah Ezzat A. (toim.): From Crime Policy to Victim Policy. Basingstoke. 1986.

2. Helminen K, Kuusimäki M. & Rantaeskola S. 2012. Poliisilaki. Talentum Media Oy.

3. Pellonpää Matti – Gullans, Monica – Pölönen, Pasi – Tapanila, Antti: Euroopan ihmisoikeussopimus. 5., uudistettu painos. Liettua 2012.

4. Tolvanen M. 2014b, Poliisilain lainsäädännön nykytila. Teoksessa Muittilainen M.& Huotari V.

Poliisin toimintaympäristö. Poliisiammattikorkeakoulun raportteja 112. Tampere.

5. Rantaeskola Satu. Poliisilaki-kommentaari. Poliisiammattikorkeakoulu. Tampere. 2014.

6. Rikander Henri. Poliisin kokemus virkamiehen väkivaltaisesta vastustamisesta. Edilex 2017/43.

7. Sinisalo Kari. Poliisin toimivallan määräytyminen. Tutkimus poliisin vallasta yläpitää yleistä järjestystä ja turvallisuutta. Vammala 1971.

8. Tyler, Tom R. Why people Obey the Law. Lontoo 1990.

9. Van Craen Maarten – Skogan, Wesley G.: Trust in the Belgian police: The importance of responsiveness. European Journal of Criminology 2015, Vol. 12(2), S. 129–150. Yliopistopaino- Juvenes Print.

10. Viljanen Pekka: Väkivallasta virkamiehen vastustamisrikoksissa. Teoksessa: Lohiniva- Kerkelä, Mirva (toim.): Väkivalta – Seuraamukset ja haavoittuvuus. Terttu Utriaisen juhla- kirja. Hämeenlinna 2006.

基于PIK高流量研究堆（ICNR　PIK）的国际中子研究中心国际科技合作模式的特点
CHARACTERISTICS OF INTERNATIONAL SCIENTIFIC AND TECHNICAL COOPERATION MODEL OF THE INTERNATIONAL CENTER FOR NEUTRON RESEARCH ON THE BASIS OF THE PIK HIGH-FLOW RESEARCH REACTOR (ICNR PIK)[1]

Gulyaeva Tatiana Konstantinovna
Candidate of Juridical Sciences., Senior Lecturer
Kutafin Moscow State Law University

抽象。　正在进行的研究项目国际化，其中一个生动的例子是ITER国际热核能组织和欧洲核研究组织的运作，以及开始实施“大型科学”级项目　–　国际中子中心基于俄罗斯PIK高流量研究堆的研究，考虑到Laue-Langevin研究所和欧洲中子源的强制性国际存在，已经确定了形成国际科学和技术模型的客观需要和迫切需要。技术合作和法律方面的研究，使俄罗斯和外国代表之间能够实现互利的国际合作。

关键词：Megascience，国际政府间组织，科学和技术合作。

Abstract*. The ongoing internationalization of research projects, a vivid example of which are the functioning ITER International Organization for Thermonuclear Energy and the European Organization for Nuclear Research, as well as the initiated implementation of a “mega-science” class project[2] - The International Center for Neutron Research, based on the PIK high-flow research reactor*[3]

[1]As part of the implementation of Project 18-29-15015 “Formation of a legal model for managing the creation and operation of the International Center for Neutron Research on the basis of the PIK high-flow research reactor”

[2]Chetverikov A.O. Organizational and legal forms of big science (megascience) in the context of international integration: a comparative study part I. megascience as a scientific and legal phenomenon. Legal aspects of the functioning of mega-science in the form of international intergovernmental organizations and national legal entities // Legal Science. 2018. №1. P. 13-26.

[3]Passport International Center for Neutron Research (PIK Neutron Research Facility) (eng.).

Official site of the CREMLIN Project on the development of international scientific and technical cooperation between Russia and the European Union in the field of research facilities of the "mega-science" class [Electronic resource]. URL:

https://www.cremlin.eu/sites/sites_custom/site_cremlin/content/e17712/e60687/Passport_PIK_Neutron_Research_Facility.pdf (appeal date: 09.09.2019).

CREMLIN recommendations regarding collaboration on mega-science projects between European and Russian partners from 2018 (First CREMPLIN Recommendations for the European-Russian Megascience Collaboration). URL: https://indico.desy.de/indico/event/20397/material/7/0.pdf (appeal date: 09.09.2019).

in Russia, taking into account the mandatory international presence of the Laue-Langevin Institute and the European neutron source have identified the objective need and urgent need for the formation of a model of international scientific and technical cooperation[4] *and the study of its legal aspects, allowing to achieve mutually beneficial international cooperation*[5] *between representatives of Russia and foreign countries.*

Keywords*: Megascience, international intergovernmental organizations, scientific and technical cooperation.*

At present, there is no single approach regarding the selection of the appropriate legal form of the project of the "megascience" class International Center for Neutron Research based on the PIK high-flow research reactor (hereinafter - ICNR PIK) with subsequent international participation in the Russian Federation.

As a result of the analysis of legal forms, two of the most suitable for use in creating the ICNR PIK were identified: an international intergovernmental organization (hereinafter - IGOs) and the European Research Infrastructure Consortium (hereinafter - ERIC). This paper presents a comparative analysis of the selected legal forms and identifies the most suitable one.

1. IGO:

IGO is an association of states created in accordance with international (public) law and on the basis of an international treaty, in order to carry out cooperation in various fields of activity, including scientific and technical; having an appropriate organizational mechanism, rights and obligations derived from the rights and obligations of states, and autonomous will, the limit of which is determined by member states[6].

IGO legal status implies the following:

1. Creation in accordance with international (public) law:

- IGO activities should be carried out in accordance with generally recognized principles and norms of international law;
- the IGO charter is subject to registration with the UN Secretariat (Article 102 of the UN Charter);

2. Implementation of cooperation in specific areas of activity:

- IGO activities should be based on the principles of openness for participation of all interested states and their equal mutually beneficial cooperation;

3. The presence of international legal personality:

- in particular, the right to conclude international agreements and have observers

[4]Zadumkin K.A., Terebova S.V. International scientific and technical cooperation: essence, content and forms // Problems of the development of the territory. 2009. № 3 (47). P. 22-30.

[5]Kuzmin I.V. Trends in state regulation of innovative activity abroad // Questions of territorial development. 2014. №. 10 (20).

[6] International public law: textbook / L.P. Anufrieva, K.A. Bekyashev, E.G. Moiseev, V.V. Ustinov (and others) / Resp. ed. K.A. Bekyashev. - 5th ed „ rev. and add. - Moscow: Prospect, 2008. - 1008 P.

at other international organizations whose activities are consistent with the statutory goals of IGO;

4. Legal entity status.

The legal status of IGO is determined by an international agreement, the charter, as well as a separate agreement between IGO and the state, the territory of which will be the location of the organization[7]. It is also allowed to apply additional international treaties to the activities of an IGO, for example, the Convention on the Legal Status, Privileges and Immunities of Interstate Economic Organizations Operating in Certain Areas of Cooperation, dated December 5, 1980. In addition, IGO has the right to develop its own internal rules aimed to regulate its activities[8]. The charter of the organization may establish the priority of such rules over the national legislation of the country of location of IGO.

International participation in such an IGO can be carried out in several formats:

- based on membership;

Membership is determined by an international treaty and IGO charter. Member states of the Organization are entitled to participate in the financing of the Institute and have equal rights in the management of the Organization.

- on the basis of bilateral and multilateral agreements on participation in the implementation of individual scientific programs (studies).

In this case, the legal basis for the participation of states, international and national research organizations and institutions, individual scientists who are not members of IGO, in the scientific activities of IGO are the above agreements. The agreements establish the scope of joint cooperation, mutual obligations of the parties, etc.

- in observer status:

The observer status allows one to participate in the prescribed manner in the work of the IGO supreme bodies in order to exchange information, organize cooperation and coordinate activities.

2. ERIC:

In addition to IGO, it is advisable to apply and carefully consider the legal form of the European neutron source (hereinafter - ESS).

Based on the provisions of the Treaty on the Functioning of the European Union of 1957 [9] and Council Regulation (EU) No 723/2009 of 25 June 2009, "The

[7]The legal basis for JINR regulation is the Agreement on the Organization of the Joint Institute for Nuclear Research of March 26, 1956 and the Charter of September 23, 1956 (with subsequent amendments). JINR official site [Electronic resource]. URL: http://www.jinr.ru/docs/ (appeal date: 09.09.2019).

[8]Regulation on the organization of experiments conducted by international collaborations using the capabilities of JINR basic facilities of January 24, 2017; JINR Code of Professional Ethics for JINR Workers July 16, 2018 JINR Official Website [Electronic resource]. URL: http://www.jinr.ru/docs/ (appeal date: 09.09.2019).

[9]Article 187: "The Union can create joint ventures or any other structures necessary for the effective implementation of research programs, technological development programs and demonstration programs of the Union."

legal basis for the European Consortium of Research Infrastructure in the Community", the European Commission decided[10] to establish an ESS in the form of a European Research Consortium infrastructure (hereinafter - ERIC).

Initially, ESS was created as a limited liability company under Swedish law (ESS AB (Reg. No. 556792-4096)[11]. However, on September 4, 2014, the Government of Sweden, together with the Government of Denmark, after consultation with all partners, decided to submit an application to the European Commission on the establishment of ERIC in accordance with Art. 5 of Council Regulation (EC) № 723/2009 and the transformation of ESS into ERIC form under EU law, the main task of which was to create and operate a research infrastructure that supports multinational cooperation.

Accordingly, a new tool has emerged within the EU to create a European research infrastructure with a legal entity recognized in all member states.

One of the primary tasks of ERIC is the establishment and operation of research infrastructure. [12].

With regard to legal status, ERIC - has an international legal personality, that is, is endowed with the status of an international organization. In each Member State, it has legal capacity granted to legal entities under the national law of a Member State.

An exhaustive list of categories of entities eligible to act as ERIC members is provided for in Art. 9 of Council Regulation (EU) № 723/2009.

ERIC members may be:

- EU member states;
- Associated countries (within the framework of the EU Framework Program for research, technological development and demonstration activities);
- third countries other than associated countries;
- intergovernmental organizations (it should be borne in mind that ICNR PIK can become a member of the ESS if established in the form of IGO).

Council Regulation (EC) No 723/2009 establishes the minimum requirements for the ERIC Charter (Art. 10), which can be used in the subsequent ICNR PIK when developing its own charter document.

The legal framework for the regulation of activities directly by ESS already

The official journal of the EU [Electronic resource]. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12016E187 (appeal date: 09.09.2019).

[10]Commission Implementation Decision (EU) 2015/1478 of August 19, 2015 on the Establishment of a European Neutron Source in the Form of a European Research Infrastructure Consortium.

The official journal of the EU [Electronic resource]. URL: https://eur-lex.europa.eu/legal-content/GA/TXT/?uri=CELEX:32015D1478 (appeal date: 09.09.2019).

[11]ESS was established in 2010.Ol. Hallonsten. Unpreparedness and risk in Big Science policy: Sweden and the European Spallation Source // Science and Public Policy, Vol. 42, Issue 3, 2015. P. 422.

[12]Art. 3 of Council Regulation (EU) № 723/2009.

includes the following acts:

- Council Regulation (EU) №723/2009 of June 25, 2009.;
- Implementing Commission Decision (EU) 2015/1478 of August 19, 2015;
- Charter approved by members of ESS ERIC;
- National legislation of the Kingdom of Sweden.

The provisions of the ESS Charter cover the following issues: name, location, working language, tasks and activities, membership, rights and obligations of members and observers, governing bodies, reporting to the European Commission, cooperation with third parties etc.

The Preamble to the ESS Charter identifies the initial participating states (founding states) and the initial observer states. It is worth noting that the Preamble already contains a provision on the possible participation in the activities of ERIC of other states, which applies to the Russian Federation.

Legal Form of ESS is proclaimed to be ERIC.

Art. 2 of the ESS Charter contains a wide range of ESS core tasks and activities:

- conducting research of a high level, technological development, innovation policy;
- providing effective access for interested parties etc.

With regard to membership and representation in the ESS, the following legal entities may become members or observers without the right to vote [13]:

- EU member states;
- Associate countries in the framework of the EU Framework Program for research, technological development and demonstration activities;
- third countries other than associated countries,
- intergovernmental organizations.

ICNR PIK can participate in the activities of ESS, being in the status of a third country or intergovernmental organization. In the latter case, the ICNR PIK must be established in the above IGO form.

However, it should be borne in mind that observer status does not provide voting rights at meetings of ESS governing bodies and there is no possibility of making contributions in cash and in-kind contributions.

The rights and obligations of members and observers are dedicated to Art. 6 of the Charter of the ESS.

Initial Member States contribute in cash or in kind regarding construction costs (installation costs).

Contributions of subsequent members are indicated in a separate Appendix to the Charter.

The procedure for calculating in-kind deposits is determined in the corresponding annex to the Charter (Basic rules and principles for making in-kind contribu-

[13] Art. 3 of the ESS Charter.

tions) and a separate agreement on in-kind deposits[14].

Each member contributes with respect to construction, operating and installation costs. Observers do not have these powers. Accordingly, if ICNR PIK intends to make a contribution both in cash and in kind, it is advisable to consider obtaining ESS member status.

An in-kind contribution is a contribution provided only by a member in relation to the organization and includes the following:

- Technical components for the construction of the ESS (personnel (employees) necessary for testing, installing and/or integrating any of the components);
- Research and development work;
- Employees for special construction tasks;
- Other components (products or services) necessary to complete the ESS.

A list of suitable in-kind contributions is contained in the Organization's Program Plan[15] and is distributed to all members.

Each in-kind contribution is made out by an appropriate written contract[16], which includes the annex - "Framework for the management of in-kind deposits for the period of construction work"[17] the so-called internal rules on deposits.

In addition, the ESS Charter allows for the conclusion of agreements with third parties - any individual or legal entity, if it considers it appropriate [18].

ESS is also required to provide effective access for European and international researchers and other interested parties.

[14]In-kind Contribution Agreement between European Spallation Source ERIC and [Partner] – Construction Phase (eng.).

[15]Programme Plan (eng.).

[16]In-kind Contribution Agreement between European Spallation Source ERIC and [Partner] – Construction Phase (eng.).

[17]Annex 1 – Framework for handling in-kind contributions during the construction phase (eng.).

[18]Art. 14 of the ESS Charter.

3. Conclusion:

Therefore, the most acceptable legal form for ICNR PIK is IGO. The international participation of ICNR PIK in the ESS, including the financing of its activities through contributions in cash and in kind, is acceptable if you have the status of an ESS member through the conclusion of international agreements. In addition to IGO, it is also possible to allow the introduction of a new legal form within the EAEU specifically designed for ICNR PIK with the participation of interested member states and third countries, similar to ERIC. However, it is necessary to preliminary agree on the development and adoption of the corresponding Protocol to the Treaty on the EAEU of May 29, 2014[19], in which issues of scientific and technical cooperation will be settled[20]. Currently, solely in the context of implementing the industrial policy within the framework of the EAEU, the member states can "conduct joint research and development activities with the aim of stimulating high-tech industries" (Article 92 of the EAEU Treaty).

References

1. International public law: a textbook / L.P. Anufrieva, K.A. Bekyashev, E.G. Moiseev, V.V. Ustinov (and others) / Resp. ed. K.A. Bekyashev. - 5th ed., rev. and add. - Moscow: Prospect, 2008 .-- 1008 P.

2. Zadumkin K.A., Terebova S.V. International scientific and technical cooperation: essence, content and forms // Problems of the development of the territory. 2009. № 3 (47). P. 22-30.

3. Kuzmin IV Trends in state regulation of innovative activity abroad // Questions of territorial development. 2014. № 10 (20).

4. Chetverikov A.O. Organizational and legal forms of big science (megascience) in the context of international integration: a comparative study part I. megascience as a scientific and legal phenomenon. Legal aspects of the functioning of mega-science in the form of international intergovernmental organizations and national legal entities // Legal Science. 2018. №1. P. 13-26.

[19]Treaty on the Eurasian Economic Union of May 29, 2014 // Access from the legal system "Guarantor".

[20]"Only by implementing a coordinated and complementary scientific and technical ... policy, can the EAEU member countries withstand global competition." The annual report of the Integration Club under the Chairman of the Federation Council "Eurasian Vector - Integration of the Future" (2017) [Electronic resource] URL:

http://council.gov.ru/media/files/sArGy2sXEAod9mudV4n6aiHuqABdRLnS.pdf (appeal date: 09.09.2019).

UDC 343.851

重新社会化和社会囚犯适应监禁的立法规制问题
PROBLEMS OF LEGISLATIVE REGULATION OF RE-SOCIALIZATION AND SOCIAL ADAPTATION OF CONVICTS TO IMPRISONMENT

Chigrinets Ekaterina Aleksandrovna
PhD student, Department of criminal law and criminology
The All-Russian State University of Justice
(RLA of the Ministry of Justice of Russia)
Moscow, the Russian Federation

注解。 本文分析了俄罗斯联邦刑事制度发展概念到2020年的实施情况。有必要更新有关进一步改革监狱服务的相关法律框架的必要性。 它提供了在国内刑事执法立法中确定再社会化和社会适应的定义。

关键词：刑事执法立法，累犯，再社会化，社会适应，囚犯矫正手段。

Annotation*. The article analyzes the implementation of the Concept of development of the penal system of the Russian Federation until 2020. The necessity of updating the relevant legal framework for the further reform of the penitentiary service is substantiated. It is offered to fix definitions of resocialization and social adaptation in the domestic criminal executive legislation.*

Keywords: *criminal-executive legislation, recidivism, re-socialization, social adaptation, means of convicts correction.*

By order of the Government of the Russian Federation of October 14, 2010 № 1772-p, the Concept for the development of the penal system until 2020 was approved. The concept involves the development of a set of measures aimed at enhancing positive factors and weakening the factors that provoke the growth of post-prison relapse. However, despite the importance of the provisions of the Concept, there are still problems that cannot be resolved by the provisions, or these solutions are practically not feasible.

In order to minimize the negative effects of isolation, the Concept as amended on September 23, 2015[1], provides for the development of new forms of educa-

[1]The concept of development of the penal system of the Russian Federation until 2020, approved by order of the Government of the Russian Federation of 14.10. 2010 № 1772-p. (as amended on September 23, 2015) // SZ RF. - 2010. - № 43. - Art. 5544.

tional work with prisoners; the organization of the educational process and employment in the new conditions of serving the sentence; improvement of criminal and penal enforcement policies aimed at the socialization of convicts; creation of conditions for a gradual reduction in the number of convicts held in the same dwelling, and other forms.

However, at the moment, many progressive ideas of the Concept are not implemented in practice. Also, in addition to the positive aspects, the Concept contains a number of provisions, the implementation of which can negatively affect the personality of the convicts. For example, the Concept includes the following provision: "development of disciplinary measures for minor offenses" (ban on playing sports and participating in cultural events, ban on using television and the press, entertainment literature, etc.). According to V.I. Seliverstov[2], the prison term proposed in the Concept with strict isolation of convicts can lead to increased desocialization and the loss of socially useful connections for those convicts who still have such connections. In criminological terms, the increased desocialization of convicts is fraught with an increase in the level of post-prison recidivism and, as a result, the disappointment of society in the effectiveness of measures taken to combat crime.

The provisions of the PC RF are aimed at the re-socialization of prisoners sentenced to imprisonment, fixing the basic, special rights and legitimate interests of prisoners. PC RF also contains a list of the main means of correction of convicts (Part 2 of Art. 9 of the PC RF), including labor, vocational education and training (Art103 to 106 of the PC RF, Art.108 of the PC RF), educational impact (Art.109-110 PC RF, Art.112-113 PC RF), as well as the possibility to improve the conditions of detention (Part 1, Part 2 Art.120 PC PC RF) while serving a sentence, depending on the behavior and attitude to work , Part 1, Part 2 of Art. 122 PC RF, Part 1, Part 2 of Art. 124 of PC RF, Part 3, Part 4 of Art. 127 of PC RF, Art. 129 of PC RF, Part 4, Part 5, Art. 130 PC RF, Part 2, Part 4, Art. 132 PC RF).

It should be noted that the term "resocialization" itself is not enshrined in PC RF, but it is claimed by the legislator in other regulatory legal acts. So, in accordance with the Concept, it is planned to "supplement the system of rewards for convicts with other incentives for law-abiding behavior and active resocialization".

The re-socialization of prisoners sentenced to imprisonment is impossible without their social adaptation, which is a set of measures and means aimed at preparing for life in freedom. Social adaptation is an essential component of resocialization. In accordance with the penal legislation of the Russian Federation, the

[2]Seliverstov V. I. Report on the Concept of development of the penal system in the Russian Federation at a meeting of the Union of Forensic and Criminologists (02.15.2011 - Moscow State Law Academy). Utopia instead of the Concept. URL: http://www.crimpravo.ru/blog/ugolovno-ispolnitelnay_systema/768.html (access date: 30.05.2018).

preparation of convicts for release begins 6 months before the end of the sentence (paragraph "a", part 1 Art. 97, part 3 Art. 121, part 5 Art. 132, part 4 Art.133, part 1, part 2 Art. 180 PC RF), while this task should be subordinated to the whole process aimed at correcting the convicts, and begin from the first days of the execution (serving) of the sentence. Obviously, the level of recidivism in the country depends on the effectiveness of the measures taken, and therefore the safety of society as a whole.

To achieve this goal, it is necessary to solve such problems as the social adaptation of prisoners during the period of serving their sentences in correctional institutions and the provision of post-prison assistance to persons released from places of imprisonment.

The social adaptation of prisoners to imprisonment is facilitated by socially useful work, obtaining general and higher education, vocational training, social impact, as well as maintaining contact with the outside world (visits(Art. 89 PC RF); receiving parcels, packages and parcels (Art. 90 PC RF); correspondence, receipt and sending of money transfers (Art. 91 PC RF); telephone calls (Art. 92 PC RF); watching movies and TV shows, listening to radio broadcasts (Art. 94 PC RF); the ability to travel without a convoy or escort outside of correctional facility (Art. 96 PC RF); trips outside the correctional institution (Art. 97 PC RF)), the possibility of changing the type of correctional institution (part 2 of Art. 78 PC RF), preparation for release (part 3 of Art. 121 , Part 4 Art. 133 PC RF, Art. 180 PC RF).

However, the type of correctional institution, the task of which would be the social adaptation of convicts (similar to European open prisons)[3], is not provided for in the penitentiary system itself, and Part 3 Art. 78 PC RF does not allow the gradual integration of all categories of prisoners and their transfer to a colony-settlement, even before release. The rules of the regime cover all spheres of life of prisoners sentenced to imprisonment. Obviously, such a detailed regulation of the daily routine in the correctional institution does not stimulate the convicts' sense of responsibility, does not contribute to their independence, and impedes social adaptation and subsequent reintegration into society. This is the biggest difficulty in realizing the tasks of the penitentiary regime and in neutralizing its negative factors[4].

In general, even in the presence of the totality of rights proclaimed in the law [5] [6], a

[3]Borsuchenko S. A. Social adaptation of convicts and measures to ensure it: the experience of foreign countries // RPA Bulletin. - 2013.- №. - P.41-44.

[4]Borsuchenko S. A. The regime for the execution (serving) of sentences and the problems of its legislative regulation // Monitoring of enforcement. - 2016. - № 1. - P.54-58.

[5]Standard Minimum Rules for the Treatment of Prisoners (adopted at the first UN Congress on the Prevention of Crime and the Treatment of Offenders on August 30, 1955, approved by the Economic and Social Council at the 994th plenary meeting on July 31, 1957). Access from LRS "Garant".

[6]United Nations Standard Minimum Rules for the Treatment of Prisoners (Mandela Rules). Adopted by General Assembly resolution 217 A (III) of 05.21.2015. The official website of the United Nations.Access from LRS "Garant"

person does not receive real opportunities for their use. In our opinion, first of all, the convict should be provided with conditions in which he could make a free, informed choice between law-abiding behavior and violation of the law. The process of execution (serving) of a sentence of imprisonment must be subordinated to the main task - preparing prisoners for life in freedom, which is quite difficult in isolation.

Based on the above reasoning of the relevance of the issue, it is necessary to highlight the aspect of legislative regulation of resocialization in the Russian Federation today. So, in accordance with part 2 of Art. 1 PC RF[7], assistance in the social adaptation of convicts is one of the tasks of the penal law. Fixing this task in the PC RF shows how important and relevant this function of the penal system is.

Art. 9 PC RF defines the concept of correction of convicts and its fixed assets. Correction of convicts means the formation of a respectful attitude towards a person, society, work, norms, rules and traditions of human society and the promotion of law-abiding behavior (Part 1 Art. 9 PC RF). In accordance with Part 2 Art. 9 PC RF, the main means of correction of convicts are: the established procedure for the execution and serving of sentences (regime), educational work, community service, general education, vocational training and social impact.

It should be noted that the law refers only to general education. At the same time, the convict's desire to get a higher education needs to be stimulated, because, according to statistics, "relapse among people who received higher education during their sentence ... is more than 5 times lower than that of convicts who haven't studied at universities"[8].

However, according to some authors, "correcting a person" by another person seems impossible. A.F. Stepanyuk and V.M. Trubnikov[9] draw attention to the fact that the idea of the possibility of correcting convicts was an integral part of the communist ideology developed by the leaders of the CPSU and the Soviet state. B. Z. Malikov[10] explicitly writes about the need to exclude the concept of "correction of convicts" from the penal legislation. It should be emphasized that the goals of criminal punishment have always been different, along with the means and objectives of their achievement (Art. 43 CC, Art. 9 PC RF)[11].

[7]The Penal Code of the Russian Federation of 01.01.1997 № 1-ФЗ (as amended on 04/05/2017). Access from LRS "Consultant Plus".

[8]Aleksandrov Yu. It's not too late to study in prison // Captivity. - 2006. -№ 6. URL: http://www.ckofr.com/obrazovaniye/85-uchitsya-i-v-tyurme-ne-pozdno (access date: 22.03.2016).

[9]Stepanyuk A. F., V. M. Trubnikov. Execution of sentences of imprisonment and features of post-prison adaptation of those released: Textbook - Kiev: Publishing house of the UMK VO, 1992. - 95 P.

[10]Malikov B.Z. Theoretical problems of the nature and content of deprivation of liberty and their expression in the criminal and penal legislation of Russia // Aut. dis ... Dr. jur. sciences. Ryazan, 2004. - 56 P. - P.13.

[11]Kozlov A. P. Criminal liability: concept and forms of implementation: monograph; Ministry of the agricultural economy of the Russian Federation, FSBEI HPE "Krasnoyarsk State Agrarian University". - Krasnoyarsk: Krasnoyarsk State Agrarian University, 2013. - 620 P. - P. 48.

A similar ambiguous view of the legislator on the goals and objectives of criminal punishment is evidence of the state's attention to its citizens and the desire to achieve a positive result by convicting the perpetrator and applying one or another punishment to him, using means aimed at his re-socialization.

Work has long been recognized as an effective mean of correcting convicts. In this regard, part 1 Art. 103 PC RF enshrines the duty of each convict to work, taking into account individual characteristics. The "Model Regulation on the center for the labor adaptation of convicts or the training and production (labor) workshop of an institution that executes criminal sentences in the form of imprisonment"[12] sets forth the main tasks and functions of the centers (workshops). So, one of the main tasks of the center (workshop) is to instill inmates with the necessary labor skills and respect for work, create conditions for moral and material interest in the results of work.

Work in a correctional institution pursues not only educational, but also economic goals: it helps the state reimburse part of the costs of maintaining a correctional institution. However, it should not be regarded as a coercive measure. In accordance with Part 2 Art. 103 PC RF, convicted men over 60 years old and convicted women over 55 years old, as well as convicted persons with disabilities of the first or second group, are involved in work at their request in accordance with the legislation of the Russian Federation on labor and the legislation of the Russian Federation on social protection of persons with disabilities. Convicted minors are involved in labor in accordance with the legislation of the Russian Federation on labor.

The function of well-organized labor is that it allows the correctional institution to function normally in modern conditions, to provide for the needs of the convicts themselves, gives them the opportunity to help their families, and also to save some money for the rehabilitation after serving the sentence. According to the Federal Penitentiary Service, the wages of convicts from 2013 to 2015 increased by 11.6% (from 195.5 rubles to 218.6 rubles per day per person). There is a positive trend in the repayment by convicts of claims for writ of execution. 84.5 thousand people were employed and repaid, which amounted to 51.3% of the total number of persons in this category (46.2% as of 2013).

Art. 108 PC RF enshrines the norm of organizing a correctional institution for the provision of primary vocational education or vocational training for convicts. Getting a profession in a penitentiary institution, in which a convicted person can work at large, is an important part of his preparation for release. In the 2016/17 academic year, 162.5 thousand prisoners were trained in the working profession, including 112.8 thousand prisoners in educational institutions of the Federal Penitentiary Service of Russia, and 48.2 thousand prisoners were sent to work in cor-

[12]Appendix No. 1 to the order of the Ministry of Justice of the Russian Federation of April 1, 2008 No. 80. An approximate provision on the labor adaptation center of convicts or the training and production (labor) workshop of an institution that executes criminal sentences of imprisonment. Access from LRS "Guarantor".

rectional facilities. After graduation, 86.8 thousand convicts, or 52.8% of those trained, were employed (in 2013 - 50.6%)[13].

A special place in the penal system is taken by educational work. Of great importance is given to acquainting convicts with the cultural heritage of the world, the formation of their involvement in spiritual values. An important role is played by physical education. In addition to physical education, convicts receive knowledge about the basics of human physiology, maintaining a healthy lifestyle.

In addition to correctional institutions, public associations and socially-oriented non-profit organizations also contribute to the process of social adaptation of the convicted person. In particular, subparagraph 4 of paragraph 1. Art. 22 №. 76-ФЗ "On public control over ensuring human rights in places of forced detention and on assistance to persons in places of forced detention" dated June 10, 2008[14] (as amended on December 27, 2018) determines that one of the main forms of assistance to public associations to persons in places of forced detention is: "assisting the administration of the place of forced detention in creating new jobs for prisoners sentenced to prison, placing production orders in correctional facilities and their enterprises."

Of great importance is the interaction of convicts with religious organizations. So, on February 22, 2011, a "Cooperation Agreement" was signed between the Russian Orthodox Church and the Federal Penitentiary Service of Russia. Currently, 487 churches of the Russian Orthodox Church operate in the institutions of the Federal Penitentiary Service of Russia, 568 prayer rooms operate. The construction of another 61 places of worship continues. In a number of constituent entities of the Russian Federation, 252 Sunday schools have been organized where over 9.5 thousand convicted believers undergo religious training.

Due to the fact that in accordance with the Decree of the President of the Russian Federation № 314 "On the System and Structure of Federal Executive Bodies" dated 03/09/2004 (as amended on 12/07/2016)[15], the FSIN is a service subordinate to the Ministry of Justice, issues of social adaptation are also regulated by departmental regulatory legal acts. In particular, Order of the Ministry of Justice of the Russian Federation No. 262 "On approval of the Regulation on the social protection group of convicts of the correctional institution of the penal system" of December 30, 2005 (as amended on July 21, 2016)[16] establishes the legal basis for social work with convicts.

[13]Report on the results and main lines of activity for 2015-2017 of the Federal Penitentiary Service. Official site of the FSIN.URL: http://fsin.su/structure/inspector/iao/Doklad/DROND%202015-2017.pdf (access date: 22.02.2019).

[14]The Federal Law "On Public Control over the Ensuring of Human Rights in the Forced Detention Places and on Assistance to Persons in the Detention Places" dated 10.06.2008 N 76-ФЗ. Access from LRS "Consultant Plus"..

[15]Decree of the President of the Russian Federation of March 9, 2004 N 314 (as amended on December 7, 2016) "On the system and structure of federal executive bodies". Access from LRS "Consultant Plus".

[16]Order of the Ministry of Justice of Russia dated 30.12.2005 N 262 (as amended on 07/21/2016) "On approval of the Regulation on the social protection group of convicts of the correctional institution of the penal system". Access from LRS "Consultant Plus".

Thus, the material presented allows us to conclude that the criminal-executive legislation of the Russian Federation contains norms that enshrine the legal aspects of the social adaptation of persons sentenced to imprisonment. However, there are no clearly defined definitions of resocialization and social adaptation. The established tasks, measures and norms are not sufficient to implement the processes of resocialization and social adaptation of prisoners sentenced to imprisonment and to prevent relapse. There is a need for legislative regulation and normative fixing of terms for the subsequent development of plans for the implementation of resocialization and social adaptation of imprisoned.

References

1. Aleksandrov Yu. It's not too late to study in prison // Captivity. - 2006. -№ 6. URL: http://www.ckofr.com/obrazovaniye/85-uchitsya-i-v-tyurme-ne-pozdno (access date: 22.03.2016).

2. Borsuchenko S. A. The regime for the execution (serving) of sentences and the problems of its legislative regulation // Monitoring of enforcement. - 2016. - № 1. - P.54-58.

3. Borsuchenko S. A. Social adaptation of convicts and measures to ensure it: the experience of foreign countries // RPA Bulletin .- 2013.- №. - P.41-44.

4. Kozlov A. P. Criminal liability: concept and forms of implementation: monograph; Ministry of the agricultural economy of the Russian Federation, FSBEI HPE "Krasnoyarsk State Agrarian University". - Krasnoyarsk: Krasnoyarsk state. Agrarian University, 2013. - 620 P. - P. 48.

5. Malikov B.Z. Theoretical problems of the nature and content of deprivation of liberty and their expression in the criminal and penal legislation of Russia // Aut. dis ... Dr. jur. sciences. Ryazan, 2004. - 56 P. - P.13.

6. Seliverstov V. I. Report on the Concept of development of the penal system in the Russian Federation at a meeting of the Union of Forensic and Criminologists (02.15.2011 - Moscow State Law Academy). Utopia instead of the Concept. URL: http://www.crimpravo.ru/blog/ugolovno-ispolnitelnay_systema/768.html (access date: 30.05.2018).

7. Stepanyuk A. F., V. M. Trubnikov. Execution of sentences of imprisonment and features of post-prison adaptation of those released: Textbook - Kiev: Publishing house of the UMK VO, 1992. - 95 P. - P.20.

技能护照作为教育高等教育机构毕业生专业成长的指标
SKILLS-PASSPORT AS INDICATOR OF PROFESSIONAL GROWTH OF THE GRADUATES OF PEDAGOGICAL HIGHER EDUCATION ESTABLISHMENTS

Kungurova Irina Michaelovna
Candidate of Pedagogic Sciences, Dean at the Faculty of Humanities
Slizkova Elena Vladimirovna
Candidate of Pedagogic Sciences, Associate Professor, Head of the Department of Pedagogy and Psychology
Fadich Diana Nikolaevna
student
P.P. Ershov Ishim Pedagogical Institute, branch of University of Tyumen

抽象。 本文将未来专业人员软技能的发展问题作为现代教育大学的主要任务，以及确保这一过程成功的手段。 现代教师需要具备一定的技能：交际识字，时间管理，项目管理，情商等。对所述问题最普遍的解决方案是技能护照 – 一种专业的投资组合，展示了教育专业毕业的专业技能 大学有这些技能的知识水平。

关键词：技能，软技能，软技能发展，教师培训大学，技能护照，专业组合，数字空间，专业活动，专业环境，研究生。

Abstract. *The article considers the problem of development of soft skills of future professionals as the main task of a modern pedagogical university, as well as the means to ensure the success of this process. A modern teacher needs to have a number of skills: communicative literacy, time management, project management, emotional intelligence, etc. The most universal solution to the stated problem is Skills passport - a professional portfolio that demonstrates what professional skills a graduate of a pedagogical university has and what is his level of knowledge of these skills.*

Keywords: *skill, soft skills, development of soft skills, teacher training university, Skills-passport, professional portfolio, digital space, professional activity, professional environment, graduate.*

Recently, when employing a young specialist, employers have been interested not only in the diploma of a graduate of an educational institution, but also in his relationship with WorldSkills - having a Skills passport and participating in

professional competitions. All available information regarding Skills passports is mainly related to graduates of SWP - specialists in working professions who demonstrate their competencies during demonstration exams. We want to touch on those skills that are very difficult to diagnose, and take as an example students of pedagogical universities. These skills are soft skills.

In the context of our studies of the preparation of a competent graduate of a pedagogical university, it would be correct to define the digital space of a pedagogical university as an environment built by integrating information on traditional and electronic media, computer-telecommunication interaction technologies, including extended didactic support, according to implemented educational programs that contribute to the development of student of a pedagogical university synergetic competency system for effective active implementation of professional activities in the information society.

Global informatization of educational environments leads to the formation of an information space, a new, informational, lifestyle and professional activity. Informatization of society forms a new information culture of a person - a person who knows how to work in the context of the introduction of information technology, computerization, mediatization and intellectualization of all spheres of human activity.

New educational goals are based on the priority of the individual, the development of which should become the main value and the most important result of education, which is ensured by the practical orientation of the educational process. Today, higher professional education is not just aimed at improving the level of education, professional competence of a person, but forms a new type of emotional intelligence, a different way of thinking.

We completely agree with the opinion of A.V. Mamatov, that "the future of Russia depends on the education of people, on their desire for self-improvement and the use of their skills and talents. The future of Russia will depend on motivation for innovative behavior of citizens and on the return that each person brings. The development of national education systems is becoming a key element of global competition and one of the most important life values" [3], which explains the recent close attention to education and the formation of a "new"person.

In this regard, the development of soft skills of future professionals is becoming the main priority task of a modern pedagogical university, so the question of the means to ensure the success of this process is of both scientific and practical interest.

In regard to soft skills, everything is not so simple. These are skills whose manifestation is difficult to recognize, see and diagnose. An effective way to overcome the difficulties that may arise may be the educational and production types of practices within the framework of the development of the main educational

program implemented by the pedagogical university. From our point of view, soft skills are associated not with a specific type of professional activity, but with the communications generated by certain actions in society. The level of these communications is the thing that affects the level of development of a particular skill. Universities are guaranteed to provide students with the opportunity to learn and master hard skills, as evidenced by diplomas and certificates. There are no ready-made algorithms for mastering soft skills. Here, most likely, the student's personal motive is more important than the prepared step-by-step instructions.

The Federal State Educational Standard for Higher Education (hereinafter referred to as the FSE HE) of the training direction 44.03.05 Pedagogical education (with two training profiles) provides for the following types of practices:

- educational: orientation, technological (design and technological), research work (obtaining primary skills of research work);
- production: pedagogical, technological (design and technological), research work.

On average, the volume of the bachelor's program, which is required for the development of all types of practices, is 60 c.u, which allows the bachelor to focus on the development of the required skill.

As an example, we describe how to organize the development of students' ability to save time in practice. It should be noted that time management is a very important skill that allows not only directing this important resource in the right direction, but also deriving great benefit from it, primarily for oneself. In today's world, time management is the basis of personal effectiveness and productivity. This skill allows a person to cope with a fast pace of life, to solve important tasks. To this end, students learn how to create their own time codifiers (time limits of the working day) in order to take an inventory of time spent, in which they choose the time costs in everyday life (in the context of individual time management (hereinafter referred to as TM) or in an adapted professional environment (in context of role TM). At the same time, they learn to conduct an express analysis of the daily time spent using the organizer for a qualitative time analysis, take an inventory of the time spent yesterday from memory and plan tomorrow taking into account the reflective analysis of the effectiveness of the past day. When filling out the organizer, the previously developed working day time codifier is used; a quantitative and qualitative analysis of the daily time spent on all types of actions and activities is carried out. A mandatory point is the reflection stage, when after filling in the organizers, students need to be informed which of the express analysis indicators (usefulness, productivity, efficiency, etc.) turned out to be the most unexpected for them, made the greatest impression and why. The effectiveness of the work done is also determined by the ability of students to create mental maps of daytime interference, describing the interference itself, possible causes of their occurrence

and ways to deal with them. A prerequisite is the subsequent organization of a group discussion with an emphasis on discussing the effectiveness of the proposed methods of overcoming interference.

Practice shows that the development of soft skills in the environment of a pedagogical university is facilitated by the personal motive of each student, and it depends only on him to what extent his personal qualities will help him master the first professional tests at this stage, and then make a successful professional career, determine him productivity in a professional competitive environment.

Analyzing employers' profiles for 3 years, we came to the conclusion that a modern teacher needs to have a number of skills: communication literacy, time management, project management, emotional intelligence, etc. The high level of development of soft skills determines its success and effectiveness, popularity among colleagues and children.

The most universal solution to this situation will be a Skills passport, that include: general information about the graduate; level of generated meta-competencies in accordance with FSE HE and Professional Standards. The holder of the Skills passport will have obvious advantages over other candidates for the vacancy, as he has confirmed his real skills and has proved his desire to further develop in a professional environment. Graduates of a pedagogical university with a Skills passport are always more in demand on the labor market, as they are fully prepared for the challenges of this professional society, ready to work in it.

Skills-passport is a kind of professional portfolio that demonstrates what professional skills a graduate of a pedagogical university has and what level of possession of these skills he have [5].

Skills-passport is a phenomenon that is already deeply rooted in the SWP system, which prepares specialists in working professions. Regarding the system of higher education, this issue has not been studied enough, despite such a clear interest in modern studies to the problem of developing soft skills.

The national project "Education" provides for the expansion of forms and assessments of soft skills that confirm the graduate's professional priorities.

The picture of the formation of a soft skill is determined by the presence of the elements included in it: the skill group, skill and diagnostic tools for assessing its development level (Table 1).

Table 1

Skills-passport landscape

№	Group of soft-skills	Skills	Skill Assessment Methods
1	Communicative literacy	- connected, clear constructive speech - active listening, - the ability to negotiate and to make arrangements(the ability to explain, persuade and argue), - presentation and self, -presentation, - public performance, - business writing skills,	- observation of the behavior at the interview - open interview - cases of communicative literacy assessment - personality test questionnaires - business games
2	Interpersonal skills	- teamwork, - communication with people, - Conflict Management, - employee management (leadership)	- interview on projective issues - open interview
3	Self-management	- management of emotions, stress, own development, - planning and goal setting, - time management, - energy, enthusiasm, initiative, - perseverance, - reflection - use of feedback	- interview on projective issues - situational interview
4	Adaptability	- the ability to adapt to change, - management of several tasks, - the ability to select new technologies and adapt to changing conditions, - loyalty	- interview on projective issues - situational interview
5	Effective thinking	- systemic, creative, structural, logical, design, tactical, critical and strategic thinking, - search and analysis of information, - development and decision making	- situational interview - interview by the case method
6	Research skills	- the ability to evaluate and analyze situations, - the ability to find prospects and determine growth points, - the ability to collect more unique information	- situational interview - interview by the case method

№	Group of soft-skills	Skills	Skill Assessment Methods
7	Foresight Management	- skills of organization, planning and effective implementation of projects and tasks - motivation - mentoring, - coaching - Feedback	- quiz tests - interview by the case method
8	Problem solving skills	- the ability to use creativity, analysis of the situation, perspective vision of outcomes, past experience, information and available resources to solve problems, - conflict-free	- STAR Behavioral Interview - situational interview - interview by the case method
9	Business Process Optimization	- the ability to save time and resources, - time management, - ability to work in a team	- competency interviews (STAR behavioral interview) - business games - situational interview.
10	Work ethic	- the ability to perform work professionally, - responsibility, - value attitude to the performed activity, - reliability - the ability to do work the first time	- competency interviews (STAR behavioral interview) - interview by the case method
11	Emotional intellect	- social awareness - the ability of self-government, - management of emotions, - real interaction with others, - sense of tact, - timely response	- quiz tests - stress job interview

We believe that the landscape of Skills passport presented above can be expanded by adding both the skills themselves and diagnostic tools, which will allow to get the most accurate picture regarding the level of soft skills development of a student at a pedagogical university, which will be further reflected in his Skills passport, which will allow the future employer to see what professional skills the young man possesses and what his level of knowledge of these skills is.

Thus, we came to the conclusion that the timely interaction of the student and the professional environment determines the graduate's professional development and ensures the formation of a synergetic system of key, general professional, specialized and highly specialized competencies and the development of soft skills for the effective implementation of professional and pedagogical activities in the information society based on new axiological axiological values, which reflects current trends in domestic education. How fully formed and developed these competencies and skills are is fully demonstrated by the Skills passport of the graduate, the need for which is determined by modern reality.

References

1. Batsunov S.N., Derecha I.I., Kungurova I.M., Slizkova E.V. Modern determinants of the development of soft skills // Scientific and methodological electronic journal "Concept". - 2018. - № 4 (April). - P. 198–207. – URL: http://e-koncept.ru/2018/181018.htm.

2. Kalinin S.I. Time Management: Time management workshop. -SPb: Speech, 2006. - 371 P.

3. M Methodology for the use of distance educational technologies by university teachers / A.V. Mamatov, A.N. Nemtsev, A.G. Klepikov, A.I. Shtifanov. - Belgorod: Publishing House of BelSU. - 2006. - 161 P.

4. Portland U. What are soft skills and why are they so important for a career? – URL: http://dnevnyk-uspeha.com/rabota-ikarera/chto-takoe-soft-skills-i-pochemu-oni-tak-vazhnyi-dlya-kareryi.html.

5. Prokopiev D. Golikova: Russian companies are ready to hire by Skills Passport. – URL: https://www.tatar-inform.ru/news/2019/08/23/660298/.

6. Shipilov V. List of soft-skills and methods for their development. – URL: https://www.cfin.ru/management/people/dev_val/soft-skills.shtml.

7. Yarkova T. A., Cherkasova I. I. The formation of flexible skills in students in the implementation of the professional standard of the teacher // Bulletin of the Tyumen State University. Humanitarian research. Humanitates - 2016. - Volume 2. - № 4. - P. 222-234.

8. Slizkova E.V. Kungurova I.M. Fadich D.N. (2018) Formation of the bachelors' soft skills while studying foreign languages. The European Proceedings of Social and Behavioural Sciences, 110, 941-959.

青少年沟通技巧的形成
FORMATION OF COMMUNICATION SKILLS IN ADOLESCENTS

Voronina Evgeniia Vladimirovna
Candidate of Pedagogic Sciences, Associate Professor
Derecha Irina Ivanovna
Candidate of Pedagogic Sciences, Associate Professor
Ermakova Elena Vladimirovna
Candidate of Pedagogic Sciences, Associate Professor
P.P. Ershov Ishim Pedagogical Institute
branch of University of Tyumen

抽象。 沟通技巧的形成问题在现代社会中尤为重要。 作者分析了沟通能力的概念，其结构组成部分，沟通技巧，确定培训潜力并评估其在实践中的有效性。
关键词：沟通能力，沟通技巧，青少年，团体形式，沟通培训

Abstract. *The problem of the formation of communication skills is of particular relevance in modern society. The authors analyze the concept of communication competence, its structural components, communication skills, determine the training potential and evaluate the effectiveness of their use in practice.*
Keywords: *communication competence, communication skills, adolescents, group forms, communication training*

Problems associated with communication skills, interpersonal communication and understanding have been relevant for centuries and are now becoming increasingly important for many social sciences [4].

Communication is of particular importance for adolescents, because for the transitional age, communication with other peers is a priority in the further formation and development of the individual, is the main activity. To achieve mutual understanding with the interlocutor, a teenager must have the abilities, skills and competencies in communication. Whether or not a teenager successfully learns to build relationships with adults, his parents, and as peers in this period, will determine his satisfaction with his professional and personal life in the future.

Communication performs various functions: personality-forming (communication is a prerequisite for the formation of a person's personality: "not who you born with but who you eat with");

- communicative (information transfer);
- instrumental (communication acts as a mechanism of social management for the implementation of certain actions of people, joint activities, decision-making, etc.);
- expressive (allows partners to express and understand each other's feelings, emotions, relationships in communication);
- psychotherapeutic (communication, confirmation of people's attention to a person – is a necessary factor in maintaining psychological comfort, positive emotional well-being, physical health of a person.
- integrative (communication unites people);
- socializing (through communication, the assimilation of cultural norms and values of a certain society takes place);
- self-expression function (communication allows to demonstrate the personal, intellectual potential of a person, his individual characteristics).

Yu.M. Zhukov noted that communication competency is the "core formation" of an individual. Following this, according to psychological and pedagogical research, the author identified the following components of communication competence:

1) The emotional component, which includes emotional responsiveness, empathy, sensitivity, the ability to empathize and sympathize with another, to be attentive to the actions of partners.

2) Associated with the knowledge of another person, with the ability to anticipate the behavior of another person, the ability to effectively solve various problems that arise between people, that is, the cognitive component.

3) A behavioral component that reflects the adolescent's ability to cooperate, collaborate, to show initiative, to communicate adequately, and also includes organizational abilities, etc. [2].

An important component of communicative competence is communication skills, which are considered as a manifestation of the internal resources of adolescents necessary for effective communication in a situation of interpersonal interaction, as a manifestation of the ability to establish and maintain necessary contacts with other people.

For adolescents, given their individual psychological characteristics, group work is the best.

Following Vachkov I.V. we list the advantages of working in groups, emphasizing their essence:

1. Group experience counteracts exclusion, helps to solve interpersonal problems. When working in a group, a teenager discovers that his problems are not unique, that others experience similar feelings. For many, such a discovery in itself is a powerful psychotherapeutic factor. And as an answer, avoiding the unproductive closure of the teenager in himself with his difficulties.

2. The group reflects society in miniature, making hidden factors such as partner pressure, social influence and conformism obvious. In fact, the group simulates a system of relationships and interconnections, characteristic of the real life of the participants. And therefore it is a good school of life.

3. In a group, a person can learn new skills, experiment with different styles of relationships between equal partners. If in real life such experiments are always associated with the risk of misunderstanding, rejection and even punishment, then the groups act as a kind of "platform for psychological testing," where you can try to behave differently, try on new behavior, learn to relate to yourself and to people - everything is in an atmosphere of goodwill, acceptance and support.

4. In the group, participants identify with others, can "play" the role of another person, in order to better understand him and get acquainted with new effective behaviors used by others.

5. The ability to get support from people with situations like you. In real life, not all people have a chance to get sincere, non-judgmental feedback that allows them to see their reflection in the eyes of other people who perfectly understand the essence of your experience, since they themselves experience the same thing.

6. Teamwork creates tension that helps clarify everyone's psychological problems. At the same time, psychological stress in the group can (and should) play a constructive role, the task of the facilitator is to prevent stress from getting out of control and destroying productive relationships in the group.

7. The group facilitates the processes of self-knowledge, self-study. Without other people in the group, these processes are completely impossible. By opening yourself to others and opening yourself to yourself, you can understand, change yourself and increase your confidence [1].

In the group, through built-up systems of psychological exercises and games, participants have the opportunity to see themselves from the side, their own difficulties through the eyes of other people, it's safe for themselves to try on many new roles, acquire the required communication skills and abilities, which could not be acquired before in the early age, in the family, to master new forms of behavior, accept and, in the end, solve their problems, be happy. All this is important, since it is in communication that we can feel valued, recognized, loved, that is, satisfy the basic social needs of the individual.

The effectiveness of the formation of communication skills of adolescents is ensured by their intensive involvement in communicative activities, the use of active forms of training and education: trainings (information-training, self-regulation, development of reflection) of business, story and role-playing games, discussions, etc.

Communication skill is closely related to the future development of an adult and responsible person, therefore it is very important not only to know the rules of communication, but also to be able to apply them in practice.

Communication training can be considered as the most effective form of group work in the desired direction.

Training is one of the leading methods of practical psychology, based on a number of psychotherapeutic, psychocorrectional and psycho-forming methods.

In its most general form, the training is aimed at increasing the general cognitive competence of each member of the training group, including the development of skills of self-knowledge, self-regulation, communication, interpersonal and intergroup interaction, etc.

V.G. Romek by training, implies any curriculum or set of procedures designed so that as a result of their implementation a final product is obtained in the form of an organism capable of some specific reaction (s) or participation in some complex, demanding activity skills [4].

Socio-psychological training is a type of psychological training of the communicative side of activity. In communication, the thoughtful or substantive aspect and the aspect of interaction, or procedural, are distinguished. In socio-psychological training, in addition to the procedural side, such a substantial aspect as the psychological meaning of communicative acts is also considered. Moreover, communication itself, being filled with such content, is considered as an independent task, in contrast to understanding it as a secondary, auxiliary component of activity in solving various problems.

Implementation of the training requires compliance with a group of interrelated principles that determine its effectiveness and the extent to which the results are transferred to reality: the principles of creating a training environment, principles that characterize the behavior and activities of group members, ethical and organizational principles.

Communication training for adolescents allows one to develop skills in social behavior and interaction. Classes in the framework of exercises for communicative training for adolescents will help children acquire important skills for a future life:

- identification of non-verbal cues;
- understanding and respect for the boundaries of another person;
- ability to listen and be heard;
- ability to communicate and get in touch with the add-in;
- interoperability adjustment.

The structure of socio-psychological training traditionally includes the following components: greeting, warm-up, basic exercises, reflection.

The greeting serves to get acquainted with the group, to establish a friendly atmosphere in the team.

The purpose of the warm-up is to accelerate the process of forming the participants' trust in each other, creating a friendly atmosphere of communication and promoting the activation of participants.

In the basic exercises, those skills and abilities that the participants came for to the training are trained directly.

Reflection is carried out to summarize the results of the lesson, to analyze the group and individual work of the participants, and to make the participants aware of the experience gained. Getting feedback for a trainer.

The program was created taking into account the emotional, cognitive, behavioral criterion of communicative competence and is aimed at the development and formation of communication skills in adolescents; to get acquainted with the methods of self-regulation: the reflection of one's own behavior is taught to understand one's feelings and relationships with others the formation of a temporary perspective and goal-setting, as well as an increase in the sense of responsibility for one's behavior and a decrease in tension arising from maladaptation in family or social group relationships.

The main part of the classes is aimed at developing communication skills. The topics of the lessons reflect the personal problems of children of this age, so they can be used for all students as a prevention of adverse processes. In the classroom, adolescents gain knowledge about how to communicate, practice using acceptable methods of behavior, and master the skills of effective communication.

Characteristic features of the program are the presence of a block of personal support aimed at increasing self-esteem and its adequacy. In addition, the training uses such methodological tools as discussions, role-playing games, and actions in reality.

This course helps to establish adequate interpersonal relationships, increase communication skills, strengthen respect for others and self-esteem, and adjust ones behavior.

In the process of conducting classes, the leader monitors the relations of participants, tries to prevent situations leading to conflicts, and forms friendly relations among adolescents. Thus, this lesson is aimed at developing communication and teamwork skills. The goals and objectives of this lesson have been fully realized. The children received verbal and non-verbal communication skills, while doing the exercises they felt that it was very important to correctly transmit information to the interlocutor and also to receive it so that there would be no misunderstanding.

The pedagogical value of this lesson will be that during further communication with someone, the guys, recalling their feelings experienced during the implementation of the proposed exercises, will be more attentive to the interlocutor, trying to correctly convey their words and thoughts to him. Undoubtedly, the children will benefit from the skills acquired in the lesson of establishing contact with people, interaction, mutual support, which are no less necessary for them in their future life.

The effectiveness of the program can be identified by a psychodiagnostic examination, which is recommended to be carried out twice during the entire course of classes: before corrective developmental classes and after the entire course.

In order to establish the level of formation of the emotional criterion of competence in communication among adolescents in groups, testing was carried out using the diagnostic technique for assessing self-control in communication of M. Snyder. To study the cognitive criterion, the method of V.V. Boyko was used to diagnose general communicative tolerance.

To identify the behavioral criterion, the level of development of communicative and organizational abilities was checked, with the use of the "KOS-1" method - authors V. V. Sinyavsky and V. A. Fedorishin.

After conducting a stating and control study, we concluded that when we applied a developing psychological and pedagogical program to form communication skills in adolescents, we achieved a significant result, which was proved by the control phase of the experimental work

We can state that the effective formation of communication skills of adolescents is ensured through the following set of pedagogical conditions:

- the formation of communication skills of adolescents in the context of the integrity of the cognitive, emotional and behavioral functions of communication;
- identifying the nature and specificity of the process of formation of communication skills in adolescents;
- organization of joint activities of the teacher and adolescents in group work forms, including in the form of communication training;
- methodological support for the implementation of the training program and the intensive inclusion of adolescents in communication activities.

References

1. Vachkov, I.V. Psychological training: methodology and methods: study guide / I.V. Vachkov. - 2nd edition, revised. - Moscow: Eksmo, 2010. - 560 P.

2. Zhukov, Yu.M. Communicative training / Yu.M. Zhukov. - Moscow: Gardariki, 2004. - 223 P.

3. Romek, V.G. Confidence training in interpersonal relations / V.G.Romek. - SPb.: Speech, 2005. - 175 P.

4. Novik, N.N. A Model of Developing Communication Skills among Adolescents with Behavioral Problems // International Journal of Environmental & Science Education. – 2015. - 10(4). – p.579-587.

在培训活动过程中教练和运动员关系的特点

FEATURES OF THE COACH AND SPORTSMAN RELATIONSHIPS IN THE COURSE OF TRAINING ACTIVITIES

Galukhin Rudolf Mikhailovich
Candidate of Pedagogic Sciences, Associate Professor
Mikhailov Nikolay Georgievich
Candidate of Pedagogic Sciences, Associate Professor
Moscow City University, Moscow

抽象。 本文以体育为例，介绍了教练员和运动员在训练和竞技活动中的关系研究结果。 运动员运动员的统计表明，训练运动员教学过程的有效性与“教练员 – 运动员”系统的有效运作有关，运动员和教练员联合活动的综合研究可用于训练 体育和体育领域的高素质专业人士。

关键词：关系心理学，教练，运动员，竞技

Abstract*. This article presents the results of the study of the relationship between coaches and sportsman in training and competitive activities on the example of athletics. The statistics of athletes' sports men show that the effectiveness of the pedagogical process of training athletes is related to the effective functioning of the "coach-athlete" system, and a comprehensive study of joint activities athletes and coaches can be used in the training of highly qualified professionals in the field of physical culture and sports.*

Keywords*: relationship psychology, coach, athlete, athletics*

Relevance. Currently, in sports practice, a factor of relationship between the coach and the athlete, the coach and the team at the stage of sports development is drawing more and more attention. Since the coach and the athlete are socio-psychological elements of the “trainer-athlete” management system, their relationship is largely based on reciprocity. And, of course, the effectiveness of the pedagogical process is also due to the nature of the relationship between the coach and the athlete, and will be higher where they are better established.

Features of interpersonal relationships are characteristic of each sport, and athletics is no exception.

The main area of manifestation of personality traits is social communication, which has become one of the most urgent problems of social psychology.

Trainers, educators, psychologists are constantly faced with a variety of problems of interpersonal communication in the organization of joint activities. Modern sport cannot be imagined without communication, intense interpersonal influences and the interaction of athletes with a coach. The pedagogical process of training and education of an sportsman- an athlete, is a largely individual process, a process of direct influence on a person. Usually, good trainers are well aware of their students, including their personality traits. This knowledge is gradually accumulated in the process of many years of everyday communication with athletes in a variety of situations.

Being a coach is more than just training individual athletes or teaching isolated skills. Coaching art involves the ability to combine individual skills into a holistic activity and combine individual athletes into an effective team, not only in one training session, in a weekly cycle, but often also for a long-term training process.

The success of the athletes in this case depends on the professional competence of the coach, the level of preparedness of the athletes themselves. Therefore, the coach is a central figure in the team, a sports club.

So Brian J. Cretti [1] identifies the main roles that a coach has to play, these are: coach, teacher, pedagog; head coach; trainer psychologist and doctor; trainer dad and mom; trainer older brother or sister etc.

A sports teacher should possess scientific and pedagogical abilities - constantly strive for creativity, systematically study special literature and the experience of colleagues, be creative in work, conduct research and experiments. The desire to constantly improve their pedagogical skills also provides for the high qualification of the teacher in his specialty. The authority of the trainer, based on the principles of industriousness, competence and mutual understanding, opens up wide opportunities for leadership of students. His authority is based, on the one hand, on positive human and professional qualities, and on the other, on his skill and ability to lead people. The trainer's task is to create such a team, the sports and psychological capabilities of which would exceed the simple “sum” of the capabilities of individual athletes [2].

The success of an individual athlete or team, especially at the initial stage of preparation, 60-70% depends on the activities of the coach. The coach has the opportunity to thoroughly study his students, to learn all the nuances of their character, to properly influence the psychological state in extreme conditions of training and competition. The success of a coach when working with an individual athlete, and even more so with a team, depends entirely on his ability to build the right business and personal relationships with his students. Confidence in the coach, recognition of his authority, good working contact facilitate the improvement of athletes, provide high manageability of the team [3].

Attention should be paid to the role of the personality of the athlete himself.

So, Rudik P.A. Speaking about the upbringing of the individual in sports, he noted that all personality traits, including psychological features, arise and develop on the basis of only those relations that a person enters into with other members of society in the process – of joint activities.

Much attention to the issues of psychodiagnostics, especially the interaction of the coach and the athlete, is paid by A.V. Rodionov and V. Rodionov in the textbook "Psychology of Physical Education and Sport" [4].

The coach must be able to pass on his personal experience and knowledge to the athlete. As a result of such work, the coach and his student become one level and are equal creative employees.

Purpose of the study is in the study of the relationship of sportsman and athletes with their coaches. In accordance with the goal, the following research tasks were identified: 1. To study the assessment of the trainer by athletes according to the type “The ideal trainer - my trainer”; 2. To study the assessment of athletes gnostic, emotional and behavioral components of the relationship with the trainer; 3. To study the effect of communication between athletes and the coach in training and competitive activities; 4. To study the relationship between the coach and the athlete on some properties of the athlete's personality.

Methodology and organization of research

To solve the given tasks, we used:

- questionnaire “Ideal coach - my coach” to study the attitude of athletes to the coach;
- version of the methodology developed by Yu.L. Khanin, to study the effect of communication between an athlete and a coach in training and competitive activities in athletics. The analysis of 3 situations of relations between the coach and the athlete was carried out. Each situation was rated on a 7-point scale.

16 highly qualified athletes participated in the survey.

The relationship indicators in the “trainer-athlete” system were evaluated with the identification of the emotional, behavioral and gnostic components of communication, followed by a calculation of the degree of their relationship with the level of anxiety of the athletes and their impact on the nature of the relationship of the participants in the system.

Research results

We present to your attention the results of a study of the relationship of athletes with their coaches. As noted above, the training of highly qualified athletes is a pedagogical field, the main link being the "trainer-athlete" system. In the assessment by athletes of their trainer, they express their idea of what a trainer should be, what qualities he should possess, what pedagogical actions are carried out in the process of education and training of athletes.

The results of a study evaluating a trainer of the type “Ideal Trainer - My Trainer” showed that about half (47%) of student athletes praise their trainers. However, it should be noted that 1/3 of the athletes surveyed rated their trainers low. At the same time, the greatest discrepancy is observed in assessing the ideal and one’s trainer for such qualities as “love for the profession of a trainer”, “ability to manage training”, and “social activity in life and sport”. This led us to conduct special studies evaluating trainers on the Gnostic, emotional and behavioral components. Basically, the assessment of trainers on these components is quite favorable, nevertheless, about 20% of athletes rate the trainers low in professional terms, and 40% are not satisfied with them emotionally.

The decrease in emotional ratings / coach as a person, personality / indicates that the need for close human relations in these athletes is not satisfied, and it is possible that this is the result of conflicts or the coach’s inattention to personal affairs, concerns and interests of athletes.

A substantial analysis of the above components of the relationship of the athlete-trainer revealed the following. Athletes most highly assess the professional qualities of trainers (“the trainer knows how to predict the results of his students”, “the trainer skillfully brings me to the competition”, “the trainer can always give reasonable advice”, “the trainer knows my strengths and weaknesses well”). However, in those cases when the athlete is invited to evaluate the trainer in relation to himself, in relation to his own “I”, there is a somewhat reduced assessment of trainers on issues / “the word of the trainer is law for me”, “I have no doubt about the correctness and the need for the methods and tools that the trainer uses, "" working with the trainer is a pleasure for me, "" I would like to become like a trainer "/. In our opinion, this contradiction is explained by the duality of the conscious attitude, and therefore the conscious assessment by the athlete of his coach. On the one hand, this attitude and corresponding assessment is determined by an external factor / for example, comparison with other coaches /, on the other hand, by the athlete’s own self-awareness, his personal idea of the ideal coach.

It can be concluded that in the presence of an external positive assessment of trainers, highly qualified athletes in their sphere of self-awareness evaluate trainers much more critically. This fact is indirectly confirmed in sports practice, when there are cases of violation of the relationship of athletes with their coaches.

Thus, the data obtained testify to the pedagogical significance of the athlete’s self-awareness factor and the need for its consideration and proper use in a coach’s activities.

In the group of parameters characterizing the negative assessment of trainers, the following points attract particular attention. According to the indicator “I will not share my innermost thoughts with the coach” 53% of athletes gave an affirmative answer. In other words, the fact that in many cases athletes isolate their own

"I" from the trainers is evident. This is also confirmed by the fact that almost half of the athletes affirmatively stated “We have a purely business relationship with the coach” (47%).

Thus, an analysis of the data according to the criteria of a positive and negative assessment of trainers shows that athletes have a certain dissonance between the external and internal assessment of the coach in the field of their identity. In addition, the established fact of isolation of the “I” among athletes from their trainers, as well as their purely business relationship, is alarming. In other words, the results obtained show that coaches are largely lacking in purely human qualities, the ability to “enter” the athlete’s inner world, to become his second “I” and, therefore, to achieve genuine recognition in his personal and professional plans. This should be especially taken into account in the process of training future teachers at physical education institutes.

We have also studied the effect of communication between an athlete and a coach in training and competitive activity. For this purpose, we used a version of the technique developed by Yu.L. Hanin. This option has been compiled for athletics. We studied 3 situations of the relationship of the coach and the athlete, each of which was evaluated on a 7-point scale.

From the data obtained, almost $^{3}/_{4}$ of the athletes indicate that they work much more actively if they are given attention during training.

And half of them 53%, after the approval and praise of the coach, perform more attentively, collectively and with greater responsibility at the competitions.

About a third of athletes showed that the approval of the coach does not affect the nature of their competitive activities. And only for 14% - the coach’s praise is a relaxing factor. Answering the second question about the influence of harsh remarks by coaches in competitions, the overwhelming majority of athletes indicate that such comments either do not affect them or, on the contrary, help to gather in difficult times, activate athletes. However, during an individual survey of athletes, it was found that these remarks should not be offensive, since rude, unjust shouts, on the contrary, suppress athletes and knock them out of their rut. In addition, athletes will certainly emphasize that they receive such harsh remarks only from those coaches with whom they have close emotional contact, and who are respected by them for their professional qualities. Those coaches who do not have such contact with athletes, although it may be fair, suppress the athletes with harsh remarks, cause them to feel protest that prevents them from competing.

When studying the influence of certain personality characteristics of athletes on their relationship with coaches, an attempt was made to identify the dependence of the nature of these relationships between the coach and the athlete on some personality characteristics of the latter.

As the obtained data show, a high positive correlation was established between the need for approval and the level of anxiety (g = 0.689), i.e. it was found that highly anxious athletes have an increased need for support, attention from the coach, especially in extreme situations.

The communication effect of such athletes is also closely related to the need for approval (g = 0.614) and the athlete's anxiety.

Attention on the part of the trainer during training and competitions improves the psychological state of the athlete. Almost all highly anxious athletes, with sufficient attention and support from the trainer, train and compete much better, more actively, with greater responsibility, and therefore more productively. At the same time, highly anxious athletes to a greater degree value the emotional component of communication (g = 0.75), and to a lesser extent the behavioral component (g = 0.560).

As for the gnostic component of the relationship of the trainer with the athlete, in this case there were no significant relationships between this indicator and the level of anxiety (g = 0.125). In other words, highly anxious athletes do not always consider his professional knowledge and skills to be the most important characteristic of his coach. For them, personal relationships, mutual understanding, close social and psychological contact are more significant.

Conclusion

Based on the data obtained, the following pedagogical conclusion can be drawn: in his professional activity, the coach must know his students well, not only know their real and potential sports capabilities, but he must also study the personal qualities of athletes, their inner world, strengths and weaknesses of their character. In this case, the trainer should pay special attention to highly anxious athletes who have an increased need for support and approval from the mentor. This does not mean at all that the coach should create “greenhouse” conditions for such athletes, “cherish and nurture” them, jealously protecting them from various kinds of difficult life situations. On the contrary, the trainer should work on the education of athletes, those traits of their character that would allow them to overcome some personality traits that complicate their relationships with people and activities. However, the coach should do this carefully, delicately, given the high sensitivity of his students. At the same time, in difficult situations, the coach should support his athletes, be their good friend and wise mentor. Only in this case can the trainer count on a sufficient effect of his pedagogical activity.

The effectiveness of the pedagogical process of training athletes is associated with the effective functioning of the "trainer-athlete" system, and a comprehensive study of the joint activities of athletes and trainers can be used in the preparation of highly qualified specialists in the field of physical education and sports.

References

1. *Briant J. Cretti. Psychology in modern sports. – Moscow, 1978.*
2. *Marischuk V.L., Serova L.K. Information aspects of athlete management. – Moscow, 1983.*
3. *Paranoid V., Lazarevic L. Psychodynamics of the sports group. – Moscow, 1977.*
4. *Rodionov A.V., Rodionov V.A. Psychology of Physical Education and Sports. Academy, 2016.*

C. 施密特的大空间理论
C. SCHMIDT'S THEORY OF LARGE SPACE

Lomako Leonid Leonidovich
Senior Lecturer at the Department of Theory and Methodology of Science at Belgorod Shukhov State Technological University
Maltsev Konstantin Gennadievich
Professor at the Department of Theory and Methodology of Science at Belgorod Shukhov State Technological University

抽象。 形成一个“多极世界”（即使在理论层面，在意识形态领域，作为一种“可能的替代方案”）意味着需要一种概念上的辩护。“多极化”唯一已知的理论依据是“大” 空间“由C. Schmitt撰写。
关键词：大空间，国际秩序，主权，帝国，欧洲中心主义。
Abstract. *The formation of a "multipolar world" (even at the doctrinal level, in the field of ideology, as a "possible alternative) implies the need for a conceptual justification. The only known theoretical justification for “multipolarity” is the theory of “large space” by C. Schmitt.*
Keywords: *large space, international order, sovereignty, empire, Eurocentrism*.

In the 20-30s of the twentieth century, K. Schmitt created the theory of "large political spaces", the only conceptual justification for "political multipolarity" to date; Schmitt specifically stated the theory in the work “The Order of Large Spaces in the Law of Peoples, with a Prohibition of intervention of forces foreign to the space” [10] (it should be remembered that the first publication of the work relates to 1939, the fourth edition, the last of which was amended to 1941; the work could not be free from the conditions of its time, the circumstances of its writing and the sympathy of the author, of course, prejudice him, some statements are simply unacceptable, the terms, as we have said, are taboo; however, the idea presented in the work retains its significance regardless of these circumstances, which, we repeat once again, is confirmed by a wide discussion, which has been increasingly active recently; and also: Schmitt is certainly not a “friend”, if his opposition “friend-enemy” is accepted as constitutive for the “political field” as such, but in any case it is a “legitimate enemy”, that is, one can argue with him and he should be listened to).

The international order, still to this day, is the order of sovereign states; “Any order of settled peoples living together or next to each other, taking each other into account, is determined not only personally, but is at the same time a territorially specific order of space. The necessary elements of the spatial order so far consisted mainly in the concept of the state, which, in addition to the personally defined sphere of domination, also means, and even first of all, some territorial restriction and territorially closed unity” [10, p. 482]. Schmitt considers it necessary to introduce the concept of “large space”: “For us, the word large space expresses a change in ideas about the space of the Earth and the very dimensions of the space of the Earth, which has mastered today's world political development. While “space”, along with various specific meanings, retains a universal, neutral, mathematical and physical meaning, “large space” is for us a concrete modern historical and political concept” [10, p. 483]. This idea of a "large space" did not arise suddenly. Schmitt traces his history (not in more detail in the cited work, but in the book “Nomos of the Earth” [9], published after the World War), starting with great geographical discoveries, assuming and proving that for modernity Europe is a kind of semantic “center of the world” (Eurocentrism is a fact of law, including international law). First, this includes “lines” that divide the rights to colonize in the New World, enshrined initially by papal bulls; “Lines of friendship” of a later time, dividing the space of anything unlimited, primarily sea war, from the territories of the “guarded war”, from Europe itself; the concept of colony also applies to this group. In general, this is the “border” that distinguishes Europe as a special, privileged area of the legal order. Secondly, the order of large spaces also operates within Europe. European equilibrium systems; regional pacts (Entente) before and after the First World War; special status of neutral powers; contracts defining joint activities (for example, in the Arctic; still valid) - all this applies to this case. Thirdly, the formation of large spaces on the basis of the Monroe Doctrine (American politicians suddenly began to refer to it in 2019 in connection with the situation around Venezuela), the Wilson Doctrine (especially regarding the structure of Eastern Europe after the First World War; the right of nations to self-determination referred to first of all, the situation of the collapse of the Austro-Hungarian Empire); this also includes the nameless, but valid one and a half century, "principle of communications security of the British world empire." Regardless of the specific content, all of the above was a method of "limitation", forming a "large space". Finally, one should also remember geopolitical theories (and their predecessors), which introduce into scientific circulation, for example, the idea of “natural boundaries”, understood not only “geographically”. The theory of "closed trading state" of I.G. Fichte [5], or the concept of the American scientist W.U. Willoughby, whom Schmitt mentions, introducing the concept of “demographic right to land” [10. from. 491] (growing nations, which “run low on space”, for ex-

ample, Japan, as the named author, acquires the right to capture the "empty land", and this " empty " is the same as the unsettled western lands in America (Indians - a natural phenomenon, Hardt-Negri also recalls this [7, p. 162-163]). The theory of “living space”, which became notorious at the very time when Schmitt’s work was published, is also mentioned here. All this can be considered as a “prehistory” of the concept (and the corresponding “reality”: we miss the opportunity to talk about the methodology of correlation of one with the other, for us in this case it is not fundamentally important) of “large space”.

Schmitt considers the following as “direct prerequisites” of the theory of “large space”. The first one. Here Schmitt already in the 30s sees that the development of the economy (even in its classical, "modern" state) involves the formation of "large spaces": "There is a technical-industrial-economic order in which the isolation of small space and the separation of the old energy economy” [10, p. 485]; processes similar to those occurring in the energy sector are characteristic of the “national economy” (here we mean in Schmoller’s terminology) as such. Thus, “a large space is an area of human planning, organization, and activity arising from an extensive modern development trend” [10, p. 486]. Secondly, the fact is the difference between peoples and states (if the people have not yet created their own state) in strength and ability to ensure their own existence, some simply cannot be independent and must receive guarantees from outside. Among states, there is a natural hierarchy that “was on principle ignored by the science of international law” [10, p. 534]; “In political-historical reality, of course, there have always been leading great powers; there was a “concert of European powers” and in the Versailles system “allied major powers” [10, p. 534]. The order of large spaces is a simple conceptualization of "what is." Thirdly, history and culture determine the proximity, or, on the contrary, the “foreignness” of various peoples and their states; in our time, S. Huntington [6] argues the need for the organization of "large spaces" in accordance with cultural and civilizational boundaries; at the time when Schmitt wrote, the concept of a “cultural-historical type” was lively, which cannot be ignored without consequences (in the form of wars, uprisings, etc.) when structuring the political space: “An international legal review should see not only internal uniqueness, but also the joint life and coexistence of political values that are the bearers and creators of the international legal order. Both for practical and theoretical reasons, it is necessary to keep in mind this coexistence, joint life and mutual opposition of real values” [10, p. 530].

Schmitt claims that what he calls the "Reich orders" (Schmitt never talks about the one German Reich), solves these (and not yet named) problems of structuring space. The first one. The Reich combines the concepts of order and location [10, p. 570], that is, the Reich is not an “empty”, but a qualitatively

defined space: “The Reich designation, which is proposed here, best describes the international legal content of the connection between a large space, people and the political idea, which defines our starting point. The designation "Reich" in no case does not eliminate the peculiar feature of each individual of these Reichs "[10, p. 531]. The second one. The concept sets forth the ability of a qualitatively defined organized space to independence (to autonomy, that is, freedom): “The huge order of not only “natural” measures in the sense of nature of these properties at once, this includes conscious discipline, enhanced organization and the ability to create on one’s own strength and confidently hold in one’s hands a person who can only be mastered with great stress Coy force intelligence apparatus of the modern social order "[10, p. 541]. The third. Reich, according to Schmitt, is a political form corresponding to the completion of the process of formation of the people (in this regard, the nation state can be assessed as a form that is preceding and imperfect primarily because of the immaturity of the “substrate” itself - the people). The people “in themselves” and “for themselves” (what they have become) presuppose the Reich as their own political form: “The new concept of the order of new international law is our concept of the Reich, which comes from the popular order of a large space. In it, we have the core of a new international legal way of thinking, which proceeds from the concept of the people and which fully preserves the elements of order contained in the concept of the state, but which at the same time is able to cope with today's ideas about space and with real political life forces, which can be "planetary", that is, take into account the space of the Earth without destroying peoples and states and not striving, as imperialist international law of Western democracies, from the inevitable overcoming of of the concept of the state in universalist-imperialist world law ”[10, p. 546]. We see that the concept of the world imperial order was well known to Schmitt, and he connected its "implementation" with the very actors to whom this order refers Hardt-Negri. That is, the concept of the Reichs was then opposed to the Empire. One of the main arguments of precisely a value nature (this is important in connection with the order of legitimizing the Empire through value, morality, justice) is the preservation of historical and cultural originality (it is valuable in itself, but also “universally valuable” as *soil*): “Other concepts of space that are necessary today are, first of all, the soil, which in a specific sense would be interfaced with the people, and then subordinate to the Reich, going beyond the boundaries of the people's soil and state territory, a large space of cultural, economic, industrial and organizational radiation, spread. The Reich is not just an enlarged state, just as a large space is not an enlarged small space. The Reich is also not identical with a large space, but each Reich has a large space, and because of this it rises both

above the state, spatially characterized by the exclusivity of its state territory, and above the national soil of an individual people. An authority without this large space, which crowns the state territory and popular soil, would not be a Reich" [10, p. 552]. In general, according to Schmitt, imperium "often has the meaning of a universalist one, encompassing the world and humanity, that is, a supranational entity (if it should not be that there can be many and diverse empires with each other)" [10, p. 529]; as for the Reich, it "is determined essentially by the people and is essentially a non-universalistic, legal order based on respect for each nationality" [10, p. 529]. Thus, the definition of the Reich, proposed by C. Schmitt, is as follows: "The order of large spaces is included in the concept of the Reich, which here as a specific international legal quantity must be introduced into the international legal scientific discussion. Reichs in this sense are leading and bearing forces, the political idea of which spreads in a certain large space and which relatively this large space fundamentally excludes the intervention of forces belonging to a foreign space" [10, p. 527]. In political and legal terms, according to Schmitt, the Reich order implies four main areas / levels of relations between and within them (the fundamental difference between internal and external is kept and constantly updated): "There are four different ways of conceivable legal relations: First, relations between large spaces in general, since these large spaces, needless to say, should not be hermetically isolated blocks, but there is also an economic and other exchange between them, and in this sense place "international trade"; secondly, inter-reich relations between the leading Reichs of these large spaces; thirdly, relations between peoples within a large space and, finally, with the reservation of non-interference with forces foreign to space, international relations between peoples of various large spaces "[10, p. 545].

The question of the legitimacy of the Reich is entirely in the "horizon of modernity" and is quite suitable for analysis by means of a toolbox developed by M. Weber [2] in the theory of legitimacy. The challenge of the Reichs is the so-called revolutionary war, but this is already a subject for special consideration. The order between sovereigns and the preservation of peace fits into the logic remarkably described by R. Aron [1] in the work "War and Peace between Peoples". Sovereigns are in a natural state; it is a state of war (according to Hobbes [3; 8]); but that is precisely why the achieved equilibrium ensures peace, even if fragile (the logic of the bipolar world in the most detailed way and the multipolar world only fragmentarily is presented in the aforementioned work of Aron).

References

1. Aron, R. Peace and war between nations. - Moscow: Nota Bene, 2000.880 P.

2. Weber, M. Economy and Society: Essays in Understanding Sociology. In 4 volumes. V. 1. Sociology. - Moscow: Publishing House of the Higher School of Economics, 2016.445 P.

3. Hobbes, T. Leviathan, or matter, form and power of a church and civil state. / Works in 2 volumes. V. 2. - Moscow: Mjsl, 1991.731 P.

4. Lal, D. Praise to the empire. - Moscow: New Publishing House, 2010.364 P.

5. Fichte, I.G. The closed trading state / Works in 2 volumes. Vol. 2. - St. Petersburg: Mithril, 1993. P. 225-357.

6. Huntington, S. The Clash of Civilizations. - Moscow: Publishing house AST, 2003.576 P.

7. Hardt, M., Negri, A. Empire. - Moscow: Praxis, 2004.440 P.

8. Schmitt, K. Leviathan in the doctrine of the state of Thomas Hobbes. St. Petersburg: Vladimir Dal, 2006.300 P.

9. Schmitt, K. Nomos of the Earth in the law of peoples jus publicum europaeum. St. Petersburg: Vladimir Dal, 2008. 630 P.

10.Schmitt, K. The order of large spaces in the law of peoples, with a ban on intervention for forces foreign to space / Nomos Earth in the law of peoples publicum europaeum. St. Petersburg: Vladimir Dal, 2008. P. 479-572.

胆囊切除术前后胆石症患者的生活质量
QUALITY OF LIFE IN PATIENTS WITH CHOLELITHIASIS BEFORE AND AFTER CHOLECYSTECTOMY

Bagmet Alexander Danilovich
Doctor of Medical Sciences, Full Professor
Head of the Department of Outpatient Therapy
Ruban Alexander Petrovich
Assistant at the Department of Outpatient Therapy
Nedoruba Elena Alexandrovna
Candidate of Medical Sciences
Assistant at the Department of Outpatient Therapy
Rostov State Medical University

抽象。 本文对胆囊切除术前后胆石症患者的生活质量进行了评估。 在生活质量参数的研究中，使用诺丁汉健康概况。 我们将这些指标视为：疼痛，精力，情绪状态，社交隔离，睡眠和身体活动。 结果表明，与健康人相比，没有特定康复措施的胆囊切除术并没有显着改善生活质量。

关键词：胆结石病，评估胆囊切除术前后的生活质量，询问患者，康复计划。

Abstract*. The article provides an assessment of the quality of life in patients with gallstone disease, before and after cholecystectomy. In the study of quality of life parameters, the Nottingham Health Profile was used. We consider such indicators as: pain, energy, emotional state, social isolation, sleep, and physical activity. It was shown that cholecystectomy without specific rehabilitation measures does not significantly improve the quality of life in comparison with healthy people.*

Keywords*: Gallstone disease, assessing the quality of life before and after cholecystectomy, questioning patients, rehabilitation programs.*

Assessing the quality of life is a promising new area of medicine that provides an opportunity to more accurately assess disorders in the patient's state of health, more clearly present the essence of the clinical problem, establish the most rational method of treatment, evaluate the expected results from it according to the parameters located at the junction of the patient's subjective opinion and scientific specialist approach. The quality of life is an integral characteristic of the psychological, physical, social and emotional functioning of the patient, which is based

on his subjective perception. The components of the quality of life are: physical, social, psychological and spiritual well-being. To date, the cost-effectiveness and effectiveness of different methods of treatment is also advisable to evaluate by indicators of quality of life included in special methods.

The study of quality of life is the basis for rehabilitation programs. To a large extent, the possibility of returning to a normal, full life of the patient and his full recovery depend on the individual monitoring of the quality of life during various periods of rehabilitation.

The article considers the assessment of the quality of life in 136 patients (21 men and 115 women) with gallstone disease (cholelithiasis) who were outpatiently treated at the City Polyclinic No. 4 MBUZ in Rostov-on-Don. The duration of the course of the disease (when diagnosing gallbladder stones) reached from 1 year to 8 years. In accordance with the objectives of the study, two groups were formed. The first group of 66 patients who underwent conservative treatment of calculous cholecystitis. The second group included 70 patients with cholecystitis who underwent surgical treatment.

Criteria for inclusion in the study: gallstone disease outside the period of exacerbation or asymptomatic stone carriage (group 1), surgical treatment of cholelithiasis without postcholecystectomy syndrome (group 2).

Criteria for exclusion from the study were: postcholecystectomy syndrome, various types of anemia, viral hepatitis, alcoholism, cancer and cirrhosis. The control group included 35 healthy individuals.

Patients of all groups were comparable by gender and age.

In the study of quality of life parameters, the Nottingham Health Profile (NHP) scale was used, which includes a two-part questionnaire. The first part expresses the possible limitations experienced by a person in everyday life. The second part allows you to assess the impact of health on the main types of daily human activities.

We obtained the following data on the considered indicators as a result of the studies: pain, energy, emotional state, social isolation, sleep and physical activity. Obtained during the survey before cholecystectomy and after cholecystectomy in patients with cholelithiasis, the data are presented in table 1.

Table 1

Quality of life indicators for patients with cholelithiasis before and after cholecystectomy

Characteristics	Control, N=35	Cholelithiasis, N=66	After cholecystectomy ХЭ, N=70
Energy	11,27±5,29	50,66±7,23***	41,65±6,14***·
Pain	9,26±4,66	33,34±7,43**	25,77±5,17*·
Emotional condition	13,56±4,28	27,97±4,55*	21,35±3,74
Sleep	17,78±5,76	44,57±6,50**	50,50±4,38***·
Social isolation	8,23±3,33	28,04±3,93***	13,23±3,36·
Physical activity	11,5±4,82	26,58±4,56*	16,25±4,72
Total	74,11±9,0	223,27±10,64***	152,73±9,06***·

Notes: *p<0,05; **p<0,01; ***p<0,001 - in comparison with control

•p<0,05; ●● p<0,01 – comparison between Cholelithiasis and After cholecystectomy.

The results obtained in the studied groups of patients with cholelithiasis before and after cholecystectomy were characterized by a significant decrease in the quality of life indicators for all the considered Nottingham Health Profile parameters (p <0.05-0.001). However, a number of parameters after cholecystectomy significantly improved (p <0.01) - this is an indicator such as “social isolation” and the total score, and scores for the characteristics - “energy”, “pain”, “emotions”, “physical activity” unreliably decreased.

Thus, the results of the studies convincingly demonstrated that the patient’s assessment of the severity and consequences of his illness, the general perception by a person of his health, had a large negative orientation in all respects for cholelithiasis. After cholecystectomy, most indicators improved, but still remained significantly worse than control. These data indicate that cholecystectomy without specific rehabilitation measures does not significantly improve the quality of life in comparison with healthy people. It is necessary to develop a set of rehabilitation measures, including medical, physiotherapeutic, balneological methods of treatment for this group of patients.

References

1. Loranskaya I.D. Biliary dysfunctions and their prevention / I. D. Loranskaya, M. L. Kukushkin, N. A. Panina // Experimental and clinical gastroenterology. - 2011. - № 5. - P. 48 - 52.

2. Nemtsov L.M. Serum cholecystokinin and clinical - functional variation of biliary pathology / L. M. Nemtsov // Experimental and clinical gastroenterology. - 2014. - № 12. - P. 24 - 29.

3. Nechushkin A.I. The standard method for determining the tone of the autonomic nervous system in norm and pathology / A. I. Nechushkin, A. M. Gaydamakina // Journal of Experimental and Clinical Medicine - 1981. - V. 21. - №2. - P. 164 - 172.

4. Krylova N. A. Clinical examination and stages of rehabilitation of patients with cholelithiasis in a polyclinic / N. A. Krylova, E. A. Lipina // Siberian Journal of Gastroenterology and Hepatology. - 2004. - № 18. - P. 153 - 155.

5. Chen L.Y., Qiao Q.H., Zhang S.C.,atal. Metabolic syndrome and gallstone disease. World J. Gastroenterol. 2012 August 21; 18(31):4215-20.

6. Chuang S.C., His E., Lee K.T. Mucin genes in gallstone disease. Clin Chim Acta.2012 Oct 9; 413(19-20):1466-71.

7. Den Hertig A. The action of mebeverine and metabolities on mammalian non–myelinated nerve fibres / A. Den Hertig, J. Van den Akker. // Eur. J. Pharmacol. – 1987. – № 139. – P. 353 - 355.

不同骨质合成条件下骨组织的再生和微循环

Regeneration and microcirculation of bone tissues under different conditions of osteosynthesis

Onoprienko Gennady Alekseevich
Corresponding Members of RAS, Doctor of Medical Sciences
Full Professor
Voloshin Victor Parfentevich
M.F. Vladimirsky Moscow Regional Research and Clinical Institute, Moscow

抽象。我们自己的实验研究表明，骨微观结构的形态发生的所有阶段同时提供并且连续伴随局灶性和定型血管生成（毛细血管发生）。实施修复性骨生成的一个有力因素是受损骨段末端的骨诱导相互作用，即使在片段之间有显着的淀粉（如果稳定固定）的情况下，这也是积极表现的。为了确保整个巩固期间骨损伤区域的稳定性，在任何类型的稳定骨缝合术后，由于直接骨生成（即没有纤维 – 软骨组织）而形成最小体积的骨内皮质骨再生并在最短的时间内。在这种情况下，骨膜成骨实际上是骨形成的储备来源，其表现为不充分稳定的条件。骨损伤区域，特别是金属植入物的不稳定性充满了最严重的破坏性后果。

关键词：骨组织再生和微循环，生理和创伤后成骨，直接成骨，稳定的骨缝合。

Abstract. *Our own experimental studies have shown that all stages of morphogenesis of bone microstructures are simultaneously provided and continuously accompanied by focal and stereotypical angiogenesis (capillary genesis). A powerful factor in the implementation of reparative osteogenesis is the osteoinductive interaction of the ends of the damaged bone segment, which is positively manifested even in cases of significant diastases between fragments (if stably fixed). In order to ensure the stability of the zone of bone damage for the entire period of consolidation, after any type of stable osteosynthesis, endosteal-cortical bone regenerate is formed due to direct osteogenesis (i.e., without fibro-cartilaginous tissue) of a minimum volume and in the shortest possible time. In this case, periosteal osteogenesis is actually a reserve source of bone formation, which manifests itself in insufficiently stable conditions. The instability of the area of bone damage and, especially, of the metal implant is fraught with the most serious destructive consequences.*

Keywords: *bone tissue regeneration and microcirculation, physiological and post-traumatic osteogenesis, direct osteogenesis, stable osteosynthesis.*

In an experiment on animals (dogs), fractures and defects of the tibial diaphysis with stable osteosynthesis with a metal pin, a bone plate, Ilizarov apparatus were simulated. In addition to standard X-ray morphological techniques, the work used advanced technologies for contrast visualization of the microvasculature of bone tissue. The observation periods are different - from 6 hours to 2 years after surgery.

It has been established that the implementation of the processes of post-traumatic reparative osteogenesis is carried out against the background of a stereotypical adaptation-compensatory complex of vascular reactions - regional hypervascularization of the damaged limb and bone segment, increased capacity and increased vascular permeability of the microvasculature of the bone tissue, sinusoidal transformation of capillaries in the formation zone of new tissue structures, the formation of tissue microcysts associated with the microvascular network, activation extravascular ways of microcirculation. The sinusoidal nature of the transformation of the capillary link of the terminal channel of bone tissue, which normally is absent in adults and appears in the repair zone, as well as the formation of multiple tissue microcysts surrounded by a microvascular network, can be considered as part of the functional and structural manifestations of the general adaptive-compensatory reaction of the body in response to trauma (damage).

The high resistance of compact bone tissue to post-traumatic ischemia was revealed in conditions of significant circulatory disorders caused by trauma and surgical intervention, due to the ability of the interstitial space of the bone matrix to provide an adequate volume of extravascular microcirculation, as well as the long-term preservation (until restoration of collateral blood supply) of the function of the microcirculatory bed of the cortical plate diaphysis (that is, Haversian and Folkman channels) in absence of natural blood perfusion.

With a minimal degree of circulatory disorders, for example, with an oblique-spiral fracture of the tibial diaphysis and stable fixation with AO screws (tap thread), on the 7th day after the surgery, electron microscopy in the fibroreticular tissue filling the inter-fragment gap and medullary cavity reveals fibroblast cells of varying degrees of differentiation. Moreover, on enlightened preparations (Fig. 1.) after 1-2 weeks after the surgery, newly formed sinusoidal capillaries, coming both from the side of the medullary cavity and sharply expanded Haversian channels of the cortical plates of opposite ends of the fragments, are found in the fracture gap. After 3 weeks, the slit-like space between the cortical plates of both fragments is filled with a proliferating network of sinusoidal capillaries, beam structures of the newly formed bone tissue and osteogenic cellular fibrous elements. After 8 weeks, the cortical intermediate regenerate is represented by lamellar bone tissue, the microstructure and microvasculature of which are in the stage of functional adaptive reconstruction (Fig. 2.). After 3 months, the spongy structures of the endosteal regenerate are reduced. Completeness of the process of restoration of definitive structures is ascertained 5 months after the surgery.

The indicated dynamics of reparative processes under conditions of ensuring and maintaining tight contact of bone fragments for the entire period of consolidation is stereotypical and is observed after almost all types of stable osteosynthesis, including an intraosseous massive pin with a recess of medullary cavity. In this case, direct osteogenesis is ascertained, where osteogenic cell-fibrous tissue emanating from the medullary cavity and Haversian system of cortical plates of the ends of the fragments forms a mature bone intermediate regeneration of a small volume without connective tissue and cartilage elements, as well as without noticeable periosteal bone formation. The differences are only in the timing and scale of reparative processes, which are completely caused by the "primary" circulatory disorders, i.e. advancing once as a result of trauma and subsequent surgical intervention. The greatest circulatory disorders of the cortical plate of the diaphysis are noted, for example, after a fracture and open intramedullary stable osteosynthesis of the tibia with a massive metal pin with a reaming of the bone marrow cavity. In such a situation, the completion of diaphysis revascularization and the formation of mature bone callus requires a period 2-3 times longer than with minimal circulatory disorders, which are observed in cases of an oblique-spiral fracture of the tibia after less traumatic transosseous osteosynthesis (Fig. 3.).

At the same time, experimental studies have revealed high regenerative capabilities of bone tissue - with a segmental defect of the tibia equal to the diameter of the diaphysis - but under conditions of stable "neutral" fixation by the Ilizarov apparatus, that is, without distraction and compression and without any bone plastic interventions. Endosteal-cortical regenerates emanating from the ends of the bone fragments towards each other, have filled the defect after 6-9 months and after 1 year formed a new area of the diaphysis. A similar result was obtained by us with a diaphyseal defect of the radius, which is stably fixed by the method of synostosis with a paired ulnar bone of the forearm. It should be noted that the longitudinal orientation of newly formed bone beams is clearly traced in the structure of the emerging regenerates. We observed a similar fact (like other researchers) when modeling the distraction osteosynthesis of the tibia with the Ilizarov apparatus after transverse osteotomy of the diaphysis and subsequent dilution of bone fragments. A favorable circumstance in the latter case is the absence of avascular sections of the cortical plates of the ends of the fragments, the restoration of the unity of the medullary circulation of both fragments, and the beginning of reparative processes in the interfragmental space 2 weeks after the operation, i.e. before starting the distraction process. And as a result, the accelerated formation of a “distraction” regenerate and restoration of the integrity of the bone organ.

Thus, while ensuring the stability of the zone of bone damage for the entire period of consolidation, an endosteal-cortical bone regenerate is formed due to direct osteogenesis (i.e., without fibro-cartilaginous tissue) of a minimum volume and in the shortest possible time. A powerful factor in the implementation of reparative osteogenesis is the osteoinductive interaction of the ends of the damaged bone segment, which is positively manifested even in cases of significant diastases between fragments (if stably fixed). The effect of mutual osteoinduction of the ends of the fragments can be explained by the well-known in the literature bone morphogenetic protein (bone

morphogenic protein, BMP), which is formed in significant quantities and is involved in the formation of the osteoblastic phenotype from multipotent mesenchymal cells migrating to the area of bone damage. All stages of morphogenesis of bone microstructures are simultaneously provided and are continuously accompanied by focal and stereotypical angiogenesis (capillary genesis). In this case, periosteal osteogenesis is actually a reserve source of bone formation, which manifests itself in insufficiently stable conditions. The instability of the area of bone damage and, especially, of the metal implant is fraught with the most serious destructive consequences.

Most researchers came to the conclusion that reparative osteogenesis after a bone injury by the mechanism of its implementation actually corresponds to physiological manifestations, differing only in the scale and intensity of the processes. Our experimental data does not contradict this (Fig. 4.).

In case of violation of the stability of bone fragments, the dynamics of reparative processes is very diverse - from the formation of an extensive periosteal callus containing avascular fields of cartilaginous tissue, with a dubious prognosis regarding the onset of consolidation to active and widespread resorption of bone tissue with an outcome in the false joint. Under conditions of tissue hypoxia and the absence of an oxybiotic environment, osteoblastogenesis becomes impossible, and the proliferating pool of stem stromal cells on the periosteal surface of bone fragments differentiates in the direction of fibro- and chondrogenesis. As a result, an extensive fibrocartilaginous periosteal callus is formed. The end surface of unstable bone fragments is covered with a dense network of constantly traumatic sinusoidal capillaries.

In the event of a significant degree of instability in the area of bone damage, excessive regional hypervascularization occurs, which is induced by a continuous and powerful flow of tissue decay products. Against the background of deep circulatory disorders and constant microbleeding in the area of contact of bone fragments, regional resorption of cortical plates occurs. The interfragmental space expands and is filled with extensive cysts with a plasma-like fluid. Cortical osteogenesis is absent. Destructive processes end with the formation of an atrophic pseudoarthrosis.

The most devastating effects are noted after osteosynthesis with instability of the metal implant. Under such conditions, persistent tissue trauma with a metal pin is accompanied by the continuous formation of cell necrosis products and the induction of excessive vascular proliferation while maintaining tissue hypoxia, extensive fields of osteolysis and the absence of any reparative processes that lose their protective and adaptive nature. There is a breakdown of the adaptive reaction with dysregeneration for an indefinite period. As a result of intensive and widespread resorption of bone tissue by a “wide front,” the cortical plate loses its osteon structure, in some parts of the diaphysis it is absent or has a spongy structure. Naturally, the mechanical strength of such a bone segment is extremely low and it is prone to pathological fracture.

In more detail - see the monograph Onoprienko G.A., Voloshina V.P. "Microcirculation and bone regeneration: theoretical and clinical aspects." - Moscow: Publishing house "BINOM", 2017. - 184 P, Fig 183.

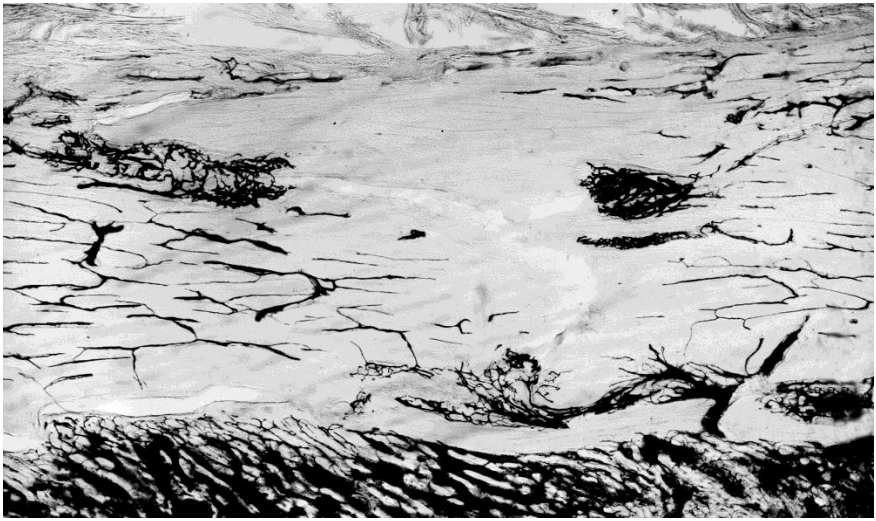


Fig. 1. Vascular proliferation along the fracture gap from the side of the enlarged Haversian canals of the ends of the fragments. An abundant network of sinusoids in the area of endosteal bone formation 2 weeks after osteosynthesis. Illuminated slice. x 12.

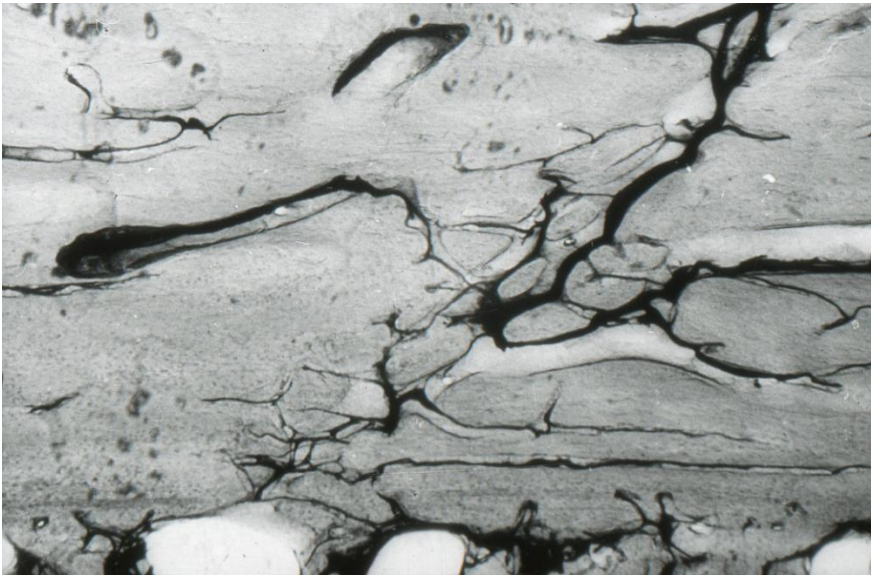


Fig. 2. Reconstruction of microvessels of the intermediate regenerate at the site of the former fracture 8 weeks after surgery. Hematoxylin and eosin staining. x 90

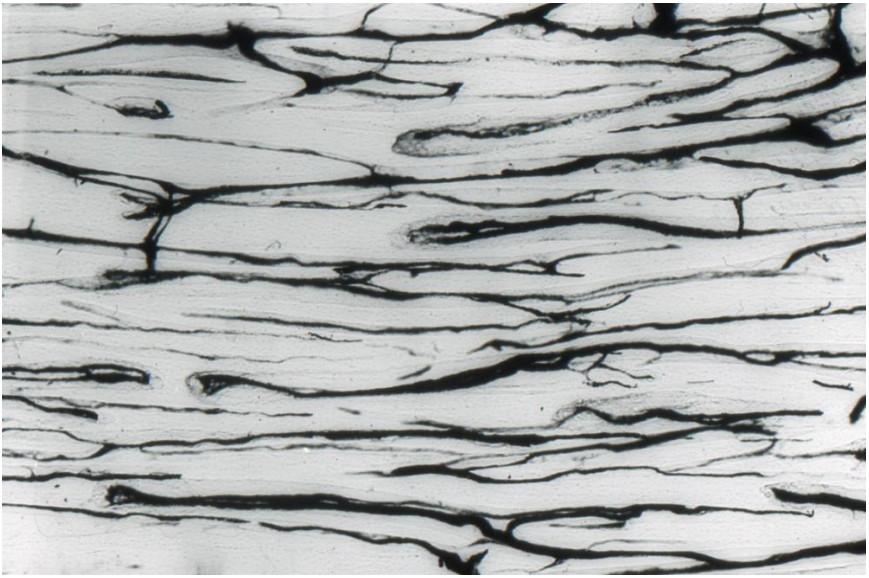


Fig. 3. The formation of a new osteon system of the cortical plate of the diaphysis 1 year after surgery. Illuminated slice. x 20.

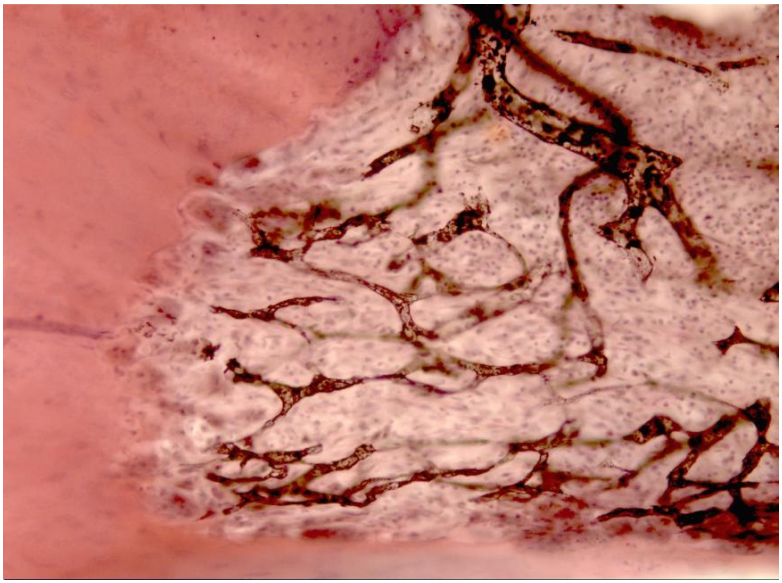


Fig. 4. The local site (locus) of osteoclastic bone resorption, angiogenesis, the formation of osteoblastic tissue. Hematoxylin and eosin staining. x 90.

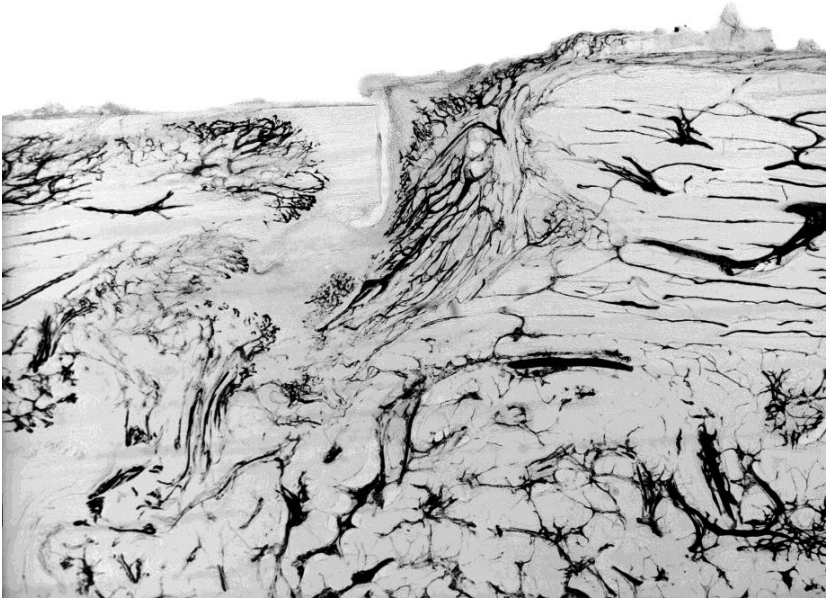


Fig. 5. Active resorption of cortical plates of the ends of fragments in the area of their unstable contact. Illuminated slice. x 18.

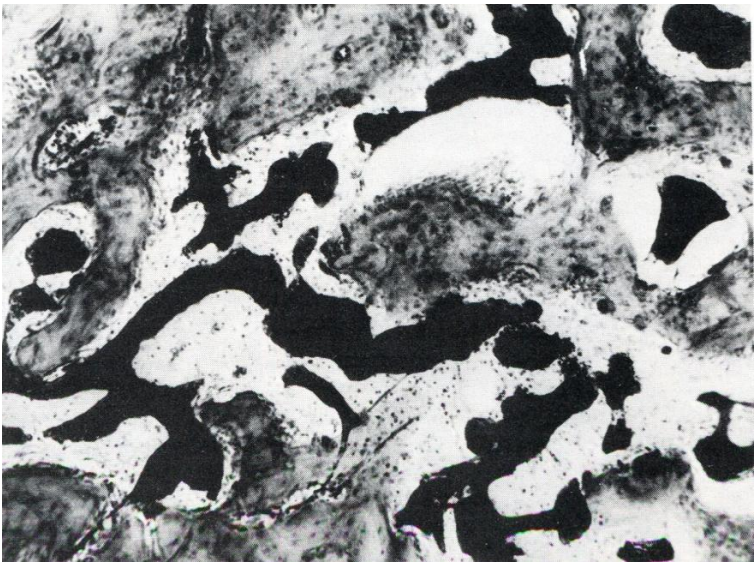


Fig. 6. Network of varicose sinusoidal capillaries of the endosteal regenerate 4 weeks after surgery. Hematoxylin and eosin staining. x 90.

云杉根多糖的吸附活性
ADSORPTION ACTIVITY OF SPRUCE ROOTS POLYSACCHARIDES

Gulyaev Dmitry Konstantinovich
Candidate of Pharmaceutical Sciences
Senior Lecturer of the Department of pharmacognosy
with the course of botany
Perm State Pharmaceutical Academy
Belonogova Valentina Dmitrievna
Doctor of Pharmaceutical Sciences, Full Professor
Head of the Department of pharmacognosy with the course of botany
Perm State Pharmaceutical Academy
Hamidullina Zhanna Evgenievna
Kryazhevskikh Alena Igorevna
students
Perm State Pharmaceutical Academy

注解。云杉 - Picea abies（L。Karst。）是彼尔姆地区和俄罗斯联邦其他地区的一种广泛的木材植物。该工作涉及云杉根的水溶性多糖复合物吸附活性的研究，云杉根是伐木残留物。研究的原材料是云杉的根源，收集在切割区域（爱尔兰斯克地区，彼尔姆地区）。水溶性多糖复合物以两种方法从原料中获得。通过结合亚甲蓝的能力来确定吸附活性，亚甲蓝是大多数医用吸附剂的标记物。根据研究结果，用30%乙醇提取得到的云杉根水溶性多糖复合物（方法1）是最活跃的。发现它在参考制剂（活性炭）水平上显示出吸附活性。所获得的物质可以用于开发吸附剂药物。

关键词：挪威云杉，根，水溶性多糖，吸附活性。

Annotation. *The spruce – Picea abies (L. Karst.) is a widespread wood plant in the territory of Perm region and other regions of the Russian Federation. The work is related to the research of water-soluble polysaccharide complex sorption activity of spruce roots, which are logging residues. The raw materials for the research were the roots of spruce, collected in the cutting area (the territory of Ilyinsky district, Perm region). Water-soluble polysaccharide complex was obtained from raw materials in two methods. Adsorption activity was determined by the ability to bind methylene blue, which is a marker for the most medical sorbents. According to the results of the research, the water-soluble polysaccharide complex*

of spruce roots obtained by extraction with 30% alcohol (method 1) was the most active. It was found that it exhibits adsorption activity at the level of the referential preparation (activated carbon). The obtained substance can be prospective for the development of sorbent drugs.

Key words: *Norway spruce, roots, water-soluble polysaccharides, adsorption activity.*

Introduction

Spruce – Picea abies (L.) is one of the main logging tree species. There is a huge amount of wood waste in the cutting areas as a result of logging enterprises activities.

The large majority of researches in this area are aimed at finding an effective way to recycle foliage, which remains in the cutting area. However, the root system, which is about 20-30% of the total amount of wood waste, can also be considered as a source of biologically active substances [1].

The purpose of the work is the research of adsorption activity of spruce roots water-soluble polysaccharide complex.

Materials and methods

The raw materials for the research were the spruce roots, collected on the cutting area of Ilyinsky district of Perm region.

Water-soluble polysaccharide complex (WSPC) was obtained in two methods.

Method 1. The quantity of air-dry raw material was cut to a particle size with a diameter of 2 mm. Then it was extracted with purified water at a ratio of 1:10 at a temperature of 80°C for 1.5 hours. The obtained extraction was filtered and evaporated under vacuum at a temperature of 70°C. The water-soluble polysaccharide complex was precipitated by triple adding the amount of 96% alcohol with stirring. Polysaccharides were filtered, washed with 80% alcohol and dried in a drying closet at a temperature of 50°C.

Method 2. The quantity of air-dry raw material was cut to a particle size with a diameter of 2 mm. Then it was extracted with 30% ethanol at a ratio of 1:10 at a temperature of 80°C for 1.5 hours. The obtained extraction was filtered and evaporated under vacuum at a temperature of 70°C. The water-soluble polysaccharide complex was precipitated by triple adding the amount of 96% alcohol with stirring. Polysaccharides were filtered, washed with 80% alcohol and dried in a drying closet at a temperature of 50°C.

To determine the monosaccharide composition of the specified fractions, the acid hydrolysis with 1% sulfuric acid solution was made during the heating under reflux for 10 hours. Monosaccharide composition of hydrolyzates was determined by ascending paper chromatography in the solvent system: butanol-pyridin-water (6:4:3). Chromatograms were chemicalized with an aniline phthalate reagent and displayed in a drying closet at a temperature of 100-105°C until color is produced [10].

Sorption activity of spruce roots polysaccharides was determined by the following method [2,3]. About 0.2 g of polysaccharides (exact linkage) was placed in a 250 ml capacity conical flask. Then 50 ml of 0.15% methylene blue solution was added and stirred on a shaker with a number of oscillations 140 per minute during 1 hour. Separation of the equilibrium solution after sorption was made by centrifugation at 8000 revolutions per minute during 5 minutes. 1 ml of the supernatant liquid was transferred to a 500 ml capacity measuring flask and made up to the mark with purified water. Then the optical density was measured on the spectrophotometer SF 2000 at 664 nm in a cuvet with a layer thickness of 10 mm. As a comparison solution the purified water was used. The calculation of the sorption activity mg/g was made according international formula:

$$x = \frac{(A_1 \cdot A_0) \times a \times 50 \times 100}{A_1 \times b \times 1 \times (100 - W)}$$

A_0 – the optical density of sample solution;
A_1 – the optical density of PCO_1 methylene blue solution;
a – the actual concentration of PCO methylene blue solution, mg/ml;
b – the quantity of sample tested, g;
W – the humidity of sample tested, %.

Results and discussion

By means of ascending paper chromatography the composition of the obtained complexes hydrolyzates was determined.

Table 1 – *Monosaccharide composition of WSPC*

Agent	Discovered monosaccharides				
	arabinose	galactose	galacturonic acid	rhamnose	xylose
WSPC (method 1)	+	+	-	-	-
WSPC (method 2)	+	+	+	-	-

As a result of the research (table 1), it was found that the water-soluble polysaccharide complex obtained by water extraction (method 1) was constructed from arabinose and galactose residues. The water-soluble polysaccharide complex obtained by extraction with 30% alcohol (method 2) consists of arabinose, galactose and galacturonic acid.

Adsorption activity of WSPC, obtained by two methods, was determined by the ability to sorb methylene blue, which is a marker for most medical sorbents.

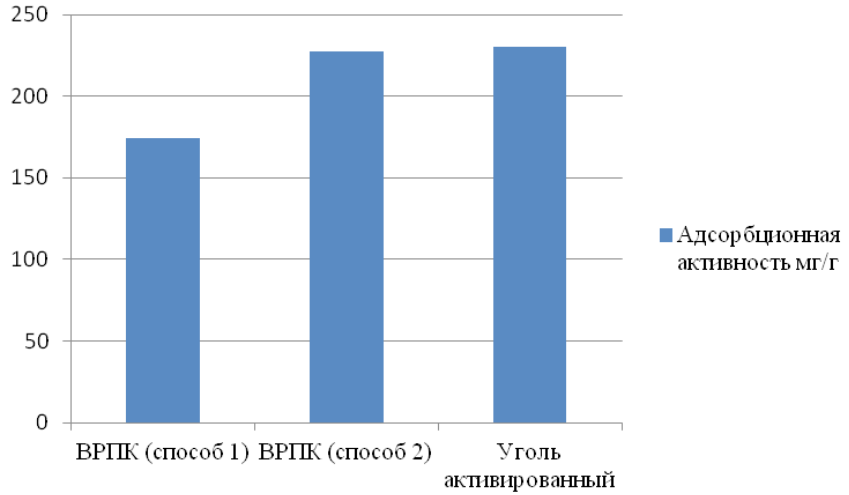


Fig. 1. *Adsorption activity of spruce roots WSPC*

Figure 1 shows that the water-soluble polysaccharide complex obtained by extraction with 30% alcohol (method 2) exhibits adsorption activity comparable in strength to the referential preparation (activated carbon). Water-soluble polysaccharide complex obtained by water extraction (method 1) was less active. These results can be explained by the presence of galacturonic acid in the polysaccharide complex obtained by extraction with 30% alcohol (method 2).

Conclusion

Water-soluble polysaccharide complex of spruce roots, obtained by extraction with 30% alcohol (method 1), exhibits adsorption activity at the level of activated carbon. The obtained substance can be prospective for the development of sorbent drugs.

References

1. Fedorotva T.E., Babkin V.A. Ekstraktivnye veschestva korney Piceae obovata (L.) // Khimiya rastitel'nogo syr'ya. 2016. №4. p. 165–168.

2. Reshetnikov V.I. Printsipy razrabotki lekarstvennykh form sorbentov: monographiya.- Perm: GOU VPO PGPA Roszdrava, 2008.-196 p.

3. Babeshina L.G., Gorina Y.V., Kolokolova L.P., Krasnov E.A., Karpova M.R. Issledovaniye polisakharidov nekotorykh vidov roda Sphagnum L. // Journal of Siberian Federal University. 2010. № 3. p. 413-422.

研究叶子的元素组成，一种普通桃子的密集提取物 – Persica vulgaris Mill

THE STUDY OF THE ELEMENTAL COMPOSITION OF LEAVES, THICK EXTRACT OF COMMON PEACH - PERSICA VULGARIS MILL

Ivantsova Lyubov Vitalievna
Chief Technologist, Apifitofarm, Ltd
Belonogova Valentina Dmitrievna
Doctor of Pharmaceutical Sciences, Full Professor, Head of the Department of pharmacognosy with the course of botany Perm State Pharmaceutical Academy
Gulyaev Dmitry Konstantinovich
Candidate of Pharmaceutical Sciences, Senior Lecturer of the Department of pharmacognosy with the course of botany Perm State Pharmaceutical Academy
Perm, Russia

抽象。 研究了常见桃 – 厚朴的厚叶提取物的叶片元素组成。 研究样本是在俄罗斯联邦克拉斯诺达尔地区Maykop附近准备的。 该研究使用Thermo Scientific QUANT'X X射线荧光光谱仪进行。 根据研究结果，桃叶的主要元素是钾和钙，其中微量元素中含量最大的是铝，铁和锰。 还确定除了硅之外的所有主要元素都会进入厚厚的桃叶提取物，但它们之间的相互关系会发生变化。

关键词：普通桃，粗提物，元素组成，X射线荧光法。

Abstract. *The study of the elemental composition of the leaves, thick extract of common peach - Persica vulgaris Mill was conducted. Samples for the study were prepared in the Krasnodar Territory of the Russian Federation in the vicinity of the city of Maykop. The study was carried out using a Thermo Scientific QUANT'X X-ray fluorescence spectrometer. According to the results of the study, the main macroelements of peach leaves are potassium and calcium, and among the microelements in the largest amount accumulate: aluminum, iron and manganese. It was also established that all the main elements with the exception of silicon go into a thick extract of peach leaves, but their mutual relationship changes.*

Keywords*: common peach, thick extract, elemental composition, X-ray fluorescence method.*

Introduction

An ordinary peach is a tree 3-5 m high with branches forming a wide crown. The leaves are oblong - lanceolate, 8-15 cm long, 2-3.5 cm wide, alternate, ellipti-

cal. The flowers are pink or red, numerous, uneven in size, sessile. Appear before the leaves, on a short peduncle. Fruits - juicy drupes, usually large, ovoid, pubescent or glabrous. The bone is furrowed, ribbed [1].

In the wild, the peach is unknown. The subtropics of East Asia are considered its place of origin. From China, where it was still grown 4000 years ago, peach spread through Northern India and Persia to Central Asia, the Caucasus and the Mediterranean.

In its wild form, peach is found in North and Central China, India, and Afghanistan. It is cultivated in East Transbaikalia, in the Caucasus, in Central Asia, in Moldova and in Ukraine. Peach is a cultivated plant only [1].

According to published data, peach seeds contain 55% fatty oil. Peach fatty oil is non-drying and contains triglycerides of unsaturated fatty acids - oleic, linoleic, linolenic, hydroxyoleic.

The pulp of peach fruits contains polysaccharides, including pectins, sugars - up to 27%, carotenoids, ascorbic acid, nicotinic acid, micro and macro elements, among which potassium dominates [1,2].

Peach leaves contain: coumarins, tannins (tannin), flavonoids (nagenin, persicoside, quercetin), carotenoids, phenol glycosides (amygdalin), aromatic phenolic acid (chlorogenic). The complex of polyphenolic compounds of peach leaves revealed trace elements: manganese, copper, zinc, silver, phosphorus [3,4].

According to research results, herbal preparations of a polyphenolic nature from the leaves of common peach increase the phagocytic activity of neutrophils and macrophages, promote the active production of antibodies, increase the number of T-lymphocytes, that is, they stimulate the immune system. Peach-based products, as well as the fruits themselves, have antioxidant properties and cleanse the body of free radicals that lead to age-related changes.

The active components in the composition of peach fruits reduce the negative impact of stress on the body, limit the action of toxins, which lead to impaired immunity [4,5,6,7,8].

Official medicine recommends using peach preparations to prevent cancer and increase the immune status, to increase the body's resistance, with increased adverse environmental stresses, for the treatment of diseases of the respiratory system, digestion, prostate, gynecological, cardiovascular, oncological ailments, to prevent consequences of intoxication and for inhibition of aging [7,8].

The action of medicinal plant materials is associated with the presence of not only the main groups of biologically active substances, but also with the content of chemical elements, which also cause an important pharmacological effect.

The aim of the work was to study the elemental composition of leaves, and a thick extract of common peach leaves.

Materials and methods

The objects of study were peach tree leaves collected in the vicinity of Maykop, Krasnodar Territory. A thick extract was obtained according to the following procedure: about 10 kilograms of crushed peach leaf was placed in a digester, poured with 100 liters of water, and extraction was carried out under heating for 1 hour at a temperature of 50-60 degrees. The spent raw materials were filtered, the aqueous part was evaporated at a temperature of 50-60 degrees, to a residual moisture content of not more than 25%.

Elemental composition studies were carried out using the X-ray fluorescence method. Samples were prepared according to the following procedure: a sample of about 10 g of dry raw material was ground to a powder state, placed in a crucible and burned on a stove until smoke stopped. The crucibles were placed in a muffle furnace at a temperature of 600 ° C, kept in a muffle furnace for about 2 hours, until complete ashing and the absence of black coal mass. After complete cooling of the crucibles, 50% nitric acid was added and it was evaporated on a tile, avoiding splashing, then it was placed in a muffle furnace at the same temperature for 2 hours [9]. After cooling the crucible, in the ash residue, the qualitative and quantitative composition of the elements was determined using a Thermo Scientific QUANT'X X-ray fluorescence spectrometer.

Results and discussion

Using X-ray fluorescence analysis, we studied the elemental composition of peach leaves and a thick extract of common peach leaves.

By to the results of the study, it was found that the content of chemical elements in the peach leaf and thick extract is different. Among macronutrients in a leaf of peach in a greater amount accumulate: potassium and calcium. Trace elements contain more: aluminum, iron and manganese.

Row of biological absorption of chemical elements for common peach leaves is as follows:

K>Ca>Na>P>Mg>S>Al>Fe>Mn>Si>Ti>Zn>Cu>Ba>Ni>Mo>Sn.

In the study of the elemental composition of a thick extract of peach leaves, a row of chemical elements were established by the degree of their decrease:

K>Na>Ca>P>Al>Fe>Mg>S>Zn>Mg>Ti>Cu>Ni.

As you can see, the largest transition to a thick extract was noted for elements such as potassium, sodium, calcium, phosphorus. Among the trace elements in the largest amount, a thick extract transfers: aluminum and iron. Iron is an essential element for the human body, with its insufficient intake , iron deficiency anemia develops [10]. Aluminum is also necessary for the body as a component of enzyme systems, but with an excess of aluminum entering the human body, dysfunction of the central nervous system, progressive senile dementia, and a tendency to depression can occur [10].

Element	Content,% of the total number of elements	
	Peach leaf	Thick peach leaf extract
Cu	0,0249	0,0533
Zn	0,0371	0,0824
Na	3,4	5,2
Mg	1,059	0,531
Al	0,778	0,812
Si	0,1548	0
P	1,509	1,48
S	0,7843	0,3312
K	57,8	87,8
Ca	33,5	2,878
Ti	0,0759	0,0654
Cr	-	0
Mn	0,224	0,0827
Fe	0,5899	0,6977
Co	-	0
Ni	0,0037	0,0084
Pb	0	0
Mo	0,0029	0
Sn	0,0027	0
Ba	0,012	0

Thus, it was found that all the main elements with the exception of silicon transfer into a thick extract of peach leaves, but their mutual relationship changes.

References

1. An ordinary peach. Pharmacological properties. - [Electronic resource]. - Access: http://lektrava.ru/encyclopedia/persik-obyknovennyy/).

2. Georgievsky, V.P. Biologically active substances of medicinal plants / V.P. Georgievsky, N.F. Komisarenko, S.E. Dmitruk. - Novosibirsk: Nauka, 1990.- P. 191-198.

3. The healing properties of the peach tree. - [Electronic resource]. - Access: http://www.press-release.ru.

4. "Akan" – user manual - [Electronic resource]. - Access: http://www.transfer-faktory.ru/akan.

5. "Oleksin" - source of miraculous bioflavonoids. - [Electronic resource]. - Access: http://oleksin-perm.ru/production/ oleksin/instruktsii_po_primeneniyu/.

6. "Persifen"- user manual – [Electronic resource]. - Access: http://www.eurolab.ua/medicine.

7. "Flavopersin" - the double energy of peach and sea buckthorn flavonoids. - [Electronic resource]. - Access: http://oleksin-perm.ru/production/flavopersin/

8. Garbuzov, G.A. Cancer can be defeated! Trap for cancer cells / G.A. Garbuzov / Peter - 2012. - 320 P.

9. Gulyaev D.K., Belonogova V.D. The elemental composition of underground organs and extracts of ordinary spruce // Pharmacy. - 2018. - № 6. P. 20-23.

10. Kozhin A.A., Vladimirsky B.M. Microelementoses in human pathology of ecological etiology // Human Ecology. - 2013. - P. 56-63.

UDC 614.48 : 620.193

抗腐蚀性N,N-双(3-氨基丙基) - 十二烷基胺
ANTICORROSIVE PROPERTIES OF N,N-BIS(3-AMINOPROPYL)-DODECYLAMINE

Gerasimov Vladimir Nikolaevich
Doctor of Biological Sciences, Lead Research Officer
Kiseleva Natalia Vladimirovna
Candidate of Chemical Sciences, Lead Engineer
Korobova Nadegda Aleksandrovna
Technologist
Dyatlov Ivan Alekseevich
Doctor of Medical Sciences, Academician of RAS, Full Professor, Director of the "State Research Center of Applied Microbiology and Biotechnology" of Rospotrebnadzor
Obolensk, Russia

抽象。 我们研究了合金锡相对于烷基二甲基苄基氯化铵和N,N-双(3-氨基丙基) - 十二烷基胺(三胺)溶液的稳定性,它们分别或以不同比例取得。 结果表明,烷基二甲基苄基氯化铵(QAC)与三胺抗腐蚀性能的混合物浓度大于1%。 QAC的数量不得超过三胺的浓度。 当氯化烷基二甲基苄基铵的浓度为3%时,三胺的浓度必须超过QAC浓度的2倍,以防止金属腐蚀。

关键词:烷基二甲基苄基氯化铵,N,N-双(3-氨基丙基) - 十二烷基胺,缓蚀剂,消毒剂。

Abstract. *We investigated the stability of the alloy tin in relation to the solutions of alkyldimethylbenzylammonium chloride and N,N-bis(3-aminopropyl)-dodecylamine (Triamine), taken separately or in different ratios. It is shown that the mixture of alkyldimethylbenzylammonium chloride (QAC) with Triamine anti-corrosion properties occur at concentrations greater than 1%. The number of QAC must not exceed the concentration of Triamine. When the concentration of the chloride alkyldimethylbenzylammonium is 3%, concentration of Triamine must exceed 2 times the concentration of QAC in order to prevent corrosion of the metal.*

Keywords: *alkyldimethylbenzylammonium chloride, N,N-bis(3-aminopropyl)-dodecylamine, corrosion inhibition, disinfectants.*

High rates of expansion of the range of disinfectants, intensification of their production impose certain requirements for the creation of reliable packaging that provides long-term storage without compromising the consumer characteristics of the preparations, which are complex compositions of aggressive chemical compounds. In this regard, the specialists developing disinfectants are faced with the task of choosing a metal that is resistant to the components of the disinfectant, or optimizing the component composition of the disinfectant in such a way as to ensure the stability of the metal with respect to the chemical compounds present in the mixture. In the national economy, inhibitors are used to prevent corrosion, which are selected depending on the mechanism of corrosion protection, depending on the nature of the metal and the liquid medium in which the process takes place. There are organic and inorganic inhibitors, according to the mechanism of action - adsorption or passivation. Aliphatic or aromatic derivatives of amines are often used as organic inhibitors. It is believed that their maximum protective effect manifests itself in an acidic environment [1-7].

The aim of this work is to study the aggressiveness of the effect on doped tin of alkaline solutions of quaternary amine (alkyldimethylbenzylammonium chloride) and tertiary amine - N, N-bis (3-aminopropyl) dodecylamine.

Materials and methods

Doped tin (GOST R 52204-2004) in the form of plates 2 × 2.5 cm in size was used as a test object. The tin plates were placed in a suspension of chemical compounds on a silk thread, which was passed through a polypropylene plug tightly rubbed to the walls glass beaker, incubated at room temperature. The choice of alloyed tin as an object of study is due to the fact that it is often used for the manufacture of packaging of disinfectants or household chemicals that are used in the form of an aerosol.

During the experiment, aqueous solutions of alkyl dimethylbenzylammonium chloride (0.01%, 0.02%, 0.05%, 0.5%, 1.0%, 3.0%, 6.0%) and N,N-bis(3-aminopropyl) -dedecylamine (0.01%, 0.02%, 0.05%, 0.1%, 0.5%, 1.0%, 3.0%, 6.0%) solutions were analyzed. The pH of the solutions ranged from 9.83 to 10.86. The duration of the experiment is 1050 hours.

The interaction of the metal with aqueous solutions of chemical compounds was evaluated visually using a Panasonic camera and an optical microscope equipped with a Leica M165C camera (Leica, Germany). The maximum magnification factor of the device is 50.

Results and discussion

Triamine and FAM are used as components in a wide range of disinfectants. The aggressiveness of their effect on doped tin was evaluated by the color change of the analyzed solutions, by the change in the integrity of the protective coating of tin, and also by the appearance of the products of the interaction of these chemical

compounds with the metal. We used tin plates cut from one sheet. This was done in order to determine the effect of FAM and Triamine not only on the protective layer, but also on uncoated tin in order to assess the risk of corrosion when the protective layer is broken in unforeseen situations.

The experiments were carried out in two directions:

– investigation of metal stability with respect to FAM and Triamine solutions separately;

– investigation of metal resistance to alkaline solutions of a mixture of FAM and Triamine, taken in various ratios. The maximum concentration of each of the components is 6% of the mass.

Table 1 presents the test results of the stability of tin in relation to FAM and Triamine separately. The concentration of the components is 0.01%, 0.02%, 0.05%. The duration of the experiment is 1050 hours. First of all, it should be noted that both FAM and Triamine cause corrosion of alloyed sheet, but the degree of aggressiveness of their effect varies and depends on the nature of the chemical compound, its concentration and the duration of incubation of the plate in the solution.

Table 1 - *The results of the study of the aggressiveness of the effects of alkyl dimethylbenzylammonium chloride and N, N-bis (3-aminopropyl)-dodecylamine on tin*

Alkyldimethylbenzylammonium chloride (FAM)			**N, N-bis (3-aminopropyl)-dodecylamine (Triamine)**		
0,01 %	**0,02 %**	**0,05 %**	**0,01 %**	**0,02 %**	**0,05 %**
The main signs of aggressive solution and damage to metal plates					
The solution turned yellow after 20 hours	The solution turned yellow after 16 hours	The solution turned yellow after 8 hours	The solution turned yellow after 20 hours	The solution turned yellow after 35 hours	No change after 92 hours
Corrosion along the edge of the plate after 44 hours	Corrosion along the edge of the plate after 35 hours	Corrosion along the edge of the plate after 20 hours	Corrosion along the edge of the plate after 44 hours	Corrosion along the edge of the plate after 44 hours	No change after 170 hours
Corrosion along the edge of the plate after 120 hours	Corrosion along the edge of the plate after 120 hours	Plate surface corrosion after 120 hours	Corrosion along the edge of the plate after 120 hours	Corrosion along the edge of the plate after 120 hours	No change after 120 hours
Plate surface corrosion after 430 hours	Plate surface corrosion after 430 hours	Plate surface corrosion after 430 hours	Plate surface corrosion after 430 hours	Plate surface corrosion after 430 hours	No change after 1050 hours

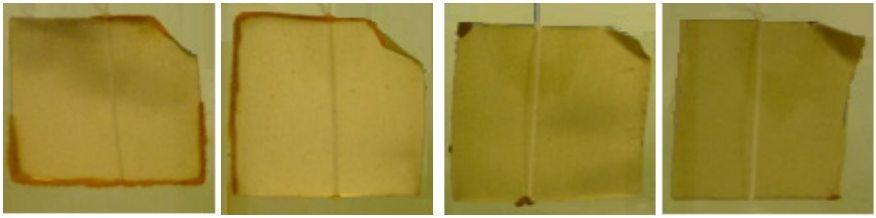
The experimental results showed that FAM is a more aggressive compound than Triamine. With increasing concentration of FAM, the degree of exposure to the metal increases. The first signs of corrosion - a change in the color of the liquid, are observed in a solution of the highest FAM concentration (0.05%) already 8 hours after the start of the experiment. After 20 hours, separate yellow spots appear along the edge of the plate - where there is no protective layer. In a solution of 0.01% concentration, yellowing of the solution is observed 20 hours after the start of incubation. Corrosion products appear in unprotected areas of the plate after 44 hours. After 120 hours of experiment on the surface of the plate, which was in a solution of 0.05% FAM concentration, dark spots of ulcerative corrosion were observed, the tin plate in a solution of 0.01% concentration is destroyed only along the edge - where there is no protective layer.

On the contrary, with the action of Triamine on tin, corrosion begins in solutions of a lower concentration, and with an increase in the concentration of Triamine, the aggressiveness of solutions decreases. A color change of a 0.01% solution of Triamine is observed after 20 hours, a color change of 0.02% after 35 hours after the start of the experiment. After 44 hours of incubation of the metal in 0.01% and 0.02% triamine solutions, signs of corrosion of unprotected sections of tin appear along the edge of the plate. In a solution of a higher concentration of Triamine (0.05%), the metal does not corrode. 120 hours after the start of the experiment, the picture does not change: in solutions of 0.01% and 0.02% concentration of Triamine, corrosion is observed along the edge of the plate. A plate in a solution of 0.05% concentration remains unchanged.

After 430 hours of incubation of the metal in 0.01% and 0.02% triamine solutions, the integrity of the protective film of the tin samples is violated, rust spots appear on the surface of the plates. A tin plate incubated in a 0.05% Triamine solution remains clean without signs of corrosion. The picture did not change after 1050 hours. The solution remained clear and colorless. Therefore, N, N-bis (3-aminopropyl)-dedecylamine in a solution of 0.05% concentration has protective properties against tin. Corrosion is absent both on the plate surface and on unprotected metal areas. It is likely that N, N-bis (3-aminopropyl)-dedecylamine is adsorbed on the surface of the sheet and forms a protective layer that prevents corrosion of the alloyed sheet.

In another series of experiments, the anticorrosive properties of triamine alkaline solutions in a composition with alkyldimethylbenzylammonium chloride (FAM) were investigated. In the experiments, mixtures were analyzed in which the concentration of Triamine ranged from 0.05% to 6.0%, the FAM concentration ranged from 0.5% to 6.0%. The results showed that at a maximum FAM concentration of 6%, tin corrosion decreases with increasing Triamine concentration.

After 1050 hours of the tin plate being in a solution containing 0.05% (or 0.10%) of Triamine and 6% FAM, active formation of orange hydroxide is observed along the edge of the plate in unprotected areas (Figure 1A and 1B). At a triamine concentration of 1%, corrosion products are also formed along the edge of the plate, but they are local in nature (Figure 1C). With a maximum concentration of Triamine (6%) and a Triamine / FAM ratio of 1: 1, the tin plate is almost clean. Only at the bottom right is there a faint spot of local corrosion at the corner of the plate (Figure 1D).



A **B** **C** **D**

Figure 1. *Photographs of a series of plates placed in Triamine and FAM solutions taken in the ratios:* **A** *– 0.05% Triamine and 6% FAM;* **B** *–0.1% Triamine and 6% FAM;* **C** *– 1.0% Triamine and 6% FAM;* **D** *– 6.0% Triamine and 6% FAM*

A closer look reveals that the corrosion products of plates in solutions with different Triamine concentrations look different. At the edge of the plate, incubated in a solution containing 0.05% triamine and 6% FAM, iron hydroxide is orange. In a 1% solution of Triamine, corrosion products appear on separate areas of the plate. In this case, the rust has a brown color, the layer of iron hydroxide is more smooth and shiny. It can be assumed that it is covered with a film, which probably significantly reduces the rate of corrosion propagation.

Table 2 presents all the results of the study of the aggressiveness of the action on the tin of solutions of a mixture of Triamine and FAM.

Table 2 - *Temporal parameters of the appearance of the first signs of corrosion on the unprotected edges of alloyed tin plates in alkaline solutions of Triamine and alkyldimethylbenzylammonium chloride (FAM)*

FAM, % mass.	**Triamine,% of mass**				
	0,05	**0,1**	**1,0**	**3,0**	**6,0**
0,5	4 hour	4 hour	–	–	–
1,0	4 hour	4 hour	–	–	–
3,0	4 hour	4 hour	48 hour	–	–
6,0	4 hour	4 hour	48 hour	250 hour	950 hour

The results showed that, in a mixture with alkyldimethylbenzylammonium chloride, the anti-corrosion properties of the Triamine appear at concentrations of more than 1%. In the concentration range from 1% to 3%, the amount of FAM should not exceed the concentration of Triamine. In solutions of 6% concentration of Triamine, metal corrosion is not observed if the amount of FAM is 3%.

Conclusions

1. FAM has been found to be a more aggressive compound than Triamine. With increasing concentration of FAM, the degree of exposure of the metal increases.

2. When Triamine acts on tin, corrosion begins in solutions of a lower concentration, and with an increase in the concentration of Triamine, the aggressiveness of solutions decreases.

3. N,N-bis(3-aminopropyl)-dedecylamine in a solution of 0.05% concentration has protective properties in correlation with tin. Corrosion is absent both on the plate surface and on unprotected metal areas.

4. It was found that, in a mixture with alkyldimethylbenzylammonium chloride, the anti-corrosion properties of Triamine are manifested at concentrations of more than 1%.

5. Disinfecting composite mixtures based on alkyldimethylbenzylammonium chloride (mass fraction 1-3%) and Triamine (mass fraction 3-6%) have anticorrosion properties and can be recommended for processing of medical tools, devices and apparatus, technological equipment.

References

1. Grigoryev V.P., Ekilik V.V. Chemical structure and protective effect of corrosion inhibitors. - Rostov on Don: Publishing house of Rostov State University, 1978.- 184 P.

2. Zhuk N.P. Corrosion and metal protection course. - Moscow: Metallurgy, 1976.- 472 P.

3. Kofanova N.K. Corrosion and metal protection: Textbook - 2003. - 181 P.

4. Rosenfeld I.L. Corrosion inhibitors. - Moscow: Chemistry, 1977. - 350 P.

5. Semenova I.V. Corrosion and corrosion protection: Textbook / I.V. Semenova, G.M. Florianovich, A.V. Khoroshilov. - Moscow: Fizmatlit, 2010. - 413 P.

6. Tarchigina N.F. Chemical resistance of materials and corrosion protection: Textbook / N.F. Tarchigina, V.N. Rusin, Yu.M. Galkina. – Moscow: Open State University, 2012. - 154 P.

7. Ulig G.G., Revi R.U. Corrosion and the fight against it. - L.: Chemistry, 1989. - 456 P.

雌性Wistar大鼠在固定光照和恒定照明下一岁时某些生化常数的昼夜节律特征
DIURNAL RHYTHM CHARACTERISTIC OF SOME BIOCHEMICAL CONSTANTS OF FEMALE WISTAR RATS AT THE AGE OF ONE YEAR IN A FIXED LIGHT MODE AND CONSTANT LIGHTING

Shmigelskiy Egor Alexandrovich
Research Scientist
Makartseva Lyudmila Andreevna
Head Research Scientist
Gritsyunayte Agelica Andrusovna
Research Scientist
Research Laboratory of Experimental Biology and Biotechnology, Scientific and Educational Center of Moscow State Region University in Chernogolovka, Mytishchi, Russia

抽象。 在固定光照和恒定照明条件下，研究一岁时雌性Wistar大鼠血浆中总蛋白，白蛋白，碱性磷酸酶，胆固醇，胆红素和甘油三酯的日常节律特征。 呈现。

关键词：昼夜节律，不同步，总蛋白，白蛋白，甘油三酯，胆红素，碱性磷酸酶，胆固醇。

Abstract. *The results of the study of the peculiarities of the daily rhythm of total protein, albumin, alkaline phosphatase, cholesterol, bilirubin and triglycerides in the blood plasma of female Wistar rats at the age of one year under conditions of fixed light mode and constant lighting are presented.*

Keywords: *circadian rhythm, desynchronosis, total protein, albumin, triglycerides, bilirubin, alkaline phosphatase, cholesterol.*

Light is a leading exogenous factor that affects almost all the physiological functions of the body of mammals, including humans. The main role in coding information about the light regime is played by the pineal gland [1], which regulates other endocrine glands with the help of the secreted hormone melatonin [2]. This hormone forms bilateral connections with the suprachiasmatic nuclei of the hypothalamus [4], determines the effect of the pineal gland on the rhythmic functioning of the hypothalamic-pituitary-adrenal system [6].

With constant illumination, SCN inhibits the production of melatonin in the pineal gland, which leads to desynchronosis [3,5,10] and disruption of homeostasis [8], which is expressed in changes in biochemical and hematological constants.

Based on this, it seemed relevant to us to study the daily rhythm of biochemical and hematological parameters of female Wistar rats at the age of 1 year, contained in a fixed light mode and constant lighting.

The study was conducted on 2 groups of female Wistar rats at the age of 1 year. The first group, consisting of 32 rats, was in a fixed light condition (L: D; 12: 12 hours) for three weeks. The second group of animals was kept under the same conditions, but with constant illumination (LL) for three weeks as well. Animals were kept in standard laboratory conditions with free access to water and feed. The studied parameters were determined by Zeitgeber time, at 9, 15, 21, 3 hours [7].

Biochemical analysis of blood plasma was performed on Stat Fax 3300 (USA) using Spinreact reagents (Spain). The following parameters were determined: the content of total protein, albumin, triglycerides, cholesterol, bilirubin, as well as the daily activity of alkaline phosphatase.

GraphPad Prism 6.0 (USA) was used for statistical analysis of the obtained data. The obtained values were presented as Mean ± SD. The reliability of the data was calculated using t-student test. A p value <0.05 was considered statistically significant.

To analyze the circadian rhythm characteristics of the studied substances, we used a cosinor analysis performed using the Cosinor Ellipse 2006-1.1 program (RF). Kosy-nor analysis allows to analyze chronobiological data, find out the rhythm of various functional indicators, and also calculate the parameters of established rhythms. The presence of a reliable circadian rhythm, as well as its acrophase and amplitude, has been established. Acrophase is a measure of the peak time of the total rhythmic variability over a 24-hour period. The amplitude corresponds to half the total rhythmic variability in the cycle. Acrophase is expressed in hours and minutes [9].

As a result of the study, it was found that with a fixed light mode, the daily rhythm of the protein content in the blood is characterized by a maximum of 21 hours, with a mini-mum of 3 hours. With constant lighting, the rhythm experiences slight fluctuations in the period from 9 to 21 hours, but by 3 hours, there is a significant decrease in the value of this parameter (Fig. 1.).

The results of cosinor analysis confirm the presence of a reliable circadian rhythm of this indicator in both light modes. But, with a fixed light mode, the acrophase of the rhythm occurs for 19^{16} hours at an amplitude of 8.44 g/l, and with constant lighting it shifts for 17^{19} hours with an increase in amplitude to 15.70 g/l (Fig. 2).

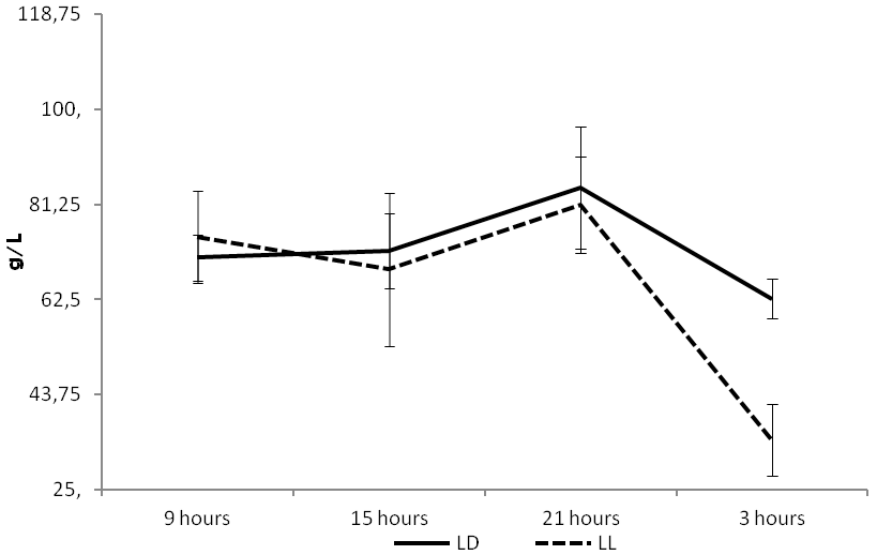


Fig. 1. *Daily dynamics of the content of total protein in the blood plasma of rats*

Note: hereinafter: LD - indicators at a fixed light mode, LL - indicators at a constant lighting mode

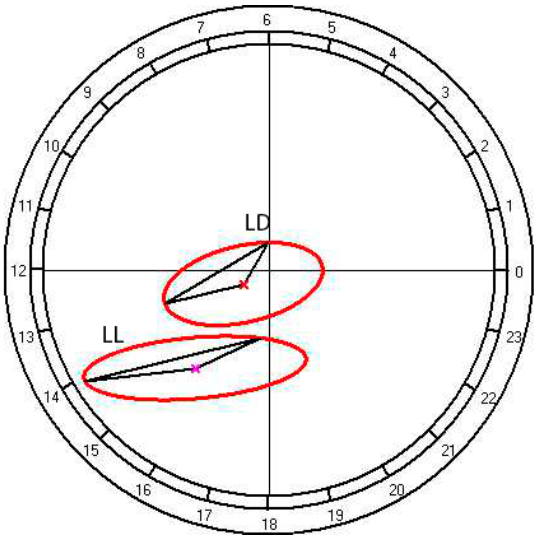


Fig. 2. *The results of cosinor analysis of the circadian rhythm of the content of total protein in rat blood plasma*

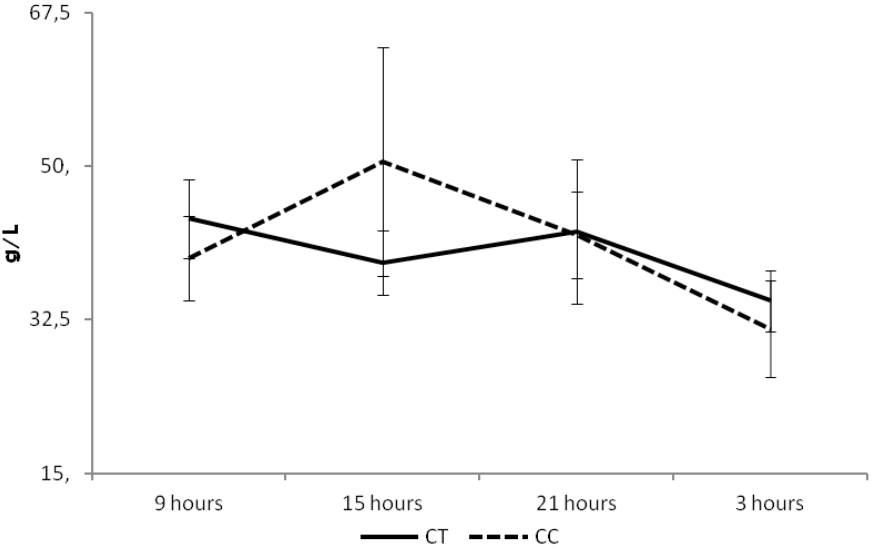


Fig. 3. *Daily dynamics of albumin in rat plasma*

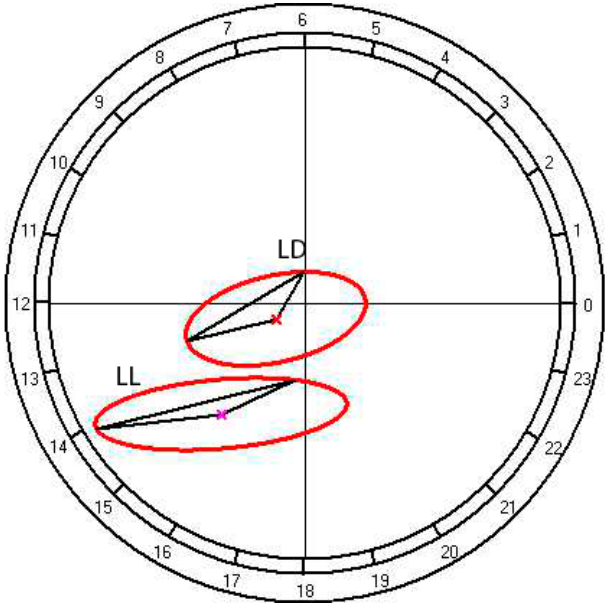


Fig. 4. *Results of cosinor analysis of the circadian rhythm of the total protein content in rat plasma*

The daily dynamics of the albumin content in the blood of rats is also quite clearly expressed both in a fixed light mode and in constant light. In the first case, the maximum values are noted at 3 hours, and the minimum - at 15 hours. After changing the lighting mode, the maximum point shifts by 21 hours (Fig. 3). At the same time, according to the results of cosinor analysis, a reliable circadian rhythm is not observed with a fixed light mode, and the containment of rats under constant lighting will allow this rhythm to occur with an acrophase of 15^{32} hours and an amplitude of 9.58 g/l (Fig. 4).

When considering the diurnal dynamics of alkaline phosphatase activity under both light conditions, the maximum values are observed at 9 o'clock, and the minimum - at 21 and 15 o'clock under the fixed light mode and constant illumination, respectively (Fig. 5).

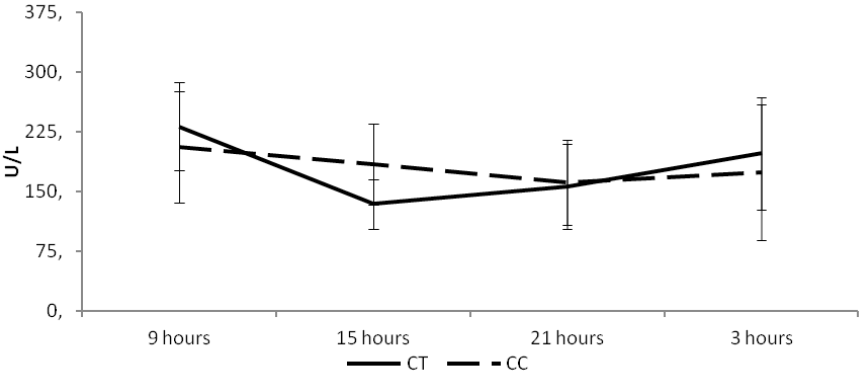


Fig. 5. *Daily dynamics of alkaline phosphatase activity in rat plasma*

According to the results of cosinor analysis at a fixed light mode, a reliable circadian rhythm is detected and its acrophase lasts for 6^{15} hours, the amplitude of the rhythm is 49.38 U/L, but disappears with constant lighting (Fig. 6).

When considering the dynamics of the cholesterol content in the blood of rats, the minimum values of 15 hours are observed in both light modes. The maximum values for a fixed light mode are observed at 3 hours, and with constant lighting, the maximum occurs at 21 hours (Fig. 7).

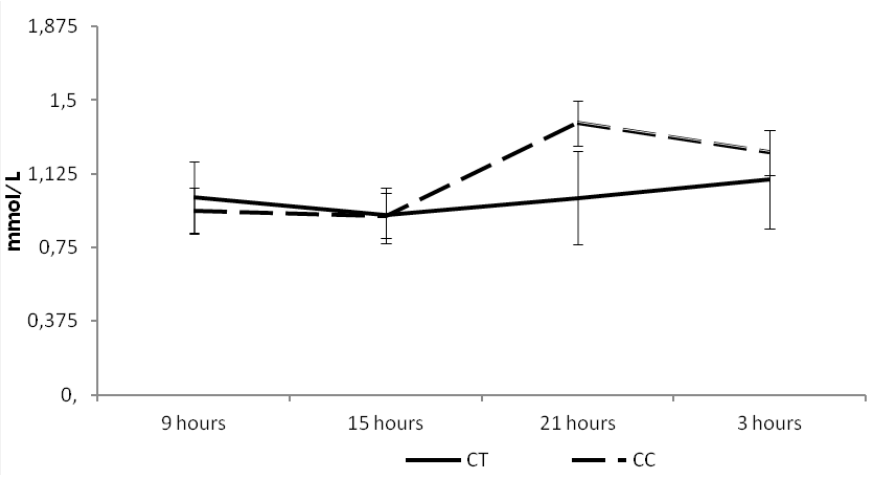


Fig. 7. *Daily dynamics of rat cholesterol*

According to the results of cosinor analysis, no reliable circadian rhythm is detected in both light modes.

As a result of studies of the dynamics of rat plasma bilirubin, the minimum occurs in 9 hours under both light conditions. The maximum in fixed light is noted at 3 hours, and in constant light it shifts by 21 hours. The results of the cosinor analysis showed the absence of a reliable circadian rhythm in both groups.

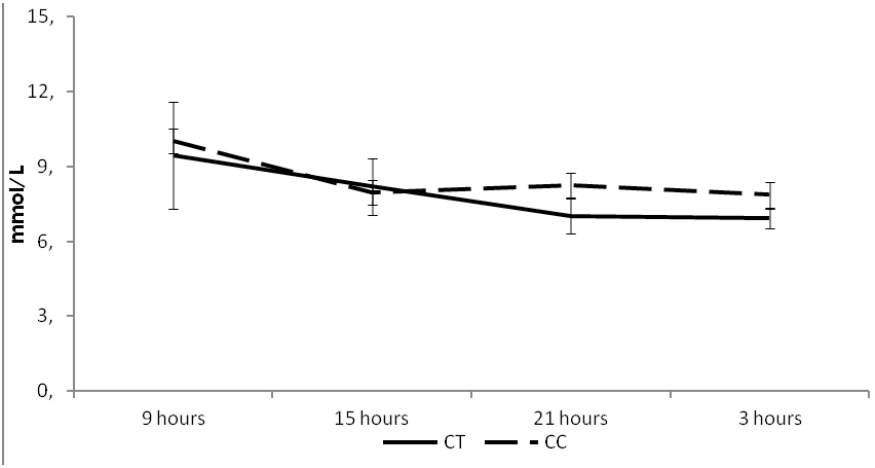


Fig. 8. *Daily dynamics of the content of triglycerides in the blood plasma of rats*

An analysis of the daily triglyceride content under both light conditions reveals a similarity in their dynamics. The maximum values in both modes coincide with 9 hours, the minimum 3 hours (Fig. 8). At the same time, cosinor analysis shows the presence of a reliable circadian rhythm with a fixed light mode and its acrophase occurs in 10^{48} hours, the rhythm amplitude is 1.37 mmol/L (Fig. 9).

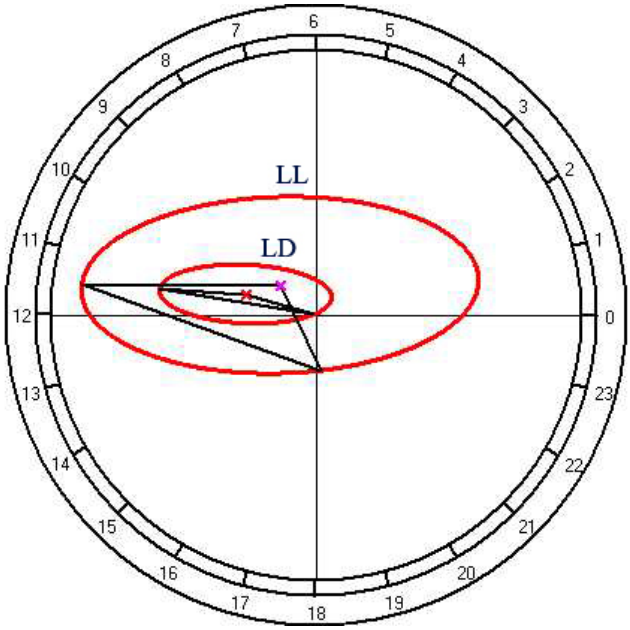


Fig. 9. *The results of cosinor analysis of the circadian rhythm of the content of triglycerides in rat plasma*

Thus, the study indicates that a violation of the light regime, and in particular, staying in constant lighting conditions, causes a breakdown in the normal daily rhythm of a number of physiological parameters studied. It is noteworthy that of all the studied parameters, the circadian rhythm in the new lighting conditions occurs only in blood proteins, but at the same time, in the case of triglycerides, the diurnal rhythm absent in the fixed light mode is observed under constant illumination. In all other cases, a three-week keeping of animals under constant light conditions leads to the destruction of circadian rhythms.

The lack of circadian rhythm of bilirubin and cholesterol, in our opinion, may be due to the fact that animals had unlimited access to food, and for these parameters, the vivarium food regime can serve as a secondary rhythm initiator.

In general, the containment of rats under constant lighting leads to the emergence of desynchronosis, accompanied by a decrease in the adaptive capacity of the body.

References

1. Agadzhanyan N. A., Gubin D. G. Desynchronosis: developmental mechanisms from the molecular genetic to the organismal level // Uspekhi Fiziologicheskikh Nauk. - 2004. - V. 35. - № 2. - P. 57-72.

2. Anisimov V. N., Vinogradova I. A. Aging of the female reproductive system and melatonin // St. Petersburg: System. - 2008. - V. 45.

3. Anisimov VN Melatonin and his place in modern medicine // Rus. med. journal - 2006. - V. 14. - № 4. - P. 269-273.

4. Arushanyan E. B., Popov A. V. Modern ideas about the role of suprachiasmatic nuclei of the hypothalamus in the organization of daily periodism of physiological functions // Advances in physiological sciences. - 2011. -V. 42. - № 4. - P. 39-58.

5. Gubin D. G. Molecular mechanisms of circadian rhythms and principles of development of de-synchronosis // Advances in physiological sciences. - 2013. - V. 44. - №. 4. - P. 65-87.

6. Goncharova ND and others. The hypothalamic-pituitary-adrenal system and enzymes of the glutathione-dependent antioxidant system in stress and aging // Bulletin of experimental biology and medicine. - 2007. - V. 144. - № 11. - P. 574-577.

7. Areshidze D.A., Kozlova M.A., Makartseva L.A. Morpho-functional state of hippocampus of rats of young and senile age at fixed light regime and its inversion // J. Pharmaceutical, Biological and Chemical Sciences. – 2018. – Vol. 9(4). – P. 1436–1442.

8. Areshidze D.A., Kozlova M.A., Makartseva L.A. Kucher S.A. Circadian rhythms of some metabolites of rats at the age of 18 months in conditions of constant illumination // Research journal of pharmaceutical, biological and chemical science. – 2018. – RJPBCS. 9(5). – P. 1333-1342.

9. Cornelissen G. Cosinor-based rhythmometry //Theoretical Biology and Medical Modelling. – 2014. – V. 11. – №. 1. – P. 16.

10. Qing Yan. Cellular rhythms and networks. Implications for systems medicine//SpringerBriefs in cell biology(eBook) DOI :10.1007/978-3-319-22819-8

植物生物量的臭氧化。 臭氧化松木的TG / DTG / DSC分析
OZONATION OF PLANT BIOMASS. TG/DTG/DSC ANALYSIS OF OZONIZED PINE WOOD

Mamleeva Nadezhda Alekseevna
Candidate of Chemical Sciences, Senior Research Officer
Shumyantsev Alexey Viktorovich
Candidate of Chemical Sciences
Lunin Valery Vasilyevich
Lomonosov Moscow State University,
Moscow, Russia

抽象。通过在氧化环境中的热分析研究了在臭氧影响下松木的转化。从不同吸收臭氧量的木材中木质素（LG），半纤维素（HC）和纤维素（CL）转化的角度分析了TG / DTG和差示扫描量热法（DSC）的数据。

TG / DTG分析的结果表明在松木臭氧化过程中半纤维素的破坏。降低从臭氧化木材获得的LCM的热分解温度与在生物质臭氧化期间CL含量的降低和CL的解聚一致。从-ΔH= 5.6kJ / g（源木材）到-ΔH= 3.6kJ / g（臭氧化木材）观察到总放热效应的降低。所述热性质的变化与臭氧化过程中芳族和多个木质素键的破坏有关，并且可能与无定形纤维素的比例增加有关。

关键词：臭氧，松木，脱木素，氧化环境中的热分析

Abstract. *Transformations of pine wood under the influence of ozone were studied by thermal analysis in an oxidizing environment. The data of TG / DTG and differential scanning calorimetry (DSC) were analyzed from the point of view of transformations of lignin (LG), hemicelluloses (HC) and cellulose (CL) in wood with different amounts of absorbed ozone.*

The results of TG / DTG analysis indicate the destruction of hemicelluloses during ozonation of pine wood. Lowering the temperatures of thermal decomposition of LCM obtained from ozonated wood is consistent with a decrease in the LG content and depolymerization of CL during ozonation of biomass. A decrease in the total exothermic effect is observed from –ΔH = 5.6 kJ / g (source wood) to -ΔH = 3.6 kJ / g (ozonized wood). The noted changes in thermal properties are associated with the destruction of aromatic and multiple lignin bonds during ozonation, and, possibly, with an increase in the proportion of amorphous cellulose.

Keywords: *ozone, pine wood, delignification, thermal analysis in an oxidizing environment*

Ozonation is one of the methods for the delignification of lignocellulosic materials (LCM) at the pretreatment stage in the processes of obtaining polysaccharides and monosaccharides [1-8].

Studies of transformations of aspen and pine wood under the influence of ozone showed the possibility of deep delignification of lignocellulosic materials (LCM), which is accompanied by destruction of hemicelluloses (HC). A decrease in the degree of polymerization of cellulose (CL) from ozonized wood of aspen and pine was also noted [2,3].

The study of various types of plant biomass by thermogravimetric analysis (TGA) has been the subject of many studies [5–16]. In combination with the methods of IR spectroscopy, X-ray powder diffraction, and chemical analysis, TGA is widely used to study the transformation of biomass after processing in various ways. It is known that TGA is used to study the content of cellulose and hemicelluloses and their structural transformations in the treatment of biomass by ionic liquids [11,12]. A correlation between the thermal stability of biomass and the content of crystalline cellulose is noted, and delignification of biomass leads to a decrease in its thermal stability.

Most often, an inert thermal analysis option is used to study LCM. In the works [5,6]. TG / DTG analysis is used to study biomass transformations after treatment with ozone [5], as well as a combination of ozonation with ultrasound [6]. In [17], thermogravimetric analysis in an inert medium is used to study the transformation of pine wood under the influence of ozone. Based on the TG / DTG data and mass spectrometric analysis of biomass pyrolysis products, it is assumed that, when the wood is treated with ozone, not only degradation but also polymerization of aromatic lignin structures takes place.

There are works on the application of thermal analysis in an oxidizing environment to study the properties of lignin cellulose, hemicelluloses and LCM [13-16]. In this work, TG / DTG and DSC analysis in an oxidizing environment was used to study wood transformations under the influence of ozone.

Experimental part

Ozonation of samples of pine wood (*Pinus silvestris*) (fraction with a particle size of 0.315 - 0.63 mm) with a water content of 60-63% relative to the mass of absolutely dry wood was carried out in a flow system in a fixed-bed reactor. The amount of ozone absorbed per gram of absolutely dry wood (Qr, mmol / g) is determined as described in [3.8].

After treatment with ozone, the wood samples were washed to remove water-soluble products of ozonation and dried in air. The resulting lignocellulosic material (LCM) was further investigated by thermal analysis.

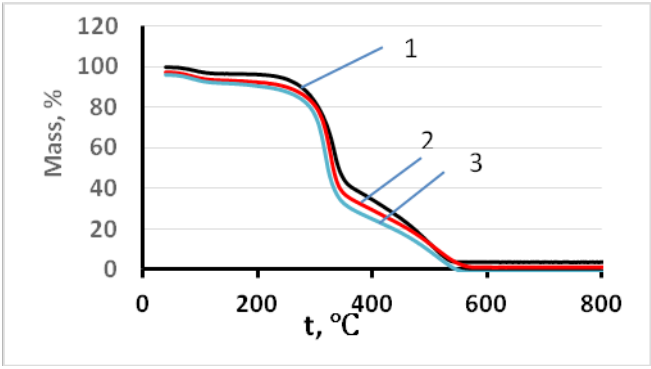
Thermal analysis of the samples was carried out on a Netzsch 449 C Jupiter synchronous thermal analyzer, combined with a NETZSCH 409 AOELOS mass spectrometer. An air-dry source or ozonized wood sample was analyzed at a heating rate of 10 °C min^{-1} in the range from 40 °C to 1000 °C in the atmosphere air, gas flow rate - 8 ml / min, sample weight 7 mg.

Results and discussion.

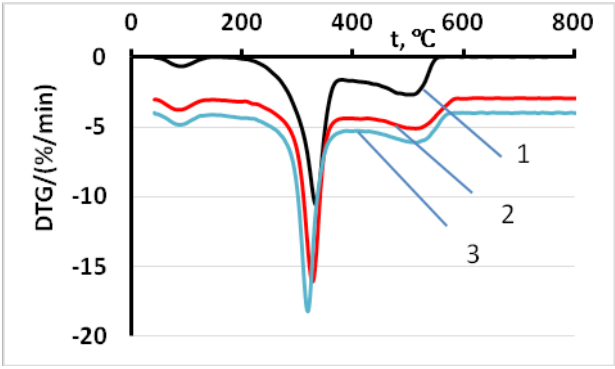
The thermogravimetry data (TG), differential thermal analysis (DTG) in air for a pine wood sample and LCM from ozonized samples are shown in Figure 1 and in Tables 1 and 2.

At the first stage (I Interval in Table 1) of wood heating, its drying and removal of the volatile components of the material are observed. At temperatures from 36 to 138 ° C, physically adsorbed water is removed. The mass loss is 3.2%.

Further weight loss in the range 370 - 543 °C is associated with the thermal degradation of cellulose and lignin. The mass loss at this stage was 35.5%. In the range of 430-543 °C, the destruction of lignin and the combustion of coal formed during thermal decomposition are completed.



A



B

Fig. 1. *The results of thermal analysis of pine wood samples in air. TG (A), DTG (B). Qr, mmol/g: 0 (1), 1.3 (2), 3.3 (3).).*

Table 1. *Stages of thermal decomposition of pine wood and ozonized samples in an oxidizing environment*

№ of samples	Q_r, mmol/g	I temperature range, °C / Mass change, Δm, %	II temperature range,°C / Mass change, Δm_1, %	III temperature range,°C / Mass change Δm_2, %	$\Delta m_1 / \Delta m_2$
1	0	36–138 -3,2	138 – 370 -58,8	370- 543 -34,9	1,7
2	1,3	36 – 132 -4,1	207 – 387 -60,6	387 – 586 -24,5	2,5
3	3,3	36 – 143 -4,1	143 – 389 -65,3	389 – 564 -27,6	2,4

The values of the maximum mass loss rate and the corresponding temperatures are shown in Table 2. It can be seen that the mass loss at a temperature of 332 °C is characterized by a high speed, and at 499.6 °C the oxidation process is slow. The residual mass is 3.32%. (Table 2.) The indicated ranges of thermal decomposition of the main structural components of pine wood are given in [10]. It should be noted that the studied sample of pine wood belongs to sawmill waste, and, of course, in composition and a number of properties it cannot coincide with the properties of freshly cut samples described in work[10]. A rapid increase in the rate of weight loss with a further increase in temperature to 370 ° C is mainly due to the thermal decomposition of hemicelluloses and cellulose. The mass loss in this temperature range (II temperature range) is 58.8%, which is consistent with the data of work[10].

Table 2. *Thermal degradation rate of wood samples in an oxidizing environment: maximum temperatures (t_{max}) and their corresponding values (DTG_{max}), as well as the residual mass fraction (m_{res},%) for pine wood samples with different specific ozone absorption (Qr)*

№ of sample	Q_r, mmol/g	t_{max} °C	DTG_{max}%/ min	t_{max} °C	DTG_{max}, %/ min	t_{max} °C	DTG_{max}, %/ min	m_{res}, %
1	0	88,8	-0,69	332,6	-10,5	499,6	-2,7	3,32
3	1,3	83,9	-0,80	326	-13,1	513	-2,1	4,36
4	3,3	85,9 °	-0,85	317,6	-14,3	514	-2	2,75

The peak on the DTG curve with a maximum at 332.6 °C is expanded to the low-temperature region where the thermal decomposition of hemicelluloses begins. This is due to the fact that the peak of thermal decomposition of pine wood hemicelluloses, which include glucomannan (60-70 wt.%) And arabinogalactan (15-30 wt.%), Is blocked by the peak of predominant decomposition of cellulose.

The temperature range of 370-548 ° C (III temperature range in Table 1) corresponds to the third peak of mass loss with a maximum at 499.6 °C. In this area, thermal decomposition of cellulose and lignin occurs.

Tables 1 and 2 also provide thermal analysis data for ozonized samples. From Table 1 it can be seen that the first interval of mass loss in ozonized samples № 2 and № 3 is in the range of 84 - 86 °C, close to the temperature of mass loss in the original sample, and the mass loss is slightly greater in ozonized samples. After ozonation, the samples were washed with water to remove low molecular weight oxidation products formed during ozonation. Apparently, some of these compounds remained in the pores of the studied samples. Among the oxidation products are formic, glyoxalic and oxalic acids, which are removed from the surface of the samples upon heating.

The second interval of mass loss is observed at the same temperatures as for the initial sample, the mass loss of ozonized samples № 2 and № 3 - is greater (Table 1). The rate of maximum mass loss increases, and the corresponding temperature decreases, i.e. ozonized samples lose weight at this stage easier than the original. Mass changes in the third temperature range are characterized by opposite signs: mass loss is less, and the temperature of the maximum mass loss rate increases. The ratio of the mass loss values in the second and third temperature ranges increases from 1.7 for the initial sample to 2.5 for sample № 3. The values of the residual mass range from 2.02 to 4.36% (Table 1). During thermal degradation of the initial wood, two main peaks are observed on the DSC curve: in the first - (36 ÷ 138) °C - the endothermic effect (ΔH = 120 J / g) associated with evaporation of moisture is observed, in the second - (138 -543) °C thermal decomposition of wood substance occurs, accompanied by the release of heat (exotherm) with two maxima on the DSC curves at 370 and 514 °C (Table 3, Fig. 2).

Table 3. *Indices of thermal degradation in the medium of wood samples at various LG contents: maximum temperature (t_{max}, °C), magnitude of the thermal effect for three temperature ranges and total exothermic effect (Q_{exo})*

№ of sample	LG,% [3]	t_{max}, °C	Q_{endo}, J/g	t_{max1},	$Q_{1\ exo}$, J/g	t_{max2}, °C	Q_{2exo}, J/g	Q_1 / Q_2	Q_{exo}, kJ/g
1	28,0	96,3	-120	370,8	2660	514,5	3050	0,9	5,6
2	17,8	92,3	-141	363,3	2680	511,5	1860	1,4	4,5
3	16,2	92,3	-152	359,4	2215	506,3	1380	1,6	3,6

The exothermic effect corresponds to the burning of polysaccharides and lignin. The calorific value of pine wood was 5600 J/g.

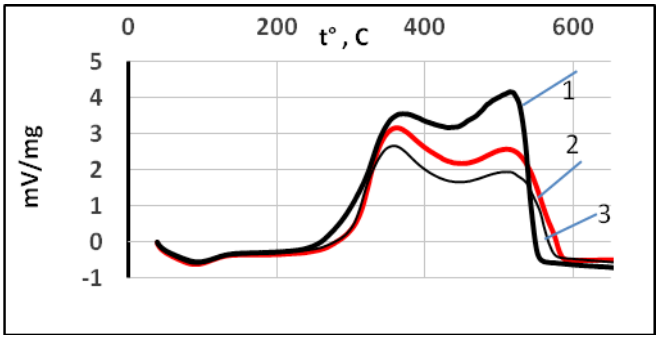


Fig. 2. *DSC curves of pine wood samples.*
Qr mmol/g: initial sample (1). 1.3 (2), 3.3 (3)

As shown by the analysis of DSC curves for coniferous wood [16], the first exothermic maximum (at 370 °C) relates to the combustion of hemicelluloses and cellulose with an amorphous structure. The second - to the combustion of crystalline cellulose and lignin, as well as coal formed in the previous stages of thermal decomposition of lignocellulosic material.

For samples No. 2 and No. 3, the endothermic maximum practically coincides with the endothermic effect in the initial sample; the endoeffect in ozonized slightly increases, apparently due to the presence of a small amount of ozonation products noted above. The temperatures of the maxima of the exothermic effect t_{max1} and t_{max2} of samples № 2 and № 3 are shifted to lower temperatures compared to the original pine wood, which is in complete agreement with the data on weight loss (Tables 1 and 2).

Part of LG undergoes ozonolysis, low molecular weight compounds are formed, which are washed out of the sample with water. The LG content in the sample decreases; various polymer fragments of oxidized LG are retained in the ligno-carbohydrate matrix. Part of the oxygen-containing LG residues burns quickly in an oxidizing medium during thermal analysis, since according to [18], the presence of oxygen-containing LG fragments reduces the thermal stability of lignin. According to IR spectroscopy [3,7,8], with an increase in Qr, the content of aliphatic structures on the surface of CM increases, among which there are many carbonyl- and carboxyl-containing compounds that have less thermal stability. This explains the easier mass loss by samples № 2 and № 3 observed at the second stage of thermal degradation.

Figure 2 shows that in the region of 230 - 320 °C, the DSC curves of ozonized and initial samples have a noticeable difference. It is explained by the destruction of not only lignin, but also hemicelluloses, which accompanies the processing of wood with ozone. In samples No. 2 and No. 3, an expansion of the second exothermic maximum is observed; in this temperature range, lignin and coal, formed at the previous stages of thermal destruction, are burned [16]. From Table 3 it is seen that the ratio of the maxima (Q_1/Q_2) increases by 2.5 times. There is a decrease in the total exothermic effect from $-\Delta H = 5.6$ k/ g to $-\Delta H = 3.6$ kJ/g. The noted changes in thermal properties are associated with the destruction of aromatic and multiple lignin bonds during ozonation, and, possibly, with an increase in the proportion of amorphous cellulose, which manifests itself in an increase of (Q_1/Q_2).

For ozonized samples, an expansion of the DSC curve was noted in the temperature range of more than 500 °C. In this area, the combustion of coal formed earlier takes place. The carbonization of modified LG and the combustion of coal is characterized by structural features that increase the thermal stability of coal.

The data of thermal analysis in an oxidizing medium are consistent with the data on the destruction of LG [3]. It is noted that simultaneously with LG, HC are destroyed. It is also assumed that under the influence of ozone, amorphization of the ligno-carbohydrate complex cellulose partially occurs. Comparison of the results of studying the ozonized wood by the thermal method — thermal analysis in an inert and oxidizing environment — allows one to obtain complementary information on the thermal properties of ozonized wood and the processes that occur during the ozonation of plant material.

References

1. Travaini,R., Martín-Juárez, J., Lorenzo-Hernando, A., Bolado-Rodriges S.// Biores. Technol. 2016, V.199. №1. P. 2.

2. Mamleeva N.A., Autlov S.A., Bazarnova N.G., Lunin V.V. // Russ. J. Bioorg. Chem. 2016. V.42. №7. P. 694.

3. Mamleeva N.A., Kharlanov A.N., Chukhchin D.G. et al. // Chemistry of plant raw materials. 2019. №1. P. 85.

4. Ben'ko E.M., Chukhchin D.G., Lunin V.V.Russian Journal of Physical Chemistry A, 2017. 91, № 11, 2092.

5. Andersen S.L., Castoldi R., Bracht A et al.//Wood Sci. Technol. 2018. doi:10.1007/s00226-018-1061-7.

6. Perrone O. M., Colombari F. M., Rossi J. S.et al.// Biores. Technol. – 2016. - V. 218. - № 1. P. 69.

7. Mamleeva N.A., Kharlanov A.N., Lunin V.V // J. of Phys. Chemistry. - 2019. - V.93. - №12.

8. Mamleeva N.A., Babaeva N.A., Harlanov A.N., Lunin V.V // J. of Phys. Chemistry. - 2019. - V.93. - №1. P.28.

9. Carrier M., Loppinet-Serani A., Denux D., et al. //Biomass &Bioenergy. 2011, 35: 298-307.

10. Loskutov S.R., Shapchenkova O.A., Aniskina A.A.// Siberian Forest Journal. 2015.V.6: P.17.

11. Labbé N., Kline L. M., Moens L., et al. // Biores. Technol. 2012. V.104. P.701.фрм

12. Zhang J., Feng L., Wang D.,et al. //Biores.Technol. 2014. V.153. P. 379.

13. Korošec R.C., Lavrič B., Rep G., et. al. //J. Therm Anal. Calorim. 2009, V.98. № 1. P. 189.

14. Brostow W., Menard K. P., Menard N. Combustion properties of several species of wood. Chem. Chem. Technol. 2009, 3(3): 173–176.

15. Shen D., Gu S., Luo K.H., Bridgwater A.V., Fang M. X. Kinetic study on thermal decomposition of woods in oxidative environment. Fuel. 2009, 88: 1024–1030.

16. Tsujiyama S., Miyamori A. Assignment of DSC thermograms of wood and its components. Thermochim. Acta. 2000, 351:177-181.

17. Mamleeva N.A., Shumyantsev A.V., Lunin V.V // J. of Phys. chemistry. 2020.V. 94. in print

18. Sharypov V.I., Grishechko L.I., Tarasova L.S. et al.//J. Siberian Federal Univ. Chemistry. 2011. V.3. P.221.

吸烟期间3,4-苯并芘形成的原因以及减少烟草烟雾毒性的方法
CAUSES OF 3,4-BENZPYRENE FORMATION DURING SMOKING AND WAYS TO REDUCE TOBACCO SMOKE TOXICITY

Zaytseva Tatyana Alexandrovna
Research Officer of Chemistry and Quality Control Laboratory, Postgraduate
Perezhogina Tatyana Anatolievna
Senior Research Officer
Head of Chemistry and Quality Control Laboratory,
Medvedeva Svetlana Nikolaevna
Research Officer of Chemistry and Quality Control Laboratory, Postgraduate
Russian scientific research institute of tobacco, makhorka and tobacco products

抽象。 解决与提高吸烟产品质量和降低烟草烟雾毒性相关的问题与其理化性质的研究有关。 为了评估和监测卷烟烟草烟雾中的有害有毒物质，世界卫生组织确定了九种优先有毒成分。 在烟草烟雾的多环芳烃（PAHs）中，3,4-苯并芘具有特殊的地位，因为它是一种致癌物质，被归类为危险等级1物质（极其危险）。

本文考虑了烟草烟雾气溶胶的化学成分，多环芳烃（PAH）的形成以及降低香烟烟雾毒性的方法。 给出了PAH的化学和毒理学特征。

关键词：PAH，苯并（a）芘，3,4-苯并芘，气溶胶，ETHS，香烟，烟草烟雾，固液烟

Abstract. *Solving issues related to improving the quality of smoking products and reducing the toxicity of tobacco smoke is associated with the study of its physicochemical properties. To assess and monitor harmful toxic substances in cigarette tobacco smoke, the World Health Organization has identified nine priority toxic components. Among the polycyclic aromatic hydrocarbons (PAHs) of tobacco smoke, 3,4-benzpyrene is given a special place, since it is a carcinogen and is classified as a hazard class 1 substance (extremely dangerous).*

The article considers the chemical composition of tobacco smoke aerosol, the formation of polycyclic aromatic hydrocarbons (PAH) and ways to reduce the toxicity of cigarette smoke. The chemical and toxicological characteristics of PAH are given.

Keywords: *PAH, benz (a) pyrene, 3,4-benzpyrene, aerosol, ETHS, cigarettes, tobacco smoke, solid - liquid smoke*

3,4-benzpyrene (or, benz (a) pyrene, benzpyrene, benzapyrene, BAP) $C_{20}H_{12}$ is a polycyclic aromatic hydrocarbon (PAH) which is light yellow crystals and has the following physicochemical properties: melting point 179 ° C, boiling point 495 ° C, density: 1.24 g/cm³; Molar mass: 252.3 g/mol. It is soluble in benzene, toluene, xylene and other organic solvents, an aqueous solution of methanol. Forms colloidal solutions with water. Registration number for Chemical Abstract Service (CAS) 50-32-8.

3,4-benzpyrene is formed by exposure to high temperatures on some organic substances. Of a number of carcinogenic polyaromatic hydrocarbons (PAH) is the most common in the environment.

The structural formula of 3,4-benzpyrene is quite simple: five benzene rings joined in a certain sequence (Fig. 1), but the ring coupling sequence is very important.

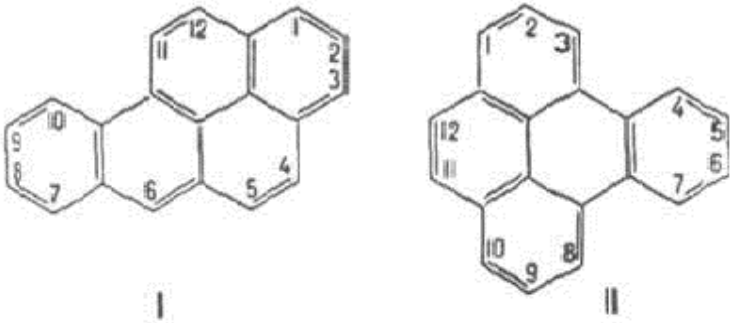


Fig. 1 *Structural formula of 3,4-benzpyrene and 4,5-benzpyrene*

3,4-Benzpyrenes are hydrocarbons that are derivatives of pyrene, a tetracyclic hydrocarbon lacking carcinogenic activity. Whether a five-ring hydrocarbon is carcinogenic or not depends on how the fifth ring joins. If, as in 3,4-benzpyrene or if rearrangement occurs and a 1, 2, 5, 6-dibenzanthracene molecule is formed, then the substance has the ability to cause malignant tumors. If five rings form a different structure, then inactive compounds are formed (eg 4,5-benzpyrene) (Fig. 1).

3,4-Benzpyrene is classified as hazard class 1 substance (extremely dangerous), as it can cause the formation of malignant tumors in humans. The main routes of entry into the human body are inhalation, cutaneous, transplacental. In experimental studies, 3,4-benzpyrene was tested on nine species of animals, including monkeys. With all methods of exposure, malignant tumors formed in animals.

One of the widespread sources of 3,4-benzpyrene is the combustion process of almost all types of combustible materials. It is present in flue gases, soot and soot, settling in chimneys and on surfaces that have been in contact with smoke, including tobacco, more precisely in resinous substances contained in combustion products. It is found in places of spontaneous forest fires, it appears in the atmosphere as a result of volcanic eruptions. However, the actual combustion process (i.e., carbon oxidation) does not always lead to the formation of 3,4-benzpyrene. It is formed as a result of polymerization processes of relatively simple structural fragments of molecules (having free radicals), which are formed from the initial product due to the action of high temperatures under adverse combustion conditions.

In the molecularly dispersed state, 3,4-benzpyrene can be found only in negligible amounts. In air, it is mainly associated with solid particles of atmospheric dust. Particulate matter containing 3,4-benzpyrene precipitates quite quickly from the air due to sedimentation (destruction of the colloid and precipitation), as well as from atmospheric precipitation and passes into the soil, plants, enter soil water and water bodies. This leads to a rather large variability in the concentration of 3,4-benzpyrene in atmospheric air, which depends not only on the intensity of its release from the pollution source, but also on meteorological conditions. Being chemically relatively stable, 3,4-benzpyrene can migrate from one object to another for a long time. As a result, many objects and processes occurring in the environment, which themselves do not have the ability to synthesize 3,4-benzpyrene, become its secondary source.

A literature review of foreign and domestic literature showed that the hydrocarbon content in the aerosol of tobacco smoke depends on the botanical variety of tobacco, the agrotechnical conditions of cultivation (soil moisture saturation and the nature of mineral nutrition), the degree of maturity of the tobacco leaves during harvesting, coloring of the tobacco leaves, and drying method. The level of hydrocarbon formation in tobacco smoke is determined by the conditions of smoking and the technological characteristics of tobacco products, such as tobacco moisture and packing density. Scientists have identified the important role of providing the combustion zone with oxygen in the formation of the hydrocarbon complex of smoke.

PAHs quickly react with nitrogen oxides or with HNO_3. For example, anthracene is oxidized to anthraquinol with HNO_3 or produces a nitrogen-derived compound through a substitution reaction with NO_2.

PAHs are formed by pyrolysis or incomplete combustion of organic substances containing carbon and hydrogen. At high temperatures, as a result of the pyrolysis of organic compounds, fragments of molecules and radicals are formed, which combine and form PAH.

Hydrocarbons, and especially 3,4-benzpyrenes, determine the carcinogenic activity of smoke. Therefore, one of the ways to reduce the danger of tobacco smoke is to regulate the content of hydrocarbons in it and to find ways to reduce the content of 3,4-benzpyrene consumed by the smoker.

After Richard Doll [1] for the first time established the connection between smoking and lung cancer in 1950, the search for carcinogens that are part of tobacco smoke aerosol began. When carcinogenic polycyclic aromatic hydrocarbons (PAH) were discovered in the resin (solid-liquid phase of smoke), the main scientific direction of scientists was to study the causes of their formation, methods for their qualitative and quantitative determination and reduction of their content.

The Department of Environmental Carcinogenesis at the Sloan-Kettering Cancer Research Institute in New York, led by D. Hoffmann and G. Rathkamp [2] conducted a series of studies in the 70s that showed that most of the substances tested reduced 3.4-benzpyrene in smoke . The best results were obtained by adding copper and potassium nitrates to tobacco, which are destroyed in the combustion zone with the formation of metal oxides, oxygen and nitrogen oxides. Each of these products has its own specific effect on the combustion process. Oxides of metals and oxygen contribute to the oxidation of the formed 3,4-benzpyrene, and nitrogen oxides are inhibitors of the chain reactions of its pyrosynthesis. Analysis of the smoke of various types of cigarettes showed that nitrogen oxides are formed during the pyrolysis of ammonium nitrate and inhibit the synthesis of aromatic hydrocarbons. Glycerin, which produces water during thermal breakdown of tobacco, also reduces the formation of 3,4-benzpyrene.

M.E. Counts [3] with colleagues from the US Research Center conducted research on 48 commercial brands of cigarettes Philip Morris USA, Philip Morris International and reference cigarettes 1R4F. The purpose of the study was to determine the influence of smoking parameters on a smoking machine on the composition of tobacco smoke aerosol. Cigarettes were smoked on a smoking machine in three modes: International Organization for Standardization (ISO), Massachusetts Department of Public Health (MDPH), and Canadian intensive mode Health Canada (HC). Smoking modes are shown in table 1.

Table 1

Smoking mode	Puff volume, ml	Interval between puffs, s	Puff Duration, s	Blocking of the ventilation zone, %
ISO	35±0,3	60±0,5	2±0,2	0
MDPH	45±0,5	30±0,5	2±0,2	50
HC	55±0,5	30±0,5	2±0,2	100

As can be seen from the data presented in the table, the modes of smoking cigarettes differ in volume, interval between puffs and % of ventilation block.

As a result of the studies, it was found that the amount of harmful substances increases in the order of the methods: ISO <MDPH <HC.

The maximum content of analytes in the main stream of smoke was established using the intensive method of smoking cigarettes (HC). In addition, the possibility of predicting smoking results according to the Canadian intensive method has been proved, which will significantly simplify the work of research laboratories in predicting the content of harmful substances.

Scientists at the Laboratory of Environmental Pollution Control, Faculty of Chemistry [4], determined 16 PAH in the solid-liquid and gas phases of various brands of cigarettes with different technological characteristics. The results showed a direct dependence of the PAH content in the solid-liquid phase of tobacco smoke aerosol on the content of tar, nicotine and carbon monoxide. In contrast to the solid-liquid phase, a weak correlation was observed in the gas phase.

One of the important indicators of cigarette paper is its breathability, the increase of which entails a completely natural decrease in the content of 3,4-benzpyrene in smoke. It is known that one of the ways of the formation of 3,4-benzpyrene is its pyrosynthesis from unsaturated gaseous hydrocarbons, which can escape from the main stream of smoke through the pores of the paper.

An effective means to affect tobacco smoke in order to reduce its toxicity is the use of filters of various materials and designs. In this case, filter additives are used that selectively remove an individual compound or group of toxic compounds. Currently, a rather wide range of materials is used in the production of filters in the form of granules: activated carbon, aluminates, catalysts, molecular sieves, ion exchange resins, sepiolite, silica gel, zeolites. The development of new cigarette filters with increased retention capacity for certain groups of substances continues throughout the world [5].

When studying cigarettes on the Canadian market, Collishow N. et al. [6] noted the inverse relationship between the content of tobacco specific nitrosamines (TSNA) and 3,4-benzpyrene. One possible explanation is that nitrates, which are abundant in Burley type tobacco, contribute to the formation of TSNA and can absorb free radicals when smoking tobacco, which leads to a decrease in PAH. However, the nature of this dependence is not fully understood. Comparison of smoking methods according to ISO and Canadian intensive method shows that different smoking conditions significantly change the amount of harmful substances produced. The article gives an example that the nicotine content varied by 33% depending on the method of smoking.

Since 1955, Lam et al. have published a number of reports [7] that the formation of polycyclic hydrocarbons in smoke occurs mainly due to the combustion of paraffins contained in tobacco. Conclusions were made based on the pyrolysis of paraffins isolated from tobacco. The authors found that the amount of polycyclic hydrocarbons formed strongly depends on the pyrolysis temperature of paraffins. In the pyrolysis of 5 g of tobacco paraffins, an increase in temperature from 700 °C to 800 °C entailed an increase in the yield of polycyclic hydrocarbons from 32.4 mg to 130.4 mg.

The burning area of a conventional cigarette is in the shape of a cone, the base of which approximately corresponds to the diameter of the cigarette. The height of the smoldering cone depends on the amount of air entering the combustion zone per unit of time: during a puff, it increases, and during a pause, it decreases.

In the combustion zone of a cigarette, the temperature reaches 850-900 ° C, and the amount of incoming oxygen is not enough for the complete combustion of tobacco.

No smoke arises in the combustion zone; its formation is possible only in the smoldering zone. As a result of pyrosynthesis reactions, a significant part of high-molecular substances that are absent in tobacco are formed. The products of pyrosynthesis and distillation condense in the form of small aerosol particles in a very small area beyond the smoldering zone. At the same time, a part of substances characterized by low vapor pressure is concentrated in aerosol particles, and vapor of volatile compounds and true gases surround these particles, creating a gas phase of smoke.

There are many studies evaluating the amount of chemicals in cigarette smoke. According to some reports, smoke contains more than 5,300 chemicals.

Many of these substances are initially present in tobacco in very small quantities, but are formed as a result of thermal decomposition, pyrolysis and (or) incomplete combustion of tobacco at temperatures above 300 ° C, so:

• Carbon monoxide (CO) is formed as a result of the pyrolysis of tobacco components and incomplete combustion of tobacco in the smoldering zone at temperatures above 300 ° C;

• Nitric oxide (NO) is formed in two temperature ranges - about 300 ° C and 450 ° C, respectively;

• Hydrocarbons and aldehydes (such as formaldehyde and acrolein) are formed as a result of thermal decomposition of tobacco components mainly at temperatures above 300 ° C;

• Phenols are the products of the pyrolysis of the structural components of tobacco (carbohydrates, lignin, aliphatic and aromatic acids) with a formation temperature from 250 ° C to 550 ° C;

• Polycyclic aromatic hydrocarbons (PAH) are associated with the decomposition of the structural components of tobacco at temperatures above 400 ° C;

• Butadiene-1,3, benzene and styrene are formed at temperatures above 400 ° C;

• Tobacco specific nitrosamines (TSNAs) are present in tobacco itself. Their quantitative content also depends on the method of post-harvest processing. They enter tobacco smoke as a result of distillation reactions, and are formed as a result of pyrosynthesis at temperatures from 200 ° C to 400 ° C.

Recently, the number of consumers using electric tobacco heating systems (ETHS) is growing all over the world and in Russia, providing alternative tobacco use [8,9]. The principle of operation of ETHS is based on heating tobacco without burning or decay, which leads to a reduction in the formation of harmful and

potentially hazardous substances that are part of the aerosol, including 3,4-benzpyrene. Thus, ETHS aerosol intake can also be a way to reduce the intake of 3,4-benzpyrene in the smoker's body. Unfortunately, so far very little research has been done in this area. Further research is needed on the effects of ETHS on human health in order to objectively evaluate the quality and safety of these devices.

References

1. Doll R., Hill A.B. Smoking and carcinoma of the lung; preliminary report// Br.Med.J.-1950.-Vol.2. № 2.-P.739-748.

2. Beitrage zur Tabakforschung Band 4 Heft, February, 1968.

3. Regulatory Toxicology and Pharmacology 41 (2005) 185–227, doi:10.1016/j.yrtph.2004.12.002

4. Beiträge zur Tabakforschung International/Contributions to Tobacco Research Volume 21 № 6 July 2005 DOI: 10.2478/cttr-2013-0799 Distribution of Polycyclic Aromatic Hydrocarbons between the Particulate and the Gas Phase of Mainstream Cigarette Smoke in Relation toCigarette Technological Characteristics

5. Taylor, M.J. Designing a reduced risk cigarette / M.J. Taylor // Tabexpo

6. Collishaw N. Tales of toxic tobacco. BAT research on the harmful properties of smoke. Physicians for a Smoke-Free Canada, 2000. http://www.smokefree.ca/pdf_1/ documentresearchpdf/toxictobacco.PDF (Accessed 30 Nov 2007).], [King B, Borland R, Fowles J. Mainstream smoke emissions of Australian and Canadian cigarettes. Nicotine Tob Res 2007;9:835–44.

7. Lam, J.: Determination of 3,4-benzopyrene and other aromatic hydrocarbons formedby pyrolysis of aliphatic tobacco hydrocarbons; Acta. Path. Microbiol. Scand. 39 (1956) 207–210; 3,4-Benzopyrene as a product of the pyrolysis of aliphatic hydrocarbons; Acta. Path. Microbiol. Scand. 37 (1955).

8. Zaitseva T.A., Medvedeva S.N., Perezhogina T.A. The study of electronic nicotine delivery systems // General question of world science: materials of the V International Scientific Conference (July 31, 2018). Brussels, 2018. № 5. P.5-8. (Doi 10.18411 / gq-31-03-2018-03)

9. Zaitseva T.A., Medvedeva S.N., Pokrovskaya T.I. Polycyclic aromatic hydrocarbons in an aerosol of nicotine-containing products [Electronic resource] // Scientific support for innovative technologies for the production and storage of agricultural and food products: Coll. Mat. I Intern. scientific-practical conf. young scientists and graduate students (April 09 - 23, 2018, Krasnodar). P. 254-258. URL: http://vniitti.ru/conf/conf2018/ sbornik_conf_2018.pdf

评估Aujeszky病病毒的初乳免疫力

EVALUATION OF COLOSTRAL IMMUNITY TO THE VIRUS OF AUJESZKY'S DISEASE

Kondibayeva Zhanat Burkitbayevna
Candidate of Veterinary Sciences, Senior Research Officer.
Research Institute for Biosafety Issues
Koshemetov Zhumagali Kaukarbaevich
Doctor of Veterinary Sciences, Head of Laboratory.
Research Institute for Biosafety Issues
Syrym Nazym Syrymkyzy
Candidate of Veterinary Sciences, Senior Research Officer.
Research Institute for Biosafety Issues

抽象。 本文介绍了通过调整Kordai株对Aujeszky病的灭活疫苗的代谢状态来确定新生牛犊的初乳免疫力的结果。 为了确定新生小牛的初乳免疫力，采用代谢状态校正方法对出生后4个月从免疫绵羊中获得的羔羊进行接种。 研究结果表明，从免疫绵羊获得的羔羊具有高VNA滴度。 同时，VNA滴度的增加可达21-30天，然后在一个月内保持在同一水平，并在出生后4个月逐渐降至1.0-1.5 log2。

关键词。 Aujeszky，疫苗，免疫原性，Corday株，Aujeszky病病毒，初乳免疫。

Abstract. *This article presents the results of determining colostral immunity in newborn calves by adjusting the metabolic status of the inactivated vaccine from the Kordai strain against Aujeszky's disease. To determine colostral immunity in newborn calves, the method of metabolic status correction was used to vaccinate lambs obtained from immune sheep 4 months after birth. Research findings indicate that lambs obtained from immune sheep have high VNA titers. At the same time, an increase in the VNA titer goes up to 21-30 days, then they remain at the same level for a month and gradually decrease to 1.0-1.5 log_2 by 4 months after birth.*

Keywords. *Aujeszky, vaccine, immunogenicity, Corday strain, Aujeszky's disease virus, colostral immunity.*

Relevance. Currently, there is a tendency to find new forms of vaccines that can cause earlier (colostral) immunity in vaccinated animals [1, 2, 3]. Colostral immunity is an immunity that forms in a newborn due to colostrum immunoglobulins during the first 24-36 hours of life. The creation of early post-vaccination immunity, first of all, depends on the immunobiological reactivity of the animal organism, quantitative and qualitative characteristics of antigenic irritation. Ultimately, it is necessary to develop vaccines that can cut off the development of infection at an earlier date [4, 5, 6, 7, 9, 10].

The need for vaccination of animals at an early age dictates the relevance of studying the effect of colostral immunity and its effect on the immunogenic activity of the vaccine.

For newborns of some types of farm animals (ruminants, pigs and horses), antibodies are transmitted to offspring only through colostrum in the postnatal period. Therefore, the intensity of absorption of adequate amounts of colostrum immunoglobulins is necessary for the acquisition of passive immunity. The insufficiency of its transfer predetermines the immunodeficiency state and the risk of diseases in newborns, mainly of infectious etiology. In this regard, the determination of colostral immunity in newborn calves by correcting the metabolic status of the developed vaccine against Aujeszky virus disease is relevant.

Research objective is the determination of colostral immunity in newborn calves by the correction of the metabolic status of the vaccine against Aujeszky virus disease.

Subject and research methods. The work was performed at the Research Institute of Biological Safety of the Republic of Kazakhstan.

In the experimental work, we used: The strain of Aujeszky's disease virus "Korday" (isolated from a pig in the Republic of Kazakhstan), grown by roller method in a cell culture of BHK-21/13 with an infectivity titer of at least 7.5 lg TCD50 / cm3.

To develop methods for inactivating vaccine strains, the components of the designed vaccine, inactivants, theotropin and propolis, were used.

To study the immunogenic activity of vaccines against Aujeszky's disease, the adjuvant properties of aluminum hydroxide with saponin and MontanideGel01, the peptide adjuvant V + XC55 (Russia) and Chitosan were studied.

To determine the avirulence, harmlessness and immunogenic activity of the experimental vaccine series, sheep of 10-12 months of age were used, with a live weight of 30-35 kg.

The neutralizing activity of blood serum was determined by the neutralization index, which was calculated by the difference between the logarithmic indicators between normal and test sera.

The calculation of a 50% immunizing dose (ImD_{50}) was carried out according to the Kerber-Ashmarin formula [7].

To determine colostral immunity in newborn calves, the method of metabolic status correction was used to vaccinate lambs obtained from immune sheep 4 months after birth.

The results of the study. To determine colostral immunity in newborn calves, the method of metabolic status correction was used to vaccinate lambs obtained from immune sheep 4 months after birth. The vaccine was administered to lambs subcutaneously at a dose of 1 cm^3 in the region of the inner side of the thigh. Blood samples were taken from lambs from immune sheep 2, 10, 14 and 21 days after birth, then monthly. Blood serum was tested in the neutralization reaction according to the standard method.

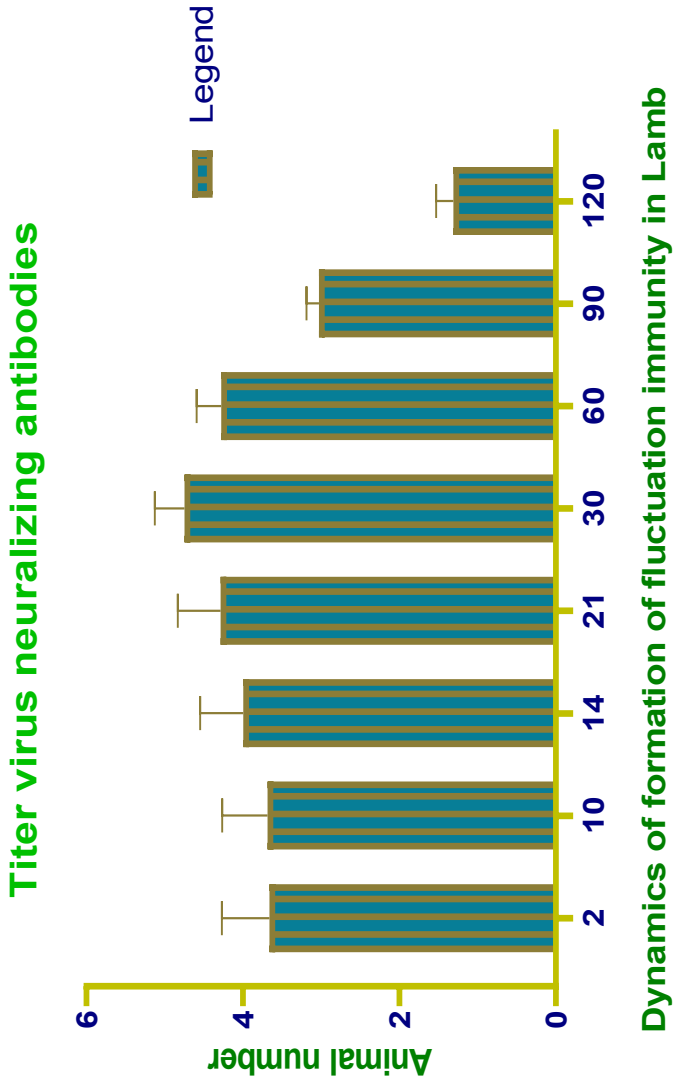


Figure 5 *– The dynamics of the formation of colostral immunity in lambs*

The data from the research results show that lambs obtained from immune sheep have high titers of VNA (virus neutralizing antibodies) against the background of colostral immunity. At the same time, the increase in VNA titer lasts up to 21-30 days, then they remained at the same level for a month and gradually decreased to 1.0-1.5 log2 for 4 months after birth. VNA titers in lambing sheep on day 30 after immunization were 4.0–4.5 log2.

The vaccine against Aujeszky's disease virus after a single injection induced the formation of a high level of VNA in lambs against the background of colostral immunity. Allergic reactions to the introduction of a vaccine against Aujeszky's disease in vaccinated lambs have not been recorded.

Therefore, when carrying out preventive vaccinations of lambs against Aujeszky's disease born from ewes immunized with the vaccine against Aujeszky's disease virus, the possible high level of colostral antibodies should be taken into account, which can have a significant impact on the effectiveness of protective measures. The optimal vaccination period for lambs obtained from immune sheep is 4 months after birth.

The effectiveness of this method consists in the fact that a comprehensive technic has been developed to increase colostral immunity in newborn calves by the method of correction of metabolic status. The method is based on eliminating the imbalance in the intensity of lipid peroxidation processes and the functional activity of the antioxidant defense system during this period, which, together with long-term respiratory metabolic acidosis, are factors in violation of the passive transport of colostral immunoglobulins.

Conclusion

The experimental series of vaccines against Aujeszky's disease, for conducting comparative tests of various doses of a biological product, are harmless, sterile, possess antigenic activity and induce the formation of a humoral immune response in animals. In experimental conditions, vaccination doses have been determined for various animals, which, subject to the technological requirements for the manufacture and biological control of the vaccine, provide a tense immune response after double immunization of animals.

A quantitative method has been developed to control the activity of the vaccine by determining 50% of the immunizing doses ((ImD_{50}), calculating the amount in one vaccine volume.

Under experimental conditions, immunizing agents (ImD_{50}) have been determined for various types of susceptible animals that provide a tense immune response after double immunization of animals.

A comprehensive method has been developed to increase colostral immunity in newborn calves by the method of metabolic status correction. An increase in the VNA level to 4.0 ± 0.15 $\log_2$ was established at 21 days after vaccination. The fact of the formation of strong immunity in lambs containing maternal antibodies during the immunization period indicates the possibility of active vaccination of newborns at 4 months of age.

Therefore, when carrying out prophylactic vaccinations of lambs against Aujeszky's disease born from ewes immunized with the vaccine from the Kordai strain, one should take into account the possible high level of colostral antibodies, which can significantly affect the effectiveness of protective measures.

References

1. Malyarets P.V. Aujeszky's disease (literature review). / P.V. Malyarets, E.V. Guseva, T.A. Anufrieva. - Vladimir, 1995. - 72 P.

2. Moscow Veterinary Web Center [Electronic resource]: Aujeszky's Disease. - Access: http://webmvc.com/bolezn/catdog1/bolauesk.php. -

19.12.2015.

3. Mettenleiter TC. Aujeszky's disease (pseudorabies) virus: the virus and molecular pathogenesis: state of the art, June 1999. VetRes. 2000; 31:99–115. [PubMed] [GoogleScholar].

4. G. Iglesias and M. Trujano, Studies on Maternally Derived Antibodies to Aujeszky's Disease Virus in Piglets Born to Naturally or Experimentally Infected Sows, Journal of Veterinary Medicine, Series B, 36, 1-10, (57-62), (2010).*

5. Bouma, M.C.M. De Jong and T.G. Kimman, The influence of maternal immunity on the transmission of pseudorabies virus and on the effectiveness of vaccination, Vaccine, 15, 3, (287), (1997).

6. Efanova, L.I. Protective mechanisms of the body. Immunodiagnostics and immunoprophylaxis of infectious animal diseases / L. I. Efanova, E. T. Saiduldin. - Voronezh: VGAU, 2004. - 391 P.

7. Efanova, L.I. Immune status of calves and colostrum quality in factor infections / L.I. Efanova, O.A. Manzhurina, V.I. Morgunova, M.I. Adodina // Veterinary Medicine. - 2012. - № 10. - P. 28–31.

8. Shakhov, A. G. Methodological recommendations for assessing and correcting the immune status of animals / A. G. Shakhov, Yu. N. Masyanov, M. I. Retsky and others // New research methods on problems of veterinary medicine. Part III. Research methods on non-communicable pathology in productive animals. - Moscow: RAAS, 2007. - 115 P.

9. Gershwin, L. J. Immunology of bovine respiratory syncytial virus infection of cattle / L. J. Gershwin // Comp. Immunol. Microbiol. Infect. Dis. – 2012. – V. 35. – N. 3. – P. 253–257.

10. Logan, E. F. The role of colostral immunoglobulins in intestinal immunity to enteric colibacillosis in the calf / E. F. Logan, A. Stenhouse, D. J. Ormrod, W. L. Penhale // Res. Vet. Sci. – 1974. – V. 17. – N. 3. – P. 280–301.

细菌对非典型细菌的生物学特性
BIOLOGICAL PROPERTIES OF BACTERIOPHAGES AGAINST ATYPICAL MYCOBACTERIA

Syrym Nazym Syrymkyzy
Candidate of Veterinary Sciences, Senior Research Officer
Research Institute of Biosafety Problems
Yespembetov Bolat Amanbaevich
Candidate of Veterinary Sciences, Head of laboratory
Research Institute of Biosafety Problems
Suzuki Yasuhiko
PhD, ***Director,***
Research Center for Zoonosis Control Hokkaido University
Nakajima Chie,
DVM, PhD, ***Associate professor,*** *Research Center for Zoonosis Control Hokkaido University*

注解。 本文介绍了噬菌体针对从环境对象中分离出的非典型分枝杆菌的基本生物学特性的研究结果。

关键词：分枝杆菌，噬菌体，生物材料，菌株，环境对象

Annotation*. The article presents the results of studies on the basic biological properties of bacteriophages against atypical mycobacteria isolated from the objects of the environment.*

Key words*: mycobacteria, bacteriophage, biological material, strains, objects of environment*

Relevance. In recent decades, the diagnosis of tuberculosis is largely complicated by the manifestation of non-specific reactions in cattle, due to the sensitization of their body mainly by atypical mycobacteria. The lack of perfect and effective methods for differentiating tuberculin reactions is the reason for culling out of a significant number of animals that do not show changes in sections characteristic of tuberculosis and are not confirmed by laboratory methods among a compromised herd [1, 2, 3].

It follows from the foregoing that the problem of differentiating non-specific tuberculin reactions in cattle in the region has not yet been completely resolved, which was the basis for our research.

In this regard, it is relevant to find alternative methods to combat this problem, such as the use of bacteriophages [4, 5, 6, 7].

Researchers Gardner and Weiser [8] succeeded in isolating phages from the soil that act on atypical mycobacteria. Based on the above facts, we selected bacteriophages from environmental objects for conditionally successful tuberculosis economic entities of the republic for the subsequent study of biological properties [9, 10].

The aim of this work is to study the biological properties of bacteriophages specific for atypical mycobacteria.

Subject and research methods. For the research, the following were used: samples taken from environmental objects and biological material from various regions of the Republic of Kazakhstan. To cultivate atypical mycobacteria and their phages, DubosBrothBase and DubosOleicAgarBase nutrient media were used. To study the biological properties, atypical cultures of mycobacteria were used as indicator test cultures: M. kansasii, M.avium, M.scrofulaseum, M. phlei, M. terrae, M.intracellulare, M. smegmatis.

Research results. Experimental studies on the isolation of bacteriophages active against atypical mycobacteria were carried out from collected samples of environmental objects from various relatively prosperous regions of the republic. As a result of the study, bacteriophage-specific atypical mycobacteria were isolated.

The main biological properties of the isolated phages were studied..

The lytic activity of the isolated phages was determined by the methods of Appelman and Grace by titration on a liquid nutrient medium. The results of the lytic activity of the phage are shown in table 1.

Table 1 - *Lytic activity of anti-tuberculosis phages*

Tuberculosis phages	**Mycobacterium tuberculosis test cultures**	**Phage activity in title**	
		By to the Appelman method	**By to the Grace method**
Phage - M.smegmatis	M.smegmatis	10^7	$1{,}1x10^9$
Phage - avium	M.avium	10^8	$1x10^{10}$
Phage - kansasii	M.kansasii	10^8	3×10^9
Phage - scrofulaseum	M.scrofulaseum	10^9	$1{,}1x10^{10}$
Phage - phlei	M. phlei	10^7	2×10^9
Phage - terrae	M. terrae	10^8	$4x10^{10}$
Phage - intracellulare	M.intracellulare	10^{10}	$1{,}2x10^7$

As can be seen from the table, all the isolated bacteriophages caused lysis with atypical cultures of mycobacteria.

Determination of the spectrum of lytic activity of the studied phages. The main biological properties of the bacteriophage is the range of lytic activity - this is the lysis spectrum of bacteria homologous to the phage, which is carried out by the method of applying drops of the bacteriophage to the lawn of the studied culture (table 2).

Table 2 - *The spectrum of lytic activity of anti-tuberculosis phages*

Anti-tuberculosis phages	The number of examined test cultures	The number of test cultures sensitive to bacteriophage	% of lysed cultures of mycobacteria
Phage - smegmatis	9	M.smegmatis	60
Phage - avium	9	M.avium	50
Phage - kansasi	9	M.kansasii	10
Phage - scrofulaseum	9	M.scrofulaseum	30
Phage - phlei	9	M. phlei	20
Phage - terrae	9	M. terrae	50
Phage - intracellulare	9	M.intracellulare	50

Studies have shown that the studied phages are characterized by a different spectrum of lytic activity. Tuberculosis phages are monovalent, the lysis range of the studied cultures ranges from 10 - 60%.

The determination of specificity in a dense nutrient medium was determined by the Otto method. The research results are shown in table 3.

Table 3 - *Specificity of TB phages*

Types of Mycobacteria	Tuberculosis phages							Control
	Phage - smegma-tis	Phage -avium	Phage -kansasii	Phage -scrofula-seum	Phage -phlei	Phage -terrae	Phage -intracel-lulare	
M.smegmatis	+	+	+	+	+	+	+	-
M.avium	+	+	+	+	+	+	+	-
M.kansasi	+	+	+	+	+	+	+	-
M.scrofulaseum	+	+	+	+	+	+	+	-
M.phlei	+	+	+	+	+	+	+	-
M.terrae	+	+	+	+	+	+	+	-
M.intracellulare	+	+	+	+	+	+	+	-

Based on the results, it can be concluded that the studied phages of different species are specific for atypical mycobacteria.

As a physical factor, we studied the effect of high temperature on bacteriophages, and as a chemical factor, the effect of chloroform.

Determination of the temperature stability of phages. After warming up, the activity of anti-tuberculosis phages was determined by the Graciocherez method every 10 min. The unheated bacteriophages served as a control (table 4).

Table 4 - *Temperature resistance of tuberculosis phages*

Temperature condition, ^{0}C	The activity of phages subjected to heat treatment, the number of active corpuscles in 1 cm^3						
	Phage - smegma-tis	Phage - avium	Phage -kansasii	Phage -scrofulaseum	Phage - phlei	Phage - terrae	Phage -intracellu-lare
60 – 63	$9x10^9$	$1x10^{10}$	$6 x 10^9$	$1,1x10^{10}$	$8 x 10^9$	$4x10^{10}$	$1,2x10^7$
64 – 67	$1,1x10^8$	$8x10^8$	$1.2x10^8$	$6 x 10^8$	$1 x 10^8$	$3x10^8$	$1,1x10^7$
68 – 70	$1,2x10^6$	$2x10^5$	$6x10^6$	$2 x 10^5$	$1,6x10^6$	$2x10^5$	$1,3x10^6$
71 – 73	$1,1x10^4$	$7 x 10^5$	$1,2x10^4$	$6 x 10^5$	$1,7x10^4$	$7x10^5$	$1,7x10^4$
74 – 76	$9x10^3$	$1 x 10^8$	$1,1x10^7$	$1,1x10^5$	$1,5x10^8$	$1,1x10^5$	$1,5x10^3$
77 – 79	$3 x10^2$	$1 x 10^4$	$3 x 10^2$	$1,2x10^4$	$3x10^7$	$1 x 10^7$	$1,3x10^7$
80 – 82	$1x10^1$	$2,9x10^3$	$1,1x10^1$	$1,9x10^3$	$1x10^6$	$2,3x10^8$	$6 x 10^1$
83 – 85	$8x10^9$	$2,5x10^3$	$8x10^9$	$1,5x10^8$	$8x10^9$	$2,3x10^8$	$1,1x10^9$
86 – 88	$3x10^7$	$2x10^2$	$3x10^7$	$2x10^2$	$3x10^7$	$2x10^6$	$3x10^7$
89 – 91	$1,1x10^6$	$1x10^{10}$	$1,2x10^6$	$1x10^{10}$	$1,6x10^6$	$1,2x10^{10}$	$1,2x10^6$
92 – 94	-	-	-	-	-	-	-
Activity control	$1,4x10^9$	$1,1x10^8$	$1,4x10^9$	$1,3x10^7$	$5,0x10^7$	$1,6x10^{10}$	$1,1x10^9$

As a result of studies of temperature stability, we found that the heating of phages for 30 min at 60 ° C does not affect their activity. A further increase in temperature to 65-75 °C leads to a loss of phage activity, a temperature in the range of 92-95 °C causes complete inactivation of the phages.

To determine the resistance of phages to the effects of chloroformaphagolizate, they were treated with chloroform in a ratio of 1:10 with constant shaking for 40 min, the phage activity was checked by the method of agar layers every 10 min (table 5).

Bacteriophages showed marked resistance to chloroform over a period of time from 10 to 40 minutes.

Conclusion. Research has been carried out to study the basic biological properties of bacteriophages with respect to atypical mycobacteria isolated from environmental objects.

All studied phages had a titer of 10^7 - 10^9 according to Appelman and 10^9 - 10^{10} according to Grazia, had a pronounced specificity with respect to atypical mycobacteria: M. kansasii, M.avium, M.scrofulaseum, M. phlei, M. terrae, M. intracellulare, M. Smegmatis and did not show activity against other species of mycobacteria.

All these phages retained lytic activity for 2 months; they were resistant to heating in the range of 50 ° C - 70 ° C for 30 min. The phages were resistant to 10% chloroform for 45 minutes.

Table 5 - *The resistance of mycobacteriophages of Mycobacterium tuberculosis to chloroform*

Anti-tuberculosis phages	**Phage activity after treatment with chloroform, the number of active particles in 1 cm³**				**Activity control**
	10 min	**20 min**	**30 min**	**40 min**	
Phage - smegmatis	+	+	+	+	7
Phage - avium	+	+	+	+	2
Phage - kansasi	+	+	+	+	8
Phage - scrofulaseum	+	+	+	+	6
Phage - phlei	+	+	+	+	7
Phage - terrae	+	+	+	+	5
Phage - intracellulare	+	+	+	+	8

References

1. 1. Sozikov, V. A. The role of atypical mycobacteria in the epizootic process / V. A. Sozikov // Veterinary Medicine. - 1996. - № 3. - P. 27-31.

2. 2. Kassich, Yu. Ya. Studying the sensitizing properties of atypical mycobacteria / Yu. Ya. Kassich // Veterinary Medicine. - 1985. - № 2. - P. 29-30.

3. Weisfeiler Yu.K. Biology and variability of tuberculosis mycobacteria and atypical mycobacteria. Budapest, 1975, P. 274-295.

4. Elizabeth KutterPhage therapy: Bacteriophages as antibiotics, Evergreen State College, Olympia, WA 98505 – Nov. 15, 1997.

5. Gabrilovich I.M. General characteristics of bacteriophages / Basics of bacteriophages. - Minsk. - 1973. - P.5-24

6. Vasiliev D.A., Zolotukhin S.M. (Bacteriophages of microorganisms important for plants, animals, and humans. / Monograph edited by Vasilyeva, Zolotukhina S.M. Ulyanovsk, 2013, 311 P.)

7. Broxmeyer L, Sosnowska D, Miltner E, Chacon O, Wagner D, et al. (2002) Killing of Mycobacterium avium and Mycobacterium tuberculosis by a mycobacteriophage delivered by a nonvirulent mycobacterium: a model for phage therapy of intracellular bacterial pathogens. J Infect Dis 186:1155–1160 [PubMed].

8. Gardner, G.M., Weiser, R.S.(1947),Proc.Soc.exp.Biol.66,205.

9. Syrym N.S., Espembetov B.A., Sansyzbay A.R. New approaches in the treatment of tuberculosis // Materials of the VIII Congress of TB Specialists and Pulmonologists of Uzbekistan. Tashkent, 2015. – P. 137-138.

10.Syrym N.S., Espembetov B.A. Development of a method for producing mycobacteriophage // Materials of the international scientific-practical conference "Actual problems of biology, biotechnology, ecology and biosafety" dedicated to the 80th anniversary of the honored scientist, professor V.L. Zaitsev, 2015. - P. 272-276.

UDC 630.43

自然保护区森林类型的Pirological特征«Kuznetsky Alatau»
PIROLOGICAL CHARACTERISTIC OF FOREST TYPES IN NATURE RESERVE «KUZNETSKY ALATAU»

Volokitina Alexandra Vitalievna
Doctor of Agricultural Sciences, Lead Research Officer
Forest Institute, separate division of the Federal Research Center,
Krasnoyarsk Scientific Center of the Siberian Branch
of the Russian Academy of Sciences

抽象。 基于俄罗斯森林热学的现代基础研究，对Kuznetsk Alatau自然保护区的森林类型进行了火山学描述。 我们在这个储备中使用了“森林类型方案”，并在俄罗斯科学院西伯利亚分院森林研究所开发了主要燃烧导体的类型指南。 森林类型的火山学特征使得有可能对森林中的自然火灾危险性进行更完美的评估，将植物可燃物质的大规模地图编制到火灾地点并预测其行为：传播速度 火灾的战术部分，从地面到顶部或土壤的过渡的可能性，并预测火灾的直接后果，例如，根据燃烧强度，树种及其类型，林分的死亡率（死亡百分比） 平均直径。

Abstract. *Based on modern fundamental research in forest pyrology in Russia, a pyrological characterization of forest types in the Kuznetsk Alatau nature reserve has been performed. We used the “Forest Type Scheme” for this reserve and the type guide for the main combustion conductors developed at the Forest Institute, Siberian Branch of the Russian Academy of Sciences. The pyrological characterization of forest types makes it possible to perform a more perfect assessment of the natural fire hazard in the forest, to compile large-scale maps of plant combustible materials to the places of fires and to predict their behavior: the speed of propagation of the tactical parts of the fire, the possibility of its transition from the ground to top or soil and predict the immediate consequences of the fire for example, mortality (% of deaths) of the stand depending on the intensity of burning, tree species and its average diameter.*

Introduction

The reserves of Russia are the preservation of the natural heritage of our country. In reserves, the entire natural complex is completely withdrawn from economic use. Any activity violating natural complexes or threatening their safety is prohibited here [10]. Unlike national parks, visitors are restricted in nature reserves. But even with the existing strict protection from anthropogenic sources of fire, forest fires in the reserves occur. In addition, it is impossible to exclude

natural sources of ignition — lightning.

The role of forest fires in forest, steppe, shrub and bog ecosystems is great and diverse. First of all, forest fires are a periodically acting environmental factor that sometimes even increases biodiversity. But these same fires extremely negatively affect people and their economic activities. Smoke from natural fires negatively affects people's health, the destruction of forest and agricultural resources leads to significant economic damage. In various regions, severe droughts became more frequent, causing an increase in the number of forest fires and the area covered by fire, including in the reserves [2].

But the development of large devastating fires is unacceptable on the territory of nature reserves. The problem can be largely solved by improving fire hazard assessment, forecasting and managing fires. This will prevent people from visiting areas of the forest "matured" in firehazad regard, as well as timely take optimal measures in case of ignition during thunderstorms. Management of forest fires in reserves is quite realistic on the basis of modern fundamental scientific developments in forest pyrology, which allow improving the fire hazard assessment, predicting the behavior of a fire depending on meteorological conditions, and based on it - controlling the spread of flame (or flameless) burning throughout the territory and make optimal fire fighting decisions.

Question Status

A detailed analysis of forest fires in Russian reserves was carried out by L.V. Kuleshov and V.N. Korotkov [5]. The dynamics of fires was analyzed by them for the period from 1975 to 2000. The general tendency of an increase in the number of fires in nature reserves has been identified. A certain ratio of forest and non-forest fires is noteworthy. So after 1990, there was a predominance of burned areas in non-forest areas. It is also noted that abroad (USA, Canada, Australia) have already developed guidelines for fire management in specially protected natural areas (SPNA), and that "the solution of such problems is an urgent need for Russia with its huge forest spaces, an exceptional variety of forest conditions, high danger of forest fires "[5].

There are no special recommendations on the protection of nature reserves from fires in Russia. Until now, their forest management uses developments designed for forestry activities, for example, forest fire maps are created on which the categories of forest plots are distributed according to the classes of natural fire hazard, taking into account, firstly, the sequence of fire maturation, and secondly, the possibility of development of strong fires, moreover, regardless of the order of fire ripening [9]. This led to the fact that not only dry lichen pine trees, but also all littered areas (burners, dead wood) and all coniferous young growths with any ground cover turned out to be included in class I of the scale. And the fourth class of fire hazard includes not only weakly combustible sphagnum and longhorn pine forests, but also all grassy forest types, although in spring and autumn in southern Siberia fires in grassy types with a predominance of cereals and sedges often turn into a natural disaster. In addition, there is no quantitative pyrological

characteristic of sites included in one class. Studies of quantitative criteria for the rate of fire ripening in various categories of forest and non-forest areas in different regions were actively carried out in Russia in the 1960-1970s according to the methodology of Professor N.P. Kurbatsky [6]. Scales for the sequence of sunbathing of plots were compiled, indicating the magnitude of the forest fire indicator of drought, at which fire ripening of plots of this category is achieved.

But the total number of possible categories of sites in Russia is too large to cover all of them with research. Forest typologists and forest managers in different geographical areas have identified and described hundreds of forest types. Moreover, the ground cover of many types of forests, identical in name, had large pyrological differences. For example, lingonberry pine forests from the northern taiga subzone with a developed moss cover and lingonberry pine trees from the southern subzone, where mosses are almost never found in the cover. In addition, in the stands of one type of forest, differing in the completeness, composition, and age structure of the stand, the pyrological characteristics of the soil cover can also be different, first of all, in the rate of its drying and moistening, which determine the burning intensity. If we also include logging and burning sites of different ages, as well as various non-forest areas located on the territory of the state forest fund (swamps, meadows, lawns, bushes, etc.) in this list, then it becomes obvious that to study separately all this great the variety of site categories is virtually impossible. Their pyrological classification was necessary, the division of all soil covers into a number of pyrological types.

Table 1

Type diagram of the main combustion conductors

Subgroups I of PCM Group	**Types of main combustion conductors (MCC types)**				
"Mossy"	Lh	Dm	Wm	Mm1	Mm2
"leafy""leafy"	Gd <> Lf <> Df <> Nc1 <> Nc2				
Critical drought class	I	II	III	IV	Incombustible

Note: Types of MCC: Lh - lichen, Dm - dry mossy, Wm - wet mossy, Mm1 – marsh mossy (swamp forests), Mm2 - marsh-mossy (large swamp massifs); Gd - grassy debris, Lf - loosely falling, Df - densely falling, Nc1 - non-conductive (MCC capacity is less than critical), Nc2 - non-conductive (there are other combustion conductors other than MCC: bedding, peat, turf).

A generalization and analysis of published materials for observing fire maturation, as well as conducting special studies on the layer-by-layer drying of soil cover [1], allowed developing the classification of forest combustible materials of N.P. Kurbatsky [7.8]:to distinguish types in each group of fuel [2]. The division into types of the first group of combustible materials, including mosses, lichens, and small plant debris, allowed them to be reflected on maps of plant combustible materials (PCM maps), the compilation methods of which have now been developed. The PCM types of this group were called the main combustion conductors (MCC) and their pyrological characteristics were obtained

on the basis of many years of studies of moistening, drying, and burning of various soil coverings in different regions. The idea of the classification of the main combustion conductors is clearly reflected in the following scheme (Table 1) [2]:

Critical Drought Class (CDC) - a drought class in which a state of readiness for burning of this type of main conductor of combustion is achieved. CDC scheme indicates it for typical conditions: the horizontal surface of the site, the wood of medium fullness (0.5-0.7) in the leafy (covered) state. The drought class (DC) is determined by the value of the forest fire indicator (Nesterova or PV-1 LenNIIILKh): I DC - up to 300 units, II - 301-1000, III - 1001-3000, IV - 3001-10000, V - 10001-30000, VI - more than 30,000 units of the indicator.

Pyrological characterization of forest types in the "Kuznetsky Alatau" reserve

The "Kuznetsky Alatau "Nature Reserve is characterized by low relative incineration of forests, including due to the effectiveness of preventive measures. But in order to improve fire protection during forest management in 2014, the East Siberian Forest Management Enterprise decided to draw up maps of plant combustible materials (PCM maps) on the territory of the reserve separately for the spring (autumn) and summer periods of the fire hazard season. Work on the preparation for the creation of PCM cards was carried out under Agreement № 339 of 05/05/2014 between the Forest Institute named after V.N. Sukachev SORAN and FSUE "VOSTSIBLESPROEKT". The PCM classification developed at the IL SB RAS was taken as the basis, using which the "Forest types and landscape types on the territory of the Federal State Budgetary Institution" Kuznetsky Alatau State Reserve "adopted during the forest management of this reserve were analyzed. First of all, each type of forest was characterized by the type of main combustion conductor (MCC type), for which the basic pyrological characteristics have already been developed. The results are shown in Table 2 (fragment).

To clarify the types of MCC in natural conditions, the "Determinant of the types of main combustion conductors" was used at key sites (Table 3) [2]. The taxation cards were marked with the MCC type in spring (autumn) and summer. As a result, in the process of forest inventory, an information base was created in the GIS for compiling large-scale PCM maps for different periods of the fire hazard season. On the PCM card itself, the main combustion conductors are reflected in color, while other PCM groups are shown in the pyrological description attached to the card.

Based on the compiled PCM maps for the reserve, maps of the current natural fire hazard were created for the five classes of drought according to weather conditions, which more accurately reflect the fire hazard of the territory than previously compiled forest fire cards. In addition, PCM cards can be used to predict the behavior of forest fires that have occurred in the reserve. A special computer program was developed for this purpose at the SB RAS [4].

Table 2

Forest types, types of main combustion conductors (MCC) (codes) and critical drought classes under typical conditions (CDC) in the territory of the Federal State Budgetary Institution "Kuznetsky Alatau State Reserve" (fragment)

Forest types	MCC types (codes)		CDC (under typical conditions)	
	spring, fall	summer	spring, fall	summer
Cherneva HAC of fir-deciduous forests (300-700 m)				
Large herb aspen				
Large herb aspen (**lha**)	Lf	Df	II	III
Large grass and fern fir				
Spruce-fir Fern (**sff**)	Df	Df	III	III
Spruce-fir sour-grass-green-moss				
Spruce-fir green-thyroid (**sfggt**)	Dm	Dm	II	II
Spruce-fir reed (with blunt-banded reed)				
Cheremshovo-reynikovy fir (**crf**)	Gd	Df	I	III
Cedar reedgrass				
Cedar forest Cheremshovo-reynik (**cfcr**)	Gd	Nc1	I	IV
Reedgrass cedar forest (**rcf**)	Gd	Lf	I	II
Grassland cedar forests				
Labaznikovo-reynik cedar forest (**lrcf**)	Gd	Lf	I	II
Labaznikovo-sedge cedar forest (**lscf**)	Gd	Lf	I	II
Large spruce fir trees				
Fir-tree coarse-reynik (**ftcr**)	Gd	Df	I	III
Spruce shrubs and herbs forest				
Spruce shrub-motley herb forest (**ssmhf**)	Lf	Df	II	III
Taiga-black HAC dark coniferous forests (500-1000 m)				
Large herb spruce-fir forests				
Reed-large-grassed fir-tree (**rlgft**)	Lf	Df	II	III
Grass-green moss fir forests				
Acid-reed fir (**arf**)	Gd	Df	I	III
Calamagrostis-green-moss fir (**cgmf**)	Dm	Dm	II	II
Cedar forests Cyperaceae				
Cyperaceae cedar forest (**ccf**)	Lf	Df	II	III
Acid-grass-green-moss cedar forests				
Cedar grove reed-green moss (**cgrgm**)	Dm	Dm	II	II
Birch grass bogs forests				
Ramson birch (cher)	Lf	Df	II	III
Calamagrostis birch forests				
Calamagrostis birch forests (**b**)	Gd	Lf	I	II

Note: Explanation of the symbols for the types of the main MCC combustion conductors and their codes are given in Table 1.

Table 3

A brief identifier of the types of main combustion conductors (MCC types) [2]

1.	*Define a subgroup of MCC type:* If the projective cover of mosses and lichens is 50% or more, this is a "*mossy*" subgroup (2A), if less than 50% is "*falling*" (2B).	
2.	Determine the type of MCC in subgroups	
2A	MCC type determination in the "mossy" subgroup:	
	according to the description of MCC types below, select one of 4 types and mark its code in the taxation card	
	Lh	*Lichen:* bushy lichens predominate in the cover or are present on very dry soils together with a cover of pine litter.
	Dm	*dry mossy***:** green mosses prevail in the cover, sometimes mixed with lichens, on drained soils.
	Wm	*wet mossy***:** there are green mosses with an admixture of polytrichum or sphagnum in poorly drained soils.
	Mm:	*marsh-mossy:* in the cover sphagnum mosses on swampy and bog soils or polytrichums (cuckoo flax) on any soil:
	Mm1	swampy forests and swamps among dry lands (sphagnum forest types), or the prevalence of cuckoo flax in the cover (long-moss forest types);
	Mm2	large massifs of high sphagnum bogs.
	Note: Types of MCC "*mossy*" subgroups do not change their properties during the fire hazard season. In the taxation card, the selected MCC type is indicated by its code (in brackets is a digital code): *Lh (101), Dm (102), Wm (103), Mm1 (104), Mm2 (105).*	

Table 3

A brief identifier of the types of main combustion conductors (MCC types) [2]

2B	Definition of MCC type in the “falling” subgroup:	
	according to the description of MCC types below, select one of 4 types and mark its code in the taxation card:	
	Gd	*grassy debris:* dried shrubs or sedges predominate in the cover, usually in spring and autumn (reed, sedge, cereal forest types).
	Lf	*loosely falling:* prevailing in the cover: litter of pine, cedar, loose litter from foliage of birch, aspen and other hardwoods in spring and autumn; dried herbs in spring and autumn; felt from sedges and cereal rags - in the summer; integuments of winter-green sedges - in spring and autumn.
	Df	*densely falling:* prevailing in the cover: litter from the needles of spruce, fir, larch; compacted litter from foliage of birch, aspen and other hardwoods - in the summer.
	Nc:	*non-conductive:* there are no MCC layers in the cover along which flame burning could spread.
	Nc1	areas with the presence of other, non-main combustion conductors (litter, turf, humus horizon); areas with green grass in the summer, when the supply of green herbs exceeds the supply of dried out, which excludes the spread of flame burning;
	Nc2	there are no burning conductors (sands, pebbles, roads, arable land, etc.). Such sites are incombustible.
	Note: in the *“falling”* subgroup, the MCC types may undergo changes during the fire season and pass into each other. In the taxation card, in the first place, the MCC type is noted in the spring (autumn) and through the slash - the MCC type - in the summer. In brackets - a digital tax code of each type of MCC. For example: *Gd (106)/ Lf (107), Gd (106)/ Df (108), Gd (106)/ Nc1 (109), Lf (107)/ Df (108), Lf (107)/ Lf (107), Df (108)/ Df (108), Nc1 (109)/ Nc2 (110).*	

The work was performed in the framework of Agreement № 339 of 05/05/2014 between Forest Institute, Siberian Branch of the Russian Academy of Sciences and the Federal State Unitary Enterprise "VOSTSIBLESPROEKT" with financial support from the RFBR grant № 18-05-00781A.

References

1. Volokitina A.V. Layer-by-layer moistening and drying of moss-lichen and dead cover in the forest // Forestry, 1985. № 1. - P.60-64.

2. Volokitina A.V. Classification and mapping of vegetable combustible materials / A.V. Volokitina, M.A. Sofronov. - Novosibirsk: SORAN, 2002. - 314 P.

3. Volokitina A.V. On the regulation of the pyrogenic factor in reserves and national parks / Long-term observations in protected areas. Story. The current state. Prospects / A.V. Volokitina, M.A. Sofronov, T.M. Sofronova. - Krasnoyarsk: GPP "Pillars", 2005. - P.3-5.

4. Korets M.A. Program for predicting the spread of ground fire / M.A. Korets, A.V. Volokitin. - Certificate of state registration of computer programs № 2015661771, 2015.

5. Kuleshova L.V. Toward a strategy for managing forest fires in nature reserves / Monitoring communities on fire burns and managing fires in reserves / L.V. Kuleshov, V.N. Korotkov. - Moscow: VSRI of nature, 2002. - P.159-174.

6. Kurbatsky N.P. Guidelines for the pilot development of local fire hazard scales. - L.: TSNIILH, 1954. - 33 P.

7. Kurbatsky N.P. Technique and tactics of extinguishing forest fires. - Moscow: Goslesbumizdat, 1962 .-- 154 P.

8. Kurbatsky N.P. Investigation of the quantity and properties of forest combustible materials // Questions of forest pyrology. Krasnoyarsk: ILiD SO AN SSSR, 1970. - P.5-58.

9. Collection of departmental acts on forestry. - Moscow: Gosleskhoz, 1979. - 206 P.

10. Federal law on specially protected natural territories. On environmental protection. Collection of regulatory acts as of 11/15/1997. - Moscow: Yurayt, 1997. - 31 P.

使用鹌鹑肉和苋菜籽生产膳食肉制品的生物和技术方面
BIOLOGICAL AND TECHNOLOGICAL ASPECTS OF PRODUCTION OF DIETARY MEAT PRODUCT USING QUAIL MEAT AND AMARANTH SEEDS

Patiyeva Aleksandra Mikhailovna
Doctor of Agricultural Sciences, Full Professor
Patiyeva Svetlana Vladimirovna
Candidate of Technical Sciences, Associate Professor
Zykova Alena Viktorovna
student
Kuban State Agrarian University
Krasnodar, Russia

抽象。 提供有关食物过敏流行的信息。 研究了鹌鹑肉的生物学价值和化学成分。 给出了食物技术中鹌鹑肉用于食物过敏儿童的理由。 肉蛋奶酥配方设计。
关键词：鹌鹑肉，苋菜种子，食物过敏，肉蛋白牛奶酥

Abstract. *Information on the prevalence of food allergies is provided. The biological value and chemical composition of quail meat were studied. The rationale for the use of quail meat in food technology for children with food allergies is given. Meat souffle recipe is designed.*
Keywords: *quail meat, amaranth seeds, food allergy, meat souffle*

An important direction in the production of meat-based food for children is the adaptation of formulations in accordance with age groups. Unfortunately, every year the number of children suffering from certain diseases is increasing, which is associated with the ecological situation in the world. According to statistics, infant mortality in the Russian Federation is 4 times higher compared to European countries. Over the past few decades, cases of congenital pathologies in children have increased by almost 2.2 times. According to epidemiological studies, food allergies affect: about 11-26 million European populations, as well as 10 to 12 million US residents, including 3 million children. The World Health Organization has provided evidence that 2.5% of the population experience food allergies. In this case, symptoms of food allergies are observed in 17.3% of children. Today, the range of products for baby food of healthy children is quite diverse. But the range of products of therapeutic and preventive nutrition for children is extremely limited.

It is known that children are prone to various food allergies. For normal development and growth of the body, meat protein is necessary, which is balanced in amino acid composition and is necessary for a growing body. By allergenic activity, meat is divided into three types: high, medium and low activity. Studies have shown that white meat contains fewer protein peaks and has less antigenic activity. Therefore, for children with food allergies, it is preferable to use white poultry (turkey, chicken and quail).

Purpose of the work

The aim of our work is to develop a meat souffle recipe for feeding preschool children, as well as increasing the range of specialized products.

Research methodology

When forming the recipe composition of meat soufflé for children's nutrition, the following requirements were taken into account: the basis of the recipe should use meat raw materials with low allergenic activity, grown in accordance with sanitary and veterinary requirements, namely: without the use of growth stimulants, vaccines, hormones, synthetic substances, feed antibiotics, as a herbal component, it is advisable to use a component that favorably affects all life-supporting system of a growing organism and has a preventive effect.

To conduct a technological experiment, we used quail meat obtained by manual deboning of "Pharaoh" breed carcasses grown in appropriate conditions.

As additional raw materials used, enriching the recipe composition, we used quail eggs, cream sauce, amaranth seeds, parsley, salt, broth.

Due to the natural resistance of quail to infectious diseases, it is possible to eat environmentally friendly meat that does not contain drugs. In addition to environmental safety, quail meat has dietary properties, a balanced amino acid composition, and a high content of important nutrients. Table 1 and 2 shows the general chemical composition of quail meat, as well as the mineral and vitamin composition of quail meat.

Table 1 - *The chemical composition of quail meat*

Name	Content, %
Moisture	67,93-74,17
Dry matter	25,0-27,0
Protein	21,0-22,0
Fat	2,5-4,0
Ash	0,92-0,97

Table 2 - *Mineral and vitamin composition of quail meat*

Indicator	Mg content per 100 g of product
	Quail meat
Minerals:	
P	275
Ca	21
K	257
Mg	35
Na	25
Fe	3,2
Vitamins:	
A	0,31
B_1	0,10
B_2	0,26
E	1,35

The production of dietetic baby food from quail meat has high prospects, especially in combination with plant components, which will only enhance the therapeutic and prophylactic effect of the product.

One of such plant components that can be used in the production of baby food is amaranth. Only relatively recently, the beneficial properties of amaranth were discovered, which the ancient Aztecs and Rusich knew about. The uniqueness of the culture lies in a balanced combination of proteins, carbohydrates and fats. In addition, it has a high content of vitamins and minerals. Amaranth is a rich source of high-quality protein, the content of which ranges from 16 to 18%. By nutritional value, it is equated with breast milk. Amaranth contains all the essential amino acids. Table 3 presents the chemical composition of amaranth seeds.

Table 3 *& The chemical composition of amaranth seeds*

Indicator	Content, %
Protein	15,5
Fat	7,6
Energy value is 476 kcal per 100 g of product	

It is also known that 100 grams of amaranth contains about 6 grams of lysine, which contributes to better absorption of proteins in the human body. Amaranth seeds have a high content of polyunsaturated fatty acids (about 70%), which is extremely important for the proper functioning of the body and the development of children. In many countries, amaranth is used for feeding young children along with rice and buckwheat, since in addition to containing the above listed nutrients

it does not contain gluten. Amaranth seeds contain squalene, a polyunsaturated hydrocarbon that prevents oxygen deficiency in the human body. The high content of squalene has a preventive effect on the body. Squalene, combining with oxygen, saturates the body's cells with oxygen, which provides a preventive effect on the body, acts as a powerful antioxidant, and has immunostimulating, bactericidal, detoxifying and anti-inflammatory effects. Of all plants, it can rightfully be considered the least allergenic, which makes amaranth safe in the production of food for children.

Research results

On the basis of the studied literature data, we developed the formulation shown in table 4.

Recipe component	Mass fraction, %
quail meat	50,0-53,0
quail egg	13,0-14,0
sauce	21,0-22,0
amaranth	4,5-5,0
parsley	1,8-2,0
salt	1,8-2,0
bouillon	rest

Quail meat is valued for its high protein content; it is most balanced in amino acid composition. There is no limiting amino acid in the composition of meat; it is equated to a standard. It is a dietary raw meat, has a low allergenic activity, which allows it to be used for feeding children. The composition of quail meat contains a significant amount of potassium, which is responsible for the work of the brain, has an arrhythmic and hypotensive effect, and the presence of sulfur and phosphorus are necessary for the normalization of metabolism. In quails, the threshold and susceptibility to various infectious diseases is reduced, which naturally determines the environmental safety of meat.

Amaranth seeds are prepared in the following way: amaranth seeds are thoroughly washed beforehand, boiled for 30 minutes until a viscous consistency appears, allowed to cool to room temperature and washed.

Parsley greens containing polyphenols that have anti-inflammatory effects on the body.

Quail eggs containing easily digestible protein, fats, vitamins, amino acids, and the use of quail eggs in the prescription composition can normalize metabolism and blood circulation, increase immunity, have a beneficial effect on the gastrointestinal tract, and promote cholesterol excretion.

We made meat souffle using the following technology: quail meat was used as the main raw material. To prepare soufflé, quail meat was cooked, the result-

ing broth was used when added to the minced meat. The sauce was prepared as follows: the cream was heated with the addition of semolina in a ratio of 1: 1 and boiled to a thick consistency. Boiled quail meat was ground on a spinning top with a lattice hole diameter of 8-12 mm. Parsley was chopped. Amaranth seeds were previously thoroughly washed, boiled for 30 minutes until a viscous consistency appeared, allowed to cool to room temperature, washed. Stuffing for souffle was made from prepared raw materials. The ingredients according to the recipe were laid in a cutter in the following sequence: quail meat, sauce, egg, parsley and amaranth seeds. Stirring was carried out for 3-5 minutes. Forms were filled with prepared minced meat. Forms with minced meat were subjected to heat treatment in heat chambers at 90 ° C for 0.3-1.0 hours until the temperature reached 72 ° C in the center of the mold, then it was cooled. Table 5 presents the organoleptic characteristics of the finished product.

Table 5 - *organoleptic characteristics of the finished product*

Organoleptic indicators	**Characteristic indicators**
Appearance	The product has clean surface
Color	The color is characteristic of those foodstuffs from which the product is prepared; the color is grayish-pink with interspersed amaranth seeds
Consistency	The consistency of the product is dense, the dish is whole in cross section, there are interspersed amaranth seeds
Smell	The smell corresponds to the ingredients from which it is prepared, without extraneous odors
Taste	The taste corresponds to the ingredients from which it is prepared, harmonious, has a piquant taste.

To confirm the effectiveness of the proposed method, studies were conducted on satisfaction in basic nutrients for preschoolers (1-3 years), the indicators of which are presented in table 6.

Using the proposed method for producing meat souffle for children suffering from food allergies gives the following advantages:

- the use of components with a reduced allergenic ability in the prescription composition allows the product to be used for people prone to food allergies;

- the use of amaranth seeds in the product allows its use for the diet of children. The increased content of squalene in amaranth seeds gives the product useful properties, including acting as an antioxidant, it has an immunostimulating, bactericidal, detoxifying and anti-inflammatory effect;

- allows to expand the range of meat products intended for mass nutrition, as well as for people of different age groups suffering from food allergies.

- the meat souffle contains natural environmentally friendly raw materials and there are no food additives of a chemical nature, therefore it can be used to feed children of preschool age.

Thus, quail meat in combination with amaranth can be used for the production of dietetic baby food, especially for children at risk of food allergies (except for children with individual intolerance).

Table 6 - *Comparative assessment of satisfaction in basic food substances in 100 g of the finished product according to the prototype and the claimed method*

Indicators	Content in product	Daily requirement, for preschoolers (1-3 years)	The degree of satisfaction, children,%
Protein, g	14,6	42	34,7
Fat, g	4,4	47	9,4
Vitamins:			
B_1, mg	0,1	0,8	12,5
B_2, mg	0,4	0,9	44,4
Minerals:			
Potassium, mg	216,3	400	54
Magnesium, mg	36,4	80	45,5
Calcium, mg	44,4	800	5,5
Phosphorus, mg	217,5	700	31,1
Iron, mg	2,7	10	27
Energy value, kcal	158,3	1400	11

Refrences

1. Patieva, S.V. The technology of meat products functional and special purpose: textbook. / S.V. Patieva, N.V. Timoshenko, A.M. Patieva. - Krasnodar: KubSAU, 2015. - 326 P.

2. Timoshenko N.V. Rational use of biologically valuable products of slaughter of animals in meat technologies / N.V. Timoshenko, A.M. Patieva, S.V. Patieva, N.A. Martynenko // Young scientist. - 2015. - №5-1 (85). P.49-53.

3. Popova, N.N. The basics of good nutrition [Electronic resource]: training manual. - Electron.dan. - Voronezh: VSUET (Voronezh State University of Engineering Technologies), 2013. - 109 P.

4. Timoshenko N.V. Optimization techniques for prescription compositions of specialized sausages for baby food / N.V. Timoshenko, A.M. Patieva, S.V. Patieva, K.N. Aksenova // Political Internet Journal of the Kuban State Agrarian University. - 2014. - №100. P.725-734.

5. Patieva A.M. Substantiation of biomedical and nutrient requirements for the composition and quality of canned meat products for diabetic nutrition of people / A.M. Patieva, S.V. Patieva, A.V. Ponomarenko // Collection of articles on the materials of the 3rd scientific and practical conference of students, graduate students and young scientists dedicated to the 95th anniversary of the Kuban State Agrarian University. - 2017. - P.119-123.

6. Lisovitskaya E.P. Development of the formulation and technology of semi-finished products for special purposes / E.P. Lisovitskaya, A.M. Patieva, S.V. Patieva, Yu. N. Shakota // Collection of articles on the materials of the 10th All-Russian Conference of Young Scientists dedicated to the 120th anniversary of I.S. Kosenko. - 2017. - P.1290-1291.

2009–2010季节甲型流感（H1N1）pdm跨西伯利亚波的成核与传播模型

THE MODEL OF NUCLEATION AND PROPAGATION OF TRANS-SIBERIAN WAVE OF INFLUENZA A(H1N1)PDM IN THE 2009-2010 SEASON

Kolesin Igor Dmitrievich
Doctor of Physico-mathematical Sciences, Full Professor
Kolpak Evgenij Petrovich
Doctor of Physico-mathematical Sciences, Full Professor
Zhitkova Ekaterina Mihajlovna
Research Officer
Saint Petersburg State University

抽象。 随着大流行性流感的出现及其在俄罗斯的传播，模拟了远东地区2009 – 2010年流行病学状况的发展。 研究了这种现象的机理。 考虑了远东和中国居民之间感染和交流的进口案例。 大流行波在俄罗斯境内的移动是使用多相机模型建模的，其中远东地区扮演第一台相机的角色。 结果表明，由于中国没有流行病，世界上第一次大流行2009年的发展并没有导致远东地区的流行病，只有第二次大流行浪潮席卷中国的发展也导致 大流行病毒传播给远东居民。

Abstract. *The development of the epidemiological situation of 2009-2010 in the Far East is simulated with the emergence of a pandemic influenza wave and its spread throughout Russia. The mechanism of this phenomenon is investigated. Import cases of infection and communication between residents of the Far East and China are taken into account. The movement of a pandemic wave across the territory of Russia is modeled using a multi-camera model, where the Far Eastern region plays the role of the first camera. It is shown that the development of the first pandemic wave of 2009 in the world did not cause an epidemic in the Far East due to the absence of an epidemic in China, and only the development of the second pandemic wave that swept China also led to the transmission of the pandemic strain to residents of the Far East.*

Introduction

The Trans-Siberian wave of pandemic influenza A is a unique phenomenon, the mechanism of which is of particular interest for two neighboring countries - China and Russia. The fact is that a feature of all the known pandemic influenza A that covered Russia in the 20th century was its spread from the Far East [2]. The same peculiarity was observed in the pandemic of influenza A (H1N1)pdm in 2009. A

number of considerations were expressed on the nature of the mechanism of the emergence of the trans-Siberian wave of pandemic influenza. Before discussing this phenomenon more broadly, it would be useful to provide these considerations for the 2009–2010 pandemic.

The first pandemic wave that engulfed the world's population (spring-summer 2009) caused only a small spike in imported cases of infection in Russia that did not lead to a pandemic outbreak [4, 7, 8]. However, the subsequent, second pandemic wave (fall-winter 2009-2010) caused a rapid increase in pandemic morbidity in Russia. The speed with which the first wave swept the population of the Earth, but bypassed Russia, and the second captured it, raises the question of the causes of this phenomenon. The most significant of them seems to be tight control at the entrance to the country - identification of infected people and their isolation [4]. However, the autumn pandemic wave, despite the same tight control, penetrated Russia and caused a pandemic outbreak. It could be assumed that the penetration was caused by the increase in the flow of returning from summer vacations by the end of August, in which some of the infected were not detected in a timely manner (such examples are given in [8]). However, this assumption is doubtful, since the autumn epidemic of 2009 began in Russia with ordinary influenza strains, which only then gave way to a pandemic.

More plausible is the fact cited in work [9]: the uncontrolled communication of the inhabitants of the Far East with the Chinese population, experiencing a pandemic increase in the incidence rate at that time. Indeed, the first pandemic wave in China began in the fall (as in Russia [9]), but somewhat ahead of the Russian one. Therefore, the reason for the lack of conditions in Russia for the spread of the pandemic strain should be sought in the etiology of influenza diseases in China. The absence of a summer pandemic wave in China excluded the traditional transfer of the pandemic strain to Russia through the Far East, but with the beginning of the autumn wave this factor gained its epidemic significance [10]. How influential it was can be found using the model linking the listed factors together. By exploring their different relationships, one can evaluate the contribution of each. It should be noted that cooperation between the two countries in the epidemiological surveillance of the emergence of new influenza strains would make it possible, knowing the mechanism of transmission and spread of influenza, to make joint decisions to reduce the incidence in both China and Russia.

The purpose of this article is to illustrate the influence of household contacts of residents of the Far East and China on the occurrence of the Trans-Siberian flu wave on a mathematical model.

Materials and research method

Based on the picture of phenomena that developed in Russia in May-June 2009 (the movement of the first pandemic wave in the world) and in September-October 2009 (the movement of the second, which became the first in Russia), a diagram of the

acting factors is constructed. The research method consists in setting up an experiment on a mathematical model that describes the development of a pandemic taking into account the importation of infection from abroad [7] and the indication of a pandemic strain in the Far East [10]. The governing factor is the epidemiological situation in China [9] in the presence of traditional contact between the inhabitants of the Far East and China. The criterion for the adequacy of the model is the following consideration. If the model does not show the occurrence of an epidemic, but lacks the traditional contact of the inhabitants, and taking into account it shows, it should be assumed that the import of infection was not a leading factor, but rather it was the second factor - the contact of the residents of the Far East with China when it was in a pandemic.

Model

The basis for constructing a mathematical model is the principle of displaying spatio-temporal processes using multi-chamber models [5]. Each camera represents a classic model of the development of an epidemic in a particular region. Variables *S, I, R* denote, respectively, the number of susceptible, infected, immune individuals in the *i*-th region. Regions (cameras) are connected by traffic flows. In addition, each chamber is supplemented by terms reflecting the specifics of introducing the pathogen (importation from other countries). Bearing in mind that two pandemic waves in the world caused two bursts of imported cases of infection in Russia, we introduce the two-wave import function in each chamber: $f_A(t)$:

$$f_A(t) = A\sin^2 \omega t, \quad \omega = 2\pi/T, \quad T = 55 \text{ (weeks)}$$

In addition, we supplement the first camera, which is correlated with the Far East, by the factor of household transmission of the pandemic strain in the course of communication between the Chinese and Russian population:

$$f_B(t) = B/(1 + l(t-\tau)^2), \quad \tau = 3T/4, \quad T = 55 \text{ (weeks)}.$$

As a result, the 2009-2010 epidemic development model in the Far East (i.e., in the first region) will take the form:

$$\frac{dS_1}{dt} = -a_1 S_1 I_1, \quad \frac{dI_1}{dt} = a_1 S_1 I_1 + f_A(t) + f_B(t-\tau) - \delta_{12} I_1 +$$
$$+ \delta_{21} I_2 - \beta I_1, \quad \frac{dR_1}{dt} = \beta I_1,$$

and its distribution model to other regions of Russia (where only import was observed) - as its spatial continuation:

$$\frac{dS_i}{dt} = -a_i S_i I_i, \quad \frac{dI_i}{dt} = a_i S_i I_i + f_A(t) + \delta_{i-1,i} I_{i-1} - \delta_{i,i+1} I_i +$$
$$+ \delta_{i+1,i} I_{i+1} - \beta I_i, \quad \frac{dR_i}{dt} = \beta I_i,$$

$$i = \overline{2,n}, \quad \delta_{n,n+1} = \delta_{n+1,n} = 0,$$
$$I_i(0) = 0, \quad aS_i(0) - \beta < 0, \quad R_i(0) = 0, \quad i = \overline{2,n}.$$

Results and discussion

The initial assumption about the reason for the absence of a pandemic outbreak in Russia during the first pandemic wave in the world, but its beginning in the second, was checked on the model by setting first $B = 0$ (which simulates the absence of a pandemic wave in China), and then $B > 0$. (occurrence of pandemic in China). As the experiment shows, at $B = 0$, the model does not detect the presence of a pandemic outbreak in Russia in either the first or second pandemic outbreaks in the world (Fig. A), but at $B > 0$ it does (Fig. *B*). Therefore, at the selected parameter values, the model qualitatively faithfully reproduces the nature of the development of the epidemiological situation in the Far East (1st camera), and then in the remaining regions of Russia (subsequent cameras). Although this is not direct evidence of the initial assumption, it serves as an argument in favor of the fact that the reason for the penetration into Russia of only the second pandemic wave could be the everyday communication of the inhabitants of the Far East with China, shortly before that, covered by an autumn pandemic outbreak. The dependence on the etiology of influenza in China is simulated by setting $B > 0$ in the case of a pandemic strain and $B = 0$ in the case of an ordinary one.

An interest in the specifics of the spread of the pandemic variant of influenza A (H1N1)pdm can be noted in work[14], where an attempt is made to comprehend them using mathematical models. The usefulness of mathematical modeling is also evidenced by the work of foreign researchers [12, 13], who studied the features of the development of the pandemic of 2009-2011. Of the domestic works, we will call Boyev's article [3], which continues the tradition of domestic modeling laid down by Baroyan, Rvachev, Ivannikov [1].

Conclusion

The proposed mathematical model imitates one of the possible mechanisms for the emergence and spread of the pandemic influenza A wave in Russia in the 2009-2010 season, confirming the dominant role of the factor of everyday communication between the inhabitants of China and Russia in the emergence of the wave.

References

1. Baroyan O.V., Rvachev L.A., Ivannikov Yu.G. Modeling and forecasting influenza epidemics for the territory of the USSR. M., NIIEM named after N.F. Gamalei, 1977.

2. Bukrinskaya A.G. Virology. - Moscow: Medicine, 1986.

3. Boev B.V. A model for the development of the influenza A (H1N1) epidemic in Russia in the 2009-2011 season // Epidemiology and Vaccine Prevention. 2010; 5; 52-58.

4. Karpova L.S., Pelikh M.Yu., Stolyarov K.A. Popyscheva N.M., Stolyarova T.P. Influenza pandemic in Russia as part of the global spread of influenza A (H1N1) pdm 09 in 2009-2010 // Questions of virology. 2012; 6; 26-30.

5. Kolesin I.D., Zhitkova E.M. Analysis of a three-stage three-wave epidemic cycle of influenza A virus // Biophysics. 2015; 3; 542-546.

6. Kolpak E.P., Gorbunova E.A., Zhukova I.V. The mathematical model of the population wave // Natural and mathematical sciences in the modern world. 2014; 16; 25-41.

7. Lvov D.K., Burtseva E.I., Shchelkanov M.Yu. et al. Distribution of a new pandemic influenza A (H1N1)$_v$ virus in Russia. // Questions of virology. 2010; 3; 4-9.

8. Onishchenko G.G. Epidemic situation of influenza caused by highly pathogenic virus A (H1N1) in the Russian Federation and in the world // Journal of Microbiol. 2010; 1; 3-9.

9. Sominina A.A., Grudinin M.M., Eropkin M.Yu., Karpova L.S. et al. Analysis of an influenza pandemic in Russia as part of a global process based on materials from a reference center for influenza monitoring // Journal of Microbiol. 2011; 3; 20-24.

10. Shchelkanov M.Yu., Lvov D.N., Fedyakina I.T. et al. Dynamics of the spread of pandemic influenza A / H1N1 swl in the Far East in 2009. Virology issues; 2010; 3; 10-15.

11. Yakovlev A.A., Kotlyarova S.I., Musatov V.B. et al. Three epidemic seasons of influenza 2009-2013. // Epidemiology and infectious diseases. 2014; 2; 33-39.

12. Flasche S., Hens N., Boëlle P.Y., et al. Different transmission patterns in the early stages of the influenza A(H1N1)v pandemic: a comparative analysis of 12 European countries. Epidemics. 2011; 3(2); 125-133.

13. Lessler J., Thais dos Santos, Aguilera X., Brookmeyer R., Group PITW, Cummings DA. H1N1pdm in the Americas. Epidemics 2010; 2; 132-138.

14. Rvachev L.A., Longini I.M. A mathematical model for the global spread of Influenza. Math. Biosci. 1995; 75 (1); 3-22.

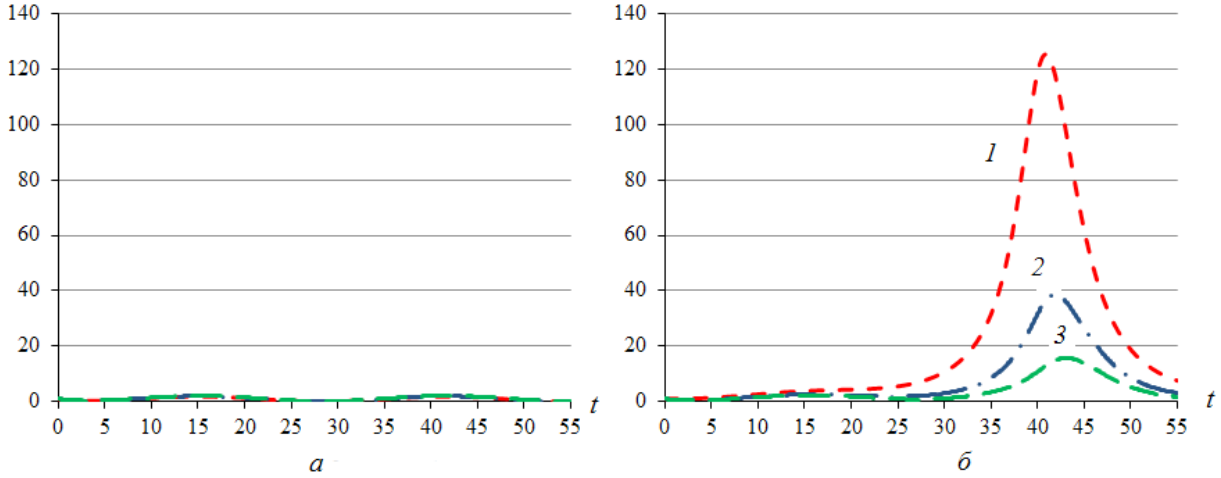


Fig. *The development of an influenza pandemic according to the model: a - if there is only an importation of infection from outside (B = 0), b - if the importation is supplemented by communication with people from the focal point of infection (B > 0); (1, 2, 3 - numbers of regions sequentially covered by epidemics). The calculations are performed at* $a_1 = a_2 = a_3 = 0.000005$, $b = 0.5$, $T = 55$, $\omega = 0.1185$, $A = 1$, $\delta_{12} = \delta_{23} = 0.3$, $\delta_{21} = \delta_{32} = 0.25$, $S_i(0) = 999$, $I_i(0) = 1$, $R_i(0) = 0$, $i = 1,2,3$, *on the horizontal axis - weeks, on the vertical - the number of infected.*

UDC 624. 131.5

压缩和剪切装置中非岩土变形各向异性实验研究方法
METHODOLOGY FOR EXPERIMENTAL STUDIES OF DEFORMATION ANISOTROPY OF NON-ROCKY SOILS IN COMPRESSION AND SHEAR DEVICES

Korobova Olga Alexandrovna
Doctor of Technical Sciences, Full Professor
Novosibirsk State University of Architecture and Civil Engineering
Maksimenko Lyubov Aleksandrovna
Candidate of Technical Sciences, Associate Professor
Siberian State University of Geosystems and Technologies
Solovyanova Irina Yuryevna
deputy chief
PTE LLC «C-2»,
Novosibirsk, Russia

抽象。 本文提供了压缩和剪切装置中土壤样品的测试程序。 样品应在两个相互垂直的方向上进行。 基于实验研究的结果，获得各向异性指数，其允许建立土壤的变形各向异性程度和剪切模量。 获得剪切模量对剪切应变的大小和负载大小的依赖性。

关键词：变形各向异性，应力 – 应变状态，土壤基础，实验，压缩条件，各向异性指数，剪切模量。

Abstract. *The article provides a test procedure for soil samples in compression and shear devices. Samples should be taken in two mutually perpendicular directions. Based on the results of experimental studies, an anisotropy index was obtained, which allows one to establish the degree of deformation anisotropy of the soil and the shear modulus. The dependence of the shear modulus on the magnitude of shear strains and on the magnitude of the load is obtained.*

Keywords*: deformation anisotropy, stress-strain state, soil base, experiment, compression conditions, anisotropy index, shear modulus.*

Currently, the problem of forecasting and assessing the stress-strain state (SSS) of base soil massifs is relevant in the design and construction of buildings and structures. Regulatory documents for the calculation of soil bases [1] recommend taking into account the anisotropy of soils, due to the lack of simple and effective methods for accounting for deformation anisotropy. In order to take into ac-

count the deformation anisotropy that all non-rocky soils possess, it is necessary to evaluate the degree of deformation anisotropy of soils and develop an appropriate technique.

Figure 1. *Sample of undisturbed soil with natural moisture*

Figure 2. *Sampling in the vertical and horizontal directions*

For experimental studies, soil samples should be taken at natural humidity and density. (picture 1). Soil samples should be taken with metal rings with a height of 0.025 m and a cross-sectional area of 60×10^{-4} m^2 (for testing in a compression device) or 0.035 m and a cross-sectional area of 40×10^{-4} m^2 (for testing in a seal of the Hydroproject system). To determine the deformability of soils in two mutually perpendicular directions, soil samples were taken with the vertical and lateral position of the rings (six samples in each case) (Figure 2).

Studies of naturally sedimented soils were carried out in compactors and a single-plane cutoff device of the "Hydroproject" system according to the standard method [2] (Figure 3).

Figure 3. *Compression device (odometer) and system seal* "Hydroproject"

The magnitude of the deformations is fixed by indicators of the type ICh-10 with a scale division value of 0.01 mm. The greatest sealing load was created by pressure p = 0.3 MPa. Before testing, the instruments must be calibrated with steel bars. The calibration results are used in the processing of experimental data.

The values of deformations of soil samples obtained in experiments in the vertical and horizontal directions are sufficient to assess the deformation anisotropy of soils.

The degree of deformation anisotropy of soils can be set by the anisotropy index $\alpha = s_X/s_Z = \varepsilon_X/\varepsilon_Z$; where s_Z and s_X, ε_Z and ε_X– are the absolute and relative deformations in the vertical and horizontal directions, respectively, and it can also be estimated not only by the ratio of deformations of soil samples in orthogonal directions, but also by the ratio $\alpha = E_Z/E_X$ taking into account different values of Poisson's ratios (coefficients of lateral expansion of the soil) [3]; E_Z and E_X– deformation modules in vertical and horizontal directions. For example, for the investigated soils (table 1). Tables 2-4 present the results of experimental studies of soil samples under compression conditions. Figures 4 and 5 show a graph of the deformability of soil samples 1 - 3 in mutually perpendicular directions (z, x) and their anisotropy indices α.

Table 1

Characteristics of the investigated soils

№	Name of soil	g, kN/m ^{3}	w, %	I_p	I_l	n, pc	Sampling Site Location
1	Loam solid, subsiding	17,2	18	7,5	<0	10	Novosibirsk region
2	Loam solid, subsiding	17,1	15	13	<0	6	Novosibirsk region
3	Loam solid	17,0	18	11	<0	6	Novosibirsk region

Table 2

The results of the study of soil № 1

σ, MPa	s_x, mm	s_z, mm	E_x, MPa	E_z, MPa	$\alpha = s_X/s_Z$	$\alpha = E_Z/E_X$
Before soaking						
0,05	0,62	0,53	1,78	2,10	1,17	1,17
0,10	1,55	1,20	1,42	1,84	1,3	1,3
0,15	2,23	1,68	1,48	1,97	1,33	1,33
0,20	2,75	1,99	1,60	2,22	1,38	1,38
0,25	3,14	2,21	1,76	2,49	1,42	1,42
0,30	3,50	2,44	1,89	2,71	1,43	1,43
After soaking						
0,30	4,00	2,85	1,65	2,32	1,40	1,40
0,35	4,29	3,08	1,80	2,51	1,39	1,39
0,40	4,50	3,23	1,96	2,73	1,39	1,39

Table 3

The results of the study of soil № 2

σ, MPa	s_x, mm	s_z, mm	E_z, MPa	E_x, MPa	$\alpha = s_X/s_Z$	$\alpha = E_Z/E_X$
Before soaking						
0,05	0,32	0,30	3,74	3,50	1,07	1,07
0,10	0,77	0,47	4,69	2,86	1,64	1,64
0,15	1,02	0,58	5,75	3,24	1,77	1,77
0,20	1,25	0,68	6,53	3,54	1,84	1,84
0,25	1,43	0,76	7,25	3,85	1,88	1,88
0,30	1,65	0,90	7,35	4,02	1,83	1,83
After soaking						
0,30	2,24	2,21	2,99	2,95	1,01	1,01
0,40	2,55	2,66	2,32	3,46	0,96	0,96

Table 4

The results of the study of soil № 3

σ, MPa	s_x, mm	s_z, mm	E_x, MPa	E_z, MPa	$\alpha = s_X/s_Z$	$\alpha = E_Z/E_X$
Before soaking						
0,05	0,58	0,22	1,90	5,01	2,64	2,64
0,10	1,13	0,51	1,95	4,32	2,22	2,22
0,15	1,57	0,86	2,11	3,85	1,83	1,83
0,20	2,00	1,24	2,21	3,56	1,61	1,61
0,25	2,29	1,57	2,41	3,51	1,46	1,46
0,30	2,55	1,91	2,59	3,46	1,34	1,34
After soaking						
0,30	3,08	2,69	2,15	2,46	1,14	1,14
0,40	3,59	3,36	2,46	2,62	1,07	1,07

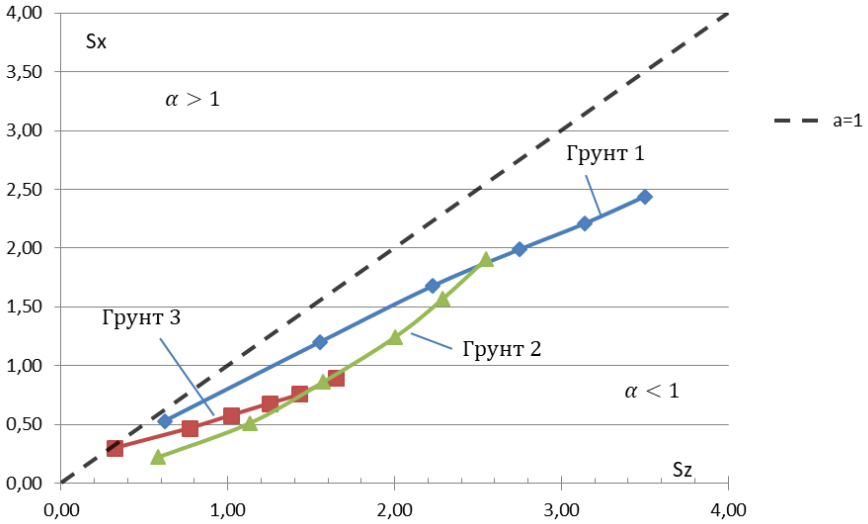


Figure 4 - *Deformability of soils 1 - 3 in mutually perpendicular directions (z, x)*

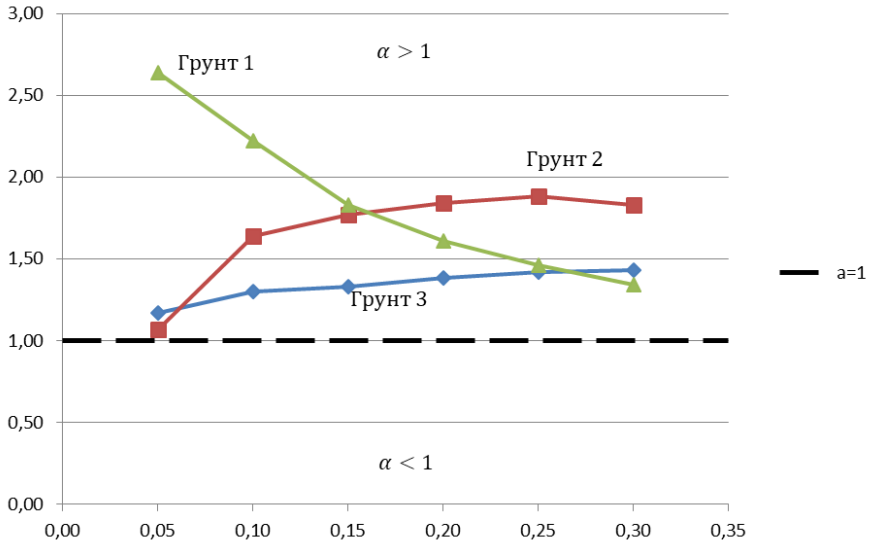


Figure 5 - *Indicators of anisotropy α of soils 1 - 3*

Clay soils of the city of Novosibirsk, previously studied by V.P. Pisanenko [4] was characterized by values of **α** = 1,43 (loams).

The proposed method for experimental determination of the anisotropy index a of soils allows one to take into account the real properties of soils, taking into account their deformation anisotropy, because having a complete picture of the stress-strain state obtained in any of the modern software systems, it is easy to calculate correction factors showing how much of the stress in an isotropic medium is the corresponding stress in the anisotropic medium, which makes it possible to more accurately and reliably calculate the foundation draft [5].

Of great practical importance is the question of taking into account the deformation anisotropy of soils in the calculation of bases, which leads to a change in the size of the shear zones and the value of the calculated soil resistance, which leads to the need to adjust the size of the foundations in comparison with the dimensions established without taking it into account. As the anisotropy index α increases in characteristic zones of soil bases, signs increase corresponding to the appearance of conditions of extreme stress state, which must be taken into account in their calculations of soil bases and thereby increase their reliability and accuracy [6].

To conduct a study of the influence of deformation anisotropy of differently oriented samples on the shear modulus in a shear device, it is necessary to take soil samples with metal rings with a height of 0.035 m and a cross-sectional area of 40×10^{-4} m^2.

The fabricated sample is weighed and proceed to its preliminary compaction.

When pre-compaction in the seal, the working ring with the prepared soil sample should be placed in the seal holder, and then the assembled clip should be installed in the seal bath on the perforated insert (the ends of the sample must first be covered with a damp paper filter).

Next, it is necessary to install a perforated stamp on the sample, adjust the load mechanism, install instruments for measuring vertical soil deformations and record their initial readings.

After sealing in the seal of the "Hydroproject" system, seal up to a load of σ_z = 0,3 MPa (consolidated section) and place it in a single-plane shear device. Next, it is necessary to fix the working ring in the shear box, install a perforated stamp, set the gap between the movable and stationary parts of the shear box equal to 0.5 mm, install measuring equipment for recording vertical deformations of the sample.

The gap was created using a metal plate-template inserted between the upper and lower rings of the device.

Shear strain γ was established by the dependence:

$$\boldsymbol{\gamma = s/\delta} \qquad (1)$$

where $\boldsymbol{\gamma}$ – are shear strains corresponding to increments of the horizontal shear load.

A comparison of the values of the shear deformations of soil samples taken in the vertical and horizontal directions was made for the same experimental conditions (i.e., with a constant gap).

The shear modulus G_{zx} was determined by the known dependence:

$$G_{zx} = \boldsymbol{\tau/\gamma} \qquad (2)$$

Table 5

Averaged values for samples taken horizontally

Time interval	***T*, kg**	$\boldsymbol{\gamma}$	$\boldsymbol{G_{zx}}$
0:15	1,2	0,10	3,80
0:30	2,4	0,65	1,81
0:45	3,6	1,04	1,13
1:00	4,8	1,82	0,80
1:15	6	2,62	0,69
1:30	7,2	4,13	0,52
1:45	8,4	Shear	

Table 6

Averaged values for samples taken vertically

Time interval	*T*, kg	*γ*	G_{zx}
0:30	1,2	0,16	2,1
1:00	2,4	0,50	1,35
1:30	3,6	1,15	0,8
2:00	4,8	1,94	0,63
2:30	6	3,19	0,512
3:00	7,2	7,23	0,278
3:30	8,4	Shear	

The dependence of the average value of the shear modulus on the magnitude of shear deformations is shown in Fig. 6.

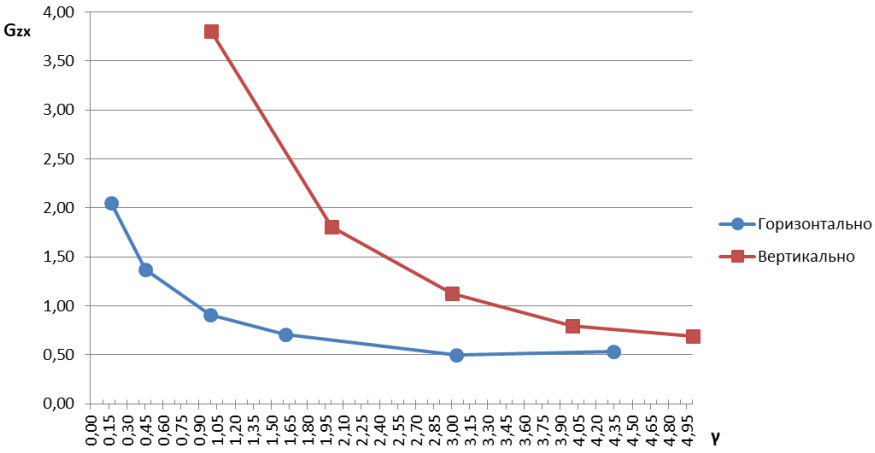


Figure 6 - *Dependence of the average value of the shear modulus on the magnitude of shear deformations*

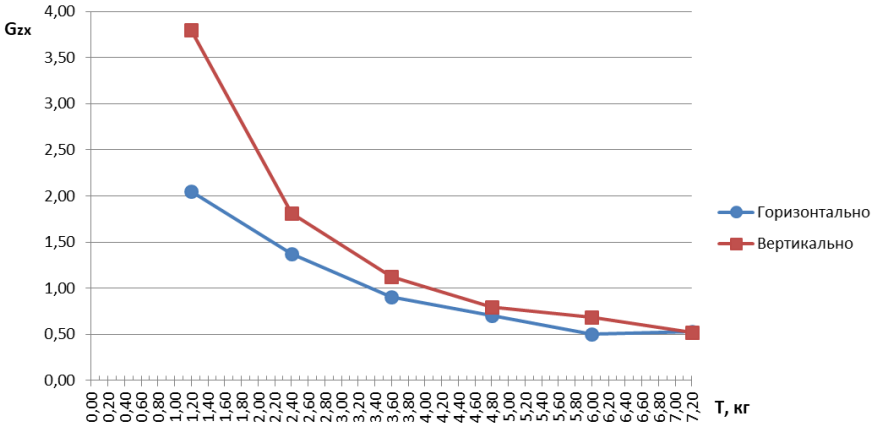


Figure 7 - *The dependence of the average value of the shear modulus on the magnitude of the load*

Conclusions. It was revealed that the indicator Conclusions. It was revealed that the indicator α, which establishes the degree of deformation anisotropy of the studied soils, is different from one, which confirms its presence and the need for further consideration of this factor in the calculation of soil bases. The anisotropy index should be obtained experimentally for each particular investigated soil. The shear modulus G_{zx} of soil samples taken in the vertical direction exceeds the shear modulus of soil samples taken horizontally. Samples must be taken, necessarily, in two mutually perpendicular directions and tested according to standard methods.

References

1. SP 22.13330.2016. Set of rules. Foundations of buildings and structures. Updated version of SNiP 2.02.01-83 (approved by Order of the Ministry of Regional Development of the Russian Federation of December 16, 2016 No. 970, introduced on June 17, 2017) [Electronic resource]. - Access: http://www.consultant.ru.*

2. GOST 12248-2010. Soils. Laboratory methods for determining the characteristics of strength and deformability, the order of the Federal Agency for Technical Regulation and Metrology of 04/19/2011 № 46-st was put into effect on 01.01.2012, [Electronic resource]. - Access: http://docs.cntd.ru/document/gost-12248-2010.

3. Korobova O.A., Maksimenko L.A. Methods for improving the calculation of sediments of soil bases // Interexpo Geo-Siberia. - 2015. -V. 3.- № 4. - P. 198-203.

4. Pisanenko V.P. On the anisotropy of the deformation properties of clay soils of the Novosibirsk Ob region // Works of the Novosibirsk Institute of Railway Engineers (NIIZhT). 1977. Vol. 180. P. 80–83.

5. Korobova O.A., Maksimenko L.A., Glushkova O.I., Kuzmina A.V. Evaluation of the influence of deformation anisotropy of sandy and clay soils on the calculations of the foundations of buildings and structures for deformations // News of universities. Construction. - 2018. -№11. - P. 34 - 49.

6. Korobova O.A., Maksimenko L.A., Shesternova A.A. On the issue of forecasting the ultimate stress state of anisotropic soil bases // News of universities. Construction. - 2017, -№ 7. - P.21 - 28.

一种全面的方法来保护轻型装甲车的航空器从精密武器中脱离出来
A COMPREHENSIVE APPROACH TO PROTECT LIGHTLY ARMORED VEHICLES AIRBORNE TROOPS FROM PRECISION WEAPONS

Zaraysky Denis Aleksandrovich
Adjunct full-time staff guards the course of the Ryazan higher airborne command school named for army General V. F. Margelov
Aleshin Victoria Y.
Teacher of the Department of primary communication networks of the Ryazan guards higher airborne command school named after army General V. F. Margelov
Gordievsky Victor Nikolaevich
Professor of the Department of operation of weapons and military equipment of the Ryazan guards higher airborne command school named after army General V. F. Margelov

抽象。 本文考虑了高精度武器对空降部队轻装甲装备保护复杂增加的问题，对高精度武器，外国武装部队子弹药的分析及其运作原则是 执行。 提出了关于空降部队轻装甲装备复杂保护的建议，以及有前景的武器模型

关键词：空降部队，轻型装甲车，安全，装甲，精确武器，子弹药，失败，增加安全的方法。

Abstract. *in this article the issues of complex increase of protection of lightly armored equipment of airborne troops from high-precision weapons are considered, the analysis of high-precision weapons, submunitions of armed armies of foreign States, as well as the principle of its operation is carried out. recommendations on complex protection of lightly armored equipment of airborne troops, as well as promising models of weapons are given*

Keywords: *airborne troops, lightly armored vehicles, security, armor, precision weapons, submunitions, defeat, method of increasing security.*

Modern military policy of highly developed countries, involves the transition from wars to the destructive nature of the wars of the functional impacts on the entire territory of the opposing side, that is, to the implementation of operational-strategic concept "omnibus rule", one element of which is the "precision impact" is ensured by the use of precision weapons (WTO) in all types of combat in the joint military operations by all branches of the Armed Forces, as well as in various types of military conflicts.

The experience of the past regional conflicts demonstrates that a further increase in efficiency, improvement on the traditional weapons and their integration with the intelligence systems and jamming devices allows simultaneous, massively hit the samples of armored vehicles and other important objectives in the entire depth of the operational formation of troops. By the massive use of the WTO, the enemy is able to inflict losses on a group of troops, in which it can largely lose combat capability even before the troops enter direct fire contact.

Another indication of the growth of the number and types of WTO are the statements of American experts: if in 1991 only 7 % of the weapons can be categorized as high -, but now its share is around 95% precision weapons at up to 150 km and to 8% at a depth of 150 km to 1000 km. of the total number of precision weapons [1]. This type of WTO in the first place, is cluster weapons with infrared, radiometric, radar and combined homing (GOS), combat elements-precise targeting and aiming. In addition, massive and rapid strikes on the divisions equipped with armored vehicles, will be applied also to normal WTO short-range, which includes the helicopter (ground) ATGM command-guided antitank guided missiles with semi-active laser homing head, and aircraft with UR TV, semi-active laser and radar homing.

The armor-piercing capability of these means is up to 300 mm of steel armor for submunitions that hit armored vehicles in the upper hemisphere.

The presence of such an Arsenal of modern weapons makes it easy to predict the nature of the armed confrontation of the future.

What is WTO? The WTO as a weapon, as a rule, driven, able with a given (and relatively high) probability to hit the target shot (trigger) to any range within its reach [2]. The second group of definitions converges to the following: the WTO-a weapon that provides a hit on target with a high probability.

Over the past decade, the WTO has made a qualitative leap in its development, significantly expanding the ability to overcome and fire suppression of air defense systems, hitting objects anywhere in the world, at any time of the day and in any climatic conditions. Moved the borders of the start of the WTO, has decreased its visibility, increased flight speed, use combined guidance system. One of the distinguishing features of modern warfare, we observe from media sources and the experience of warfare in the Syrian Arab Republic on the massive application of the WTO. All this complicates the use of weapons and military equipment on the battlefield, can lead to an increase in losses and puts forward a number of requirements in the development and modernization of combat vehicles (BM) airborne troops (airborne forces). In these conditions, the preferential protection of BM should be the most important trend in the development of BM and airborne as a whole.

The question arises. Is it possible to defend against high-precision weapons? Are there ways to improve BM security?

There are ways to improve security and in fact not all so hopeless.

And the solution is just to reduce the parameter detection.

The probability BM (Porag.BM) some means of destruction can be simplified as the product of the probabilities of the following events:

Coreg.BM= Pobnews. x Popad. x Poreg/get caught.

where Pobnews. - the probability of detection and identification of BM opponent;

Popad. - the probability of hitting the detected BM;

Poreg/get caught. - probability of injury if hit.

Yesterday the probability (Popad.) and defeat when getting (Poraz/get caught.) conventional anti-tank ammunition was only a few per cent. In this case, the probability of detection (Posnaree.) did not greatly affect the final result.

But today the situation has changed radically. Appeared and start to really apply the WTO. Multipliers Popad. Poreg/get caught. immediately became close to 1 and record Pobnews. determining the degree of unmasking characteristics of armored vehicles, began to directly affect the level of their protection.

This is well illustrated by the chart showing trends in the use of conventional and precision weapons in recent local military conflicts.

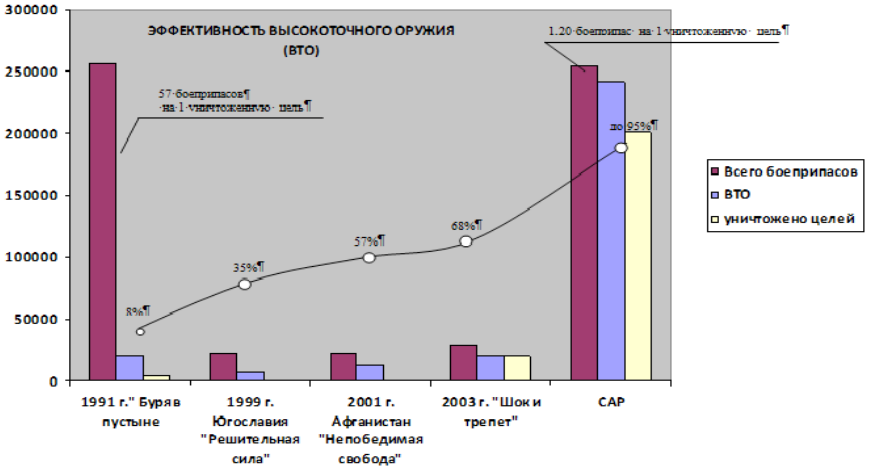


Figure 1. *Diagram of the effectiveness of high-precision weapons*

If in 1991 57 munitions of various types were required to destroy one target, in 2003 only 1.5 [1], and in the SAR operation we see an increase in the use of the WTO.

We will then analyse existing cluster munitions and their characteristics.

Since airborne forces can operate separately, perform combat missions in the rear of the enemy, it is natural that the enemy will affect all available modern means of destruction, which does not exclude the use of the WTO [3]. Therefore, protection must be carried out continuously, throughout the period of the combat mission, in any situation.

The main purpose of booking any combat vehicle is to ensure the protection of the crew in it (combat calculation, landing), units, instrument systems and devices from damage by weapons of various types.

Being in the area of concentration, military formations can be detected by aircraft or unmanned aerial vehicles and other means of intelligence. The enemy can use cluster munitions to defeat group lightly armored targets at a greater range while covering a larger area of destruction.

The following types of ammunition are used in the WTO: guided missiles, mines, artillery shells, aircraft bombs, cluster munitions. Cluster munitions use two types of munitions: self-aiming and homing. In modern conditions of war due to the extension of the range of tasks of anti-tank combat at the WTO lies with the application of the first fire strikes on the distant approaches to directly combat enemy vehicles. The bulk of the submunitions are shown in figure 2.

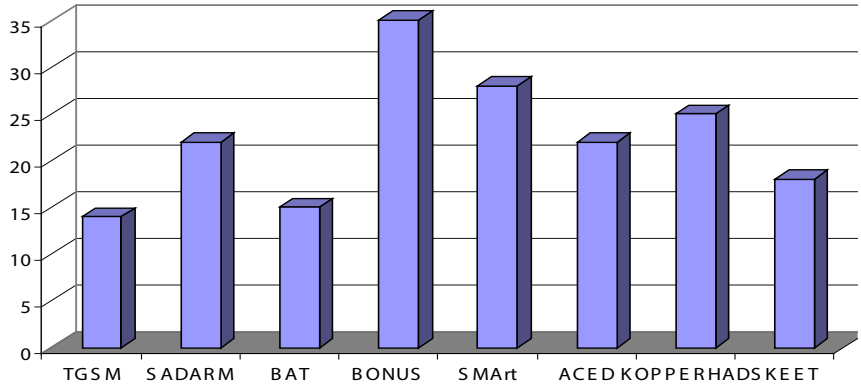


Figure 2. *The range of high-precision sub-munitions*

From figure 2 we see that all of these tools in the complex are able to fight against BM both at distant approaches and in close combat.

The current stage of development of the WTO is characterized by the following main features: appearance ammunition, those in the Autonomous search mode, hover, and defeat BM top TGSM, SADARM (USA), Wat, BONUS (France-Sweden), SMArt (Germany), ACED, COPPERHEAD, as well as improving the efficiency of such type of weapon.

The main directions of development of self-aiming combat elements (SPBE) are to increase the detection ability, selectivity and noise immunity of target coordinators, as well as to increase the armor penetration of the combat unit.

The most significant international projects on creation of high-precision munitions (VTB) cannon artillery should include:

155-mm guided missiles Pelican Pelican LR and VLR with a range of 60-85 km (France);

155 mm Vulcano guided projectile with a range of up to 70 km from Sao PzH2000 (Italy-Spain);

Guided artillery shells (UAS) ImpaQt Mk1 with two SPBE of type Bonus with a maximum range of up to 60 km;

UAS ImpaQt Mk2 with three SPBE type Bonus with a maximum range of up to 100 km;

UAS Excalibur 155-mm projectile with a homing system, uses signals from the global GPS satellite system [4].

The creation of precision-guided munitions, operating on the principle of "shoot-forget", is one of the areas of improvement of the Arsenal of ammunition.

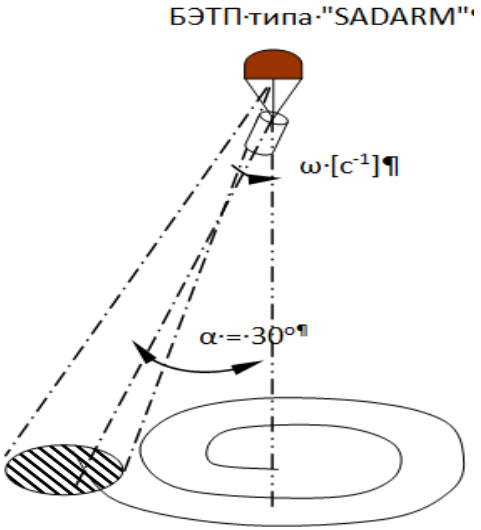


Figure 3. *Principle engage targets with precision munitions*

An important feature of the technical policy in the creation of this weapon was the development of modular unified units of cluster homing and self-aiming combat elements, which are equipped not only with artillery shells, but also the head parts of tactical missiles, multiple launch rocket systems, as well as controlled and unguided aircraft containers.

The principle of operation is as follows. After spreading SPBE over the intended area of concentration armored targets SPBE perform search and detection of the object during the descent with simultaneous rotation, figure 3, after the sighting of the submunition ejection is self-destructive element of the "impact core". Self-aiming ammunition is optimized to hit very specific targets (armored vehicles), and is virtually ineffective for other combat applications.

The most important point in the self-targeting process of an intelligent munition is the operation of its onboard sensors, including accompanying algorithms. The system of onboard sensors must not only detect the camouflaged target in terms of countering enemy on all types of terrain, in different climatic zones, but "to be able" to distinguish be defeat a heavy tank of the similar military facilities (lightly armored machines, decoys). This problem is usually solved by combining sensors, whose operation is based on different physical principles.

Analysis of the existing and future submunitions WTO shows that their penetration is relatively low in relation to the cumulative means of destruction and ranges from 200 to 300 mm. But at the same time, they are capable of effectively striking examples of modern BM, because VTB is exposed in a low-security top projection.

To suppress the guidance system of the WTO can create active interference. Aerosol, smoke, multispectral curtains, organized quickly and in the right direction – it is an effective and reliable way to deal with this formidable weapon.

Thus, the problem of ensuring the protection of the sample from precision weapons is relevant.

Concluding the conversation about modern means of destruction, we can conclude: they are developing rapidly, and hit lightly armored vehicles (LBT) will not be a problem, which can not be said about the sufficient level of protection LBT airborne, which should resist modern means of destruction. Therefore, to increase the security of LBM it is necessary:

- consistent implementation of constructive measures to reduce the signature of the combat vehicle;
- production of the base body of the machine using modular technology and lightweight designs;
- optimization of the external shape of the body with a reduction of protruding parts, working as corner reflectors;
- carrying out measures to reduce the probability of detection of BM, the use of special coatings and capes that reduce radar reflection in a wide range of wavelengths;
- redesign of MTO and exhaust system to reduce thermal visibility;
- the use of an armored capsule to protect the crew;
- equipment BM the complex of active protection from the WTO.

Summarizing the above, we can conclude that it is necessary to increase the protection of LBM with the required level of protection from existing and promising weapons. A promising BM should be prepared for any military scenarios where local military conflicts can escalate into global wars.

References

1. Ardashev, A. Protection of mine ICBM launchers from high-precision weapons / / Equipment and weapons. - №4. - 2004. P. 31-34

2. Wikipedia [Electronic resource] – Access Mode: URL:http://EN.wikipedia.org/wiki/Air-desantnoye (date of treatment:(08.2018)

3. Zaraisky, D. A. Problematic issues of protection of lightly armored equipment of airborne troops / / Zaraisky D. A., Elistratov V. V., Izergin N. D. - Tula: Tulgu. Izvestia. - №6. - 2018. – p. 207-214.

4. Russian weapons and technology. Vol. 7. Ammunition and weapons. Encyclopedia / ed. by N. Spassky. – Moscow, 1998. – 845 p.

用于评估设计对象的显式和隐式专家知识的建模和使用
MODELING AND USING EXPLICIT AND IMPLICIT EXPERT KNOWLEDGE FOR THE ASSESSMENT OF DESIGNED OBJECTS

Gromov Victor Nikiphorovich
Doctor of Technical Sciences, Full Professor
Saint Petersburg State Technical University
Karimova Olga Sergeevna
Senior Lecturer
General of the Army A. V. Khrulev Military Logistics Academy

抽象。使用数学参数来描述一般物体模型的基本元素目前正变得越来越流行。改变几何参数允许以最小的建造成本选择最合理的设计方案。正确决策的标准是衡量所选路径实现目标的有效性。在对设计对象模型进行初步评估的阶段，小组检查适用于专家的参与，以证实最佳解决方案。这项任务主要包括无法明确形式化的定性指标，只能通过吸引专家知识，科学假设和研究人员的直觉来解决。重要的是，专家能够衡量“不可估量”。模型的选择基于专家定性评估的形式化。在这种情况下，该方法的数学基础是模糊数的代数。所提出的方法在添加剂技术在建筑中的应用领域中具有很大的应用问题。

关键词。添加技术，几何参数化，投影对象模型，专家估计，实验规划理论，模糊数代数。

Abstract*. The use of mathematical parameters to describe the basic elements of the general model of objects is becoming more and more popular at present. Varying the geometric parameters allows to choose the most rational design scheme with minimal construction costs. The criterion for the correct decision-making is a measure of the effectiveness of the chosen path to achieving the goal. At the stage of preliminary assessment of models of designed objects, a group examination is applicable with the involvement of experts to substantiate the best solution. This task includes, mainly, qualitative indicators that cannot be clearly formalized and can only be taken into account approximately and are solved by attracting expert knowledge, scientific hypotheses, and intuition of researchers. The important thing is that an expert is able to measure "immeasurable". The choice of model is based on the formalization of expert qualitative assessments. The mathematical basis of the approach in such cases is the algebra of fuzzy numbers. The presented approach has great potential for implementing a new class of applied problems in the field of application of additive technologies in construction.*

Keywords. *Additive technologies, geometric parameterization, model of the projected object, expert estimates, experiment planning theory, fuzzy number algebra.*

Developing additive technologies can change the existing technological chain in the development of construction projects and not only of simple forms.

Additive 3D technologies allow to create full-sized forms of small architectural structures using 3D building printers [1].

The process of creating an object is as follows: special software generates a virtual solid-state 3D model of the structures being designed, then the information is translated into a code understandable for a 3D building printer, which forms building elements layer-by-layer in an on-line mode using extrusive printing with semi-liquid material.

Parametric models of various designs are becoming more and more popular. Parametric geometric modeling is a design based on the use of the parameters of elements that are an integral part of the overall model, as well as the relationship between these parameters, which determine the geometric shape of the model.

The main advantage of geometric parameterization is that in a short time, changing any parameter, you can significantly change the geometry of the model.

When designing buildings and structures, varying geometric parameters allows you to accept the most rational constructive design of the building with minimal construction costs.

Before the decision maker (DM) on the construction of the object, questions arise about the time, cost of designing and choosing the most appropriate model. The choice of the type of construction object is carried out on the basis of a feasibility study, taking into account the functional purpose of the object and architectural requirements, as well as design stages, manufacturing conditions and construction.

First of all, DM is interested in indicators that should answer the question: "To what extent will the projected (virtual) object under consideration have the properties (ability) to satisfy consumer needs?"

The criterion for the correct decision-making in the design is a measure of the effectiveness of the chosen path to achieving the goal.

Such criteria can be simple or complex, including several indicators.

The choice of criteria is determined by specific goals at different stages of the creation of the object. Criteria should most fully take into account the relationship between individual tasks and their impact on the achievement of the ultimate goal.

The design phase is represented by two stages: development and modification of the model. The application phase is represented by three stages: setting up the model for the task, solving the problem and analyzing the results.

Temporary assessments of the stages of the life cycle of a projected object when considering, for example, two options (models) can be represented by the following steps: 1) development (months); 2) modification (weeks); 3) setting (hours); 4) decision (min.); 5) analysis (days).

We take the execution time of each stage as an indicator of the assessment of the proposed options for the designed object. In order to reduce design time, each indicator should be minimized.

To achieve the ideal goal, we choose a method with a weighted average additive generalizing function:

$$v_i^a = \varphi_a(v_i) = \sum_{j=1}^{n} w_j v_{ij} \quad (1)$$

In formula (1), the variable v_{ij} means the normalized estimate of the value of the -th indicator of the i-th object, and i-ht object, and w_j characterizes the importance (weight) of the j-th ndicator, moreover:

$$\sum_{j=1}^{n} w_j = 1$$

This approach allows the decision maker to use the obtained indicators to select the best options for the object and apply optimization methods accordingly to achieve the real goal of reducing design time [3].

At the stage of preliminary evaluation of models of designed construction projects, in the absence of measured or calculated indicators of their adequacy, complexity and development, a group examination is applicable with the involvement of experts to substantiate the choice of the best model.

These tasks do not include quantitative assessments (parameters), but qualitative indicators that cannot be clearly formalized can be taken into account only approximately and are solved by involving expert assessments, scientific hypotheses, and intuition of researchers.

To evaluate each property of the model, experts use the same qualitative estimates: very high (VH), high (H), medium (M), low (L) marks.

Models are ordered according to the specified four ratings and consistency of estimates.

The solution to such problems is based on the application of methods widely used in technical applications to the analysis of fuzzy weakly structured complex systems.

The mathematical basis of this approach is the algebra of fuzzy numbers.

In the proposed approach, it is important that the expert is able to measure “immeasurable”, i.e. work in a "virtual space" and build models for predicting the performance of an object at the pre-design stage, when the object itself does not yet exist.

To solve the problem of minimizing expertise and ensuring the consistency of expert estimates, it is advisable to use the ideas of the theory of experimental design and the methodology described in [4].

In mathematical form, the solution of the problem is performed in a certain order.

Initially, a survey is conducted, and data is collected with a lot of statements by an expert (experts) about individual indicators of the projected object in the form of production rules with fuzzy linguistic variables:

$$A_{ji} = \langle \text{if } X_1 = \tilde{U}_{j1} \wedge X_2 = \tilde{U}_{j2} \wedge \ldots \wedge X_n = \tilde{U}_{jn}, \text{then } Y = \tilde{V}_j \rangle, j = 1, \ldots, 2^n \quad (3)$$

in *n*-dimensional fuzzy space. Moreover, the values of the factors belong to the term-sets defined in fuzzy linguistic scales

$$\tilde{U}_{j1} \in T(X_1), M_1 : T(X_1) \to F(R^1), 1 = 1, \ldots, n$$
$$\tilde{V}_j \in T(Y), M_Y : T(Y) \to F(R^1) \quad (4)$$

in the form of fuzzy numbers of (LR) -type

$$M_1(\tilde{U}_{j1}) = \hat{U}_{j1} = (\underline{U}_{j1}, \overline{U}_{j1}, \alpha_{j1}, \beta_{j1}, h_{j1})_{LR},$$
$$M_Y(\tilde{V}_{j1}) = \hat{V}_{j1} = (\underline{V}_{j1}, \overline{V}_{j1}, \alpha_{j1}, \beta_{j1}, h_{j1})_{LR}. \quad (5)$$

Requirement: find and construct an approximating function

$$V = f(\vec{U}, \vec{B}), \quad (6)$$

with the help of which, the indicators of the designed object will be evaluated.

Moreover, this function must satisfy the following condition in the *n*-dimensional space of linguistic variables:

$$\sum_{j=1}^{2^n} \left(V_j - f(U_{j1}, \ldots, U_{jn}, \vec{B}) \right)^2 \to \min_{\vec{B} \in F(R^k)} \quad (7)$$

where U_{j1} – fuzzy number; $\tilde{U}_{j1}$ – fuzzy number value; $\tilde{U}_{j1} \in T(X_1)$ – term set of a linguistic variable X_1, characterizing the corresponding component of the factor space in the problem of evaluating the generalized parameters of the designed object; $\tilde{V}_j \in T(Y)$ – term set of the dependent linguistic variable Y, $\vec{B}$ – polynomial coefficient vector; $F(R^k)$ – fuzzy *k*-dimensional space.

An analysis of expressions (3) - (7) indicates that the problem of quantifying the state of a complex building project being designed in an n-dimensional space of fuzzy variables by formalizing expert information (3) can be solved on the basis of the proposed concept of constructing a generalized state indicator represented by function (6) in a fuzzy factorial space (4) and (5) under condition (7).

The fundamental feature of the process of extracting and generating new knowledge about the projected object is it's replacement with an appropriate model by formalizing expert information and then researching it to justify the adoption of the right decisions.

This allows us to reduce the decision-making process to formal procedures, leaving the decision maker to conduct a professional interpretation of the results of mathematical research.

The presented approach of modeling the projected (virtual) object and the use of explicit and implicit expert knowledge provides great opportunities for implementing a new class of applied problems in the field of application of additive technologies in construction.

References

1. Karimova O.S. Overview of additive technologies in online construction production // Actual problems of military research. ISSN: 2658-7009. Special issue. Collection of articles of the inter-university scientific and practical conference "Development of life support systems, energy conservation and environmental protection" / SPb: Publishing house of the Polytechnic University, 2019, P. 161-166.

2. SNiP 52-01-2003. Concrete and reinforced concrete structures. - Moscow: Gosstroy, 2003, 24 P.

3. Mikoni S.V. Theory of managerial decision making: textbook - St. Petersburg: Doe, 2015, 448 P.

4. Ignatiev M.B., Marley V.E., Mikhailov V.V., Spesivtsev A.V. Modeling of weakly formalized systems based on explicit and implicit expert knowledge // St. Petersburg: POLITEH-PRESS, 2018, 430 P.

使用不同编码方法对SAW设备的元素进行建模的主要方法

THE MAIN APPROACHES TO MODELING ELEMENTS OF SAW DEVICES WITH DIFFERENT CODING METHODS

Sorokin Aleksandr Vasilevich
Department assistant, orcid.org/0000-0002-5450-244X,
Saint-Petersburg State University of Aerospace Instrumentation,
Saint-Petersburg, Russia

抽象。 该文章描述了编码无源编码的现代方法和方法，即没有声电识别标签和传感器的外部电源。 为了从每个标签或传感器接收响应信号，询问信号的能量就足够了。 为了分析编码方法，有必要考虑建模声电子设备的各种方法。 考虑了用于构造无源声电子标签和传感器的典型设计。

结果表明，射频数据识别系统运行中的主要问题是轮询时响应信号的冲突问题。

用于分析和优化设计的现代模型的分析使得可以制定解决碰撞问题的要求。

关键词：RFID，SAW，防撞，声电，控制，自动化

Abstract. *The article describes modern methods and approaches to coding passive, that is, without external power supplies of acoustoelectronic identification tags and sensors. To receive a response signal from each tag or sensor, the energy of the interrogation signal is sufficient. To analyze encoding methods, it is necessary to consider various approaches to modeling acoustoelectronic devices. The typical designs used in the construction of passive acoustoelectronic tags and sensors are considered.*

It is shown that the main problem in the operation of radio-frequency data identification systems is the problem of collision of response signals, while polling.

The analysis of modern models used to analyze and optimize the design made it possible to formulate requirements for solving the collision problem.

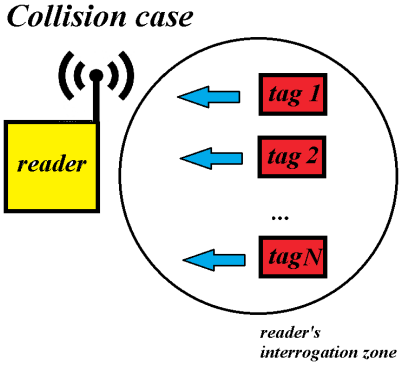
Keywords: *RFID, SAW, anticollision, acoustoelectronics, control, automation*

Introduction

The main advantages of devices on SAW are high performance, resistance to external climatic influences, high reliability and durability during operation [1-5].

Modern RFID systems can use sensors and ID tags on the SAW. Radio frequency systems on SAW find their application in solving such problems as wireless temperature control of electric power facilities, identification of automobile and railway vehicles, measurement of mechanical stresses in systems for monitoring the stress-strain state of objects, etc.

When conducting simultaneous polling of several passive tags or sensors on the SAW, a conflict problem arises, consisting in the superposition of response signals from sensors or tags in the time domain. When several sensors hit the reader's antenna field of action, their response signals overlap each other in time, making it impossible to reliably read the code of each device and obtain information about the measured value.



Picture. 1. *Schematic representation of the problem of signal collision of passive SAW tags*

If several identifiers hit the reader's antenna field simultaneously, their response signals can overlap each other in the time domain, making it impossible to read the code of each acoustoelectronic device and identify it [2-4].

The main approaches used for modeling of acoustoelectronic devices.

To simulate acoustoelectronic devices, it is necessary to consider the typical structural elements used to build acoustoelectronic devices [1-6].

Interdigital transducers (IDTs) are used to excite and detect SAW in various technical applications. IDT is shown in the figure. 2.

Picture. 2. *IDT symbol*

They are metal pins-electrodes deposited on a piezoelectric substrate, like brushes inserted into each other. IDT is shown without proportions. The actual length of the electrodes is 100 or more times their width.

As a rule, separate reflector electrodes are placed along the length of the mark on the SAW. They are positioned on the surface in such a way as to encode data using a time delay, amplitude and phase.

Reflectors are implemented using a system of metallized strips on a piezoelectric substrate, as shown in Fig. 15a), or a system of grooves (Figure 15b)) formed by etching.

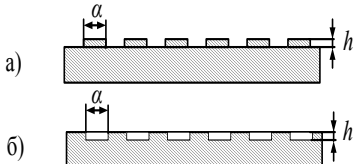
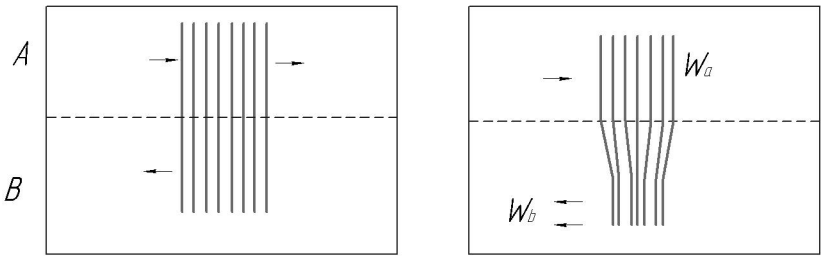


Figure 3. *Reflectors in the form of metallized strips on a piezoelectric substrate (a) and in the form of grooves formed by etching (b)*

The paper [?] provides an overview of the types of IDT and reflectors, on the basis of which various designs of passive acoustoelectronic devices can be implemented.

Figure 4 shows the possible options for multi-strip couplers used in tag designs when implementing anti-collision algorithms developed in the dissertation.



Picture. 4 - *Quadrature and asymmetric multi-strip couplers*

The following approaches can be used to build models of passive acoustoelectronic devices:

1. The technique of modeling the basic structural elements of sensors, such as: IDT, orthogonally frequency coded reflective structures using the P-matrix method based on the theory of coupled modes and the application of the methods of equivalent Mason schemes.

2. The methodology and algorithm for constructing the time-frequency matrix to obtain the identification code of the temperature sensor.

3. The mathematical method of processing the phase characteristics of the response of the label

4. The method of coupled modes

The design of an acoustoelectronic device can be mathematically described as a matrix called the "**P** matrix":

$$\begin{bmatrix} b_1 \\ b_2 \\ i_3 \end{bmatrix} = \begin{bmatrix} P_{11} & P_{12} & P_{13} \\ P_{21} & P_{22} & P_{23} \\ P_{31} & P_{32} & P_{33} \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \\ u_3 \end{bmatrix}, \quad (1)$$

where P_{11}, P_{12}, P_{22}, P_{21} – are S parameters of the acoustic port, i.e. elements of the multipath scattering matrix, which describe the scattering of waves entering the structure, while P_{11}, P_{22} – reflection coefficients, and $P_{12} = P_{21}$ – transmission coefficients; coefficients P_{13}, P_{23} describe the excitation efficiency of IDT, P_{31}, P_{32} – coefficients show what current is generated in the IDT from incoming surface acoustic waves; a_n, b_n – waves arriving at IDT and reflected from it, respectively, i_3 and u_3 - electric port parameters (current and voltage, respectively), P_{33} – admittance or full complex conductivity.

In the absence of losses, the equality:

$$\text{[illegible]} \quad (2)$$

If the IDT is a weighted bidirectional transducer, the elements of the matrix **P** can be represented as: $P_{12} = P_{21}$, $2P_{23} = -P_{32}$, $2P_{23} = -P_{32}$.

Based on the formula (2), taking into account the above relations, replacing, respectively, the matrix elements, the cascading of the elements of the acoustoelectronic device can be written through the following expressions (6-8). For the case under consideration, the IDT **P**-matrix can be defined as:

$$\mathbf{P}_{\text{ВШП}} = \begin{bmatrix} S_{11} & S_{12} & P_{13} \\ S_{21} & S_{22} & P_{23} \\ -2P_{13} & -2P_{23} & Y \end{bmatrix}, \quad (3);$$

where Y- is the total complex conductivity, and S_{11}, S_{22}– are the reflection coefficients, $S_{12} = S_{21}$ – transmission coefficients.

Since the reflector does not have an electric port, the matrix elements expressing the parameters of the electric port are filled with zeros, and the **P**-matrix for the reflector is defined as:

$$\mathbf{P}_{\text{рефлектора}} = \begin{bmatrix} S_{11} & S_{12} & 0 \\ S_{21} & S_{11} & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad (4);$$

For an acoustic transmission line (ALP), in the matrix all elements are filled with zeros, except for S_{21} and S_{11}. Then the **P**-matrix for the acoustic transmission line takes the form:

$$\mathbf{P}_{\text{АЛП}} = \begin{bmatrix} 0 & e^{-jk_0L} & 0 \\ e^{-jk_0L} & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}, \quad (5)$$

where the *S*-parameters correspond to the parameters of the transducer with a closed electric port, k_0 – the wave number associated with the parameter *L*– the length of the acoustic line..

To simulate a bipolar surface wave device in which the acoustic ports are connected in series and the electrical ports are isolated from each other, creating a two-port system.

Using the previously obtained expressions for the P matrix, in the case of cascading of two elements, we obtain:

$$\begin{bmatrix} \frac{i_3^A}{u_3^A} & \frac{i_3^A}{u_3^B} \\ \frac{i_3^B}{u_3^A} & \frac{i_3^B}{u_3^B} \end{bmatrix} = \begin{bmatrix} P_{33}^A + \frac{P_{23}^A P_{32}^A P_{11}^B e^{-j2KL}}{1 - P_{22}^A P_{11}^B e^{-j2KL}} & \frac{P_{13}^B P_{32}^A P_{11}^B e^{-jKL}}{1 - P_{22}^A P_{11}^B e^{-j2KL}} \\ \frac{P_{23}^A P_{31}^B e^{-jKL}}{1 - P_{22}^A P_{11}^B e^{-j2KL}} & P_{33}^B + \frac{P_{13}^B P_{31}^B P_{22}^A e^{-j2KL}}{1 - P_{22}^A P_{11}^B e^{-j2KL}} \end{bmatrix} \quad (6)$$

This approach is simple for determining the matrix when cascading structural elements of SAW devices.

To simulate SAW devices and their elements, equivalent circuits are used, which are obtained on the basis of the analysis of Mason's electrical equivalent circuits [2-9].

Each elementary section of the transducer, based on its geometric dimensions and physical characteristics of the materials of the electrodes and sound duct, can be displayed with an equivalent circuit. The equivalent section circuit is an electro-acoustic six-terminal, and the transfer function of such a circuit is essentially the transfer function of the section. By combining such electro-acoustic six-terminal, it is possible to obtain an equivalent circuit monopolar bi-directional transducer.

The above designs differ in location and type of IDT. In the figure, IDT allows reflecting SAW waves both to the right side of the substrate and to the left, which complicates the design, but allows one to reduce the attenuation of a signal that carries temperature information [2-5].

The main approaches used in resolving a collision

A typical conditional design of an acoustoelectronic device on SAW, defining its individual identification code and the physical principles of constructing the structure are given in [1-2]. Based on the above design

Currently, two approaches to the separation of tag signals are most widely used - time and frequency division [2-4], the time-frequency method is described in [2]. In practice, only time division is actually used [5-6].

Frequency and time-frequency separation can be implemented for passive tags. It should be noted that the time-frequency separation has better characteristics when identifying individual tag codes in comparison with the frequency, but requires a more complex interrogation-reading device. In addition, when interrogating tags in conditions where metal structures can fall into the interrogation zone, the time-frequency method is more resistant to interference caused by re-reflection of the interrogation signal from these structures. However, a detailed discussion of this issue is beyond the scope of this article. Therefore, in this paper, due to the limited volume, we consider the characteristics of only the time-frequency method for separating the response signals of tags [2-4].

Conclusion

The set of conducted studies allowed us to develop a method for code separation of passive sensor signals into SAW, using the new, proposed tag topology, a polling signal corresponding to this topology, and a time-frequency code that allows the response signals of the SAW sensor to be identified and, accordingly, to obtain reliable information, which made it possible to prevent collisions of response signals of sensors during simultaneous interrogation arising as a result of increasing the information content of the monitoring system due to increasing the number of sensors at the monitored object [6-10].

Existing anti-collision algorithms used in RFID systems with a semiconductor chip are not applicable for RFID on SAW. [2,3]. Readers using anti-collision algorithms for active tags can write and read data from specific tags. Thus, the use of such algorithms is advisable only for active RFID SAW tags, that is, tags using a power source. For RFIDs on SAW using passive tags, difficulties arise due to signal energy loss, the topology and design of SAW radio markers. Existing approaches for identification in a collision environment, such as dividing a signal by level, time, spatial separation, are largely dependent on the distance between the reader antenna and the tag, the presence of interference, the delay between the time of polling and the moment the response is determined by the tag topology. The number of tags shared by the methods used does not meet modern requirements.

Since the SAW device has a unique code that is embedded inside the topology during its manufacture, the time separation method, which uses a different initial signal delay and which can be used for a particular case, will provide a solution to the problem only with a total number of labels of several tens. This limitation is associated with an increase in the dimensions of the substrate, which causes technological difficulties in the manufacture and leads to an increase in the cost of tags. The use of frequency separation will require highly stable generators and selective band-pass filters or other technical solutions that allow designing label structures whose slots are notch filters with a fairly narrow notch band [11].

References

1. Koigerov A. S., Dmitriev V. F. Radiomarker on surface acoustic waves with noise-resistant frequency-manipulated code // Information-control systems. 2010. №4. P. 22-28.

2. A. V. Sorokin, A. P. Shepeta. Anti-collision radio-frequency identification system using passive SAW tags // Proc. SPIE, Smart Sensors, Actuators, and MEMS VIII, Barcelona, Spain. 2017. Vol. 10246, PP. 1024613; doi: 10.1117/12.2263223

3. Sorokin A., Shepeta A., Wattimena M. Encoding of Passive Anticollision Radio Frequency Identification Surface Acoustic Waves Tags //Proceeding of the Electrical Engineering Computer Science and Informatics. – 2017. – Vol. 4. – P. 605-609.

4. C. S. Hartmann. Design of global SAW RFID tag devices //Second International Symposium on Acoustic Wave Devices for Future Mobile Communication Systems, Chiba University, Japan, 2004.

5. Plessky V. P., Reindl L. M. Review on SAW RFID tags //Proc. IEEE Trans Ultrason Ferroelectr Freq Control. Vol.57(3), 654-68 (2010).

6. Harma S., Arthur W. G., Hartmann C.S., Maev R.G., Plessky V. P. Inline SAW RFID Tag Using Time Position and Phase Encoding //Proceeding IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control. –Vol. 55(8), P.145-158.

7. David P. Morgan. Surface Acoustic Wave Filters. 2nd Edition. With Applications to Electronic Communications and Signal Processing, 2007. – 448 P – ISBN: 9780080550138.

8. Malocha D.C., M. Gallagher, B. Fisher, J. Humphries, D. Gallagher, N. Kozlovski. Passive Wireless Multi-Sensor SAW Technology Device and System Perspective// Sensors. – 2013. –Vol. 13. – P. 1-27; doi: 10.3390/s130505897

9. H. Kogelnik and C. V. Shank, "Coupled-wave theory of distributed feedback lasers,"Journal of Applied Physics, vol. 43, № 5, P. 2327-2335, 1972.

10.D. P. Chen and H. A. Haus, "Analysis of metal-strip SAW gratings and transducers,"IEEE Transactions on Sonics and Ultrasonics, vol. Su-32, № 3, P. 395-408, 1985

11. Sorokin A. V., Shepeta A. P., Nenashev V. A., Wattimena G. M. Comparative characteristics of anti-collision processing of radio signal from identification tags on surface acoustic waves// Information management systems,2019, №1, P. 48–56. doi:10.31799/1684-8853-2019-1-48-56

功能性饮料中适应原作用的植物提取物的用途
THE USEGE OF PLANT EXTRACTS OF ADAPTOGENIC ACTION IN FUNCTIONAL BEVERAGES

Khasanov Arthur Railevich
postgraduate
Matveeva Natalya Alekseevna
Candidate of Technical Sciences, Associate Professor
Saint Petersburg National Research University of Information Technologies, Mechanics and Optics
Saint-Petersburg, Russia

抽象。他在功能性饮料消费量方面的年均增长率超过8%，而且该指标继续增长。由于消费者对健康和健康食品的需求增加，食品工业的代表倾向于制造功能性食品，特别是饮料，作为最快的可消化形式。制造商越来越多地利用创新来获得市场地位和新的目标受众。由于技术进步和影响身体的因素的增加，与神经系统和大脑相关的疾病的风险增加。世界卫生组织（WHO）预测，到2020年，脑疾病和精神障碍将成为导致残疾的五大疾病之一。在这方面，当务之急是创造一种基于植物材料的功能性饮料，使用具有适应性效应的天然干燥提取物来改善身体对有害环境因素的抵抗力，同时降低神经系统和大脑疾病的风险。作为刺激认知功能。我们使用无感官描记法模拟了基于直接挤压果汁，茶叶输注和积雪草提取物的功能性饮料。

关键词：健康生活方式，神经系统和大脑疾病，功能饮料，适应原作用，积雪草干燥植物提取物，功能饮料建模。

Abstract. *he average annual growth in functional beverage consumption is more than eight percent, and this indicator continues to grow. Representatives of the food industry have a tendency to create functional foods, in particular drinks, as the fastest digestible form, due to increased consumer demand for healthy and wholesome foods. Manufacturers are increasingly using innovation to gain market position and a new target audience. Due to technological progress and an increase in factors affecting the body, the risks of diseases associated with the nervous system and the brain have increased. The World Health Organization (WHO) has predicted that in 2020, brain diseases and mental disorders will be among the top five diseases leading to disability. In this regard, the urgent task is to create a functional drink based on plant materials, using natural dry extracts that have adaptogenic effects to improve the body's resistance to harmful environmental factors, reducing the risks of diseases of the nervous system and brain, as well as stimulating cognitive functions. We have modeled, using the sensory free profiling method, a functional drink based on direct-squeezed juices, tea infusions and Centella asiatica extract.*

Keywords*: healthy lifestyle, diseases of the nervous system and brain, functional drinks, adaptogenic effect, Centella asiatica dry plant extract, modeling of functional drink.*

In recent years, there has been an increase in interest in healthy nutrition (HN) and a healthy lifestyle (HLS). New approaches to choosing a daily diet and food are being formed. Targeting consumers, especially millennials, is aimed at increasing body tone, reducing fatigue, stimulating intellectual activity, increasing the body's resistance to colds, reducing the risks of cardiovascular diseases and diseases associated with the nervous system and brain. This trend stimulates food manufacturers to set themselves the task of creating functional products enriched exclusively with natural, biologically active substances and micro-ingredients, vitamins, macro-, microelements, which have a multidirectional effect. Manufacturers began to use innovation to gain ground and a new target audience in the market. By "functional product" is meant a product with useful nutritional characteristics that meets the requirements of specific populations and is intended for systematic use in food diets. Such a product has scientifically based and confirmed properties, reduces the risks of developing diseases, regulates certain processes in the body due to the presence of functional, biologically active food micro-ingredients. The functional drinks market is one of the fastest growing. Mordor Intelligence is forecasting that by 2024 the functional beverage market will reach 208.13 billion US dollars. In the forecast period (2019-2024), the CAGR (Compound Annnual Growth Rate) is expected to be 8.66% [1]. Such demand is also caused by a change in consumer preferences. They began to prefer functional drinks, rather than fruit juices and carbonated drinks. Also, increase in awareness of the proper nutrition and composition of food products contributes to an increase in the consumption of functional foods. The liquid form of transport of nutrients and biologically active substances into the body is the most practical and is quickly absorbed in the gastrointestinal tract (within 15-20 minutes), which gives a clear advantage.

To give the products functional properties, manufacturers are increasingly resorting to the use of plant extracts of fruits, berries, herbs.

One of the promising areas in the field of functional drinks is adaptogenic drinks based on plant materials. Adaptogenic effect – is the increase of the overall resistance of the body to the action of extreme factors.

The relevance of such drinks is due to the fact that the level of diseases associated with disorders of the nervous system and brain activity is growing. Negative environmental factors affecting the human body, as well as a large amount of information processed by the brain, cause increased fatigue, decreased concentration, nervous disorders, stress, lethargy, fatigue and much more. The World Health Organization has predicted that in 2020, brain diseases and mental disorders will be among the five diseases leading to disability. In Russia, more than 20% of people suffer from neurotic disorders. 75-89% of all neurological diseases are disorders of memory, personality, melancholy, anxiety, psychosis, and depression.

Neurometabolic stimulants (nootropics) have adaptogenic effect, along with mnemotropic (stimulation of learning and memory) anti-asthenic (decrease in severity of weakness and lethargy), psychostimulating (inhibition of mental inertness and apathy), anxiolytic (anti-anxiety, sedative) . The mechanism is based on the influence of nootropics on metabolic and bioenergetic processes in nerve cells, as well as on interaction with the neurotransmitter systems of the brain [2].

Along with all known substances: glycine, caffeine, taurine, L-thianine, dry plant extracts have an adaptogenic effect. It is worth noting that the former have a predominantly tonic and energetic effect, which gives manufacturers the right to use energy and invigorating drinks in the production. The range of dry extracts for the food industry is great.

The most common plant extracts with adaptogenic properties are:

- Centella asiatica extract. It stimulates the release of acetylcholine, which regulates the speed of signal transmission in synaptic nodes, has a sedative effect, improves cognitive functions of the brain due to saponins (complex nitrogen-free organic compounds, glycosidic nature). Biologically active substances of centella are asiatic and madecassonic acids. It has been studied that a dose of 500 mg of Centella Asiatic twice a day reduces anxiety in humans [4].

- Radiola rosea extract. It increases the body's resistance to negative psychological environmental factors, stimulates the production of serotonin, inhibits the asthenic state, improves energy metabolism in the muscles and brain due to the earlier use of not only carbohydrates, but also fats as substrates. Also, Rhodiola rosea has an anxiolytic (anti-anxiety) effect.

- Ginkgo biloba extract. It affects concentration and long-term memory, has a pronounced nootropic effect. It is worth noting that some researchers believe that Ginkgo does not have a tangible effect on memory, despite the fact that it enhances blood microcirculation. Also, long-term use of the drug with Ginkgo biloba extract increases the risk of stroke, therefore, despite its adaptogenic properties, it is not advisable to use it without doctors' recommendations [3].

From the above, it is recommended to use extracts of Centella asiatica and Radiola rosea, in connection with the lack of detected negative side effects and their multidirectional actions.

Dry plant extracts of these plants are easily soluble in water, and all functional compounds (saponins, glycosides, flavonoids, etc.) that provide nootropic, adaptogenic and other effects are hydrophilic, which makes their use in the production of functional drinks, from a technological point of view, relevant and convenient, and also makes them easily digestible for the body.

All extracts used in production must be certified and meet the requirements of the technical regulation of the customs union: TR TS 029/2012 "Safety requirements for food additives, flavorings and processing aids".

In further work, it was decided to use Centella asiatica extract due to its studied properties.

Modeling a functional drink of an adaptogenic properties:

We have modeled a functional drink based on fruit juices and adaptogenic tea properties. The following ingredients were used:

- direct-pressed juices from the fruits of red grapes (Red Globe), apples (Granny Smith), blueberries (Ordinary), carrots (Queen of the autumn), kiwi (Abbot);
- tea: black post-fermented puer, green Chinese non-fermented;
- dry extract of Centella asiatica

All herbal ingredients for a functional drink were selected taking into account the chemical composition, biological activity, organoleptic compatibility, and the recommendations of nutritionists. Most of the ingredients contain flavonoids, tannins and anthocyanins, organic compounds of a glycosidic nature that positively affect the limbic system of the brain, nervous system, cognitive properties and have a vasoprotective effect. This allows to achieve complex effects on the brain and nervous system.

To compose the beverage, the sensory free profiling method was used. Based on the profilograms, the ratios of the ingredients among themselves are selected one by one. Assessment is made according to 6 criteria: sweet taste; sour taste; aroma; color; aftertaste; bitterness. We used a 3-point scale (1 - bad, 2 - good, 3 - excellent). Thus, the optimal ratio of ingredients is selected.

After, the drink was pasteurized at a temperature of 80-82 degrees Celsius for 2 minutes, followed by cooling. In order to avoid the destruction of the biologically active compounds of Centella asiatica, it is advisable to add the extracts to the already pasteurized, chilled functional drink of adaptogenic action, considering that the extracts are sterile and not seeded with pathogenic microflora.

Conclusion

Creating a functional drink based on plant materials using dry extracts with adaptogenic effects is an urgent and rational solution in the fight against a decrease in the human body's resistance to negative environmental factors that cause problems of the nervous system and brain. As a natural adaptogen, the use of Centella asiatica plant extract can be recommended.

References

1. https://www.mordorintelligence.com/industry-reports/functional-beverage-market

2. http://zodorov.ru/1-mehanizm-dejstviya-nootropov-naturalenie-nootropi.html

3. https://ru.wikipedia.org/wiki/Гинкго

4. Müller V, et al. Centelloside accumulation in leaves of Centella asiatica is determined by resource partitioning between primary and secondary metabolism while influenced by supply levels of either nitrogen, phosphorus or potassium. J Plant Physiol. (2013)

螺栓连接单元由薄壁冷成型型材和凹面平壁的一部分组成
BOLT CONNECTION UNIT FROM THIN-WALLED COLD-FORMED PROFILES WITH A PART OF A CONCAVE FLAT WALL

Gainetdinov Rishat Gabdulhaevich
master
Kazan State University of Architecture and Engineering
Kuznetsov Ivan Leonidovich
Doctor of Technical Sciences, Full Professor
Kazan State University of Architecture and Engineering
Salakhutdinov Marat Aidarovich
Candidate of Technical Sciences, Associate Professor
Kazan State University of Architecture and Engineering

抽象。具有凹形平壁的一部分的薄壁冷成型型材用于制造桁架框架。在这些框架中，元件使用片材形状连接。考虑到这些轮廓的形状，螺栓只能安装在两个极端的行中，而它们在平坦凹面处的壁不能紧紧地连接到角撑板，因此，这些节点的实际操作需要研究。

这项工作的目的是研究当安装两排螺栓时，薄壁冷成型型材与一部分凹面平壁的接头的应力 – 应变状态。

作为研究的结果，当在凹形平面型材壁的部分中安装螺栓时确定应力 – 应变状态。作者提出在这部分墙壁上安装由钢板制成的角撑板的加强元件，这将增加组件的承载能力，减少连接元件的长度并减少螺栓的数量。

关键词：应力 – 应变状态，薄壁冷弯曲线，局部稳定性，板框，加强元件，实验研究。

Abstract. *Thin-walled cold-formed profiles with a part of a concave flat wall are used in the manufacture of truss frames. In these frames, the elements are joined using sheet shapes. Given the shape of these profiles, the bolts can be installed only in two extreme rows, while their wall in the place of flat concavity cannot be tightly connected to the gusset, therefore, the actual operation of such nodes requires research.*

The aim of the work is to study the stress-strain state of the joint of thin-walled cold-formed profiles with a part of a concave flat wall when two rows of bolts are installed.

As a result of the studies, the stress-strain state was determined when installing the bolts in the part of the concave flat profile wall. The authors proposed to install a reinforcing element of a gusset made of sheet steel in this part of the wall,

which will increase the bearing capacity of the assembly, reduce the length of the connected elements and reduce the number of bolts.

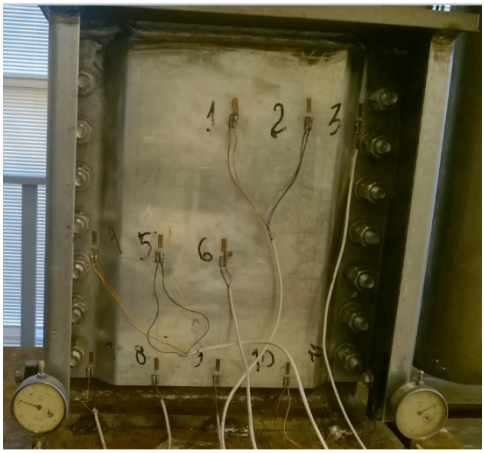
Keywords: *stress-strain state, thin-walled cold-bent profile, local stability, sheet framing, reinforcing element, experimental studies.*

Currently, frames from thin-walled cold-bent profiles are widely used in construction [1-4]. Connections in the nodes of which with bolts [5-8] and sheet gussets [9-11]. For the manufacture of the upper truss belt, paired thin-walled, cold-formed profiles with a part of a concave flat wall providing its local stability are used [12-15]. The walls of these profiles in the area of their flat concavity do not touch the sheet gusset. Therefore, the bolts can be installed in two rows near the corners of the profiles, where there is contact with the gusset. In this case, the step of the bolts across the section cannot be performed, since this distance is occupied by a concave flat section of the profile wall.

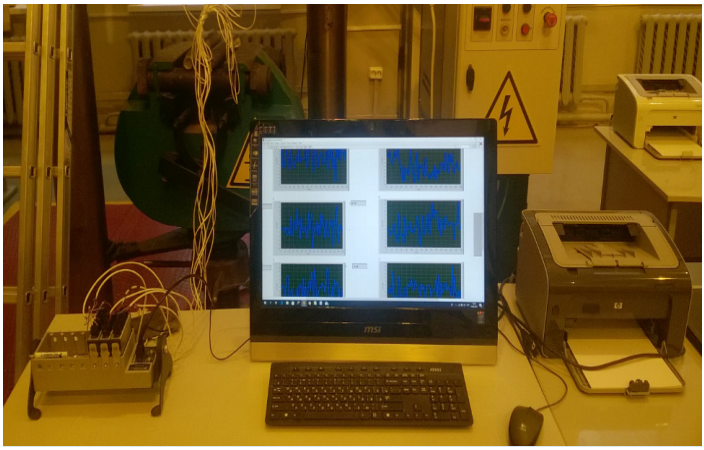
For an experimental study of the stress-strain state, a prototype is shown in (Fig. 1), which is close to the central node of the truss frame with a span of 24 m [4.17]. This assembly consists of two profiles with a part of a concave flat wall, connected by means of a sheet gusset on bolts.

Fig. 1. *The prototype of the bolt connection node*

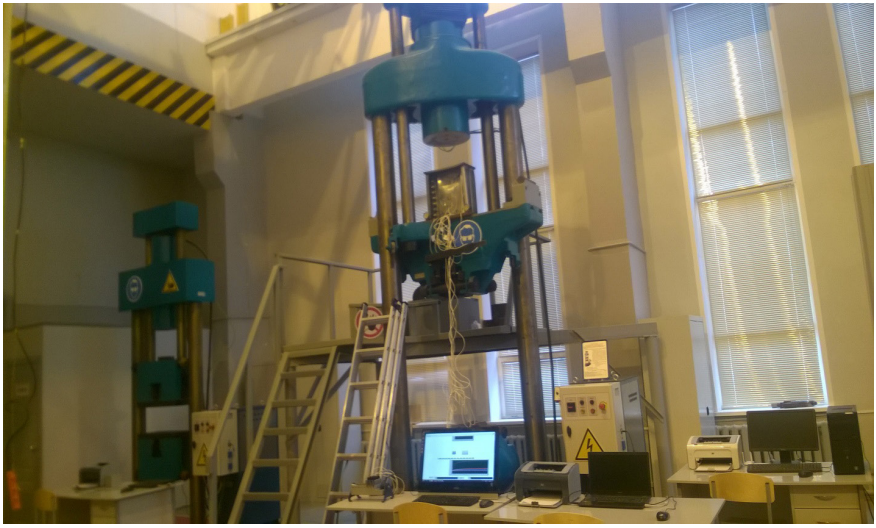
To determine the stress-strain state of the bolt joint assembly, strain gauge sensors are installed (Fig. 2a), which are connected to the strain gauge station, which in turn is connected to a personal computer, where the stress-strain state of the bolt joint assembly is processed through the NI LabVIEW 2015 program (Fig. 2b) Loading is done by the press. The movement of the cold-knotted profile of the unit is measured by two dial indicators.



a



b



c

Fig. 2. *Test bolt connection node: a - location of strain gauge sensors and dial gauges; b - data processing of the stress-strain state of the node; c is a general view of a bolt assembly test on an ASTM-Digital press*

When the bolt assembly was loaded with a compressive load, failure occurred as a result of the loss of local stability of the profile wall above the zone of location of the upper bolts at a load of N = 97.6 tons (Fig. 3). Such a loss of node stability is not precisely explained by the calculations, which requires additional consideration, since the destruction of similar nodes occurred in trusses[1, 6], and also according to [16], the influence of initial defects on the design bearing capacity is known. According to the indications of the left and right indicator, the movement of the cold-knotted profile of the assembly is 1.0 and 1.1 mm.

Strain gauges throughout the test recorded changes in stress. Sensors 3, 4, 7 and 11 are installed not along the axis of the bolt installation, but are offset somewhat towards the middle of the profile. Analyzing the readings of the strain gauge sensors, we can say that in the sensor 7 and 11, the stresses under the bolts are more than in 4 and 3, and in 1 in the middle part of the profile section more than in 6 and 9. This says that the forces in the upper part, in places of installation of bolts less, and in the bottom is more. In the section of the wall, the profile of the node, on the contrary, is larger in the upper part and smaller in the lower part. Based on this, there is a need for additional rows of bolts in the area of flat concavity of the profile for a more uniform perception of the arising forces in the cross section from the active load.

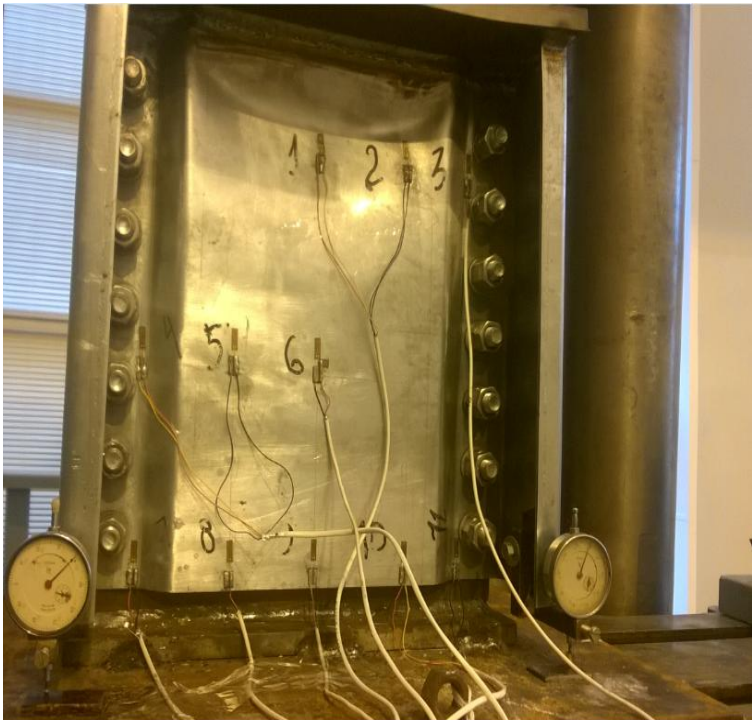


Fig. 3. *The loss of stability of the wall of a cold-formed profile*

In order to perform the installation of bolts in the area of flat concavity of the wall, it was proposed to install a reinforcing element made of sheet steel, which would eliminate the gap between the gusset and the wall of the cold-formed profile (Fig. 4).

With a bolt assembly of two thin-walled cold-formed profiles with a part of a concave flat wall, only two rows of bolts can be installed. This setting of the bolts leads to a change in the stress-strain state, namely, in the upper bolts of the assembly, minimum stresses arise, and in the lower ones, maximum. In the middle of the node profile, on the contrary, the maximum stresses act at the top, and the minimum ones at the bottom. If the bearing capacity of one bolt is multiplied by their number, then the value of the calculated load on the node will be determined. However, this is far from the case, the stresses under the bolts are distributed unevenly, namely, as shown in the study, the maximum in the lower bolts and the minimum in the upper ones. Therefore, in order to determine the bearing capacity of the connection node, it is necessary need to find out the stresses in the profile

from the lower bolts for a given number of them. This voltage should create the design bearing capacity of the node. Experimental studies have confirmed this and showed that in the nodal connection, the lower row bolts are most loaded, and the upper ones are less loaded. In this case, a uniform distribution of stresses in the assembly can be achieved with an increased number of rows, according to regulatory data, the distance between the rows of bolts is not more than 12d or 18t. To increase the number of rows of bolts, it is necessary to eliminate the gap within the concave flat section of the wall due to the installation of steel sheet plates.

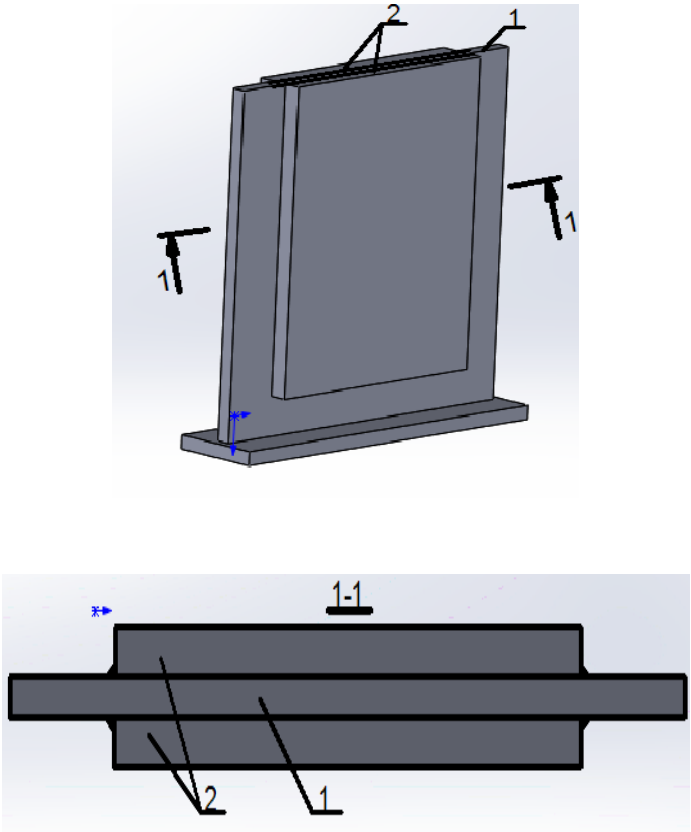


Fig. 4 *Sheet gusset: 1 - existing sheet gusset; 2 - reinforcing element made of sheet steel*

References

1. Zverev V.V., Semenov A.S. Influence of the softness of bolted joints on the deformability of a truss from thin-walled bent profiles // Construction and Architecture. Scientific Bulletin of the Voronezh State University of Architecture and Civil Engineering. - 2008. - № 2 (10). P. 9–7.

2. Bely G.I., Ayrumyan E.L. Research on the operation of a steel truss from cold-formed sections taking into account their local and general stability // Industrial and Civil Engineering. - 2010. - № 5. P. 41–44.

3. Je Chenn Gan., Jee Hock Lim., Siong Kang Lim., Horng Sheng Lin. Experimental study on the effect of heel plate thickness on the structural integrity of cold-formed steel roof trusses // 14th International Conference on Concrete Engineering and Technology IOP Conf. Series: Materials Science and Engineering 431. 2018. Pp. 1–9. DOI:10.1088/1757-899X/431/11/112009.

4. Kuznetsov I.L., Salakhutdinov M.A., Gainetdinov R.G. Bench and test results for a truss with a span of 24 m with rods made of cold-galvanized cold-bent profiles // Izvestiya KGASU. - 2018. - № 4. P. 193–199.

5. Kolesov A.I., Lapshin A.A., Yambaev I.A., Morozov D.A. Experimental study of steel trusses from thin-walled cold-bent profiles with self-tapping screws // Volga Scientific Journal. - 2013. - № 4 (28). P. 15–19.

6. Prevention of accidents of buildings and structures // PAMAG.RU: daily. online edition 2009. URL: http://prevdis.ru/naturnye-ispytaniya-stropilnoj-fermy-iz-tonkostennyh-holodnognutyh-profilej.html (application date 15.03.2019).

7. Kuznetsov I.L., Fakhrutdinov R.R., Ramazanov R.R. Results of experimental studies of the work of thin-walled element joints on shear // Bulletin of MGSU. - 2016. - № 12. P. 34–43.

8. Ibrahim Elkersh. Experimental investigation of bolted cold formed steel frame apex connections under pure moment // Ain Shams Engineering Journal. - 2010. - №1. pp. 11–20.

9. Rahima Ummi Kulsum Nadya., Fathoni Usman. Bolted connection of cold-formed steel section - a review // ARPN Journal of Engineering and Applied Sciences. 2018. vol. 13. № 17. P. 4737–4745.

10. Žilvinas B., Gintas Š. The behavior of cold formed steel structure connections // Engineering structures and technologies. - 2013. - №5. P. 113–122. DOI: 10.3846/2029882X.2013.869416.

11. Zhidkov K. E., Semenov A. S. Improvement of constructive solutions for trusses from thin-walled cold-formed profiles // XIII International Scientific Conference "Applied and Basic Research" (December 9–10, 2017, St. Louis, Missouri, USA). P. 79–83.

12. Anna Green Antony. Cold Formed Steel Sigma Section Joints // International journal of innovative research in technology. 2016. vol. 3. P. 231–237.

13. Anna Green Antony. Study on cold formed steel sigma sections and the effect of stiffeners // International Journal of Innovative Research in Science, Engineering and Technology. 2016. vol. 5. P. 16249–16255. DOI:10.15680/IJIRSET.2016.0509084

14. Bassem L., Gendy., Hanna M.T. Effect of geometric imperfections on the ultimate moment capacity of cold-formed sigma-shape sections // Housing and Building National Research Center HBRC Journal. 2015. P. 1–8. DOI: 10.1016/j.hbrcj.2015.04.006

15. Katarzyna Rzeszut., Ilona Szewczak. Experimental studies of sigma thin-walled beams strengthen by CFRP tapes // World Academy of Science, Engineering and Technology International Journal of Structural and Construction Engineering. 2017. vol. 11 № 7. P. 888–895.

16. Korsun N. D., Prostakishina D. A. Analysis of the VAT of a composite section of thin-walled profiles taking into account initial geometric imperfections // Academic Bulletin URALNIIPROEKT RASN. 2018. №. 4. P. 83–88.

17. Kuznetsov I. L. Gainetdinov R. G. Central node of the upper belt of the truss frame from rods of cold-formed profile // Izvestiya KGASU. - 2019. - №1. P. 140 - 146.

科学出版物

上合组织国家的科学研究：协同和一体化

国际科学大会的材料

（2019年9月14日。中国北京）

编辑A.A.Siliverstova
校正A.I.尼古拉耶夫

2019年9月23日。中国北京。
USL。沸点：98.7。 订单259.流通450份。

在编辑和出版中心印制
无限出版社