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

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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。
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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, Iran, 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”

确定企业经济可持续性的机构方法
INSTITUTIONAL APPROACH TO DETERMINING THE ECONOMIC SUSTAINABILITY OF A FIRM

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抽象。 本文提出了一种理解经济可持续性的制度方法。 该方法基于建立公司的机构参数：原则，规范，机制，发展。 面对不确定性，规范市场实体经济关系的机构是公司经济稳定性的组成部分之一。

关键词：制度方法，制度，公司制度结构，经济可持续性，制度可持续性。

Abstract. *This article proposes an institutional approach to understanding economic sustainability. The approach is based on the institutional parameters of building a firm: principles, norms, mechanisms, development. Institutions that regulate the economic relations of market entities are one of the components of the economic stability of a company in the face of uncertainty.*

Keywords: *institutional approach, institutions, institutional structure of the company, economic sustainability, institutional sustainability.*

The ability to maintain the specified properties and parameters during the operation of enterprises under the influence of external disturbances is called economic sustainability. Also, some authors consider the sustainability of enterprise development as a kind of system integrity, which manifests itself in the process of functioning, in the form of the destruction of old systems and the emergence of new ones. In our opinion, the processes of sustainability of functioning and development reflect the institutional content of production activities.

External factors in the functioning of business units are always uncertainty and risk. They have a stimulating effect on business entities and lead to an acceleration of their development. The activity of an economic organization as an open system is associated with the adaptation of production and financial processes to environmental conditions. Then conditionally constant preservation of institutional parameters is observed in the structure of the firm (principles, norms, development mechanisms). According to O. Williamson, the institutional structure of the company is the institution of the company, reflecting moral values, laws, traditions, which forms the institutional environment of economic units, which regulates the economic relations of market and production entities [1].

The stability of the functioning of the company as a holistic system is achieved under conditions of maintaining the production process and the efficient use of economic potential. It is very important that the mechanisms and rules for using economic resources remain constant.

Some authors understand the integrity of the system as preserving the constancy of structure and functions, and by the given parameters they determine the resources of the enterprise, the production process, and the goals of activity. We determine the integrity of the system when all its members and links carry out their activities in the face of changing socio-economic factors. According to D. North's evolutionary theory of development, effective systems survive, while others self-destruct, or continue to function with benefit for certain groups of people [2]. In this case, the specified parameters can be external and internal conditions: values, laws, traditions, competition, institutional performance of the company. The study of the institutional nature of economic sustainability begins with the identification of institutions that have the maximum impact on the functioning of the company.

We can assume that the company operates normally in the face of uncertainty, if confidence is maintained in the mandatory receipt of income, which is supported by established relationships with partners, competitors, consumers, and the state. Here, all parties are interested in observing established economic relations (agreements, arrangements). The mechanism of functioning of the system is ensured by values, traditions, laws and honest observance of these rules.

The enterprise system is organized in such a way that allows it to strive for self-preservation or, on the contrary, to develop in the direction of self-destruction, if necessary. A system is interconnected parts of something that make up a holistic formation around an idea. Incoming composite subsystems and elements perform tasks of their own free will or coercion so that the system works in a certain direction. Therefore, we can assume that the system has its own ordered mechanism, which allows it to function efficiently.

Thus, the integrity of the system is the observance of the rules and norms of behavior by all subjects of the economic process. This process will be a condition for the sustainable development of the company even if there is a negative manifestation of environmental factors.

Every system consists of subsystems. Some authors distinguish subsystems: economic, social, environmental. In this case, the technological subsystem is not considered by them and is taken as stationary. The economic system refers to dynamically developing systems for which sustainability is to ensure the constancy of the technological process at a certain level of management development. The latter at the same time regulates the ability of the system to move to a qualitatively new level, which is inherent in the creation of a sustainable economic structure.

We agree that the technology on the market is less flexible, conservative in comparison with other components of the production process, and difficult to change. But the technology is not stationary, moreover, it is subject to physical and moral wear and tear, its functioning is affected by socio-economic factors. And we dare to suggest, using the Keynesian approach, that radical changes in the organization, including management, are associated with the service life of the equipment and the amount of accumulated capital. When the service life comes to an end, and the accumulated capital significantly exceeds the volume of production, economic problems appear in all directions. Consequently, the technology is changing, but there is always a need for it, principles of work and a mechanism for managing the implementation of effective solutions. These components will provide a continuous process of economic stability of the company. The effectiveness of economic activity is ensured by the application of uniform methods, principles of management of all subjects of the economic process.

The organization system is a dynamically developing and constantly functioning (carrying out production activity) structure. An organization cannot develop without functioning, just as it can constantly function without development.

Broilo E.V. considers the economic stability of a commercial organization as the equilibrium of a socio-economic system, that is, the functioning of society and the implementation of economic relations in a situation where there are no critical threats and the subject's ability to adequately respond to these threats [3]. This author suggests comparing the category of economic sustainability with similar concepts as adaptability, flexibility, competitiveness, economic security, reliability, efficiency and dynamism. Her research deepens understanding of economic sustainability.

Of particular importance are factors internal (endogenous) and external (exogenous), which affect economic sustainability.

The nature of economic stability for all normally functioning economic entities is one. We are inclined to this conclusion. Then the integrity of the system is the ability to regulate economic activity, applying effective management decisions. Integrity is also understood as a balance of resources. The optimal amount of resources is achieved provided that the required quantity and quality of the product is produced and sold at an acceptable market price.

The traditional study of economic sustainability is associated with theories of cycles, which are based on the justification of the laws of crisis processes. Some authors define the economic crisis as the destruction of the economic system. On the one hand, we can consider the crisis as the destruction of an economically sustainable system, and on the other, as a stage of its development. The likelihood of a crisis in the system determines the attempts of subjects of the economic process to use all available means to maintain the institutional nature of economic stability.

A crisis in the system arises as a result of the inaction of managers, or under the influence of insurmountable environmental factors. The latter will lead to a change in the institutional structure of the enterprise.

In modern studies, the concepts of "stock of economic sustainability" and "stability threshold" are used, going beyond which leads to the destruction of the system, that is, to an increase in instability (negative dynamics). However, this is not a system extinction. These categories explain the existence of an internal crisis of the system as an integral part of it.

The system is prone to accumulating positive and negative trends in economic life. Factors that do not have a detrimental effect on the system are stored by it and accumulate, which characterizes the stability of the company, that is, its ability to get along with negative processes. The balance between a stable and unstable state is expressed in the fact that the manifestation of instability (inclination, probability of crisis) is restrained by sustainable development, but until the accumulated problems do not contradict the institutional structure of the company. The crisis arises as a result of the inconsistency of economic relations with established institutional norms. In these conditions, the effective functioning of the company is associated with maintaining the coherence of economic activity and its institutional order.

Thus, the institutional structure of the company is the mechanism of the functioning of the company, aimed at ensuring the effective use and application of formal and informal rules (institutional norms) in the process of economic activity, forming the ability of an economic entity to influence the institutional structure of the state and the market.

Institutional norms (institutional environment) are understood as rules, laws, moral values, traditions.

Economic activity is determined by the institutional order (institutional behavior) - the formation of leading (basic) institutions and the regulation of the interconnections of the system, which determines the course of evolution and prospects for the development of the system.

If the crisis is part of the economic system, then its manifestation and presence characterizes the integrity of the system, that is, the ability to adequately respond and survive in the new conditions of entrepreneurial activity. A crisis cannot violate integrity (as some authors claim) and eliminate the system. However, the system may self-destruct due to inefficiency - inconsistency of the firm with institutional standards. It is not the crisis that destroys the system, but the system itself that transforms inefficiency into a crisis and self-destructs, that is, the enterprise becomes bankrupt and leaves the market. Therefore, it is necessary to study the institutional nature of the economic stability of the company, as a fundamental characteristic of the system.

A functioning production system is a vibrant and dynamic organism, flexible and adaptable. If an organization has situations in which the behavior of subjects adversely affects the economic stability of the company, then a conflict arises between the existing system and the needs of the market, and the question arises of its further existence.

The reason for the general economic crisis is the cyclical development of organizations and the market economy as a whole. The development of the company does not coincide with the rhythms of the functioning of general economic systems. We adhere to the point of view that in the economy there is a natural objective order, where the organization operates in the given coordinates of the micro and macro systems (market, industry, state).

Thus, the institutional approach allows us to take a fresh look at existing theories in understanding and determining the economic sustainability of the economic system of firms.

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如何增加国家人口的持续时间
HOW TO INCREASE DURATION OF THE POPULATION OF THE COUNTRY

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抽象。 在现代信息技术，原始方法，模型，算法和计算机程序的基础上，提出了提高医疗服务质量和可获得性，增加该国人口预期寿命的方法。
关键字：医疗服务质量，信息技术，原始方法，模型，计算机程序

Abstract. *The ways of improving the quality and availability of medical services and increasing the life expectancy of the country's population based on the use of modern information technologies, original methods, models, algorithms and computer programs are proposed*

Keywords: *quality of medical services, information technologies, original methods, models, computer programs*

Formulation of the problem. Obviously, each of the people living on this earth (of those, of course, who are "in their right mind and sober memory") would like to live a long time, and, preferably, without illness. And if you have to suddenly fall ill, then quickly recover, become healthy again. But, expanding their horizons, individuals suddenly learn that in some countries people live much longer than in most others. So, judging by the published data, the number of 100-year-old centenarians in the USA is 23 per 100,000 people, in Japan - 60, and in Russia there are much less such centenarians. True, as the newspaper Izvestia writes with reference to the data of the Federal State Statistics Service (see: URL: vesti.ru/08/23/2019), as of January 1, 2019, the number of centenarians who have crossed the 100-year age limit in the last 8 years **tripled (!).**And such an extraordinary achievement turned out to be possible to carry out in an *insignificantly* short period of time (by historical standards), starting 20 years ago, socio-economic transformations in conditions of **mass poverty, population decline, economic collapse** (see, for example, in [1] the page "How we lived 20 years ago "). At the same time, it was once again shown in [1, 2] that the life expectancy of a population depends not only on GDP (GRP) per capita and on the proportion (relative number) of highly educated citizens, but also on the **quality and accessibility** of medical services provided to the population.

The question is, why is there such a big difference in the life expectancy of the population of the countries of the world? And how can the government of the country ensure the growth of life expectancy of citizens?

Based on the * method of extracting the desired subset of objects from the set of high power [3] and * the use of modern information technologies, the author offers answers to questions about ways to increase the life expectancy of the country's population.

Existing problems and difficulties. 1) Problems and difficulties faced by the patient: **Errors of the doctor in establishing the diagnosis of the disease and choosing a treatment method**. And at the same time: * Typically, television presenters and other "professionals" recommend looking for a "good doctor", or contact several doctors and compare their recommendations. But no one explains how the patient should know whose specific recommendations are correct, which of the doctors is professional and who is an amateur in the field of medicine. After all, all the doctors who are "caught" by the patient can turn out to be very mediocre specialists. * In many countries, including and in the USA, the number of unnecessary, hazardous to the patient's health operations is increasing. And these operations are done either by mistake, or, much more often, for financial support of a doctor or medical institution. * There are already publications that in some cases, doctors prescribe medications that are *beneficial for pharmacies* and not useful for improving the patient's health to treat a patient. * There are many *fraudulent copies* of the websites of famous medical institutions. Various pseudo-medicines, supplements, diets, food products to improve health and increase life expectancy, and other non-state certified medical products are actively advertised on these sites (with links to supposedly recommendations from renowned medical practitioners and medical scientists).

2) Problems and difficulties faced by the doctor: **Many diseases, many treatment methods, many tools, drugs.** And at the same time: * We are treated by different personalities-doctors, *with different levels of professionalism, with very different natural abilities, with all the advantages and disadvantages inherent in each person* (see, for example, [4, 5]). And, surprisingly, even for a very honest, sensitive and attentive professional doctor it is not at all easy to make a diagnosis of the disease (there are more than 1000 diseases). Moreover, one patient may have several diseases, i.e. A patient who has contacted a doctor may have many **combinations** of different diseases. In such a situation, the correct diagnosis is the most difficult task of classification (recognition), since it is necessary to make a diagnosis and then choose a method and means of treatment (there are also many medicines). * The period of doubling knowledge is *shrinking at an accelerated pace*. Therefore, even a talented, ambitious, responsible professional doctor will not be able to read an insignificant share of periodicals in the field of medicine to

learn * *about new medicines and new methods of treatment, * about the results of new studies in the field of nutrition, * about new approaches to ensuring a healthy lifestyle for the population* etc. This circumstance significantly *limits* the ability of the modern medical scientist (however, *and not only the physician*) to become a universal expert on new developments in the field of his professional interests (unlike, for example, I. Newton and his contemporaries).

3) Problems and difficulties faced by the government of any country in the world. **Uneven population density, many small administrative-territorial units (ATO) with a population of less than 1000 people.** And therefore: * It is impossible in many cases to ensure competition in the market of medical services (for objective reasons - remoteness, low income and small population of the ATO). * High turnover of medical personnel. * It is often impossible to *promptly* provide medical care for *injuries and other diseases dangerous to the patient's life*, both in large cities (traffic jams, lack of landing areas for helicopters), and in small populations and remotely located territorial units (lack of a 24-hour medical center or qualified paramedic). * Large *expenditures of budgets of all levels* for ensuring the quality and accessibility of *many* medical services provided.

The question is, what should citizens and the government do in this situation with a **multitude** of listed and, unfortunately, real-life difficulties and problems?

Here we show that improving the *quality and accessibility* of medical services while **accelerating and cheapening** all the processes of medical care for the country's population is possible ONLY *with the active use of modern information technologies*. For example, fifth-generation 5G communication networks can transmit information at a speed of 20 gigabits per second with a delay of about 1 millisecond. Therefore, it becomes possible: * to make wider *use of* **telemedicine**, the use of which requires huge data transfer speeds. And in China, based on 5G networks, several successful surgeries have already been performed **remotely**. * **develop projects** using fundamentally new methods, tools and technologies to ensure h*igher quality and better accessibility of medical services*, for example, projects for the optimal organization of primary health care, better medical diagnostics and other effective, less costly ways of organizing medical care for the population.

RESOURCE of the methods proposed in the article for improving medical care for the population. 1) It is assumed that, in the interests of potential patients and medical workers, the country's population, the Government *has created a state medical institution* (for example, the Citizens Health Center, the **resource equipment** of which allows: * **to develop and use, while maintaining high consumer quality**, an Automatic Classification (Recognition) System "**Consultant and assistant of physician**"; * **quickly process** large amounts of data; * **design, generate and maintain,** keeping *up to date*, the base for data (DB), protected from unauthorized access, hacker attacks, hacking and other

violations of the normal functioning process, including * a**n expert database** containing medical scientists and experienced medical practitioners, including citizens of different countries; * **symptom database** characteristic of various diseases and their combinations, *and data on the results of objective examinations of patients* in leading medical institutions of different ownership forms; * **a database of treatment methods** that comply with WHO recommendations and the best medical institutions in the world; * **a database of drugs** indicating analogues (according to the composition of the ingredients), the manufacturer and * other necessary databases; * **regularly carry out** (with the advent of new technologies) **reengineering and unification** of processes related to medical care for the population (see, for example, [6]).

1. How to reduce the likelihood of a doctor's mistake that is dangerous to the health or life of the patient. First, recall: in the RESOURCE SECURITY section it is indicated (or rather, it is assumed) that the Government created the Citizens Health Center, the resource provision of which allows us to develop, use and permanently improve and improve (as information technologies develop) consumer quality characteristics (functional completeness, speed reactions, time to perform basic functions, etc. [7]) of the "Consultant and Assistant of Physician" system. The main task of the Center is the formation of a high-quality training sample, moreover, a sample that contains relevant, regularly *updated and fresh data obtained from reliable sources.* For this purpose, in our opinion, the following should be included in the composition of such a training sample:

1.1. The results of surveys of medical experts (randomly selected from the expert database) on methods of treating citizens based on available instrumental and laboratory examinations;

The results of instrumental and laboratory examinations of patients with an already established (reliable) diagnosis of the disease;

1.3. WHO recommendations on treatment modalities and other public health concerns;

1.4.Results of studies in the field of pathological anatomy and pathological physiology related to the preservation and strengthening of the health of the population of the country, with possible consequences for the health of the patient with various methods of treatment, with the use of various combinations of drugs;

1.5. Information on the timing of patients' recovery (based on the results of objective examinations) depending on the use of a particular treatment method.

Here, using the example of choosing a method of treatment and medical diagnostics, we will consider in detail the author's method (see [3]) for the implementation of the interrogation procedure of medical experts (Section 1.1.) When creating a training sample. The proposed workflow of the examination process includes the following steps:

Step 1. Using a table or a random number sensor from a database containing information about experts in the field of medicine, competent potential participants of the examination are selected.

Step 2. Selected experts are invited to take part in solving a specific problem of medical diagnosis or choosing a method of treating a patient based on data on the results of instrumental and laboratory examinations.

Step 3. The experts who agreed to participate in the survey are assigned identifiers (also using a random number sensor). Suppose those who agreed to participate in the examination turned out to be 100.

[**Note 1.** All three steps and a series of subsequent steps are performed automatically, i.e. not only the participants, but also the organizers of the examination do not know who exactly is participating in the polls, who and how substantiated their decision, how the groupings of the poll participants form]

Step 4. Each participant in the expert survey is informed about the need to choose a method of treatment (or establish a diagnosis of the disease). As a result, some groups of experts may have the *same* specific treatment methods (or diagnoses of the patient having only one disease), while others may have different combinations of several treatment methods (or diseases).

[**Note 2.** If the expert has indicated several possible methods of treatment or possible diseases, then in this case he is asked to arrange them according to the degree of significance, priority of a particular treatment method or priority of the presence of a specific disease in a patient]

As a result of performing step 4, a table of the form of table 1 presented in [3] will be generated.

[**Note 3.** Experts with treatment methods (or diagnoses) in the lists, selected by no more than 10-15 percent of those participating in the examination, are asked to explain why this treatment method (diagnosis) was chosen, and all experts are introduced to the explanations, suggesting change their previous answers if needed].

Step 5. Processing the results of the examination in accordance with the algorithm described in [3]. The analysis of the matrix ($P_0 + P_0^2$) allows you to determine which of the treatment methods or which of the diseases, according to the participants of the expert survey, has the largest information weight (rank), i.e. **is most likely.**

Step 6. According to the analysis data, a list of possible diseases of the patient is formed for further research.

Step 7. The formed list is ranked using the method of step-by-step refinement of object ranking [3, 8, 9] with the aim of * correctly *dividing* experts into groups, * increasing the *accuracy of the examination results* due to the presence of *feedback* during the implementation of each round, * preserving the *benefits* of the Delphic procedure, * calculate the probability of the patient having each of the

alleged diseases * find the *ordering* of the patient's diseases agreed with the members of each group of participants in the expert survey, have calculated *exactly or approximately* the Kemeny median.

DERIVATION. The proposed option to improve the quality and accessibility of medical *services* and, as a result, increase the life expectancy of the country's population is **universal and has several advantages**: Firstly, using the proposed method, it is possible to **quickly** organize a **consultation** with high-level professionals living in different cities and countries . Secondly, the probability of the *correct diagnosis of the disease and the correct choice of the treatment method*, technology and tools used in the treatment process and, accordingly, *the likelihood of a successful recovery of the patient* increases significantly. Thirdly, **for the first time**, it becomes possible, based on the results of participation in specific examinations (in diagnostics, determining the method of treatment, etc.), *to formulate a rating of medical experts*. Fourth, the fact that the entire organization of examinations is carried out *in an automated mode,* and neither the participants nor the organizers of the expert surveys know who is involved in a *particular* examination, who and what gave reasons for their decision, practically eliminates the *influence on the result* of personal qualities and possible interest of participants and organizers of examinations, including lobbying, politics, conspiracy, administrative resources and other negative factors that make it difficult to obtain objective information about the studied problem e.

2. How to optimize the costs of the state, and in the future, and business (probably considerable***) for the medical care of the population.*** After all, not only the amount of funds allocated from the state budget or invested by business is important, but also how efficiently these funds are spent. Therefore, any options for organizing the processes of medical care for the population should be focused on obtaining the optimal result with restrictions on the cost of labor and financial resources, on the amount of budgeted funds.

CONCLUSION. 1. The proposed *ways* to improve the quality and accessibility of medical services for citizens and, accordingly, increase their life expectancy will provide in the future (near, preferably) the opportunity for *sick* citizens to **successfully** *overcome* existing difficulties and problems, and *the state* to **equally** improve the quality of medical care and *optimize* (for example, by the criterion of maximum social effect) budget expenditures.

2. Centralization *of the resource, scientific and informational support* of the processes of medical care for the population (the creation of the Citizens Health Center) will not only promptly and efficiently provide medical services to the population, but also significantly *reduce the cost and optimize the cost of financial resources from the state budget*, for example, by "equalizing" the flow applications for medical care (the dispersion of the time intervals between receipt of applica-

tions decreases and, accordingly, the likelihood of freedom number of medical workers at the moment necessary for the patient) and at the same time reduce the total number of necessary medical workers (this is easy to show using analytical methods of queuing theory or simulation). Not to mention that the likelihood that this Center, *the effectiveness of which is under the scrutiny of citizens of the whole country*, **capable professionals** will find themselves, will be much higher.

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利用国外经验在俄罗斯建立绿色经济模式的机会
THE OPPORTUNITIES OF USING THE FOREIGN EXPERIENCE FOR BUILDING A MODEL OF GREEN ECONOMY IN RUSSIA

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抽象。 本文分析了国外在经济部门，旅游业和酒店业绿色化方面的经验。 研究了将来将大大减轻环境负担的项目实例。 以瑞典和俄罗斯为例，对生态发展进行了比较分析。

关键词：生态，绿色经济，环境问题，绿化，税收制度的绿化，特别保护的自然区。

Abstract. *The article analyzes the foreign experience of greening the economy sectors and the tourism and hospitality industries. The examples of projects that in the future will significantly reduce the environmental burden on the environment are studied. The comparative analysis of ecological development on the example of Sweden and Russia is given.*

Keywords: *ecology, green economy, environmental problems, greening, greening of the tax system, specially protected natural areas.*

Introduction

For today, the preservation of the environment is one of the priority goals assigned to mankind. The actions of the global challenges of our time, such as environmental pollution, technological disasters, military operations, wasteful usage of resources lead to environmental problems, such as pollution of the biosphere, destruction of many species of flora and fauna, destruction of the ozone layer, exhaustion of non-renewable natural resources, etc. All this, unfortunately, contributes to increasing instability of socio-economic development of countries. The environmental problems affected almost all important areas for the country such as agriculture, forestry, trade, medicine, education, science, as well as tourism and hospitality. Since the beginning of the XX century, the active campaigns have been conducted to eliminate the consequences of environmental disasters and create a

favorable environment that ensures the health and safety of the population. So, the Declaration of Rio de Janeiro (Rio Declaration) on environment and development was adopted in 1992 in Rio de Janeiro. It's main points were 27 principles of environmentally correct behavior of the world society [8]. Following the principles of environmentally correct behavior and environmental indifference is an actual trend for Russia, and thus, it is necessary to study the world practices that have experience in building a model of «green economy».

Methods

The authors of the study used the following scientific methods:

- analysis of secondary data (analysis of scientific publications describing foreign experience of ecological development of countries);
- generalization: comparative analysis of international experiences of greening with the Russian;
- analytical and statistical research of the development of ecological tourism in foreign protected areas.

Results

In the last decade, the principles of a "green economy" have been actively introduced in the countries of the Western world. Such countries as Italy, Germany, China, Sweden, Norway, Denmark, Finland, Portugal, Iceland, Spain, Austria, New Zealand, Estonia, Switzerland consider environmental development to be priority; Australia, Brazil, Japan, USA are also leaders in environmental development, but in a lesser extent [9]. The countries use different principles, methods and strategies in the formation of a model of «green economy», depending on the climatic conditions, the level of socio-economic development, risk levels, priority areas of development (table 1).

The data presented in the table allow us to note that regardless of the mechanisms used in building a model of «green economy», the common goal of most countries in modern conditions is reducing the burden on the environment.

Currently, the countries of northern Scandinavia, in particular Sweden, have the strongest experience in using environmental protection mechanisms. The Kingdom of Sweden is the most loyal follower of greening principles. Almost a third of Swedish citizens consider ecology and environmental pollution as one of the most pressing issues, while in the European Union as a whole this figure is only 7%. Thus, Sweden has a number of distinctive features of the implementation of the greening principles.

The First of all, in Sweden, 99% of waste, is recycled and reused in one way or another. This phenomenon has got the name of «Swedish recycling revolution». In practice, in an apartment or a house of every Swedish family there are several casks for garbage sorting: glass, cardboard, metal, plastic, newspapers and food debris. The importance of garbage sorting is so entrenched in the minds of Swedes that many of them just do it automatically [10]. At that moment, no country in the world has managed to get so close to complete waste-free production. Russia is just beginning to get acquainted with the process of garbage sorting, thus, at that mo-

ment this process has a promotional, rare and absolutely non-systematic character.

Table 1. *Global «green economy trends» [2]*

Country	Usage of «green economy»	Ecological projects
Sweden	By 2020, the rejection of oil, coal, gas; the transition to energy from renewable sources	16 environmental goals: reducing the impact on climate, clean air, healthy marine environment and living lakes; non-toxic environment, etc.
Japan	«Action Program of a Low-Carbon Society»	Environmental control technologies – «the polluter pays»
USA	National energy saving programme	The concept of «wise usage» and the concept of «balancing action»
Netherlands	The concept of «system innovation», offering a comprehensive solution to environmental problems	Russian-Dutch project «Strengthening the impact of environmental non-governmental organizations (NGOs) on society through the creation of their regional networks»
South Korea	Implementing the green growth concept as a national strategy	Ecological clean nature reserve «Ecorium», consisting of eco-domes of the research center
China	Low carbon economy - a strategic task of the country	Water transfer from the Yellow River to Bayandian Lake; greenhouse gas emission reduction project
Poland	Managed to reduce harmful emissions by a third over the past 17 years	Reduced water usage
Denmark	Since 1980, gross domestic product has grown by 78% with minimal increase in energy consumption	«Environmental Education in Scandinavia», «Clean Rivers», «Acid Rains», «Green Flag»
Germany	Providing most of the electricity needs due to the energy received from solar panels	«Voluntary environmental year in Germany»

Brazil	Transfer of 80% of transport to biofuel from sugar cane	Turning of the San Francisco river: it is planned to change its direction and send two artificial branches in arid areas

Secondly, the usage of innovative environmental solutions, supported at the state level, is Sweden's powerful competitive advantage on the path to greening. The Swedish government has already invested more than 400 million krona in epy research and development of ecology and environmental protection. Biofuels, smart grids, as well as collection and storage of carbon are among the most famous developments. In 2013, the research and development expenditures amounted to 3.3% of GDP [10]. The environmental protection costs, in Russia, since 2015 amounted to 0.7% of GDP, whereas for improving the environmental situation this indicator should be at least 3% of GDP.

The third distinctive feature is the greening of the Swedish tax system. Exactly in this country, the government for the first time decided to carry out tax reform in practice: to introduce or increase the already existing rates of environmental taxes, at the same time reducing the burden of income taxation. Thus, increased environmental taxes are being offset by income tax benefits. As early as 1991, Sweden had taxes on electricity and carbon emissions. The greening of Sweden's tax system has led to increasing in the value of biofuels (derived from food and organic waste, ethanol) — in 2009, the country produced about 32% of its energy. Moreover, in comparison to 1980, the country's GDP has grown by 90%, and carbon dioxide emissions, as well as the energy intensity of the economy, fell by 40%. The tasks of reducing the greenhouse gas emissions on 40% by 2020 compared in comparison with 1990 and completely rejection of fossil fuels by 2030 are among the priorities for Sweden's environmental policy [10]. With regard to Russia, it is impossible to talk about the greening of the tax system due to the fact the taxes and fees applied in foreign countries aren't used in Russian practice yet; there is no theoretical and legal basis for environmental taxation.

The fourth feature is the role of specially protected natural areas (SPNA) in the process of greening the country and its individual industries. The main goals of their activities are the conservation of biological diversity, the maintenance of protected natural complexes and objects in a natural state, scientific research, popularization, environmental education, and the most important are those ones that have the direct impact on the environment and the development of ecotourism. Sweden has more than 30 specially protected natural areas and 3600 reserves [11]. In each district of Sweden there is a department of the Environmental Protection Ministry (Environmental Protection Agency), which employs about 20 people; there are about 21 such districts. The state participates in the development of protected areas through agreements with the local organizations for the provision of services regarding:

1. the arrangement of tourist camps;
2. the transportation of firewood;
3. the arrangement of the causeways in damp places;
4. maintaining cleanliness and order in the protected areas.

Thus, there is an intensive cooperation of the government with representatives of the local population. To maintain the agricultural landscapes open - the population is allowed to graze farm animals freely in some areas of natural reserves; local residents work under contracts with the Department of environmental protection of the areas (a division of the Ministry of environmental protection of Sweden):

1. support ecological trails, of the causeway floorings in damp places;
2. support an order on the territory of natural reserves;
3. reshape the stand of broad-leaved species, etc. [6].

It should be noted that a lot of research is being conducted in the Swedish protected areas, most of which is sponsored by the government of the country, as well as by funds and agencies. The most significant researches are being carried out in the field of conservation of the species composition of protected areas, in the field of energy, climate impact on the environment, the study of the animal population, the introduction of new technologies and others [11].

In cooperation with the Swedish environmental protection Agency and foreign partners, the government is providing advice and technical assistance in the developing of more effective environmental management.

In addition to cross-sectoral support for the establishment of strong institutions based on the principles of good governance, the government is focusing the international cooperation on the following priority areas:

1. Biodiversity;
2. Climate and air;
3. Environmental monitoring and data;
4. Sustainable urban development.

As part of bilateral cooperation, the Swedish Environmental Agency is currently focused on Albania, Bosnia, Brazil, Georgia, India, China, Palestine, Russia, Serbia and South Africa [11].

In comparison with the countries of northern Scandinavia, Russia, occupying 11.5% of the world's land, is experiencing some difficulties in the field of greening the country and sustainable development. At the same time, it should be noticed that Russia is considered as the leader among all countries in terms of natural gas and wood reserves and the richest country in the world in terms of natural resources. In terms of forest cover, exactly 20% of the world's timber reserves, it takes the 1st place in the world, 28th place in terms of water resources, 2nd place in the world in terms of coal deposits and 3rd one in terms of gold deposits. In addition, Russia is on the 2nd place of the largest deposits of rare earth minerals, despite the fact

that they are not currently mined. However, with all the natural wealth, the cost of replenishing natural resources is negligible.

In general, greening trends in Russia have not yet been sufficiently strengthened. Today, Russia, in many respects, is behind the Scandinavian countries in the field of greening. At the same time, a common distinctive feature in the direction of greening Russia with Sweden, for example, is the special role of protected areas in Russia. According to the Ministry of natural resources and ecology, there are about 12 thousand specially protected natural areas in Russia. The studies conducted by the authors (analysis of more than 100 scientific publications) and deep interviews with representatives of protected areas allowed us to make a conclusion that the functioning of the protected areas of Russia is not effective enough. Based on the analysis of secondary information and interviews with representatives of protected areas, more than 50 main problems of the protected areas functioning were identified, which were grouped into 12 blocks:

1. low level of funding;
2. poaching in protected areas, conflicts with the local population;
3. entrepreneurial activity close to the protected areas;
4. environmental degradation due to industrial waste pollution;
5. undeveloped infrastructure of protected areas;
6. lack of excursion routes and ecological trails;
7. negative impact of tourists and visitors on recreation;
8. low level of environmental education of the population;
9. insufficient efficiency of scientific departments of protected areas;
10. low rate of increase in the number of visitors;
11. seasonality of demand;
12. lack of qualified personnel [4].

In 2019, significant progress took place in Russia in the direction of greening, in connection with the development and signing of the National Ecology project. The project is being implemented as part of the May decree of President Vladimir Putin on national goals and strategic objectives for the development of Russia for the period until 2024. It includes ten directions: «Clean country», «Integrated system of solid municipal waste management», «Infrastructure for waste management of I and II hazard classes», «Clean air», «Clean water», «Volga recovery», «Preservation of the Baikal lake», «Preservation of the unique water objects», «Conservation of biological diversity and the development of ecological tourism» and «Forest conservation». There are about 191 illegal landfills across the country planned to eliminate, as well as 43 «the most dangerous objects of accumulated environmental harm»; a Federal operator for the management of hazardous waste will be created, and seven new centers will be built to work with these wastes; including batteries and energy-saving lamps;

an effective system of monitoring and control of air quality will be created, in the waters of Baikal lake, treatment facilities for wastewater entering the lake will be built; modernized and reconstructed, and the shores of the reservoir will be strengthened for 39.2 km, etc. [12].

The financing of this project comes not only from the federal budget, but also with the large companies. In total, the project budget is about 1.551 trillion rubles. Today, the realization of this project is important as never before in connection with fires in the Siberian region. According to [13] the area of fire spread is more than 3 million hectares, which is more than the area of Austria. Disasters began in July 2019 in remote areas of the Krasnoyarsk territory, Irkutsk region, Transbaikalia, Buryatia and Yakutia.

Conclusions.

It is obvious that the following of environmentally correct behavior principles and environmental indifference is an actual trend for Russia however, today, there is a significant backwardness in this issue from European countries. For instance, among the problems can be identified the lack of theoretical and legal framework for environmental taxation; the cost of environmental protection is 0.7% of GDP, while according to experts-environmentalists, for stabilization of the environmental situation at the current level, it is required to spend at least 3% of GDP, to improve it - at least 4% of GDP, for a radical change – at least 5% of GDP [14]; a significant number of mechanisms aimed at the formation of a «green economy» are in their infancy. Of course, European countries have more affluent experience in introducing ecology into society, production and business, and this experience can be not only studied, but also applied in Russian practice. Currently, the points of possible cooperation between Russia and Sweden within the framework of building relationships on the basis of protected areas are already obvious, which will contribute to environmental education, adoption of the best experience and in the future will allow Russia to become one of the leader in environmental development.

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投资决策：理性预期理论与宏观经济关系
INVESTMENT DECISIONS: RATIONAL EXPECTATION THEORY AND MACROECONOMIC RELATIONSHIPS

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抽象。基于对在俄罗斯进行的投资决策过程的社会学研究，对影响未来资本投资业务决策的因素进行了排名和系统化。作者根据已建立的现代经济方法论和理论对因素进行了系统化，这使我们能够在投资者要求和定制经济体系的能力之间寻求折衷方案。说明了国家对俄罗斯投资程序进行监管的必要性，主要是可以通过改善包括税收领域在内的机构，以及通过主要在俄罗斯中央银行的帮助下对宏观参数进行监管来实现。这项规定是必要的，因为投资者没有掌握所有信息，而要求廉价贷款可能会导致宏观经济平衡中断和本币贬值。此外，现代数字经济中的国家应该刺激这一领域的创新投资。

关键词：投资，经济增长，宏观经济学，微观经济学，数字经济，理性预期理论，政府对经济的管制。

Abstract. *Based on sociological studies on the decision-making process on investments made in Russia, the factors that influence business decisions on future capital investments are ranked and systematized. The systematization of factors was carried out by the authors in accordance with the established modern economic methodology and theory, which allows us to search for compromise solutions between investor requests and the ability to customize the economic system. The necessity of state regulation of investment processes in Russia is shown, mainly this can be achieved by improving institutions, including in the tax sphere,*

and by regulating macro parameters, mainly with the help of the Central Bank of Russia. This regulation is necessary, since investors do not have all the information, and requests for cheap loans can lead to disruption of the macroeconomic balance and depreciation of the national currency. In addition, the state in the modern digital economy should stimulate investment in innovation in this area.

Keywords: *investments, economic growth, macroeconomics, microeconomics, digital economy, rational expectation theory, government regulation of the economy.*

Introduction. In the modern world, there is an actualization of the investment problem. The states and the leaders of states are concerned about intensifying investment processes within the country, since investments in fixed assets themselves become the driver of development of the whole country, leading to economic growth and development. Economic growth of a country's economy is a macroeconomic process that leads to a higher level of realization of its production capabilities. At the same time, economic growth can be considered as a component of the economic cycle [1]. Economic growth is a phenomenon that is studied on the basis of indicators such as the dynamics of gross national product or gross domestic product, both in absolute size and per capita. This dynamics is characterized by annual growth rates (or gain).

The study of economic growth and investment is based on two main approaches: Keynesian and neoclassical [2,3].

In the *Keynesian model* of economic growth, savings and investments play an important role. The logic of economic growth, as a macro process, is as follows. Investments in fixed assets are a mechanism for triggering economic growth. The need for updating, in investment goods, leads to economic growth in the sectors that we call: “production of means of production”. The incomes of these sectors of the economy are growing, and they are increasing their demand for materials and labor. An increase in employment leads to an increase in demand for consumer goods. There is a wave of expansion of production and revenue growth, and more and more industries are involved in this process. And as a result, the growth in production volumes and net domestic product exceeds the initial investment. This phenomenon in the economy is called the “multiplier effect”, which manifests itself at the macro level, but depends on processes at the micro level, on decisions of owners who are guided by the future rate of return, bank interest, lending rate, economic expectations and risks, the effect of new technologies, etc. The state may also act as an investor, in which case a multiplier effect will also be observed.

The multiplier effect can also occur in the opposite direction: with a reduction in investment, a large-scale decline in production will be observed.

Keynes's multiplier is a coefficient that is equal to a fraction: in the numerator - one, and in the denominator the so-called MPS indicator (marginal propensity to save), therefore, the smaller it is, the higher the multiplier effect, this phenomenon is called the "thrift paradox".

Within the framework of the Keynesian concept, the Harrod-Domar economic growth model is known. The mechanism of economic growth in this model, as a factor in increasing supply and demand in the economy, is again enclosed in investment growth. Equilibrium economic growth is achieved when the aggregate demand and aggregate supply are equal (AD = AS), and based on the logic of the formulas, the investment growth rate should be equal to the product of the marginal productivity of capital and the marginal propensity to save.

Neoclassical theories of economic growth were formed in the first two post-war decades as a response to neo-Keynesian theories of growth with their conclusions about the inevitable instability of the growth of a market economy and the need for government intervention in the economy. Neoclassical models of economic growth as a research tool use the production function, which was proposed in 1928 by American scientists - mathematician C. Cobb and economist P. Douglas.

$$Y = A \times K^{\alpha} \times L^{\beta},$$

where Y – production volume;

L – volume of labor employed;

K – amount of capital employed;

α and β – coefficients of elasticity of products, respectively, by labor and capital;

A - coefficient of proportionality, or scale.

The most famous in classical theory was the model of Robert Solow, which allows to reveal the relationship of the three sources of economic growth - investment, labor force and technological progress. The influence of the state on economic growth is possible, according to neoclassicists, through its influence on the rate of savings and on the speed of technological progress.

The development of scientific and technical progress led to the inclusion of new factors in the model. The Tinbergen model is the most famous, including not only capital and labor, but also the rate of scientific and technological progress in the considered time period. J. Mead transforms Tinbergen's economic growth model into an equation of growth in which the overall growth rate of GNP is the sum of the growth rate due to capital, labor and technological progress. Thanks to a new version of the production function, the Ministry of Foreign Affairs managed to solve a very important problem of the possibility of the economy achieving steady balanced growth without government intervention.

Further we will show what factors limit investment activity in Russia according to potential and real investors (table).

Table

Ranking of factors limiting investment activity in the Russian Federation (compiled by the authors according to official data from Rosstat: source http://www.gks.ru/free_doc/new_site/business/invest/Graf-iap.htm)

Factors affecting investment in the Russian Federation according to a sociological survey	In% of the total number of organizations, according to a sample survey			Factor rank (descending)		
	2016	2017	2018	2016	2017	2018
Uncertainty of the economic situation in the country	61	57	62	1	1	1
Lack of equity	61	57	60	1	1	2
High inflation in the country	60	53	62	2	2	1
High percentage of commercial credit	56	53	54	3	2	4
Investment risks	50	51	58	4	3	3
Parameters of exchange rate policy in the country	48	43	52	5	5	5
Complex mechanism for obtaining loans for the implementation of investment projects	46	44	46	6	4	6
The economic situation in the world market	41	37	42	7	6	7
Price fluctuations in the global energy market	39	34	41	8	7	8
The existing tax regime for investment activities	33	32	39	9	8	9
Imperfect regulatory framework governing investment processes	27	29	34	10	9	10
Inadequate demand for products	27	23	23	10	10	11

Investors analyze the situation in accordance with the theory of rational expectations. Their activities are rational in terms of processes at the micro level, but may conflict with macroeconomic equilibrium. So, two factors - high inflation and a high percentage of commercial credit are two interrelated reasons. High inflation (we call it relatively high for Russia) is partly justified by the fact that this allows Russia to balance between this inflation rate and low unemployment. A high percentage of commercial credit also has its own macroeconomic explanation: a flood of cheap loans can lead to a return on investment and the depreciation of the national currency. The first limiting factor: the uncertainty of the economic situation in the country is most likely a factor that we can define as a low level of trust in the government, although this contradicts many objective economic parameters:

in Russia, at the macro level, equilibrium has been observed for quite a long time, in the tax sphere, state policy is predictable and stable, modern processes of digitalization of the economy are very actively and efficiently used by government structures, including fiscal ones, to ensure transparency and control of financial and tax flows.

From the point of view of determining the possibilities of the state investment policy, it is important not only to rank, but also to systematize the limiting factors in conjunction with theory and methodology (Fig.).

Such a systematization allows us to determine the instruments for regulating investments, as well as to seek compromise solutions between investor requests and the possibilities of customizing the economic system. A sociological study confirms the importance of institutional conditions in Russia to ensure increased investment, this is the potential that can be used [4].

The practical application of neoclassical models of economic growth based on the Cobb-Douglas function should also be guided by the law of diminishing returns of production factors (the law of diminishing returns), which has never been strictly proved, i.e. this approach is heuristic. This law says that with the expansion of one factor of production (in our case, investment in fixed assets) and keeping the remaining factors of production unchanged, the marginal product produced using this factor will begin to decrease from a certain stage. This is significant not only at the micro level for one business entity, but also investment business decisions will depend on previous investments of other business entities in the industry, which are characterized by high capital intensity. The law is applicable in the short term and for this technology. It does not apply to intellectual property objects that are transformed into intangible assets that can cause technological shifts in the industry, and, as a result, shifts in the production function. This conclusion is confirmed by the outstripping growth of the so-called "Digital economy", based on the introduction of "digital intellectual" innovations and on the capture of a new market associated with the technologies of the fourth industrial revolution and new economic patterns. This is one of the practical conclusions from the theory, which should determine priorities in state investment policy and should be a guide for business.

Conclusion. Thus, this study demonstrates the need for the interconnection of theory, methodology and practice in economic research. The polymethodological approach allows to choose tools for solving economic problems, in particular the problem of activating investments. The limitedness of the theory of rational expectations in making decisions about capital investments, which contradicts macroeconomic proportions, is shown. Sociological studies of investment decisions - is the factual, empirical material, the analysis of which on the basis of modern economic theory and methodology allows us to identify reasonable trends in state investment policy.

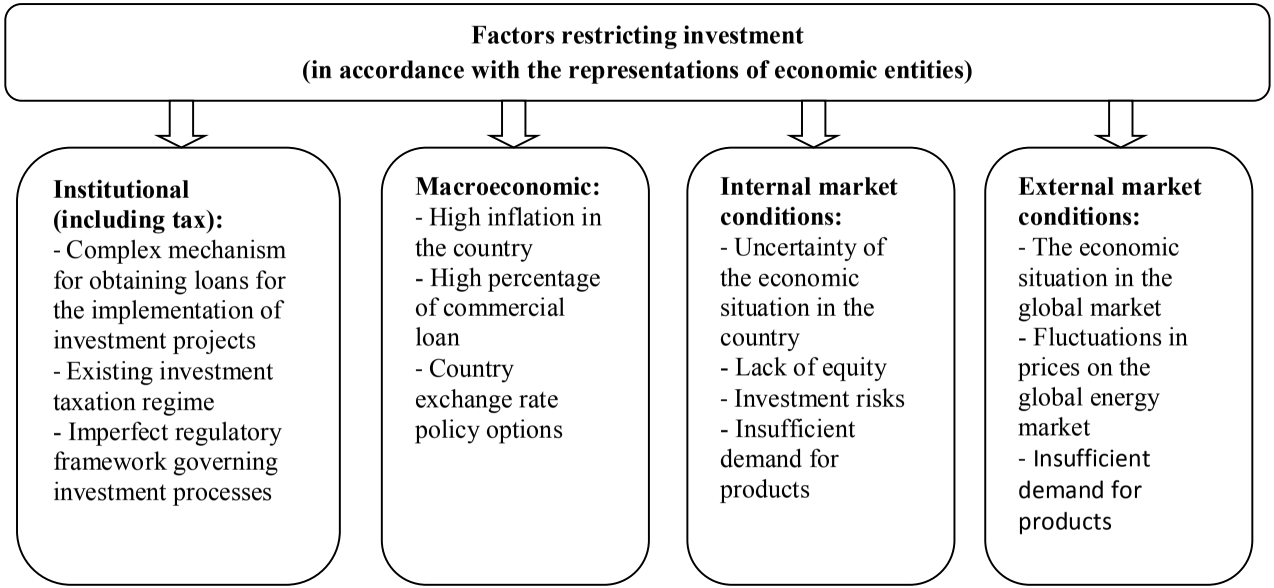

Fig. *Systematization of factors limiting investments in accordance with modern theoretical and methodological approaches (developed by the authors)*

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信贷和小额信贷在线欺诈
ONLINE FRAUD IN CREDIT AND MICROFINANCE

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抽象。 所选主题的相关性取决于是否存在以下问题：保护公民的个人数据，使用文件副本，互联网电信网络中的个人数据以及在盗窃，丢失的文件，保护文件时订立贷款协议时的欺诈行为 小额信贷组织在处理个人数据中获得消费者贷款的公民权利。 使用呼叫中心的欺诈犯罪有所增加。

关键词：身份证明，贷款，信用，诈骗者，拘留场所欺诈，假护照，小额信贷组织，个人数据。

Abstract. *The relevance of the chosen topic is determined by the presence of problems of protecting the personal data of citizens, fraudulent actions when concluding a loan agreement using copies of documents, personal data in the Internet telecommunication network, as well as stolen, lost documents, protecting the rights of citizens in the processing of personal data by microfinance organizations for obtaining a consumer loan. There has been an increase in fraudulent crimes using call centers.*

Keywords: *identification, loan, credit, scammers, fraud from places of detention, fake passport, microfinance organizations, personal data.*

According to the Central Bank of Russia, the number of fraudulent transactions through personal bank cards of customers is increasing, in 2018 transfers totaling 1.38 billion rubles were made. The Prosecutor General of the Russian Federation, Yuri Chaika, said that in 2018 there was an increase in such operations by 44%.

According to Alexey Sizov, head of the Anti-Fraud Center for the Jet Infosystems Security Center, any manipulation of a credit card (cash withdrawal) without a PIN code is doomed to failure. In case of loss or abandonment by a client of a credit card in a bank terminal, fraudsters have no chance to use this card. To ensure this, there are a number of safety measures, in the event of an attempt to re-apply

for withdrawing funds, the ATM will request a PIN code again, also if the card that is in the ATM for more than 30 seconds does not carry out operations, the device simply does not return the card back.

But fraudsters who keep up with technological progress do not have to use an ATM and know the pin code to complete their criminal plans. In most cases, they call the customer's mobile numbers and present themselves as bank security officers or managers, report that unauthorized or suspicious transactions are being performed on the customer's card, and if the client didn't carry out such manipulations, but he (the client) certainly didn't perform them, to cancel the operation they ask for the card details, including login, password and other information on the basis of which the theft of funds will be made in the future.

In order to make a money transfer, scammers use certain schemes, such as direct transfer from card to card, transfer through exchanges, virtual wallets, work with an online casino or a subscriber's account of a telecom operator, after which money is transferred to another card and cashed out [6].

According to experts in Russia, the volume of "discharge" of personal data from non-profit organizations, in particular microfinance organizations (MFIs), is increasing. At the same time, not only information about the person, but also copies of passport and SNILS documents are subjected to illegal transfer.

Experts explain the increase in the theft of personal data in these organizations by the fact that the owners and management of such companies do not pay enough attention to ensuring the safety of personal data, due to the high cost of technical equipment. The rank-and-file composition of company employees often changes due to the minimum requirements for functional duties and low salaries. Also, due to changes in the legislation of the Russian Federation in the field of microfinance activity, limiting the multiplicity of accrued interest, lowering the interest rate of accrued interest, the profit of organizations is reduced, the activity becomes unprofitable. They are leaving the market, and the fate of customer databases remains unknown.

It is easier for companies to refer to an external attack and not admit that the leak was made by their own employees. For attackers, finding an informer inside a company is often much easier and cheaper than building a complex technical attack.

As a rule, personal information is most often sold by company employees themselves. This can be both relatively high-level customer service employees with access to the entire customer base, and IT service employees, who often have unlimited authority and can copy, in principle, any corporate data. There are times when workers become victims of fraud within organizations [1].

Another method of fraud in this area is the use of personal data of citizens when concluding a loan agreement in microloan issuing offices and on the Internet.

The capture of other people's personal data of citizens on the Internet sometimes occurs through the fault of the owners of personal data. People themselves provide information about themselves, as well as their photos with 2-3 passport pages on certain sites for the purpose of registration, or send each other via social networks when buying goods on the Internet and, of course, when receiving loans online. (the round table "Fraud as the realities of life", February 20, 2019 at the SRO "MiR" [3].

Improving the technical means of interaction between people in the form of various communication devices (mobile phones, tablets) allows to remotely carry out certain actions, purchases, money transfers.

An analysis of the materials of the GUUR of the Ministry of Internal Affairs of Russia shows that fraud using mobile phones and other electronic devices is growing every year. Most of the telephone fraudsters are already in prison, to prosecute, which is very difficult due to the difficulties of documenting and collecting evidence for such crimes. Telephone scammers from places of imprisonment deceive unsuspecting citizens.

Each penitentiary body has operational units. All prisoners are constantly monitored by prison staff and video surveillance systems. At the same time, many prisoners have mobile communications, and some even have laptops or tablets with Internet access, which are prohibited by the relevant rules of the Criminal Executive Code of the Russian Federation [4, p. 71].

Currently, on the Internet, in any search system, you can enter "Buy a passport scan" or "Buy a photo with a passport in your hands" [7], and go to a web page where for a small amount anyone can buy not only a passport scan, within 100 rubles, but also any other documents: rights, Title, SNILS, TIN. Probably, the source of such resources is unauthorized hacking of databases of large organizations.

Having thus obtained the necessary copies of documents, it is not difficult for fraudsters to obtain an online loan by carrying out manipulative actions in various MFIs or even in credit organizations, even while in prison.

In accordance with Art. 21 of the Federal Law of July 27, 2006 № 152-ФЗ "On Personal Data" [5] (hereinafter - ФЗ-152), in cases where the operator (creditor) becomes aware of the unlawful processing of personal data of the client, this may be the case the appeal of the subject of PD, its representative or authorized body, the operator is obliged to block the processing of these data.

The requirements for the request of the subject of personal data contain personifying information about the subject of personal data and details indicating the processing of the data of the subject - this may be information about the contract: number, date of conclusion, any signs, verbal designations and other information indicating the processing of data by the operator.

But the legislator does not specify whether it is enough to provide information about the passport data of the person, indicating the relationship between the entities. In most cases, a citizen may not know the contract number or other data when committing fraudulent acts against him. There is also no specification of the list of documents required to block or stop processing personal data. These circumstances can be used to limit rights, as well as abuse of rights.

Currently, for violation of legislation in the field of personal data in the Russian Federation, there is only one article with a special corpus delicti - the Code of the Russian Federation on Administrative Violations of December 30, 2001 N 195-ФЗ, Art. 11/13. "Violation of the legislation of the Russian Federation in the field of personal data" [2] (hereinafter - CAO). The offense of this article is that the operator does not fulfill certain conditions laid down by law, such as processing personal data without the consent of the subject of personal data. This article does not contain separate compositions or qualifying features for persons who steal, distribute, sell personal data from credit organizations or government institutions, which entails significant harm to the consumer, since in the event of leakage of such information a person may lose pension or deposit savings.

There are also other legal provisions aimed at protecting personal data, such as Article 5.39. CAO of the Russian Federation Refusal to provide information, Art. 19.7. CAO of the Russian Federation Failure to provide information, Art. 137 of the Criminal Code of the Russian Federation Violation of privacy. Art. 140 of the Criminal Code of the Russian Federation Refusal to provide information to a citizen, Art. 272 of the Criminal Code of the Russian Federation Illegal access to computer information. The listed articles are aimed at protecting rights or authorities when handling general information about any information or about a person, and not at protecting personal data.

Summarizing the foregoing, according to the author, there is a request from the company to ensure the protection of personal data in the Russian Federation. It is necessary to carry out outreach on financial products provided by various organizations, security measures when taking actions on the Internet. Credit and microfinance organizations should also be interested in and take an active part in this, since security and mutually beneficial relations between participants depend on an understanding of the producing actions and responsibility for these actions of the borrowers. In order to improve the institution of protecting the rights and interests of consumers at the level of regulatory authorities, it is advisable to develop internal documents regulating the improvement of ways to protect personal data, the process of identifying a client, blocking Internet resources containing illegally placed personal data.

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工业安全领域的采矿工程师培训过程的实践组成部分

PRACTICAL COMPONENT OF THE PROCESS OF TRAINING OF MINING ENGINEERS IN THE FIELD OF INDUSTRIAL SAFETY

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抽象。技术大学专家的培训质量取决于学生实践培训的质量和组织。因此，准备解决工业安全领域中复杂问题的专家需要在现有采矿企业中发展实践技能。

介绍了组织针对“采矿”专业“技术安全与采矿”的二年级学生组织教育实践的经验。该专业的教育具有良好的理论基础，并通过对准军事救援队和采矿企业的教育基础中的学生进行了实践培训而得到加强。

实验证明，在3至6个学习课程中，培训实践是向生产实践转变的重要且必要的过渡，并且是对专业学科的自觉理解和实际应用的基础。

关键词：教育过程，技术大学，高等教育，采矿，采矿工程师，教育实践，工业安全，准军事救援队。

Abstract. *The quality of training of specialists of technical universities depends on the quality and organization of practical training of students. Therefore, specialists who are ready to solve complex problems in the field of industrial safety need to develop practical skills at existing mining enterprises.*

The experience of organizing educational practice for second-year students studying in the specialty "Mining" specialization "Technological safety and mining" is presented. Education in this specialty assumes a good theoretical base, reinforced by the practical training of students in the educational base of paramilitary rescue teams and mining enterprises.

It has been experimentally proven that training practice is an important and necessary transition to production practice at 3-6 courses of study and the basis for a conscious understanding and practical application of the disciplines of specialization.

Keywords: *educational process, technical university, higher education, mining, mining engineer, educational practice, industrial safety, paramilitary mine rescue team.*

The quality of training of specialists of technical universities directly depends on the quality and organization of practical training of students. In recent years, the normative documents regulating the educational process in higher education, regulate to strengthen the practical component and universities, to one degree or another, follow these requirements. However, there are many reasons that impede this process. In our opinion, the main ones are the lack of administrative, organizational, material and technical resources in the educational institution, as well as the complexity of the relationship between the employer and the university.

Higher educational institutions of Russia, which train specialists for the objects of the mineral resource complex, are most interested in the maximum adaptation of graduates to work in the real conditions of mining enterprises. The specifics of work at most mining and mineral resources facilities is that the technology of extraction, transportation, processing and storage of minerals is associated with increased risks, both for employees of the enterprise and for the environment.

An increase in the rate of extraction of minerals, large depths of extraction, the release of hazardous gases, sudden changes in rock pressure, complex geology - these and other factors lead to higher costs at enterprises to ensure industrial safety measures and the need to have professional staff in the relevant direction. The need for production in such workers has led to the formation of a separate educational area for the training of specialists in the field of industrial safety.

In 2010, there was a reorganization of paramilitary mountain rescue units (hereinafter referred to as the PMRU), paramilitary mine rescue teams (hereinafter referred to as the PMRT) and their transfer to the structure of the Ministry of the Russian Federation for Civil Defense, Emergencies and Disaster Management (hereinafter referred to as the MOE of Russia) to ensure emergency rescue and technical works at mining facilities, underground construction, as well as metallurgy and energy facilities.

Thus, a new area of specialist training was aimed at training personnel ready to solve a set of tasks in the field of industrial safety: first aid; search and rescue of people at mining sites; normative regulation, prevention, forecasting and minimization of the consequences of emergencies at the facilities for the extraction (processing) of coal, oil shale, ore, non-metallic, placer mineral deposits and construction and mining facilities.

As part of the training of such specialists for mining universities in Russia, the Federal State Educational Standard for Higher Education (hereinafter - FSES HE) has been in effect since 2011, which provides for the training of students in 12 specializations of mining engineers: “Underground development of reservoir deposits”; “Underground mining of ore deposits”; "Open cast mining"; Mine Surveying; "Mine and underground construction"; "Mineral processing"; "Explosive handling"; Mining Ecology; "Mining machines and equipment"; "Electrification and automation of mining"; "Transport systems of mining"; “Technological safety and mining”.

Until this time, in traditional mining specialties, such as Underground Mining of Mineral Reserves, Underground Mining, Opencast Mining, Explosive handling, industrial safety and mining operations were considered within the disciplines of the professional cycle. Since 2011, the training of specialists in industrial safety and mining operations has been carried out in accordance with a new specialization - “Technological safety and mining”.

As an example of training specialists in the field of mining safety, we propose to consider the program for organizing and conducting educational practice for second-year students in the specialty "Mining" specialization "Technological safety and mining". The program was implemented by us on the basis of St. Petersburg University of the State Fire Service MOE of Russia (hereinafter - the University) from 2013 to 2018.

Training for this specialization involves a solid theoretical foundation based on the study of disciplines in the field of mining, and the strengthening of the practical training of students in the educational base of paramilitary mine rescue teams and mining enterprises.

Therefore, educational and methodological support for this specialization, including curricula, work programs of disciplines, practice programs, was developed taking into account practice-oriented training in conjunction with the employer - the leadership of the Federal State Unitary Enterprise "Militarized Rescue Unit" (hereinafter - FSUE "PMRU) for students from first to sixth year.

The data on the practical training course for the period of study in the specialty "Mining" specialization "Technological Safety and Mine Rescue" from the first to the sixth year are given (Table 1).

The order of practical training for the period of study in the specialty "Mining" specialization "Technological safety and mining"

In this article, we give an example of the organization of the educational practice of second-year students as a practice preceding the cycle of production practices. The educational practice is called “Mining and geodetic familiarization practice” and its purpose was to consolidate the theoretical knowledge gained in the framework of the curriculum in the disciplines: “Geodesy”, “Introduction to the profession”, “Rock physics”, “Underground mining of mineral deposits”.

The “mining and geodetic familiarization practice” was constructed as follows: in the first week, students received practical skills in the field with geodetic instruments, learned to process the measurement results at the university’s training sites, and then went to get acquainted with the work of a paramilitary mine rescue team that ensures the safety of mining facilities production.

Such a detachment was the PMRT Pechora Basin branch located in the city of Vorkuta, Komi Republic. At this educational base, students underwent practical training, which included study tours to the mining enterprises of the city of Vorkuta - mines, opencasts, objects of the surface complex.

Table 1

Type of practices	Training Course	Duration of internship	Position of student - trainee
Training practice The practice of obtaining primary professional skills, including primary skills of research activities			
Mining and geological exploratory practice	1 year	5 year	student
Mining and geological exploratory practice	2 year	5 year	student
Training practice The practice of obtaining primary professional skills			
First field practice	3 year	5 year	sampler apprentice
Second field practice	4 year	5 year	respirator apprentice
Third field practice	5 year	4 year	part-commander apprentice
Training practice Undergraduate practice			
Undergraduate practice	6 year	5 year	student

For training and retraining of mine rescuers in Russia, as well as junior and middle management personnel of auxiliary mine rescue teams at the mine rescue team, there is a training course center, training mine and training ground, equipped in accordance with the PMRU Equipment Sheet. Such equipment, proven training methods and the teaching staff are the necessary conditions for high-quality training of students in this specialization.

Then a practice program was developed, which included the main elements of the preparation of auxiliary rescue teams, and also took into account the requirements of FSES HE, regulatory documents of the Ministry of Science and Higher Education of the Russian Federation and local acts of the University. Moreover, the training of students sometimes coincided with the flows of production groups of auxiliary mine rescue teams, which created the pedagogical effect of the student group participating in the general real process of preparing mountain rescuers.

In addition, the peculiarity of the construction of on-site training practice was the initial acquaintance of students with professional methods of work of mine rescue departments, the acquisition of skills in working with personal protective equipment and visiting mining enterprises. Thus, even before the start of production practices, students got an idea of the work of mine rescue teams and coal mines.

In the process of "Mining and geodesic exploratory practice", students first put on special clothing with personal respiratory protection, went down to mines (hazardous in gas and dust, sometimes in emissions and impacts of coal seams) to a depth of almost one kilometer in a huge double decker on a large speed We visited the existing treatment and tunneling faces, overcame several kilometers underground using specialized vehicles, observed the operation of multi-ton mechanisms and equipment, examined the types of supports, and saw various examples

of the manifestation of rock pressure at great depths. For second-year students, all this was a stressful situation, but it made it possible to get acquainted with the nature of mining and strengthen confidence in the chosen profession.

The rationale, the structural-logical scheme of compiling the program of practice and the methodology of the study group is beyond the scope of this article and requires a separate consideration. In the framework of this article, we give an example of a one-day schedule from the "Mining and geodetic familiarization practice" (Table 2).

As can be seen from Table 2 on the example of one day, the logic of practical development of knowledge obtained in the framework of theoretical training is traced; exercises and training are aimed at comprehensive practical training of students for preventive and rescue operations at a mining enterprise.

The group of students was divided into subgroups of 5 people - according to the type of full-time department of the PMRU, with the allocation of the senior group - an analogue of the commander of the department of PMRU.

Students were trained to work in a respirator, its maintenance; learned to perform exercises with the included respirator in a heat chamber, a smoky space; learned to move in tight spaces, under artificial rubble; worked with instruments for determining the speed and temperature of air flows in mine workings; Learned the techniques for installing insulating and parachute partitions; worked with mine air and dust samples in the detachment's measurement laboratory; met with fire fighting equipment and machinery. In the unit's classrooms, students worked with instruments, equipment, and specialized software installed for calculating mine parameters in all PMRU units.

Table 2

"Mining and geodetic familiarization practice"

Class Schedule

Practice day	Activities / Activities for a day	Number of hours		Teacher, location
		theory	practice	
7 day	**1st group**			
	Familiarization with laboratory equipment, the procedure for sampling mine air. Practical implementation by each student of the analysis of samples of air, a chemical absorber and oxygen, presentation of analysis results	2	3	Full name Testing Laboratory
	Visit to the sports complex		1	Full name
	2nd group			
	Exercise in the respirator R-30 in the training mine: dressing in overalls, putting on and a quick check of a respirator, inclusion in a respirator		1	Full name Training center, training mine

	Walking along the horizontal workings of 40 minutes, including 10 minutes of rest. Walking on inclined workings - 40 minutes, including 10 minutes of rest. Rest at the heat chamber - 20 minutes. Familiarization with the conditions of thermal training in the heat chamber of the training shaft at normal temperature. The duration of work in the chamber is 20 minutes.		2	Full name Full name Training mine of the Vorkuta PMRT
	Filling small-capacity cylinders with gaseous oxygen using booster compressors. Testing the methods of checking breathing apparatus by nodes and in assembled form.		2	Full name Full name Hardware room of the Vorkuta PMRT
	Hygiene procedures		1	Full name Sports complex
	3rd group			
	Preparation for exercise in a respirator P-30: -the effect of various factors on gas exchange and breathing of a person included in a respirator; -performance of an annual audit; -UKP-5, Phantom devices for checking panoramic masks; -Dismantling, disinfection and assembly of respirators; -check of respirators at UKP-5, IR and panoramic masks at Phantom		5	The part-commander of the training center; Training Center
	Visit to the sports complex		1	Full name

Conclusions:

1. Training practice in an on-site familiarization mode for existing mining enterprises and work on the training base of a paramilitary mine rescue team is an important and necessary transitional stage to production practice for 3-6 year students in the specialty "Mining" specialization "Technological safety and mining ".

2. The immersion of students from the 2nd year in the professional environment of rescuers and miners increases their interest in the chosen profession and allows us to understand the meaning and scope of practical application of special disciplines.

Fragments of training are presented in figures 1-4:

Fig. 1. *Briefing the subgroup before visiting the training mine*

Fig. 2. *Depression shooting in the mine workings*

Fig. 3. *Training in a respirator in a smoky workout. Monitoring the operation of a subgroup using a portable explosion-proof thermal imager*

Fig. 4. *Training in a respirator to overcome obstacles in a confined space*

主要教学术语的简要概述（以帮助一位年轻的数学老师）
A BRIEF SUMMARY OF THE MAIN PEDAGOGICAL TERMS (TO HELP A YOUNG TEACHER OF MATHEMATICS)

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抽象。 本文致力于研究现代教育学的基本术语和定义，并包含有关教育过程的基本原理和方法，课程分类和工作计划的准备的有用的教学材料和方法论材料。

关键字：基本的教学术语和概念，教育的教学原则和方法，课程分类，工作计划的设计。

Abstract*. The article is devoted to the study of basic terms and definitions of modern pedagogy and contains useful didactic and methodological material on the basic principles and approaches to the educational process, the classification of lessons and the plan of preparation of work programs.*

Keywords*: basic pedagogical terms and concepts, didactic principles and approaches to education, classification of lessons, design of the work program.*

"Learn as if you are constantly lacking your knowledge,
and as if you are constantly afraid
to lose your knowledge»
Confucius

One of the fundamental documents of normative-legal base in the field of educational services "Professional standard of the teacher" reglamentary as a basic component of the professional activities of school teachers of mathematics have the necessary knowledge, "theory and methods of teaching" the subject [18, C. 21]. This task is especially important for young teachers of mathematical disciplines who are just beginning their pedagogical activity. It is they who will take the baton from their mentors-teachers of the older generation and continue the high mission of teaching students. The professional sphere of activity of teachers of mathematics is wide and diverse. It includes a huge information Arsenal of didactic tools and forms of scheduled classes, the development of educational and program documentation in accordance with the latest generation of GEF and

its design, the effective use of modern pedagogical educational technologies, self-search of relevant pedagogical experience, etc. In order to solve all the pedagogical tasks the author of the article worked out the issue of selection, classification and systematization of pedagogical information on various aspects of professional activity to help the novice teacher of mathematics. The material is structured according to individual basic components of modern pedagogy and includes the following sections:

1. Basic pedagogical terms in abbreviations;
2. Basic concept;
3. Approach to learning;
4. The system of didactic principles of modern pedagogy;
5. Classification of lessons;
6. The structure of the lesson in the implementation of the system-activity approach;
7. Extracurricular (extracurricular, extra-curricular learning) ;
8. Quality assessment systems of modern education;
9. Design Of the working program in mathematics in accordance with the requirements of GEF LLC;
10. Types of AFO (Alternative forms of education).

Consider them in detail in stages:

1. **Basic pedagogical terms in abbreviations** (Table 1).

The main teaching concept in the cuts

Table 1

Designation	Decryption
UUD	Universal learning activities. In a broad sense, the term "universal learning activities" means the ability to learn, i.e. the ability of the subject to self-development and self-improvement. In a narrower sense, the term can be defined as a set of ways of action of students, ensuring their ability to independently acquire new knowledge and skills, including the organization of the process. As the main types of universal educational activities, the developers of the standard distinguish personal, regulatory, cognitive and communicative UUD. In the first place now is not the result of the training itself in the form of some specific knowledge in certain subjects, and the ability to learn, ie, obtaining knowledge.
GEF IEO, THE STANDARD THE, GEF SOO	Federal state educational standard of primary General education (grades 1-4), Federal state educational standard of basic General education (grades 5-9), Federal state educational standard of secondary General education (grades 10-11). The main legal documents defining the state policy in the field of school education (grades 1-11). The standard puts forward three groups of requirements: requirements for the results of the development of the basic educational program (personal, metasubject, subject); requirements for the structure of the basic educational program; requirements for the conditions of implementation of the basic educational program.
BRAID	Control and evaluation tools are a set of control and evaluation tools and materials that allow you to check the formation of competencies in the process of mastering the basic professional educational program [14].
FOS	Fund evaluation tools-a set of evaluation materials, as well as a description of the forms and procedures designed to determine the level of achievement of students set learning outcomes. Levels of competence formation are the planned results of training in each discipline (module) and practice - knowledge, skills and (or) experience of activity characterizing the stages of competence formation and ensuring the achievement of the planned results of the development of the educational program [17].
EOR	Electronic educational resources are educational materials for play which used electronic devices in the most General case for e-learning resources include educational videos, and audio for playback which is quite conventional tape recorder or CD player. The most modern and effective for the formation of EOR are reproduced on a computer and are called Dor (digital electronic resources), because the computer uses digital recording/playback. However, audio / video compact discs (CDS) also contain recordings in digital formats, so that the introduction of a separate term and abbreviation of DCS does not give noticeable advantages. Therefore, following the interstate standard GOST 7.23-2001, it is better to use the General term "electronic" and the abbreviation EOR. The effectiveness of the use of ESM is provided by the following features: multimedia, interactivity, modeling. There are conditionally passive, active, activity and research forms of user interaction with EOR [15].

Designation	Decryption
COR	Digital educational resources are a special case of EOR, i.e. they are educational materials, which are reproduced using a computer, as a computer uses digital recordings / reproductions [15].
ZUN	Knowledge, skills (requirements of traditional school).
KIM	Control and measurement materials are a kind of evaluation tools aimed at two main processes: control and measurement of the formation of educational results [16].
ISUD	Individual style of educational activity of the teacher. Style activities in a pedagogical sense – this is due to the typological features of a sustainable system of ways, which develops at the person, aspiring to best implement this activity individually-a kind system of psychological tools to which consciously or spontaneously run a man in order to better balance their typologically conditioned by the individuality subject external conditions of activity. Presented in a simple style definition of activity emphasizes the role of the individual identity of a combination of techniques and methods when performing activities [11].
IOM	An individual educational route is a personal way of compensating for difficulties in learning, and then realizing the personal potential of the child [26].
KOS	Competence-oriented tasks are a type of educational task with a specific structure, the implementation of which requires the use of existing or the development of new subject and General knowledge and skills in order to solve the problem situation built on the subject and life material [21].
PMO	PMO-passive methods of teaching, for example, a lecture: the teacher dominates, and the student is passive.
AMO	AMO-active teaching methods. Here, the teacher and the student act as equal participants in the lesson, the interaction takes place on the vector teacher-student, for example, an epigraph, a video fragment, a rebus, a riddle, clarifying goals, expectations, fears
IMO	IMO - interactive teaching method. The most effective methods in which students interact not only with the teacher, but also with each other. Interaction vector: teacher-student-student, for example, project method, brainstorming, debates, interviewing different characters

2. **Basic concepts** (Table 2).

Basic concept

Table 2

Name	Content
Competences	Competences - is the willingness (ability) of the student to use the acquired knowledge, educational skills, as well as ways of activity in life to solve practical and theoretical problems [2].
Competence	Competence - possession, possession by the student of the relevant competence, including his personal attitude to it and the subject of activity. Competence – already held the quality of personality (set of qualities) student and minimal experience in a given area [2].
Key educational competencies	Khutorsky A.V. identifies the following key educational competencies: value-semantic competence, General cultural competence, educational and cognitive competence, information competence, communicative competence, social and labor competence, competence of personal self-improvement. In particular, mathematical competence is the ability to structure data (situation), to isolate mathematical relations, to create a mathematical model of the situation, to analyze and transform it, to interpret the results. In other words, the mathematical competence of the student contributes to the adequate application of mathematics to solve problems arising in everyday life [19].
Technological map of the lesson	The concept of technological map came to education from industry. Technological map – technological documentation in the form of a map, a sheet containing a description of the manufacturing process, processing of a certain type of product, production operations, equipment used, the time mode of the operation. The technological map in a didactic context represents the project of educational process in which the description from the purpose to result with use of innovative technology of work with information is presented. This is a modern form of teacher-student interaction planning. The technological map has the following distinctive features: interactivity, structuring, algorithmicity when working with information, manufacturability and generality. The technological map of the lesson is a method of graphic design of the lesson, a table that allows you to structure the lesson according to the parameters chosen by the teacher. Such parameters can be the stages of the lesson, its objectives, the content of educational material, methods and techniques of organization of educational activities, the activities of teachers and students, the result (formed UUD). The structure of the flow chart includes: the name of the lesson stage, the objectives of the lesson stage, the content of the stage, the activities of the teacher, the activities of students, forms of work (individual, frontal, pair, group), the result (formed UUD, product) [20].
Quest	Quest (eng. quest), or adventure game (persistent. adventure game) — one of the main genres of computer games, which is an interactive story with the main character, controlled by the player [12].
Propedeutics	Semiology (gr. προπαιδέυω, pre-teach) - introduction to any science, preliminary introductory course, systematically set out in a concise and elementary form [9]..
Reflection	Reflection (from late lat. reflexio "turning back") is the subject's attention to himself and to his consciousness, in particular, to the products of his own activity, as well as any rethinking of them [10].

Name	Content
Goal-setting	It is the ability to set learning goals and objectives based on what is already known and learned by students, and what is not yet known [27].
Multimedia	Multimedia is an interactive (dialogue) system that provides simultaneous work with sound, animated computer graphics, video frames, static images and texts [28].
Interactivity	Interactivity (from the English. interaction - "interaction") - a concept that reveals the features of interaction in communications-is used to characterize the properties of information and telecommunication systems, programming, as well as social Sciences – such as sociology, psychology, pedagogy. Interactivity can characterize any system focused on interaction with someone or something. For example, interactive product design is a design that provides a variety of user interaction with the purchased product [29].
Media library	Media library (eng. Media "carrier" +Greek. θήκη "storage") - the collection of books, educational and methodical manuals, video films, sound recordings, computer presentations, and technical support for creating and viewing facility: computer, video camera, tape recorder, VCR, projectors [4].
Mnemonics	Mnemonics (translated from Greek τα μνημονιχα) - the art of remembering. Mnemonics-a set of special techniques and methods that facilitate the memorization of the necessary information and increase the amount of memory through the formation of associations. Mnemonics provides a deep understanding of the material, as the methods of memorization allow you to create vivid imaginative illustrations for concepts and definitions [5].
Interactive whiteboard	Interactive whiteboard (English. Interactive Whiteboard (IWB) is a large interactive screen in the form of a white magnetic marker Board. Interactive whiteboard can be represented as a stand-alone computer with a large touch screen, and connected to a laptop device that combines a projector and touch panel. Interactive whiteboards are used in classrooms, meeting rooms, halls for group classes, rooms for distance learning and other areas [6].
Reproduction	Reproduction-reproduction of works of art by photography, cliche (copying) or manual reproduction of the original. The main goal is to preserve the authenticity of the object, as accurately as possible to convey information about it and its appearance [7].

3. **Approaches to training** (Table 3).

Approach to learning

Table 3

Approaches	Characteristic
System-activity	This is an approach to learning, in which the child himself gets knowledge in the process of their own educational and cognitive activity. Technology system-active approach: motivation (self-determination) to academic activity; actualization of knowledge and retention difficulties in activities; problem definition(learning tasks); build the project the way out of difficulty and realization of the built project; the primary binding to a speech in the external speech; independent work with self-test according to the standard; inclusion in the system of knowledge and repetition; reflection of learning activities [1].
Competence	Competence approach is a set of General principles for determining the goals of education, selection of educational content, organization of the educational process and evaluation of educational results. These principles include the following provisions: the meaning of education is to develop students ' ability to solve problems in various fields and activities through the use of social experience; element, which is the own experience of students; the content of education represents didactically adapted social experience of solving cognitive, ideological, moral, political and other problems; the meaning of the educational process is to create conditions for the formation of trainees ' experience of solving cognitive, communicative, organizational, moral and other problems that constitute the content of education; evaluation of educational outcomes is based on the analysis of the levels of education achieved by pupils at a particular stage of training [23].
Problem-search	Problem-search method of teaching is often used in the formulation of research tasks by the teacher. It is characterized by the fact that the content of educational material is assimilated by students in the process of resolving specially created problem situations. This method involves the use of a chain of sequential techniques: creating a problem situation; organizing a collective discussion of possible approaches to its resolution; choosing a rational way to solve the problem; summarizing the results; forming conclusions [3].
Personality-oriented	Personality-oriented training-training in which the objectives and content of training, formulated in the state educational standard, training programs, acquire personal meaning for the student, develop motivation to learn. On the other hand, such training allows the student, in accordance with their individual abilities and communication needs, the ability to modify the goals and results of training. Personality-oriented (personality-activity) approach (Learner-centred approach) is based on taking into account the individual characteristics of students, who are considered as individuals with their own characteristics, inclinations and interests [12].

4. **The system of didactic principles of modern pedagogy** (Table 4).

The system of didactic principles of modern pedagogy

Table 4

Principle	Outline
Unity of theoretical and practical training	Connecting theory and practice into one.
The principle of dialogism	The ability to build a dialogue, Dialogic communication skills, tolerant attitude to the opinions and views of colleagues, the ability to distinguish the problem from the General situation, choose the best way to solve, predict and analyze the results
The principle of applied and practical direction in teaching mathematics	Focus on solving professional problems
Implementation of interdisciplinary relations	Study several subjects in one lesson
Principle of activity	The student is aware of the content and forms of their learning activities, accepts the system of its norms and participates in their improvement
Principle of continuity	Continuity between all levels of education at the level of pedagogical technologies, content and methods, taking into account age, personal and psychological characteristics of the child
The principle of integrity	Formation of students ' holistic and systematic understanding of the world, in particular, of nature, society, the world of activity, the role and place of each science in the system of Sciences
The minimax principle	The school should offer the student the opportunity to master the content of education at the maximum level for him and at the same time ensure the assimilation of this content at the level of a socially safe minimum
The principle of psychological comfort	The removal of most of the stress-forming factors of the educational process, the creation of a friendly atmosphere, the implementation of the idea of cooperation between teacher and student, the development of dialogue forms of contact, the student must experience academic success, teaching students on the emotions of joy, to prevent, not to punish ignorance
The principle of variability	Formation of students ' skills to consider possible options and adequate decision - making, if necessary, choice
The principle of creativity	Concentration of attention on the creative beginning in educational process, acquisition by pupils of own experience of creative activity
The principle of consistency, scientific and accessibility of the material	The presented material should be systematized and classified, scientific and understandable
The principle of logical connection between the different sections of the course	The material should be presented in a strict sequence, the subsequent chapters should be set out after the previous ones.
The principle of development of motivation to self-determination	During the lesson it is necessary to create motivation for self-education of schoolchildren [24].

5. **Classification of lessons** (Table 5).

Classification of lessons

Table 5

Lesson discovery of new knowledge
A lesson of formation of abilities and skills
Lesson application of knowledge and skills
Lesson generalization and systematization of knowledge
Lesson verification, evaluation and correction of knowledge and skills
Combo lesson
Lesson reflection
Lesson General methodological orientation
Lesson developmental control

6. **The structure of the lesson in the implementation of the system-activity approach** (Table 6).

The structure of the lesson in the implementation of the system-activity approach

Table 6

1. Organizational moment. Motivational moment.
2. Checking homework.
3. Actualization of knowledge and the fixing operation difficulties.
4. Setting goals and objectives of the lesson. Motivation of educational activity.
5. Assimilation of new knowledge and ways of action.
6. PE.
7. Control and self-control of knowledge and modes of action.
8. Inclusion in the knowledge system and repetition.
9. Reflection of educational activities in the classroom, summing up.
10. Homework information.

7. **Extracurricular (extracurricular, extracurricular) forms of education** (Table 7).

Extracurricular (extracurricular, extra-curricular learning)

Table 7

Seminars
Practicums
Open classroom
Excursions
Math clubs
Homework
Consultations
KVN
Creative indoor activities
Individual lesson

Search and research tasks
Math puzzles and crosswords
Mathematical Olympiads, conferences, competitions
Research and experimental activities (experiments, observations)
Creative tasks [25].

8. **Systems for assessing the quality of modern education** (Table 8).

Quality assessment systems of modern education

Table 8

Federal level:
OGE (GIA-9).
EXAM (GIA-11).
National education quality assessment studies (NICS).
All-Russian verification work (VPR).
International study.
Research of professional competences of teachers.
Regional, municipal and intra-school levels:
SOKO in school education is the certification of students after the ninth and eleventh grades, including the basic state exam (OGE), the unified state exam (use), as well as intermediate certification of students in grades 2-8, 10.
Regional control work.

9. **Design of the Work program in mathematics in accordance with the requirements of GEF LLC** (Table 9).

Design Of the working program in mathematics in accordance with the requirements of GEF LLC

Table 9

Basic sections	Characteristic
1. Explanatory note.	This section specifies the General objectives of basic General education, taking into account the specifics of the subject, the course, emphasizes the novelty of this program, its difference from similar programs, indicates in what system of textbooks or a complete subject line of textbooks is supposed to implement this program. This section clarifies and expands the system of basic national values stated in the concept of spiritual and moral development and education of the individual citizen of Russia: patriotism, social solidarity, citizenship, family, work and creativity, science, traditional Russian religions, art and literature, nature, humanity. Value orientations should reveal the educational potential of the educational process, the relationship of the curriculum of the subject with the program of education and socialization of students, including the formation of environmental culture, culture of healthy and safe lifestyles. In the explanatory note comments to each of sections of the program and brief methodical instructions on the statement of theoretical material, performance of laboratory practical works, and also the explanations connected with design and possible realization of the part formed by participants of educational process can be given.
2. General characteristics of the subject.	This part of the program determines the place of the subject in the solution of common goals and objectives at the level of basic General education, establishes interdisciplinary connections (on which subjects the subject is based, for which subjects it is the basis; if these connections are strong, it is advisable to note how they can be implemented). General characteristics of the subject involves a description of the features of the educational process on the subject; preferred forms of organization of the educational process and their combinations; preferred forms of monitoring and evaluation, possibility of integration with extracurricular activities (e.g. based on project method).
3. Description of the place of the subject, the course in the curriculum.	This section provides the distribution of hours for the study of the subject by class, determines the reserve of free educational time in hours and percentage of the total, which can be used for the implementation of the author's approaches, various forms of organization of the educational process, the introduction of modern teaching methods and pedagogical technologies. In this part of the program can be given recommendations for filling the plan of extracurricular activities in the aspect of solving common problems with this subject.
4. Personal, metasubject and subject results of development of a subject.	This section concretizes the planned results of the development of students of the basic educational program of basic General education, including, inter alia, personal, cognitive, regulatory and communicative universal educational actions; shows the relationship of the program of the subject with the program of development of universal educational actions (program of formation of General educational skills) at the stage of basic General education.

Basic sections	Characteristic
5. The content of the subject.	This section is the main part of the program. It is built by sections and topics in accordance with the thematic plan. When describing the content of the curriculum can be recommended the following sequence of presentation: the name of the topic; the required number of hours for its study; planned results (generalized requirements for knowledge and skills of students on the topic): the student must have an idea, know, be able to have experience; the content of educational material (didactic units); topics of practical and laboratory work.
6. Thematic planning with the definition of the main types of training activities.	The thematic plan reveals the sequence of study sections and topics of the program, shows the distribution of teaching hours by sections and topics based on the total number of hours on the subject. The thematic plan is drawn up for the entire period of study.
7. Educational-methodical and material-technical support of educational process.	This section specifies basic and additional educational literature, training and reference manuals, educational literature, a list of recommended technical training, demonstration printing AIDS, screen-sonic benefits of digital educational resources, academic and educational laboratory equipment, etc. In the bibliography are highlighted in publications for students and books for teachers. Literature is issued in accordance with GOST [13].

10. **Types of AFO (Alternative forms of education)** (Table 10).

Types of AFO (Alternative forms of education)

Table 10

Name	Characteristic
ICT-based projects	They are integrated and provide an opportunity to choose specific content within the framework of a holistic theme, on the basis of which the development of information technologies should take place.
Dives	One of the most interesting types of AFB associated with the organization of training activities for a certain time period around a particular subject, subject area, topic, problem. During the dive, a variety of scheduled and extracurricular activities are used, which, in fact, are combined into a single whole. Diving is an important part of project activities, sometimes it is difficult to draw a line between them.
Information marathon	This is a system of tasks, United by a specific topic, to solve which it is necessary to build a certain information processing technology.
Games in the classroom and in extracurricular activities	These are didactic games, they are focused on the study of a certain material, without stress control of knowledge and contribute to a more attractive organization of the educational process for students.

Name	Characteristic
Course of entertaining Sciences	The form of organization of educational activities is based on diagnostic courses and is used mainly in the classroom to help students get acquainted with the world of the subject studied at school, as well as to take the first step in self-determination, in choosing the direction of training.
Social technology	Associated with the problem of socialization of school graduates, preparing them to solve specific life problems.
Educational and research activities	Allows you to bring school education beyond the reproductive system of education, it is individual in nature and, in fact, "grows" from the project, but at a more serious level, develops creativity.
Workshops	Knowledge is not invested in children's heads, and produced together with children right in the classroom, based on the emerging.
Remedial and Advisory work	The goal is to support children with learning difficulties, those problems can be related to different reasons: poor health, social and educational neglect, lack of motivation or aptitude for the study of certain subjects, the School should support these children as it is well known that learning difficulties provoke stress, conflict, aggressive behavior, dodging kids from learning [22].

Of course, the information given by the author of the article is only a small part of the extensive pedagogical science. The famous Russian teacher V. M. Lizinsky said very correctly:"a Teacher is a person who studies all his life, only in this case he acquires the right to teach." These words can be fully attributed to the young, just beginning their professional activities of teachers in mathematical subjects. The future of our children is in their hands.

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通过阅读和图解学龄前和小学年龄儿童的文学作品来发展想象力的技术
TECHNIQUES FOR THE DEVELOPMENT OF IMAGINATION THROUGH READING AND ILLUSTRATING LITERARY WORKS WITH CHILDREN OF PRESCHOOL AND PRIMARY SCHOOL AGE

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In the modern world, large amounts of information and modern digital technologies are increasingly pushing the reading of fiction by children to the background. Young people often prefer watching videos and quick ways to get information than finding books and prints that interest them. Children are weaned to read, they know little of fiction, authors and writers, they are not interested in such an activity as reading. This happens to children all over the world, therefore this problem can be considered a global problem, and if it will not be solved, we will see many gaps in the upbringing and development of the younger generation.

In the age of modern technologies, gadgets and computer games, it is important to continue to maintain children's interest in books, to teach them to understand fiction, to love it, to enjoy reading and drawing illustrations to the books they read.

In my article I will talk about some of the methods that I use to maintain interest in books, reading fiction and drawing book illustrations by my students, children of preschool and primary school age.

Children are born with the makings of abilities, and the task of adults is to develop these abilities, making development as interesting and informative as possible: to engage in drawing, music, sports, language learning, reading and much more with children. For a child of primary preschool age, any activities are in the nature of cognitive communication with an adult. A child of this age learns the world around him, he is interested in learning everything, understanding the world around him. Growing up, to the transition to school age, the child has a new form of communication with adults - an extra-personal and personal one. A child begins to communicate with an adult not only about external events and actions, but also about internal conditions and experiences that, with his development, become an internal activity for him. A child of 6-7 years old begins to discover his inner

world, closely connected with his external activity. Imagination at this age is also activated and manifests itself first in the form of a recreating imagination, allowing you to represent the images of heroes from read books, fairy-tale characters. With regular classes, reading books, and then illustrating them, a creative imagination develops, allowing the child to come up with new images on his own and embody them in his drawings.

A characteristic feature of the imagination of children of preschool and primary school ages is its visibility and concreteness. A child of this age needs support on a specific image. In children, as they learn and grow up, a verbal-mental kind of imagination begins to develop, fiction and the ability to independently create an image come first. According to Western scientists V. Stern and D. Dewey, the imagination of a child is richer than the imagination of an adult [1,2], while researchers of imagination L. S. Vygotsky and S. L. Rubinstein argued that the imagination of a child is poorer than that of an adult, he has less life experience than an adult and the child's imagination needs to be developed [3,4].

The development of imagination, the ability to think creatively is facilitated by regular classes, including reading and analysis of literary works with subsequent illustration.

What methods of developing reader interest and developing imagination, creative thinking do I use in my classes?

Technique of transformation. This technique is widely used by many teachers on the lessons, and the technique is also described by V.P. Koptsev. This is a system of game situations, the implementation of a specific set of creative activities. Game situations are creative tasks, during which children are invited to reincarnate in different heroes of the work, using pantomime and other acting techniques and elements of theatricalization. [5].

Obviously, the use of this technique helps children to feel the character or event depicted by them in the future and arouses interest in literary works and illustrations.

The technique of visual demonstration. This technique is very suitable for the youngest students who still have visual thinking and who need reliance on a visual image in order to further illustrate the work. Applying this technique on the lessons, I read a work and at the same time show a series of illustrative material that I prepared in advance on this topic or act out scenes using a puppet theater. It can be the figures of the main characters cut out of cardboard, made of textiles, paper, other materials, which move along the background drawn on the sheets of cardboard similar to a looped animation film. This complements the reading of the fairy tale, helps my students to see visual images of the characters of the fairy tale. By stimulating the fulfillment of a creative task, we can offer children that at the end of the lesson they can take figures, examine them and try to play a scene from a literary work with them.

Drawing comics and composing sequels of stories. With older children, it is interesting to complete the task of illustrating a literary work in the form of a comic strip, as well as come up and draw a continuation of the read story. This type of task not only arouses great interest among children in both reading literature and drawing, but also stimulates further creativity, and also develops imagination and creative thinking.

Drawing illustrations to the read work and comics, but changing the situation. Invite children to portray book heroes, but if they were... Here you can think up, change various situations: on a desert island, on the moon, at your home, the heroes are your friends and you study in the same class with them, go to the same kindergarten, they your brothers or sisters etc. Such tasks cause a vivid response in children, develop an interest in reading, composing their own stories.

Illustrating a literary work, a child can choose any character that he likes best, in whom he finds features common with his character, or vice versa, opposite. Through a drawing, he can express his attitude to a hero or an event in a book, show his "reading" of a fragment of history, select artistic materials for drawing, using certain qualities of the material to create an expressive image.

While my students are performing a creative assignment, I read a book to which they perform illustrations. Reading poetry, prose, listening to music, theatrical reincarnation complete the children's emotional representation of the hero, help to feel his character.

Classes should be built in an atmosphere of trust and understanding between an adult and a child, filled with joyful emotions and have positive reinforcement. At the end of the lesson, each participant is invited to speak and talk about what he wanted to portray, and the rest can clap their hands. Thus, I try to develop confidence in each child, a sense of satisfaction with the result of my creative activity, and encourage children to further creativity. This teaching method is built only on the basis of positive reinforcement and gives positive results: the children are happy to go to class, draw with interest, rejoice, seeing the results of their activities, want to meet again, draw after classes, at home. Parents need to praise their children for any results and arrange exhibitions of drawings of their child at home. You can not criticize the drawings of children, compare them with drawings of peers or other works, scolding for soiled clothes or for drawing off-topic, or something drawn is wrong in the opinion of an adult. Such comments and relations between adults and children lead to a loss of interest in activities for children, to the development of inferiority complexes and fears in children. Adults need to be restrained in such methods of education and not to use them. These are mistakes in education, after which it may take years of painstaking work with the child, so that he can once again believe in his abilities and experience the joy of his own creativity. It is important for parents and other adults to convey the meaning of the creative development of the personality, the role of the development of artistic abilities in the formation of a thinking person.

Exhibitions of children's works are held in art studios - this is necessary for reflection, analysis of children's own results. Joint children's exhibitions allow each participant to see their work alongside the works of other participants in the context of the general theme of the exhibition. This is another method of developing interest and positive competition between children, the desire to achieve the results of their activities, the desire to create new drawings.

Along with the real events of a child's life, literary images acquire the same reality, because children believe in miracles occurring in fairy tales. A child, experiencing the events of a fairy tale or a book story, will necessarily reflect them in his drawings. Wonderful portraits of beloved literary heroes are born, vibrant dynamic action drawings based on your favorite book. In his games and creativity, the child intertwines real events with book events. Books are a part of his world, a part of his childhood, which is remembered for a lifetime.

Our classes are a dialogue between adults and children, the artist and those who make their first discoveries in the visual arts. Drawing is part of the children's game, a way of knowing the world around us and ourselves. In the classroom, the child should feel freedom. He will express his emotions, mood, play, drawing. The teacher only tells, guides, complements the drawing of the child, tries to interest him, inspire and believe in his own abilities. The atmosphere at the lessons of fine art created by the artist-teacher is a special environment where the student must feel protected, but at the same time free to search and solve the problem. It is important for the teacher to teach the child to navigate in this search, to create all the necessary conditions for the creation of a creative idea. In creative classes, it is important to keep his child open, free from dogma and adult stereotypes, thinking. The important thing is that the teacher must develop the ability to learn without interfering.

The value of doing fine art is not only to give the student the necessary knowledge, skills, it is important to teach children, expressing themselves, to experience the feelings associated with the content of the artistic image they create, to form an attitude towards their own discovery, opening for them the "zone of near development ". One of the most important conditions for classes is the creation of an atmosphere of trust and interest. Art classes not only form a positive self-esteem and motivation for achieving success. Through an understanding of art, a positive attitude towards the world and other people is formed.

Using various techniques, including those described in this article, inclusion in the creative process occurs through the experience of a literary work. The sooner you develop the emotional and sensual world of the child, the ability to understand and experience the meaning of a literary work, the brighter he will be, his inner world and the products of his work. Through reading literary works, you can bring up in a child a positively-minded personality.

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教育组织中的教育学院的公民和爱国主义教育

CIVIL AND PATRIOTIC EDUCATION AT THE PEDAGOGICAL FACULTIES IN EDUCATIONAL ORGANIZATION

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抽象。 本文致力于在教育组织的教育学系中爱国主义教育管理系统的组织。它基于方法论，教学论和科学文献的现代资料，确定了在教育组织中实施学生的公民和爱国主义教育工作的目的，目标和内容。 要定义经理要注意的学校公民和爱国主义教育的倾向。 给出了在学生中形成公民和爱国者的必要性的结论，并提供了在高等院校及其后方的教育途径。

关键词：公民，爱国者，教育，公民爱国主义教育，教育组织，学生

Abstract. *This article is devoted to the organization of the management system of Patriotic education at pedagogical faculties in educational organizations. It based on the data of modern sources of the methodological, pedagogical and scientific literature, the article defines the goals, objectives and contents for the implementation of the work of Civil and Patriotic education of students in an educational organization. Tendencies of Civil and Patriotic education at school is necessary to pay attention to the Manager are defined. Also the conclusion about necessity of formation of the citizen and the patriot in students is given, ways of their education in walls of higher education institution and behind its territory are offered.*

Key words: *citizen, patriot, education, civil -Patriotic education, educational organizations, students*

The changes taking place in modern society, set new requirements for our system of education. The beginning of the XXI century in Russia is the period of development of the rule of law and civil society, the recognition of man, his rights and freedoms as the highest value, the transition to a market economy. Effective realization of the personality during training and after its termination, its active adaptation in the labor market and socialization in society are one of the main tasks of educational activity of the educational organization.

The formation of citizenship, morality, diligence, respect for human rights and freedoms, strengthening the educational function of education, love for the Motherland, the environment, the family is considered as one of the main directions in the field of education. The formula is fully valid here: what is today's society – such is the youth, what is today's youth-such is tomorrow's society.

The works of such scientists as V. G. Belinsky, V. I. Vodovozov, P. F. Kapterev, M. V. Lomonosov, K. D. Ushinsky and others are devoted to the study the problem of civil-Patriotic education of the younger generation. They all noted how important to bring up in a child the love to the people, the native language and national culture. The problem of Patriotic education was in the field of view of Soviet teachers: N. K. Krupskaya, A. S. Makarenko, V. S. Sukhomlinsky, etc.

This problem are treated in pedagogy and in the last decades A. W. Fursikov, Gulnara Valeeva, N. V. Ippolitov, L. V. Kokoeva, L. I. Mishchenko.

Currently, the relevance of this problem is emphasized by state documents, in particular the program "Patriotic education of citizens of the Russian Federation for 2016-2020". [1]

The holistic pedagogical understanding of these issues leads to the need to find effective ways of Civil and Patriotic education of young people. Education of citizenship and patriotism is the core and important value and it concerns the fate of the present and future generations. Also, there is an urgent need to educate patriotism, citizenship, Patriotic and civic qualities of the younger generation on the basis of the history of the Native land, its symbols, works of writers, artists and musicians.

Civil-Patriotic education today is a systematic, multifaceted, coordinated and purposeful activity of state bodies, public associations and organizations to form a high Civil-Patriotic consciousness among students, a high sense of loyalty to their homeland, readiness to perform civic duty, the most important constitutional obligations to protect the interests of the country.

The purpose of Civil and Patriotic education is the formation of patriotism and citizenship among young people as the most important social, spiritual and moral social values, the development of their professionally necessary qualities, skills and readiness for their effective manifestation in various spheres of society, especially in the process of public service, loyalty to military and constitutional duty in modern realities, discipline and high responsibility. To achieve this goal it is necessary to perform the following main tasks:

– implementation of scientifically-reasoned management and organizational activities to create conditions for the successful civil-patriotic education of youth - establishment in the minds and feelings of students of civil-patriotic values, beliefs and views, respect for the historical and cultural past of the state, to the customs, increase the prestige of the state service;

– formation of the latest effective system of civil-patriotic education, providing rational requirements for the development of students devotion to the Motherland, readiness for honest performance of duty and worthy service to society and the state;

– creation of a mechanism that ensures the development of the state, the effective functioning of the entire system of civil and patriotic education of students.

In the content of civil-patriotic education is important social pedagogical orientation, based on such elements as positive worldview and position on the main social, moral, political, historical, military and other problems, the most important spiritual, moral, activity qualities (love for the Motherland, respect for the laws of the country, responsibility for the constitutional obligations to protect the country).

The socio-pedagogical component of the content is predominant and forms the core of civil-patriotic education. Only by forming the personality of a citizen and patriot of the Motherland with his views, values, interests, orientations, motives of activity and behavior, attitudes, you can count on the effective solution of more specific tasks in preparation for the implementation of the function of protecting the country, for various types of public service [2].

Civil-patriotic education is designed to ensure: a deep awareness of each child of his role and place in the service of the state, based on high personal responsibility for the implementation of the requirements of public service, conviction of the need to perform the function of protecting the homeland in modern conditions.

Currently, the contents of civil-patriotic education of students as the main are the following spiritual values:

– citizenship;

– obstacolele on a national scale;

– the predominance of public interest over personal;

– tolerance of basic social and state system, to the existing socio-political system;

– the love of country, devotion to your country;

– diligence and ability to overcome problems and hardship; morality and humanism, self-esteem;

– social activity, responsibility, intolerance to violations of the norms of morality and law.

Civil and Patriotic education is carried out according to the main trends:

– spiritual and moral-human understanding of the highest values, guidelines and ideals, socially significant phenomena and processes of real life, the ability to be guided by them as defining principles, positions in practice and behavior.

It contains the formation of high culture and education, development of professional moral and ethical standards of conduct, responsibility and collectivism, the idea of that willingness to worthy service to the state;

- historical – the study of our roots, an understanding of the uniqueness of the homeland, the place and role of countries in the world historical process, understanding the mentality, customs, beliefs, customs and traditions of our people, the military organization in the development and strengthening of society, its protection from external threats, the heroic past of different generations, who fought for the independence of the country and its people, in particular;

- political and legal – developing a conscious understanding of the legal and political events and processes in society and state the basic provisions of the concept of security of the country, the constitutional debt, military policy, space and the role of the authorities in the political system of society and the state.

Contains familiarity with the laws of the country, especially with the rights and duties of a citizen of Russia, with the functions and legal foundations of the activities of chiefs, senior officials;

- education of citizenship – education of the most important cultural, historical, spiritual and moral values, lifestyle, national identity, worldview and destiny of Russians.

It contains selfless love and devotion to the state, a sense of pride for belonging to the great people, to its achievements, problems and trials, readiness for worthy and selfless service to society and the state, respect for national shrines and symbols;

- professional activity-the formation of a responsible and conscientious attitude to work, initiative in the manifestation of professional qualities in order to successfully perform their duties and tasks.

It includes: goals and objectives, motives, professional requirements and aspiration to achieve high results of work, value orientations of professional and activity realization of a person, the ability to effectively and efficiently perform official duties and achieve specific goals, the ability to predict and implement plans for their professional growth;

- psychological – readiness to perform difficult tasks, psychological stability, emotional stability, adequate attitude to the circumstances [3].

When managing the civil and patriotic education of students in an educational organization, it is important to monitor the implementation of all of the above areas.

Without their implementation, the education of a citizen and a patriot will be defective, and the quality of the personality formed will not meet the requirements of the state. Thus, the management of civil and patriotic education of students is a complex task, which requires qualified specialists and appropriate educational institutions.

One of such institute is the University, where lays the necessary basic foundations for the further development of the individual, it is necessary to take into account the age characteristics of the student and the nature of the material studied.

Currently, the higher school focuses not only on the message to students a certain amount of knowledge, but also on the development of moral qualities of the individual, including citizenship and patriotism. An important aspect of the substantive maturity of the organization of civil and patriotic education in the University is its involvement in the main activities: educational, methodical, educational [4].

Education of the patriot and the citizen of the homeland – responsible and difficult task which main realization occurs at University. The state should actively introduce such areas of civil and patriotic education as sports, local lore and international education. These areas are implemented through extracurricular activities through various cultural centers, sports organizations and museums [5].

In order to carry out extracurricular activities in University, specialists in civil and patriotic education should be trained and young people should be more actively involved in this activity.

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加拿大土著文化的发展：《土著语言法》
THE DEVELOPMENT OF INDIGENOUS CULTURE IN CANADA: INDIGENOUS LANGUAGES ACT

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抽象。研究的主题是加拿大土著人民在文化和语言发展方面的当前趋势，即在恢复，保存和使用加拿大土著语言方面最有效体现的那些公共政策领域。作者特别关注2019年6月通过的关于保护土著语言的新法律，其目标，发展机制和前景，以及现代语言教育和使用语言的做法的问题。本文使用一般的科学方法来分析和综合研究文献，大量的统计数据和比较方法。研究表明，加拿大土著居民的语言状况仍然困难。有关保护语言的新法律旨在改善这种情况。根据该法律，预计国家将为新的语言发展计划，研究活动，出版词典和教科书，青年教育和培训合格的专家提供资金。最近，由于学前班和学校教育中的沉浸式计划，新技术的使用，媒体的发展和民族旅游的发展，加拿大的许多土著社区看到了恢复以母语为母语的人数的积极趋势。

关键词：语言，加拿大土著人民，文化，传统，教育，语言法，语言沉浸程序

Abstract. *The subject of the research is the current trends in the cultural and linguistic development of the indigenous peoples of Canada, namely those areas of public policy that are most effectively reflected in the restoration, preservation and use of the languages of the indigenous people of the country. The author pays special attention to the new law on the preservation of indigenous languages, which was adopted in June 2019, its goals, development mechanisms and prospects, as well as issues of modern language education and the practice of using languages. The article uses general scientific methods for the analysis and synthesis of research literature, a large amount of statistical data, and a comparative approach. The study showed that the situation with the languages of the indigenous population of Canada remains difficult. The new law on the preservation of languages is designed to improve the situation. Under this law, state funding of new language development programs, research activities, the publication of dictionaries and textbooks, youth education and the training of qualified specialists are expected. Recently, a number of indigenous communities of Canada have seen positive trends in the restoration of the number of native speakers thanks to immersion programs at the level of preschool and school education, the use of new technologies, the development of media and ethno-tourism*

Keywords*: language, indigenous peoples of Canada, culture, traditions, education, language law, language immersion program*

Pursuant to a resolution of the United Nations General Assembly, 2019 is declared the International Year of Indigenous Languages in order to draw worldwide attention to the existing threat of their extinction and to enhance the significance of their unique cultural heritage. Currently, there are about 7 thousand such languages in the world, and one of them dies every two weeks [4]. Only 4% of the world's population speaks indigenous languages, and according to UNESCO, 90% of all languages are endangered [4]. Obviously, the scale of this problem has reached a critical level and requires immediate action with regard to the preservation and further development of the language and cultural traditions of the indigenous people of many countries.

In Canada, there are currently more than 1.6 million indigenous peoples - 4.9% of the country's total population [19]. Officially, they are divided into three groups. The largest group consists of representatives of the First Nations (as Indians are commonly called in Canada) - about 1 million people. The second group is represented by mestizos - descendants of mixed marriages of Europeans and indigenous people in the colonial period, the number of which at the moment does not exceed 600 million people. The third group includes residents of the northern territories of Canada - Inuit, a little more than 60 thousand people [19]. About half of all indigenous peoples live in reserves [19].

For a long time, the Canadian authorities pursued a brutal policy of assimilation of the indigenous people of the country, tried to destroy their language and culture. Boarding schools were created throughout Canada, where Indians were forcibly sent and forbidden to use their native language. Of course, this led to a real tragedy - the cultural genocide of an entire generation, many of whose representatives irretrievably lost their cultural roots. The ban on the use of the native language has become an effective mechanism for eliminating the existing cultural differences and getting rid of the centuries-old traditions of many thousands of people.

In December 2016, the Canadian Prime Minister said: “We all know how boarding schools and other government decisions were deliberately used to destroy indigenous languages and cultures. If we really want to achieve reconciliation, we must correct the damage that we caused. I promise you that the government, in cooperation with representatives of all indigenous peoples - First Nations, Inuit and Métis will adopt the Law on the Preservation of their Languages (The Indigenous Languages Act) in order to ensure their restoration and further development” [16].

On June 21, 2019, Canadian Indigenous Laws were enacted. Federal, provincial, and territorial authorities participated in its development, including the Department of Canadian Heritage, the Assembly of First Nations, and the Métis National Council. Obviously, this is a long-awaited decision by the Canadian government, although to some extent a little belated for such a highly developed country. At the moment, the situation with the languages of the indigenous peoples of Canada has become so aggravated that there are great chances to lose some of them already within 10 years. According to Perry Belgard, head of the Canadian Indigenous Affairs Assembly: “None of Canada’s indigenous languages is safe. Now we have hope. This law will help indigenous peoples use and transmit their languages. Canadians and all parliamentarians are required to support this law, as we all understand that language is identity, language is culture, language is life” [14].

The results of the latest 2016 census showed that in Canada there are more than 70 different languages belonging to 12 language families spoken by the indigenous people. The most common languages include Cree languages - 96 thousand people, Inuktitut - 40 thousand people. and Ojibwe - 28 thousand people. The situation with the languages of the indigenous people of Canada is very disappointing. The number of their carriers is reduced every year. Currently, only 15.6% of indigenous peoples have confirmed their ability to speak their native language. In 2006, their share was 21% [6]. Some languages are already on the verge of extinction. So, there are less than 500 people who speak the Haida language, only 180 people are speakers of the Oneida language, and 170 people are Kutenai. At the moment, the largest number of native speakers live among Inuit - 64%, due to their remoteness and greater isolation from the rest of the country's population. Among representatives of the First Nations, only 21% of the inhabitants confirmed their native language proficiency. The smallest number of speakers of the native language among mestizos is only 2% [6]. Basically, they live outside the reserves and to the greatest extent have been integrated into European society.

The main factors of this development of the situation are still the consequences of a long policy of assimilation of indigenous peoples by the state and the ban on the use of native languages in boarding schools, on the one hand, the dominance of the English language and the lack of motivation to learn and use native languages by the younger generation, on the other side. Knowledge of English or French is sufficient for them and allows to better get in life, find a job and ensure their existence.

Note that, so far, the main legislative act regulating relations between indigenous peoples and the Canadian government has been the Indian Act of 1876, with subsequent amendments, regulating mainly land relations, self-government and public structures, education, agriculture, the use of mineral resources in the territories of the indigenous population, etc. [1].

The Indigenous Languages Act is essentially the second document in Canada's history with regard to its indigenous people and aims to restore, preserve and develop their languages. Under this law, state funding of various programs for the study and preservation of the languages of the country's indigenous population in the amount of $ 333.7 million for 5 years, then $ 115.7 million annually, as well as the creation of a new state organization of the Office of an authorized representative for language affairs, is expected Office of Commissioner of Indigenous Languages [7]. The objectives of this organization will be to ensure interaction between authorities at various levels and coordinate actions to implement and monitor programs for the restoration, preservation and development of indigenous languages, the creation of dictionaries, textbooks, etc. It is worth noting that at the moment the law does not aim to give official status to all or some languages, as well as their use in state structures at the federal level. It is rather about actions aimed generally at maintaining and developing the languages of the indigenous population. How these actions will be implemented is not yet entirely clear.

The entry into force of the new law was supported by representatives of the First Nations and Métis. The Inuit Organization (Inuit Tapiriit Kanatami (ITK)) was strongly opposed. At the first parliamentary hearing in February 2019, ITK President Nathan Obed expressed his opinion that this law does not take into account the interests of Inuit, was developed behind closed doors and is essentially a relic of colonialism [14]. The point is that the Inuit of Canada are seeking recognition of the official status of their Inuktitut language (spoken by more than 80% of the population) throughout the Inuit (Inuit Nunangat), which includes Nunavut, part of the Northwest Territories, northern Quebec and Labrador, as well as the provision of services in this language in all public institutions along with English and French. The Inuktitut language has the status of an official language only in the territory of Nunavut and the Northwest Territories of Canada, while its use extends only to the territorial authorities, in the representations of federal authorities services are provided only in English and French. In addition, Inuit officials expressed disagreement with the fact that the study of inuktitut in schools is provided as part of a bilingual education system, that is, as an addition to one of the official languages. In their opinion, most subjects should be taught in their native language, and existing restrictions impede the study and use of the native language by the younger generation.

Of course, teaching the native language of children is one of the key aspects of its development and preservation. In Canada, in recent years, in addition to bilingual education programs in pre-school and school institutions, immersion programs have begun to be introduced, which involve the study of all core subjects in the native language of the indigenous people. Currently, in most of these schools, the dive program includes only kindergarten and primary school. In middle and

high school, the teaching of basic subjects is already in English or French due to the lack of qualified teachers from among the natives of native speakers. Examples of such schools are the Eskasoni Elementary and Middle School in Nova Scotia - up to grade 3 teaching in Mikmak only, Kihew Waciston Cree Immersion in Saskatchewan - up to grade 4 teaching in Cree, Mnidoo Mnising Anishinabek Kinoomaage Gamig in Ontario - up to grade 4 in the Ojibwe language and others. In Canada there are also schools of complete immersion, where all subjects are taught in the native language of the indigenous people up to grades 10-11. The most famous of these schools is the Chief Atahm School in British Columbia, whose children learn the Shuswap language, which belongs to the Salish language family before grade 10. However, the number of such schools is still limited. The main problem is still the lack of qualified teaching staff, although a number of universities in Canada are already training them in the provinces of Ontario, Nova Scotia, New Brunswick, Manitoba, Saskatchewan, Alberta, and British Columbia. It is noted that in recent years, the enrollment of students from among the indigenous population is increasing. For example, in British Columbia, where there are more than 34 different indigenous languages, the number of young people under the age of 24 children studying their native language is growing steadily. Since 2014, their number has more than doubled [20]. As many researchers note, this is the result of language immersion programs in many schools in the province, which also include various leisure activities, including holidays, fairs, interest clubs, summer camps. It should be noted that in a number of educational institutions in Canada, where indigenous languages are taught, the administration offers free language classes for the parents of their students, thereby promoting the use of the native language in the family.

The latest trends in the cultural and linguistic development of the indigenous population of Canada include the active use of modern technology. Among youth, various language communities on social networks are becoming popular. For example, The Gwich'in Language Revival Campaign on Facebook [17] for students of the Gwitchi language, one of the official languages of the Northwest Territories. Widely used mobile applications for learning the native language. An example of such a modern application is KOBE Learn for learning Cree, Oji-Cree and Ojibwe languages [10]. The FirstVoices project, first launched in 2003 in British Columbia, and now covering the United States and Australia, has gained popularity. FirstVoices is a kind of global platform for indigenous languages, which makes it possible to download dictionaries, music, artwork and ensure their preservation [5].

The issue of language practice is a very important aspect of its further development. It is not enough to deal with issues of language education alone; it is important to expand the practical areas of its application. In Canada, the number of radio and television programs in indigenous languages is gradually increasing. The creation in 1999 of the Federal Indigenous Peoples Television Network

(Aboriginal Peoples Television Network) for the first time allowed broadcasting news programs, documentaries and feature films, entertainment and educational programs in various languages (Cree, Mikmak, Ojibwe, Inuktitut, Michif, etc.) In March In 2019, in Edmonton (Saskatchewan), the first television broadcast of the hockey match between the teams of Montreal Canadiens (Canada) and Carolina Hurricanes (USA) in Cree was a sign of support and development of this language [12], which became a historical event.

In addition to the development of new television projects, the number of radio stations for the indigenous population of the country is gradually increasing. So, in 2017, five new radio stations appeared for indigenous people in such major cities of Canada as Ottawa, Toronto, Vancouver, Edmonton and Calgary, the broadcasting geography of which covers almost the entire country [3].

Another direction of the development and preservation of indigenous languages is the development of ethno-tourism. We are talking about the emergence of an increasing number of travel companies that belong to representatives of the indigenous population. Their traditional culture, richness and diversity of traditions form the basis of tourism activities in order to improve their socio-economic status and achieve sustainable development. Attracting tourists, they develop special excursion programs in their native language. For example, Native American myths and legends told by the elders of the community around the fire, the performance of various songs and the conduct of religious rites in their native language. This allows tourists to immerse themselves as much as possible in the atmosphere of a traditional Native American village, imbued with the linguistic and cultural traditions of its indigenous people. At the same time, this practice serves as an excellent example for the younger generation, allows them to transmit their native language, and with it the accumulated for centuries culture. Note that from 2002 to 2014 the number of such travel companies almost doubled and reached 1,500, while the number of employed representatives of the indigenous population increased from 13 to 33 thousand people [13, p. XIII]. Their geography covers all the provinces and territories of Canada, but about a third of the companies are concentrated in Ontario, about 20% in British Columbia, 13% in Quebec [13, p. XIII].

Another historical event speaks of the popularization of indigenous languages and the attraction of more attention to them. In November 2018, for the first time in Canadian history, the country's parliament allowed indigenous representatives to speak in their native language. A mandatory requirement is a 2-day notification of the translation service [18].

Thus, efforts are currently being made in Canada to restore, preserve and develop the indigenous languages and cultures. On the one hand, this process is ensured by global trends of the growing popularity of indigenous peoples and awareness of the threat of their complete disappearance. On the other hand, in Canada, new con-

ditions are beginning to be created to increase their cultural significance and social status. New ways are being developed to preserve linguistic and cultural traditions. Studies show that the most effective are providing pre-school, school and higher education in their native languages (immersion programs), as well as expanding the practical areas of their application. The new law on the preservation of indigenous languages is designed to ensure their financing and control. At the moment, the desire of indigenous communities to receive state services in their native languages remains unfulfilled. This requires a lot of money, as well as qualified personnel to solve such problems. Perhaps this is only a matter of time. Qualified Aboriginal professionals are already being actively trained at many Canadian universities.

The experience of working with educational institutions in Canada with indigenous children could be very useful for developing programs for the development and preservation of the languages of indigenous peoples of Russia. Canadian educational standards, immersion programs, extracurricular activities, teaching and teaching aids, and electronic applications are worth special attention. All areas of the practical use of languages may also be of interest: radio and television, social events and occasions, various services, including ethno-tourism.

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感染甲型肝炎病毒的妇女的怀孕结果
PREGNANCY RESULTS FOR WOMEN INFECTED WITH HEPATITIS A VIRUS

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抽象。这项研究是针对8名甲型肝炎孕妇进行的。当一名妇女注册后，由肝病专家和病毒学家对她进行了检查，并根据这些专家制定了产前检查方案。根据协议，测定血液中AST，ALT，碱性磷酸酶，总胆红素的含量。每个孕期结束时进行超声检查。

为了防止肝功能受损的情况恶化，孕妇每天两次服用庚片1片（800 mg）。随着白天肝损伤指标的急剧增加，孕妇静脉注射了400 mg的肝。经过2周疗程使用庚酸巩固疗效后，孕妇继续每天服用1片药片，持续10天。

妊娠中期前肝脏功能状态的改善导致在产前可见明显的阳性结果。因此，在8名孕妇中，只有一名（12.5%）的妊娠没有完成。但是在产后阶段，有2例新生儿（25%）体重低于正常，在1例（12.5%）中发现动脉导管未闭

关键词：妊娠，肝炎，甲型病毒，肝

Abstract. *The study was conducted on 8 pregnant women with hepatitis A. When a woman was registered, she was examined by a hepatologist and virologist, and a protocol was drawn up taking into account these specialists to conduct the prenatal period. According to the protocol, the content of AST, ALT, alkaline phosphatase, total bilirubin was determined in the blood. Ultrasonography was performed at the end of each trimester.*

To prevent deterioration of the impaired functional state of the liver, pregnant women were prescribed heptral 1 tablet 2 times a day (800 mg). With a sharp increase in markers of liver damage during the day, pregnant women were given 400 mg of heptral intravenously. After a 2-week course of using heptral to consolidate the effect, pregnant women continued to receive the drug 1 tablet per day for 10 days.

An improvement in the functional state of the liver by the end of the second trimester of pregnancy led to visible positive results in the prenatal period. So out of 8 pregnant women, only in one (12.5%) the pregnancy was not completed. But in the postnatal period, in 2 newborns (25%), body weight was below normal, in the 1 (12.5%) the patent ductus arteriosus was found

Keywords: *pregnancy, hepatitis, virus A, heptral*

The widespread of viral hepatitis in women of reproductive age has made the problems associated with this disease a priority area of obstetrics-gynecology. Since to this day such issues as the possibility of successful termination of pregnancy in women with viral hepatitis, whether the detected virus is a contraindication for pregnancy or not, the resolution of pregnancy in the postnatal period should occur naturally or with the use of Cesarean section are the subject of discussion of the scientific community of obstetricians gynecologists [1,2,3].

Given the urgency of the problem, we consider it appropriate to monitor the course of pregnancy in women with viral hepatitis. For research, 78 pregnant women with viral hepatitis were involved. Only a small part of the respondents - 16 pregnant women (20.5%) knew that they had viral hepatitis. In 6 of them (37.5%), type A viral hepatitis was detected 5 years ago. In 4 women (25%), chronic hepatitis B was diagnosed 3 years ago. In 3 pregnant women, chronic hepatitis S was detected 2 years ago during check-up examination. In another 3 pregnant women, the presence of viral hepatitis was detected a year ago. One of them showed hepatitis B, two of them had hepatitis BS.

In 62 pregnant women (79.5%), hepatitis was detected in the first weeks of pregnancy. Thus, in most women, the presence of hepatitis B infection was detected during pregnancy registration. This fact itself once again proves that when planning a pregnancy, a married couple should undergo a medical examination in advance. In such cases, it is possible to eliminate in advance the factors that impede the normal course of pregnancy and, as a result, increase the chance of getting healthy offspring.

Of the pregnant women involved in the study, 8 (12.5%) had hepatitis A. When registered, pregnant women were examined by a hepatologist and a virologist. The management protocol for pregnant women was drawn up taking into account the recommendations of these specialists. In accordance with the protocol, when a blood and urine test was taken near the end of each trimester, a general analysis of blood and urine was performed, hepatitis virus markers were detected by serological reactions, and total bilirubin, ALT and AST, alkaline phosphatase activity were determined. Along with this, an ultrasound of the liver, gall bladder and bile ducts was performed.

Due to the teratogenicity of antiviral drugs, their use during pregnancy was refused, preferring symptomatic therapy. To improve liver function, the basic drug heptral was used. For this purpose, heptral was prescribed 1 tablet 2 times a day (800 mg). With a sharp increase in markers of liver damage during the day, pregnant women were given 400 mg of heptral intravenously. After a 2-week course of using heptral to consolidate the effect, pregnant women continued to receive the drug 1 tablet per day for 10 days.

It was found that when registering, the average blood AST content exceeded normal values by 272%, ALT - by 249%, alkaline phosphatase - by 41%, and total bilirubin - by 111% (table 1).

After heptral was prescribed by the end of the first trimester, the blood AST content decreased by 11%, ALT - by 5%, alkaline phosphatase - by 4%, total bilirubin - by 10% (table 1). But despite the positive dynamics, the content of markers of liver damage significantly exceeded normal values.

By the end of the second trimester of pregnancy, an even more pronounced improvement in the functional state of the liver was revealed. Moreover, a decrease in the content of markers of liver damage in the blood showed a positive trend. During this period, the AST blood level decreased already by 23%, ALT - by 14%, alkaline phosphatase - by 7%, total bilirubin - by 20% (table 1). As can be seen from the results of biochemical analyzes, the use of heptral prevents the deterioration of the impaired liver functions in pregnant women, although at the same time, although a slight, but still there is a positive trend in reducing markers of liver damage. In accordance with this, there is a slight improvement in the results of pregnancy. Of the 8 pregnant women, 1 (12.5%) pregnancy did not reach the end. This pregnant woman had a spontaneous miscarriage. In the postnatal period, some fetal defects were detected. In 2 pregnant women (25%), the weight of the newborn was significantly less than normal. In the 1st newborn (12.5%), patent ductus arteriosus was found. In 4 newborns (50%) deviations were not detected.

According to our recommendations, after birth, 13 women were admitted to the dispensary and received thorough treatment. 4 of them subsequently re-conceived. The results of a blood test in the dispensary, in which they are registered, showed that hepatitis A titers are close to normal or slightly exceed it.

When registering for pregnancy, it was found that as a result of the dispensary treatment, the functional state of the liver improved significantly. As a result, compared with pregnant women who did not receive medical treatment, the blood levels of these women AST were lower by 34%, ALT - by 41%, alkaline phosphatase - by 11.5%, total bilirubin - by 32%. To maintain an optimal liver condition, heptral was prescribed to women.

By the end of the first trimester, studies showed that under the action of heptral, the functional state of the liver improved even more, and therefore the average content of the corresponding indicators continued to decrease. So, the blood AST content decreased by 11%, ALT - by 10%, alkaline phosphatase - by 9%, total bilirubin - by 14%. Thus, the use of heptral in pregnant women who received highly professional treatment in advance by specialists more effectively prevents the aggravation of impaired liver functions.

Table 1.

The dynamics of changes in the content of markers of liver damage in pregnant women who received heptral

№	Survey Periods	Stat. indicators	AST u/l	ALT u/l	ALP u/l	TBA mq/dl
1	Before heptral	min	86	120	350	1,8
		max	130	142	500	3,2
		M	114,0	134	423,80	2,33
		m	5,5	2,6	19,7	0,25
2	I trimester	min	87	110	335	1,1
		max	125	140	490	3,2
		M	102,1	127	405,7	2,09
		m	9,3	3,7	21,8	0,30
3	II trimester	min	33	95	330	1,1
		max	118	130	480	3,0
		M	88,70	115,28	393,6	1,86
		m	11,3	5,0*	23,5	0,30

Note: *-p<0,01.

During pregnancy, maintaining liver functions within certain limits had a positive effect on the course of pregnancy. As a result of the pathology of this period, they were somewhat less pronounced. In 2 pregnant women, the birth was premature. The first of them at 34 weeks, and the other at 36 weeks. In both of these pregnant women, Caesarean section was used, the remaining 2 women gave birth physiologically. All 4 newborns had no developmental defects. Only one of them was infected with hepatitis B.

Despite the fact that the number of pregnant women with hepatitis A involved in the studies is not numerous, we believe that the results suggest that the appointment of heptral to this contingent to some extent impedes the progression of the development of hepatitis in them, which in turn has a positive effect on the course of pregnancy.

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电势在无向表面上的传播
与衰老相关的不同部位淋巴结的微量元素
PROPAGATION OF ELECTRIC POTENTIAL ON AN UNDIRECTED SURFACE

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抽象。 心肌电活动的经典偶极子模型不能解释标准导线中ECG信号幅度的差异。 Buckberg最近的发现表明，心脏的心肌具有Moebius拓扑结构，并且是非定向表面。 本文考虑了在ECG测试过程中非定向表面对标准引线中记录的电势分布的影响。 根据仿真器样本的实验研究结果，结果表明，导线中ECG信号幅度的差异可以与心肌拓扑结构精确相关。 还显示出，通过将“失真”引入样本拓扑中，可以模拟与载流电路中欧姆电阻受损相关的心脏病理。

关键字：ECG，莫比乌斯拓扑结构，电势，铅，振幅，心肌。

Abstract. *The classical dipole model of the myocardial electrical activity does not explain the difference in the amplitude of the ECG signal in standard leads. Buckberg's recent discovery showed that the myocardium of the heart has a Moebius topology and is a non-oriented surface. The article considers the influence of a non-oriented surface on the distribution of the electric potential recorded in standard leads during ECG test. According to the results of experimental studies on samples of simulators, it was shown that the difference in the amplitude of the ECG signal in the leads can be associated precisely with the myocardial topology. It is also shown that by introducing "distortions" into the sample topology, cardiac pathologies associated with impaired ohmic resistance in the current-carrying circuit can be imitated.*

Keywords: *ECG, Möbius topology, potential, lead, amplitude, myocardium.*

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In modern medicine, various programs and simulation models are widely used, which allow to evaluate the work of organs and systems of the human body. In this case, special attention is paid to the heart. In most cases, the diagnosis of vital functions of the heart is carried out according to the results of ECG recording on standard leads - electrical potentials formed during the heart. However, the mechanism of their occurrence is not yet fully understood. In particular, V. Einthoven's dipole approximation is considered to be well established [1], according to which the heart is a current dipole with a dipole moment that rotates, changes its position and point of application during the cardiac cycle (Fig. 1).

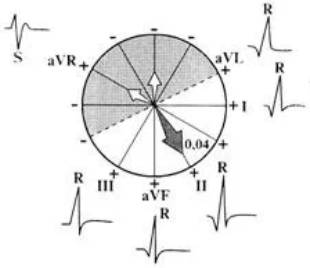

Fig. 1. *Myocardial electrical activity*

However, as can be seen from Fig. 1, the dipole model of the myocardial electrical activity does not explain the difference in the amplitude of the ECG signal in standard leads (Fig. 2).

a *b* *c*

Fig. 2. *Type of ECG in standard leads:*
a - I lead; b - II lead; c - III lead.

In development of the dipole approximation of V. Einthoven, many models were proposed that describe the electrical activity of the heart [2, 3]. For example, in a resistive model of the cardiovascular system, a non-sinusoidal alternating voltage source connected to a current rectifier, which is a heart valve, was taken as an analog of the heart. In the model of electrical activity of the heart, the approximation in the form of an alternating electric field generator was used to simulate the electrical activity of excitable heart fibers. However, all these models are based on the notion that the heart meridian is a ring (see Fig. 1). At the same time, the results of modern studies [4, 5] showed that the myocardium of the heart has a Mobius topology. This makes it relevant to assess the influence of a non-oriented surface on the distribution of the electric potential recorded in standard leads during ECG.

To perform an assessment of the electrical activity of the heart, it was experimentally studied on samples simulators how the position of the electrodes affects the amplitude of the signal. The results of 3D scanning of the myocardium showed that it has variable sizes: length 60 cm, width 8-10 cm, thickness 0.5-2 cm [6]. Neglecting the capacitive and inductive resistances of myocardial tissues, which primarily affect the propagation speed of an electric pulse, we assume that a morphologically-like model of myocardium with scalable electrophysical characteristics can be made of a conductive flexible material 60 cm long and 8 cm wide, separated by a dielectric layer (Fig. 3).

a *b*

Fig. 3. *Sample simulator: a - in the form of a ring, b - in the form of a non-oriented surface*

It is known that the frequency R of the cogs on the ECG corresponds to the heart rate, and with a pulse of 60 beats per minute is 1 Hz. In an experimental study, a G3-33 generator was used as a source of electrical pulses, which provides stable-amplitude pulses in the frequency range 20 Hz – 200 kHz. The experimental scheme is shown in Fig. 4. To simulate leads, one of the probes of the recording oscilloscope remained stationary, and the other shifted around the circumference. The Oscilloscope Action was performed using an oscilloscope C1-68.

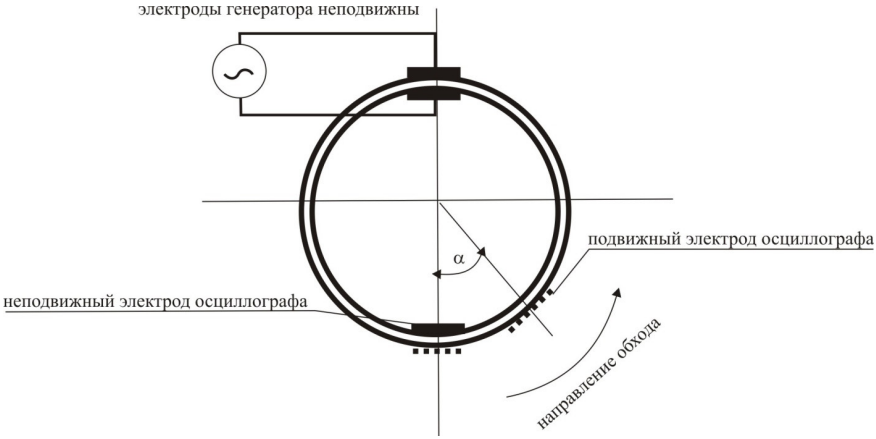

Fig. 4. *Experiment design*

The results of an experimental study of a simulator sample (see Fig. 3, a) are given in Table 1.

Table. 1

α, degree	**U_{max}, mV**	
	20 Hz	**20 kHz**
0	200	5
40	200	5
80	200	5
120	200	5
160	200	5
180	200	5

It can be seen that the signal amplitude did not change, regardless of the position of the moving electrode of the oscilloscope in the entire frequency range.

The results of an experimental study of a simulator sample with the Mobius topology (see Fig. 3, b) are given in Table 2. The waveform of the oscilloscope recorded by the electrodes, as in the first case, repeated the waveform of the generator in the entire frequency range.

The features of the sample topology are related to the fact that the G3-33 generator, in contrast to the previous experience, worked in the short circuit mode. Therefore, the voltage of the generator signal was reduced from the conditions of obtaining an undistorted harmonic signal at the generator output. As in the previous case, regardless of the position of the moving electrode of the oscilloscope in the entire frequency range, the recorded signal had a harmonic shape. However, the signal amplitude varied (Fig. 5).

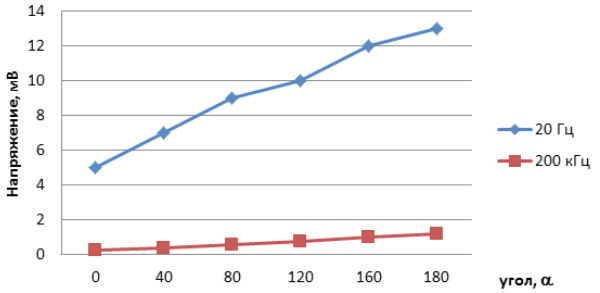

Fig. 5. *The dependence of the amplitude of the signal from the angle α This suggests that it is the Möbius topology that determines the amplitude of the recorded signal in the leads (Fig. 6)*

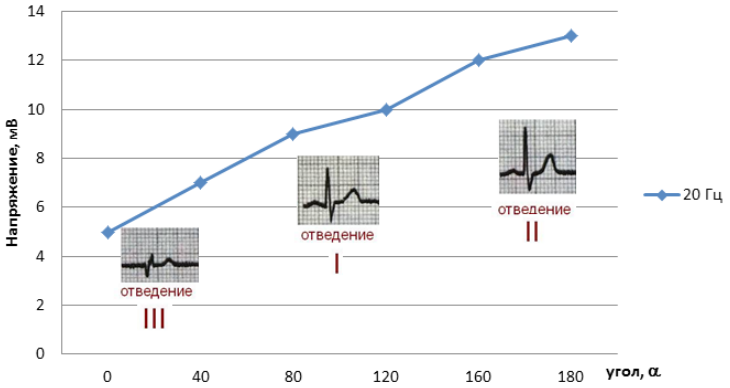

Fig. 6 *Correspondence of signals to known ECG results*

In accordance with the hypothesis put forward on the effect of myocardial topology on the amplitude of *R*-waves of an ECG signal to simulate pathology, contact on one between the current-carrying layers is open (see Fig. 3, b), which corresponds to transmural myocardial infarction. In this case, the generator, as in the first experiment, operates in idle mode, the results of the experimental data are given in Table 3.

It can be seen that the signal amplitude does not change, regardless of the position of the oscilloscope electrodes. If you look at the known results (Fig. 7), you can see that the amplitude of the signals in the I, II and III leads practically coincides. This suggests that it is the violation of the topology that leads to the equality of amplitudes.

Table. 3

α, degree	U_{max}, mV	
	20 Hz	**20 kHz**
0	10	5
40	10	5
80	10	5
120	10	5
160	10	5
180	10	5

Fig. 7. *ECG dynamics in transmural diaphragmatic myocardial infarction [7]*

This suggests that it is the violation of the topology that leads to the equality of amplitudes and confirms the hypothesis that the difference in the amplitude of the ECG signal in the leads can be associated precisely with the myocardial topology.

Conclusion.

Based on Bakberg's discovery that the myocardium of the heart has a Mobius topology and is a non-oriented surface, the influence of a non-oriented surface on the distribution of electric potential recorded in standard leads during ECG removal is considered. The results of the experiment showed that the difference in the amplitude of the ECG signal in the leads can be connected precisely with the topology of the myocardium. It is also shown that by introducing "distortions" into the sample topology, cardiac pathologies associated with impaired ohmic resistance in the current-carrying circuit can be imitated.

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与衰老相关的不同部位淋巴结的微量元素
TRACE ELEMENTS OF THE LYMPH NODES OF DIFFERENT LOCALIZATION IN THE CORRELATION WITH AGING

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抽象。应用同步辐射X射线荧光技术测定Wistar大鼠不同淋巴结中Mn，Fe，Cu，Zn和Se的含量。实验包括健康的幼小和老年动物。结果揭示了淋巴结的微量元素分布，并将其与淋巴结的定位和生命周期相关联。微量元素的含量在幼小动物不同部位的淋巴结中是最佳的。考虑到淋巴区域的概念（区域特异性），微量元素含量的差异与淋巴结的领土归属有关。衰老会导致淋巴结中的锰，铜，锌，硒，铁缺乏症的发展，而锰的过量则反映了淋巴组织的消退和免疫功能的降低。获得的结果是在寻找用于校正微量元素稳态的淋巴技术中发展淋巴区域概念的基础。

关键词：微量元素，淋巴结，老年病，植物疗法

Abstract. *The synchrotron radiation X-ray fluorescence technique was applied to the determination of Mn, Fe, Cu, Zn and Se concentration in different lymph nodes of Wistar rats. The experiment included healthy young and old animals. The results revealed the trace element profile of lymph nodes and associated it with the localization of lymph nodes and the period of life. The content of trace elements*

is optimal in lymph nodes of different localization in young animals. The difference in the content of trace elements is associated with the territorial belonging of lymph nodes, taking into account the concept of the lymphatic region (regional specificity). Aging leads to the development of cu, Zn, Se, Fe deficiency in excess of Mn in lymph nodes, which reflects the involution of lymphoid tissue and reduced immune function. The results obtained are the basis for the development of the concept of the lymphatic region in the search for lymphotropic technologies for the correction of trace element homeostasis.

***Keywords**: trace elements, lymph node, gerontology, phytotherapy*

Introduction

The lymphatic region is characterized by a variety of lymphoid structures on the border with the external environment, which ensures the safety of organs or parts of the body [1, 2]. The most important structures of the lymphatic region are lymph nodes, as indicators of exo- and endogenous effects on the body. There is a decrease in the functions of lymph nodes and the development of immune deficiency and polymorbid state due to constant contact with the external environment throughout life [3]. We can not exclude the role of trace elements in the pathogenesis of age-induced changes in the structure of lymph nodes. Many researchers point to the relationship of the immune response from the content of trace elements in different tissues of the body [4, 5]. There is little information about the microelement profile of lymph nodes, which determines the need for their study, especially in aging. Taking into account the participation of trace elements in the differentiation and proliferation of lymphoid cells in the formation of the immune response [3, 5], it is important to investigate not only the content of bioelements, but also their relationship with the aging of lymphoid tissue. It will allow to diagnose the formation of pathology systems and to enable more efficient treatment.

The purpose of this study was to find out how the concentration of trace elements reflect age-induced changes of lymph nodes of different localization.

Materials and methods

The experiment was performed on 160 white rats males of different age (3–5 months and 1.5–2 years) who conditionally divided into two groups of young and old animals. Old animals are an adequate model of age-induced immune deficiency. The experiment on animals was carried out according to the international rules and norms (European Communities Council Directives of 24 November 1986, 86/609/EEC) with the general anesthesia of painful manipulations. We conducted a histologic study of lymph nodes. Lymph nodes fixed in 10% neutral formalin. We adhered to the classical scheme of dehydration and embed in paraffin with preparation of histologic sections. Histological sections of lymph nodes painted hematoxylin and eosine, azury and eosine, Masson's trichromatic stain. The mor-

phometric analysis of structural components of a lymph node was carried out by means of a morphometric grid. We defined the content of trace elements (Mn, Fe, Cu, Zn, Se) in lymph nodes by means of the X-rayfluorescence analysis with use of the synchrotron radiation (RFA SI) at the VEPP-3 station of Institute of nuclear physics of G.I. Budker (Novosibirsk). Energy of a monochromatic bunch was 17 keV. Quantitative appraisal of data of an emission spectrum of lymph nodes was executed with «the external standard». Statistical data processing was performed with licensed statistical software package StatPlus Pro 2009, AnalystSoft Inc. Data were expressed as average arithmetic with definition of a standard (mean square) error. Belonging to normal distribution was defined when calculating criterion of Kolmogorov–Smirnov and the accompanying indicators. In work the correlation analysis with definition of a correlation coefficient of Brave–Pearson is used. A P-value < 0.05 was considered statistically significant.

Results

The content of trace elements is considered optimal in the tissues of young animals [5, 6]. Lymph nodes are not an exception. The content of trace elements in the lymph nodes differs depending on the lymphatic region, contacting differently with the external environment (table 1). The content of manganese in the inguinal lymph node is 1.6-1.9 times higher than in tracheobronchial and mesenteric lymph nodes of young animals. The iron content in the inguinal lymph node is 2.6-3.0 times higher than in mesenteric and tracheobronchial lymph nodes. The content of copper in the inguinal lymph node is 1.2 times higher than in the tracheobronchial lymph node and has no statistical difference with the index in the mesenteric lymph node. The zinc content in the inguinal lymph node is 1.3 times higher than in the tracheobronchial lymph node and has no statistical difference with the index in the mesenteric lymph node. The concentration of selenium is minimal in the inguinal lymph node, and it is 1.3–1.4 times less than in the tracheobronchial and mesenteric lymph nodes. We established a microelement profile by results of a research. The microelement profile corresponded to variant of structure of a lymph node depending on localization.

Table 1.

The content of trace elements in lymph nodes of different localization at young and old animals, mkg/g

Trace elements	Mesenteric lymph nodes		Tracheobronchial lymph nodes		Inguinal lymph nodes	
	young rats, 3–5 months, n=20	old rats, 1.5–2 years, n=20	young rats, 3–5 months, n=40	old rats, 1.5–2 years, n=40	young rats, 3–5 months, n=40	old rats, 1.5–2 years, n=40
	1	2	3	4	5	6
Mn	2.15±0.13	2.71±0.14 $P_{1-2} < 0.01$	2.54±0.15 $P_{1-3} > 0.05$	3.34±0.25 $P_{3-4} < 0.05$ $P_{2-4} > 0.05$	4.12±0.32 $P_{1-5,\ 3-5} < 0.05$	4.40±0.63 $P_{2-6} < 0.05$ $P_{4-6,\ 5-6} > 0.05$
Fe	254.8±20.6	182.5±14.33 $P_{1-2} < 0.01$	221.3±12.1 $P_{1-3} > 0.05$	226.4±14.64 $P_{2-4,\ 3-4} > 0.05$	672.5±	523.8±
Cu	6.48±0.27	5.29±0.35 $P_{1-2} > 0.05$	5.27±0.17 $P_{1-3} > 0.05$	5.37±0.14 $P_{2-4,\ 3-4} > 0.05$	6.45±	4.68±
Zn	68.71±2.52	57.27±1.72 $P_{1-2} < 0.01$	58.26±2.30 $P_{1-3} < 0.05$	47.36±2.83 $P_{3-4} < 0.01$ $P_{2-4} < 0.05$	75.6±	61.5±
Se	1.38±0.05	1.14±0.06 $P_{1-2} < 0.01$	1.25±0.06 $P_{1-3} > 0.05$	0.81±0.04 $P_{3-4} < 0.001$ $P_{2-4} < 0.05$	0.96±	0.73±

The results of the study allowed to establish a trace element profile that corresponds to the variant of the lymph node structure depending on the localization [3]. There are high levels of trace elements of Mn, Fe, Cu, Zn and low levels of Se in the inguinal lymph node. There are low levels of manganese, Fe, Cu, Zn and high Se in the tracheobronchial lymph node. There are intermediate values of the concentration of trace elements in the mesenteric lymph node (table. 1). Obviously, the difference of trace elements content determines the functional specialization of lymph nodes at a young age. The content of trace elements in lymph nodes depends on the characteristics of the lymphatic region belonging to different organs and systems [1, 3].

The microelement profile of lymph nodes changes during aging [3]. There is a decrease in the content of most trace elements of Zn (1.2 times), Se (1.2–1.5 times), Cu (1.2–1.4 times), Fe (1.3–1.4 times) with an increase in the content of Mn in lymph nodes of different localization in old age (table. 1). The accumulation of trace elements occurs with a low level of their content in the lymph nodes of old animals. There are the highest levels of Mn, Fe, Zn and the lowest Se in the inguinal lymph node. There is a high concentration of Se in the mesenteric lymph node. It exceeds in 1.4–1.5 times the content of Se in tracheobronchial and inguinal lymph nodes. There are low levels of Mn, Fe, Zn and Se in the tracheobronchial lymph node. The content of Cu does not differ in lymph nodes of different localization. The results indicate an imbalance of trace elements in the formed microelement profile of lymph nodes, reflecting the age-induced changes of structure and function of lymph nodes.

Discussion

It is presented to discuss the results of the study taking into account the concept of the lymphatic region [1]. It is undeniable that inguinal lymph nodes are somatic, and mesenteric and tracheobronchial are visceral, which allows us to attribute the lymph nodes to different lymph regions. The peculiarity of lymphatic regions is due to the feature of contact with the external environment and the structural response of lymphoid tissue in the general plan of the structure of lymph nodes [1-3]. The morphofunctional status of lymph nodes varies in different periods of life. At the same time, the range of interests additionally includes the state of the microelement exchange of lymph nodes. It was expected that the content of trace elements should be the same in the lymph nodes of different localization. But the results show a difference in the accumulation of bioelements. It is the belonging of lymph nodes to a certain lymphatic region that is decisive in the formation of the microelement profile and the functional specialization of lymph nodes associated with the predominance of drainage or immune function of lymph nodes.

The structure of lymph nodes changes with age, showing signs of their involution and function decline [3]. It is important to investigate not only the content of bioelements, but also their relationship with the aging of lymphoid tissue.

Changes in the structure of lymph nodes are associated with the development of microelements imbalance in aging animals. Aging is characterized by the low level of saturation of trace elements and reduction of immune functions of lymph nodes. At the same time, a microelement profile is formed, reflecting the territorial affiliation of lymph nodes due to different contact with the external environment (regional specificity) [3].

Conclusion

We have established a trace element profile (Mn, Fe, Zn, Se, Cu) in lymph nodes of different localization in young and old animals. We found quantitative differences in the accumulation of bioelements by somatic and visceral lymph nodes as evidence of regional determination of changes associated with the characteristics of the drained lymphatic region. Aging is accompanied by an imbalance in the content of trace elements against the background of lymphoid tissue involution and decrease in the immune function of lymph nodes. The results obtained on the content of trace elements in lymph nodes may be the basis for the development of the concept of the lymphatic region in the search for lymphotropic technologies for the correction of trace element homeostasis in the integration of bioelementology and lymphology [1, 5].

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Author's contributions

Conception and design: Olga Gorchakova, Vladimir Gorchakov. Analysis and interpretation: Olga Gorchakova, Yurij Kolmogorov. Data collection: Yurij Kolmogorov, Olga Gorchakova. Writing the article: All authors. Critical revision: All authors. Final approval of the article: All authors. Overall responsibility: Vladimir Gorchakov.

Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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与衰老相关的不同部位淋巴结的微量元素
TRACE ELEMENTS OF LYMPH NODES OF DIFFERENT LOCALIZATION IN THE CORRELATION WITH AGING

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	1	2	3	4	5	6
Mn	2.15±0.13	2.71±0.14 $P_{1-2} < 0.01$	2.54±0.15 $P_{1-3} > 0.05$	3.34±0.25 $P_{3-4} < 0.05$ $P_{2-4} > 0.05$	4.12±0.32 $P_{1-5, 3-5} < 0.05$	4.40±0.63 $P_{2-6} < 0.05$ $P_{4-6, 5-6} > 0.05$
Fe	254.8±20.6	182.5±14.33 $P_{1-2} < 0.01$	221.3±12.1 $P_{1-3} > 0.05$	226.4±14.64 $P_{2-4, 3-4} > 0.05$	672.5± 54.22 $P_{1-5, 3-5} < 0.01$	523.8± 71.91 $P_{2-6, 4-6} < 0.01$ $P_{5-6} < 0.05$
Cu	6.48±0.27	5.29±0.35 $P_{1-2} > 0.05$	5.27±0.17 $P_{1-3} > 0.05$	5.37±0.14 $P_{2-4, 3-4} > 0.05$	6.45± 0.35 $P_{1-5} > 0.05$ $P_{3-5} < 0.05$	4.68± 0.27 $P_{2-6, 4-6} > 0.05$ $P_{5-6} < 0.05$
Zn	68.71±2.52	57.27±1.72 $P_{1-2} < 0.01$	58.26±2.30 $P_{1-3} < 0.05$	47.36±2.83 $P_{3-4} < 0.01$ $P_{2-4} < 0.05$	75.6± 2.81 $P_{1-5} > 0.05$ $P_{3-5} < 0.05$	61.5± 2.06 $P_{2-6} > 0.05$ $P_{4-6, 5-6} < 0.05$
Se	1.38±0.05	1.14±0.06 $P_{1-2} < 0.01$	1.25±0.06 $P_{1-3} > 0.05$	0.81±0.04 $P_{3-4} < 0.001$ $P_{2-4} < 0.05$	0.96± 0.05 $P_{1-5, 3-5} < 0.05$	0.73± 0.08 $P_{2-6, 5-6} < 0.05$ $P_{4-6} > 0.05$

The results of the study allowed to establish a trace element profile that corresponds to the variant of the lymph node structure depending on the localization [3]. There are high levels of trace elements of Mn, Fe, Cu, Zn and low levels of Se in the inguinal lymph node. There are low levels of manganese, Fe, Cu, Zn and high Se in the tracheobronchial lymph node. There are intermediate values of the concentration of trace elements in the mesenteric lymph node (table. 1). Obviously, the difference of trace elements content determines the functional specialization of lymph nodes at a young age. The content of trace elements in lymph nodes depends on the characteristics of the lymphatic region belonging to different organs and systems [1, 3].

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indicate an imbalance of trace elements in the formed microelement profile of lymph nodes, reflecting the age-induced changes of structure and function of lymph nodes.

Discussion

It is presented to discuss the results of the study taking into account the concept of the lymphatic region [1]. It is undeniable that inguinal lymph nodes are somatic, and mesenteric and tracheobronchial are visceral, which allows us to attribute the lymph nodes to different lymph regions. The peculiarity of lymphatic regions is due to the feature of contact with the external environment and the structural response of lymphoid tissue in the general plan of the structure of lymph nodes [1-3]. The morphofunctional status of lymph nodes varies in different periods of life. At the same time, the range of interests additionally includes the state of the microelement exchange of lymph nodes. It was expected that the content of trace elements should be the same in the lymph nodes of different localization. But the results show a difference in the accumulation of bioelements. It is the belonging of lymph nodes to a certain lymphatic region that is decisive in the formation of the microelement profile and the functional specialization of lymph nodes associated with the predominance of drainage or immune function of lymph nodes.

The structure of lymph nodes changes with age, showing signs of their involution and function decline [3]. It is important to investigate not only the content of bioelements, but also their relationship with the aging of lymphoid tissue.

Changes in the structure of lymph nodes are associated with the development of microelements imbalance in aging animals. Aging is characterized by the low level of saturation of trace elements and reduction of immune functions of lymph nodes. At the same time, a microelement profile is formed, reflecting the territorial affiliation of lymph nodes due to different contact with the external environment (regional specificity) [3].

Conclusion

We have established a trace element profile (Mn, Fe, Zn, Se, Cu) in lymph nodes of different localization in young and old animals. We found quantitative differences in the accumulation of bioelements by somatic and visceral lymph nodes as evidence of regional determination of changes associated with the characteristics of the drained lymphatic region. Aging is accompanied by an imbalance in the content of trace elements against the background of lymphoid tissue involution and decrease in the immune function of lymph nodes. The results obtained on the content of trace elements in lymph nodes may be the basis for the development of the concept of the lymphatic region in the search for lymphotropic technologies for the correction of trace element homeostasis in the integration of bioelementology and lymphology [1, 5].

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Author's contributions

Conception and design: Olga Gorchakova, Vladimir Gorchakov. Analysis and interpretation: Olga Gorchakova, Yurij Kolmogorov. Data collection: Yurij Kolmogorov, Olga Gorchakova. Writing the article: All authors. Critical revision: All authors. Final approval of the article: All authors. Overall responsibility: Vladimir Gorchakov.

Conflicts of interest

The authors certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

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评价非侵入性方法诊断口腔恶性肿瘤的有效性
EVALUATION OF THE EFFECTIVENESS OF NON-INVASIVE METHODS FOR THE DIAGNOSIS OF MALIGNANT NEOPLASMS OF THE MOUTH

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抽象。口腔粘膜癌（COP）早期诊断的复杂性是由于以下事实：使用标准检查方法无法确定该过程的恶性程度，并且对病变要素的良好可视化也无法提供优势。这一时期。

当前，口腔粘膜的现代检查方法包括自发荧光（AFC）和带染色的AFC，使用它们可以检测病理过程的定位。

在2018-19年度，由FSBI FPE“ CSMA”牙科部门检查了45位年龄在35至85岁之间的因慢性机械损伤导致口腔黏膜完整性受损（糜烂，溃疡）的患者。进行了口腔镜检查的比较，以确定确定口腔黏膜病理性低位灶的恶性程度的诊断功效。基于循证医学的概念和活检结果数据对诊断测试进行了评估。

AFC和AFC染色方法的灵敏度为100％。诊断方法的信息价值低（不到10％）是根据特异性，准确性，预后价值等标准确定的；在这方面，使用这些方法不可能鉴定出病理过程的恶性。改良的带染色的AFC技术可以确定病变部位的面积，并从完整的组织中分离出病灶的边界以进行活检。因此，借助于口腔镜检查，仅可以清楚地看到口腔粘膜疾病的任何情况。

关键词：自体荧光口腔镜，染色自体荧光口腔镜，光学诊断方法，恶性肿瘤的早期诊断，口腔镜的有效性。

Abstract. *The complexity of the early diagnosis of cancer of the oral mucosa (COP) is due to the fact that it is impossible to determine the malignancy of the process using standard examination methods, and good visualization of the elements of the lesion does not give advantages in this period.*

Currently, the modern examination method for oral mucosa includes autofluorescence (AFC) and AFC with staining using which it is possible to detect the localization of pathological processes.

In 2018-19, 45 patients aged 35 to 85 years with integrity violation of oral mucosa (erosion, ulcers) due to chronic mechanical injury were examined at the Department of Dentistry of FSBI FPE "CSMA". A comparison of stomatoscopy was performed to identify the diagnostic efficacy of determining the malignancy of pathologically low-lying foci of oral mucosa. Diagnostic tests were evaluated based on the concepts of evidence-based medicine and data from biopsy results.

The sensitivity of the AFC and AFC staining methods was 100%. The low (less than 10%) informative value of diagnostic methods was established by criteria such as specificity, accuracy, prognostic value; in this regard, using these methods, it is impossible to identify malignancy of the pathological process. The modified AFC technique with staining allows one to determine the area of the lesion elements and to separate the borders of the pathological focus from the intact tissue for biopsy. Thus, with the help of stomatoscopy, it is only possible to clearly visualize any case of oral mucosa disease.

Keywords: *autofluorescence stomatoscopy, staining autofluorescence stomatoscopy, optical diagnostic methods, early diagnosis of malignant neoplasms, the effectiveness of stomatoscopy.*

The significance of the problem of early detection of cancer is determined by the incidence rate of malignant neoplasms (MNP) among the residents of Russia, which in 2018 amounted to 2562.1 per 100,000 population, which is 39.5% higher than the 2008 level [1]. Most often, cancer affects the tongue of 50-60% of patients, the mucous membrane of the bottom of the mouth 20-30%, cheek 8-10%.

Another negative aspect should be noted, the detection of oncology in the late stages of diagnosis reduces the survival of patients even after combined treatment, the five-year survival rate is 40-45% [2]. At the same time, surgical treatment in advanced cases is accompanied by disability of patients, and requires significant efforts for rehabilitation.

One of the main criteria determining the prognosis of cancer is the degree of prevalence of the tumor process at the time of diagnosis. In most cases, even with good visualization of the pathological focus, the diagnosis is established at stages 3 and 4, the course of the total number of episodes, whereas the initial in 36.9% of cases [1]. According to I.A. Zadirenko (2013), cancer of the mucous membrane of the mouth and pharynx was detected in 50-70% of patients in advanced stages [3].

A. M. Avanesov and co-authors 2016 found that in 65% of cases, a dentist can suspect a conclusion about the presence of MNP in the mouth only at the patient's third visit [4]. Research conducted by A. Pursanova et al. (2015), showed that 42.8% of specialists differentiate the early manifestations of oral mucosa cancer, but only 4.2% of doctors diagnose in accordance with the protocol of the initial examination of a dental patient [5].

The difficulty in the early diagnosis of cancer is due to the fact that it is impossible to determine the manifestation of the malignancy process using standard examination methods, and a good visualization of the elements of the lesion does not give advantages in this period. Morphological and morphometric changes in the state of the mucous membrane (thinning of the epithelial layer, the appearance of dysplasia, etc.) give variability to the pathological focus [6].

Currently, autofluorescence (AFC) is a modern method of examining oral mucosa, with the help of which it is possible to detect the localization of pathological processes. Luminescent stomatoscopy is based on differences in the intensity and spectral composition of the endogenous radiation of healthy tissues and lesions [7]. Bulgakova et al. (2016), revealed that at the site of malignancy a sharp decrease in the brightness of radiation is recorded. "Suspicious sections" of the mucous membrane spread their own light with a longer wavelength, have a dark color and an uneven surface, which indicates the presence of atypical cells. The impact on the intact (healthy) mucous membrane with a light beam of the blue spectrum reproduces a green or blue glow, the foci of inflammation have a red or maroon light, this is due to metabolic processes in the cells and the appearance of one of the most important natural fluorophores - endogenous porphyrin [8].

At the same time, Mycek M.-A., Pogue B.W. (2003) proved that porphyrins accumulate in malignant tissues, but no reasons have been identified for the increase in the content of photosensitizers in tumors [9, 10, 11].

Another method for the early diagnosis of MNP is staining of mucosal lesion elements with a cytochemical dye (1% toluidine blue solution), which is retained in the intercellular space of damaged cells and interacts with sulfated mucopolysaccharides negatively charged by mitochondrial membranes. Sol Silverman et al. (2010) indicate a high - 90% prognostic value of a positive result for determining oral mucosa cancer [12].

Despite the existing methods for detecting MNP, today the diagnostic problem remains relevant.

Purpose of the study – evaluate the prognostic value of autofluorescence stomatoscopy (AFC) and AFC techniques in combination with staining in the diagnosis of MNP of oral mucosa and oral organs.

Materials and methods. In the Department of Dentistry of FSBI FPE "CSMA" in 2018-19, 45 patients aged 35 to 85 years with pre-tumor oral mucosa diseases were examined.

Inclusion criteria: individuals with a violation of the integrity of oral mucosa (damage elements: erosion, ulcer), due to chronic mechanical injury.

Exclusion criteria: patients with infectious, allergic diseases of oral mucosa.

The study consisted of traditional methods: interrogation, medical history, external examination with mandatory palpation of the lymph nodes of the regional

region. Inspection of the mouth: a description of the condition of the mucous membrane of the lips, cheeks, hard and soft palate, gums, dentitions and the identification of factors of chronic mechanical trauma (sharp edges of teeth, fillings, orthopedic constructions, doped teeth, the presence of dissimilar metals), registration of CPITN and Green Vermilion oral indices.

The subjects were randomized by free sampling into two groups:

The first group included 22 people (men - 9, women - 13), in whom the condition of the mucous membrane was evaluated using autofluorescence stomatoscopy.

The second group consisted of 23 people (men - 8, women - 15). For the diagnosis, the authors used the improved autofluorescence technique with staining. The method consisted of the following: a solution of 1% toluidine blue was applied to pathological foci with a cotton swab, the patient was asked to rinse his mouth with water, then the dye was fixed with 1% acetic acid for 10 seconds and rinsed with water again, after which an AFC device was used for stomatoscopy. (LLC Polironik, Russia).

To confirm the diagnosis in patients in both groups, lesion sites were taken for biopsy. Histological examination (HE) was performed in the pathological department of P.A. Hertsen Moscow Oncology Research Center, the results of the morphological conclusion were taken as an indisputable criterion for establishing the presence or absence of cancer.

The effectiveness of the above diagnostic methods was evaluated using the concepts of evidence-based medicine. The sensitivity, specificity, accuracy, and prognosticity of a positive result were calculated based on the biopsy data and the results of the study of the pathological lesion obtained by the methods of AFC and AFC with staining. Thus, the criteria for diagnostic tests were formed:

positive: a) true (confirmed by biopsy results);
b) false (not confirmed by biopsy results);
negative: c) false (not confirmed by biopsy results);
d) true (confirmed by biopsy results).

Sensitivity (S) calculated by the formula: $\mathbf{S = a /a+ c \times 100\%}$.

Peculiarity (P) was calculated: $\mathbf{P = d/ b+ d \times 100\%}$.

We determined the accuracy (A) of the diagnosis of AFC and AFC with staining with a formula that shows how many correct results were obtained:

$$\mathbf{A = a+d/(a + b + c + d) \times 100\%}.$$

The diagnostic significance of the methods was evaluated by the predictive value of a positive result **(PR)** = $\mathbf{a/a+b \times 100\%,}$ which identifies the percentage of probability of the presence of MNP of oral mucosa with a positive study.

The results of the study.

An analysis of the dental status of all patients showed that the cause of various severity elements of lesions of oral mucosa95% of all cases was a different kind of chronic trauma, mainly with sharp edges of decayed and dystopic teeth.

Evaluation of the results of CPITN indices in both groups did not reveal significant differences, the share of extracted teeth was more than 50%, the carious process was established in 12% of patients of the 1st group and 14% in the 2nd, the filled teeth made up 35% of the total number and 32% respectively.

The values of the Green Vermilion index in all examined patients corresponded to a poor level of hygiene: in the I group - 2.3 ± 0.1, in the II group - 2.2 ± 0.3, which also did not have statistically significant differences.

In group I, where oral mucosa was diagnosed to detect malignant neoplasms using the AFC technique, a false positive test was established in 20 patients. One examinee had a negative result - when illuminating the element of the lesion of oral mucosa, there was green luminescence, which corresponds to the normal state of the mucous membrane, anamnesis and clinical picture also confirmed the absence of MNP.

In one case, the data of stomatoscopy (erosion had a dark halo of fluorescence) coincided with the result of a biopsy, established the presence of atypical cells (HE № 25434/2018), which made it possible to make the final diagnosis of poorly differentiated squamous cell carcinoma.

The probability of confirming the presence of oral mucosa pathology using the AFC technique was 100%, that is, the diagnostic test is highly sensitive. Since, when illuminating the oral mucosa, it is always possible to clearly visualize the boundaries of the lesion site (table 1).

Table 1. *Information content of diagnostic research methods*

Name of diagnostic methods	Evaluation Criteria,%			
	Sensitivity	Peculiarity	Accuracy	Predictive value of a positive result
Autofluorescence stomatoscopy	100	4,76	9,1	4,76
Autofluorescence stomatoscopy with staining of lesion elements	100	0	8,7	8,7

However, in 90% of cases there was a “false” identification of MNP, the absence of fluorescence zones of the pathological focus were noted in patients, which according to the instructions for the AFC device indicates malignancy of the process, at the same time HE refuted the alleged diagnosis of MNP, the so-called “false” positive ”triggering of the diagnostic method.

The peculiarity of the autofluorescence method was only 4.76%, this result demonstrates a low degree of reliability in identifying the process of malignancy.

The accuracy rate is 9.1% and the predictive value of the positive result is 4.76%, indicate the low effectiveness of the diagnostic value of this method for the detection of MNP of oral mucosa.

In group II, staining of elements of oral mucosa improved the visualization of the pathological focus, increased the intensity of the fluorescence of the affected area, made it possible to evaluate its area, to separate the boundaries of the damaged tissue from healthy tissue.

Analysis of the results of diagnostic tests in group № 2 showed the following patterns (table 1).

A high sensitivity of 100% of the modified technique was established, with its help it was revealed that all patients of group II had oral mucosa pathology. Using AFC with staining in the same way as conventional stomatoscopy in group I, it is impossible to identify patients with MNP, which was confirmed by such criteria as specificity, which was 0% in this group (table 1).

Stomatoscopy with staining did not significantly improve the diagnostic recognition efficiency of MNP of oral mucosa. The accuracy indicator is comparable with the values in group I. The predictive value of the result in group II is 1.8 times higher, but generally characterized as low - 8.7%.

The difficulty in interpreting AFC diagnostic data with and without staining is due to the fact that the presence of porphyrins is also characteristic of inflammatory processes. A number of experimental and clinical studies have confirmed the fact that fluorophores were present in areas of ischemia and tissue hypoxia, and no morphologically altered cells characteristic of malignant or benign neoplasms were found [10].

In addition, the evaluation of the examination of oral mucosa has qualitative indicators, and they are quite subjective, the lack of quantitative criteria complicates the understanding of the results of stomatoscopy.

The high sensitivity of standard and modified stomatoscopy methods makes it possible to substantiate their use as diagnostic tests to identify the presence of oral mucosa pathology. Currently, a reliable diagnosis of MNP at any stage of the disease is possible only with a biopsy.

Conclusions:

1. The dental status of patients with oral mucosa diseases is characterized by high intensity indicators of the CPITN index: the number of extracted teeth exceeds the sum of teeth filled and decayed by caries by 6% and 8%, respectively, no significant differences were found between the studied groups.

2. The Green Vermilion indices for all examined patients corresponded to a poor level of hygiene: in the I group - 2.3 ± 0.1, in the II group - 2.2 ± 0.3, which also did not have statistically significant differences.

3. It is necessary to direct efforts towards the rehabilitation of the mouth to patients with oral mucosa pathology, and, first of all, to eliminate the causes of chronic mechanical trauma, to include specialists in all dental specialties in a comprehensive care plan.

4. The sensitivity of autofluorescence stomatoscopy and autofluorescence stomatoscopy with staining was 100%. Thus, any case of oral mucosa can only be clearly visualized using these tests.

4. The low (less than 10%) informative value of diagnostic methods was established by criteria such as peculiarity, accuracy, and prognostic value; in this regard, using these methods, it is impossible to reliably detect malignancy of the pathological process.

5. The modified autofluorescence stomatoscopy technique allows determining the area of the lesion elements and separating the borders of the pathological focus from intact tissue for biopsy.

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图达库尔水库在现况下的水生生物学和鱼类学特性
HYDROBIOLOGICAL AND ICHTHYOLOGICAL PECULIARITIES OF TUDAKUL RESERVOIR AT PRESENT CONDITIONS

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Introduction

The Tudakul reservoir was created in the lower reaches of the Zarafshan River for irrigation purposes, it receives water from the middle reaches of the Amu Darya River (main source) and from the Zarafshan River. The reservoir was created in the 1950s, long-term fishing productivity of fisheries was 8-12 kg/ha, catches were 120 - 200 tons per year. Since 2003, pasture aquaculture (culture based fisheries) began to be developed in this reservoir. For this purpose, a fish hatchery was built in which carp yearlings (*Cyprinus carpio*), white carp (*Hypophthalmichthys molitrix*), spotted silver carp (*H. nobilis*), grass carp (*Ctenopharyngodon idella*) are grown up to 30 - 120 g of average individual body weight, stocked reservoir with density 300 - 500 ind./ha. Fish walk for 2 years or more. Fishing was completely transferred to non-aquatic with kurpnoy mesh (70 mm and above). As a result, since 2005, catches began to increase sharply and amounted to 1000 - 1500 tons in 2006 - 2015, and fish productivity increased to 40-60 kg/ha.

The peculiarities of the feed base and ichthyofauna of the reservoir were studied in the period before the transition to pasture aquaculture [1], [6], [9]. New conditions are very different, massive flocks of stocked fish and fish of local ichthyofauna constantly swim in the reservoir. A reservoir in this state has not been studied. The aim of this work was to study phytoplankton and zooplankton, as well as the ichthyofauna of the Tudakul reservoir in the conditions of grazing aquaculture.

Material and methodology

The material was collected during the seasonal expeditions to the Tudakul reservoir in 2016. Used generally accepted methods of collecting hydrochemical, hydrobiological and ichthyological samples [3]; [4]; [7].

The area of the Tudakul reservoir is about 22,000 hectares, the volume is about 2 billion m^3, the maximum depth is 17 m, the average is 7 m. The reservoir has seasonal regulation of irrigation flow, is filled in the autumn-winter period, water releases depending on the water content of the year from April-May to the end of October. Initially, the reservoir was filled with excess waters of the Zarafshan River, but with the commissioning of the Amu-Bukhara Canal, it is also filled with water from the Amu Darya river.

The climate - is sharply continental, the average annual rainfall is 303 mm, the minimum monthly average air temperature is -9 ° C (January - February), the maximum + 43 ° C (July - August).

Results

The water level in the reservoir is subject to significant fluctuations and depends on the irrigation flow of water from the Zarafshan and Amu Darya rivers, water intake for irrigation, evaporation from the water surface.

The water of the reservoir has a slightly alkaline reaction: during the year the pH values ranged from 8.61-8.78, the mineralization of water was at the level of 484.1-1619.2 mg/l. The maximum water temperature did not exceed 28 ° C. The content of dissolved oxygen ranged from 7.38-11.6 mg/L. The transparency of the water also varied widely and was 15-175 cm across the Secchi disk. The surface waters of the Tudakul reservoir according to the classification of Alekin belong to the sulfate class of the calcium group. SO– ions prevail in the group of anions; on average, they account for more than 70% of the total amount of anions. HCO and C1 ions are in a subordinate state to the sulfate ion, their content is much lower and averages 23 and 7%, respectively. In the group of cations, calcium dominates, its share is 45% of the total amount of cations. Magnesium ions and Na + K account for an average of 21 and 31%, respectively. The total salinity does not exceed 1600 mg / l, the total hardness varies from 5 to 7.5 mEq / l, which classifies them as weakly mineralized, soft waters.

Hydrochemical factors adversely affecting the ecosystem of the reservoir include the Zarafshan River, by the water of which agricultural wastewater is introduced into the Tudakul reservoir through the inlet channel.

Regarding the nature of the coastline, we note that the northwestern and northeastern shores have rather steep slopes; the eastern coast gradually turns into a wavy plain adjacent to the hills. The vegetation of the area around the reservoir is characteristic of the steppe zone. A significant part of the steppes adjacent to the reservoir is used for growing crops.

In our collections, the phytoplankton of the reservoir is represented by 186 species, varieties and forms of algae, including blue-green (*Cyanophyta*) - 47, diatoms (*Bacillariophyta*) - 100, green (*Chlorophyta*) - 25, pyrophytic (*Dinophyta*) - 7, cryptophytic (*Cryptophyta*)) - 3, euglena (*Euglenophyta*) - 3 and golden algae (*Cryzophyta*) - 1 species. The dominant complex of phytoplankton communities was represented by producers, the most developed and diverse among which were diatoms, blue-green and green algae.

In the samples of the zooplankton of the reservoir, only 15 species were noted, of which Rotifera - 10 species, *Cladocera* - 3, *Copepoda* - 2 species. Dominants among rotifers were: Euchlanis dilatata, Keratella tropica; kladozer - Diaphanosoma mongolianum; copepod - *Thermocyclops vermifer*. In the formation of the zooplankton biomass of the Tudakul reservoir, Copepoda plays a significant role, or rather *Thermocyclops vermifer*, from *Cladocera* - *Diaphanosoma mongolianum*. The number of zooplankton organisms was 35 390.5 spec./m^3, biomass 193.12 mg/m^3.

As a part of the macrozoobenthos of the reservoir, only 9 species of organisms were found, including double-winged larvae - chironomids - 2, oligochaetes - 3, mollusks - 1, amphipods - 1, shrimp - 1 and misid - 1 species. The basis of macrozoobenthos of the Tudakul reservoir is a complex of organisms represented mainly by widespread species: chironomid larvae of the semis. *Chironominae*, oligochaetes of the family *Tufidaidae*, brackish species of mollusks *Corbicula fluminalis*, shrimp *Macrobrachium nipponense asper*, misid *Mesomysis kowalevskyi*. The quantitative indicators of macrozoobenthos of the reservoir in the summer period varied in abundance 90-160 ind./m^2, in biomass - 0.5-3.5 mg/m^2.

In the ichthyofauna samples, 29 fish species were identified in the reservoir, including representatives of the cyprinid family - 22, and the remaining 7 families - 1 species each.

Discussion and recommendations

By to the composition of organisms of phytoplankton, zooplankton and zoobenthos, our data supplement the previously obtained results [2], [5], [8].

Hydro construction violated the isolation of river basins in the Aral Sea basin, which led to the mixing of ichthyofauna. Initially the fish fauna of the reservoir spontaneously formed at the expense of fish Zarafshan River and included 11 species (Zeravshan dace, Gobio gobio lepidolaeraus Kessler, Varicorhynus capoeta heratensis, Chalcalburnus chalcoides aralensis, Alburnoides bipunctatus and Alburnoides taeniatus Kessler, Capoetobrama, Common carp, Wels catfish, Sabanejewia aurata aralensis, Gambusia, Prussian carp, Common bream). After commissioning of the Amu-Bukhara Canal from the Amu Darya, 15 (Barbus brachycephalus brachephalus, Aspius aspius, Aspiolucius esocinus, Salmo trutta oxianus, Salvelinus pectinate, Amu Darya sturgeon, Pelecus cultratus, Grass carp, Silver carp, Black carp) entered the reservoir. [16]. Subsequent publications report the penetration through ABMK of another 4 fish species (Caucasian dwarf goby, Monkey goby, Alburnoides bipunctatus, Perca schrenkii). Thus, about 30 species are indicated in the literature [9].

In the fishery use of the reservoir, the main fishing objects in the last 10 years are carp (carp), Silver carp and Bighead carp, which stock the reservoir, as well as pikeperch, bream and, in some years, silver crucian carp, Grass carp (the latter also stocks the reservoir). Roach fishing is not part of the local fishing strategy, although its stocks are large. Such valuable species as the Amur snakehead and common catfish in catches in the Tudakul reservoir are insignificant due to the fact that their stocks are insignificant..

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The maximum catches of fish were obtained at a time when the basis of fishing was stocked species - carp, Grass carp, Silver carp and Bighead carp. In some years, the value of commercial fish productivity reached 25-28 kg / ha. This period was characterized by the stability of the fishing load on the reservoir.

Further optimization of pasture aquaculture is recommended in the following areas:

- develop technology for confident fishing of carps and grass carp, organize total fishing for large individuals during intense fishing (spawning migration of these fish, despite the ban on fishing).
- For roach, we recommend developing marketing and fish processing and increasing its fishing.
- Start developing technology for the artificial reproduction of catfish and snakehead for introduction into pasture aquaculture facilities.
- As a result, optimization of the modern direction of the enterprise's development may allow increasing fishing to 1,500 t / year based on pasture aquaculture.

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贝加尔湖南部地区土壤功能特征
FEATURES OF SOIL FUNCTIONING IN THE SOUTHERN BAIKAL REGION

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注解。 这项工作考虑了在古珊瑚条件下发展的土壤并经历了农耕作用。 已经确定土壤形成的低能级是它们的特征。 母岩的高度多样性，沿地形的位置，包括其微观形态，反映在植物群落的状态和土壤的生物活性上。 暴露于农业的土壤导致其特性显着下降，在土壤栽培过程中（块状低地古浮雕复杂化的情况下）加剧。

关键词：土壤的生态学和功能特性，古浮雕，耕作，土壤多样性，植物群落生产力，土壤生物活性

Annotation*. This work considers soils developed under paleocryorelief conditions and experienced agrogenic effects. It is established that a low energy level of soil formation is characteristic of them. The high variegation of parent rocks, the position along the topography, including its microforms, is reflected in the state of phytocenoses and biological activity of soils. Agrogenic exposure leads to a noticeable deterioration in their properties, intensifying during cultivation of soils complicated by tuberous-lowland paleocriorelief.*

Keywords: *ecological and functional properties of soils, paleocriorelief, agrogenesis, soil diversity, phytocenosis productivity, soil biological activity*

Introduction

The southern Baikal region differs from many other regions in the great diversity of its climatic conditions. The landscape range of ecosystems in the region corresponds to different subcontinents of Asia, the interpenetration of which is a unique landscape-situational example of Siberian nature within North Asia [3]. The most important factors of soil formation and soil functioning in the Southern Baikal region were climate and topography, and they determined the uniqueness of the mechanisms of local circulation of air, heat and moisture. The combined

effect of the hollow effect and the arid-shadow form of vertical zonality led to the presence in the limited area of sharply contrasting landscapes: from subtaiga to dry-steppe, and their low moisture and heat supply explained their territorial proximity. The tops of the watersheds are occupied by sub-taiga, the middle and lower parts of the slopes are occupied by the forest-steppe, and the river terraces are occupied by the real and dry steppes.

According to soil zoning [3], the study area is assigned to the Okrug of the Irkutsk-Cheremkhov Plain and the southern Baikal region of the depression with gray forest, sod-podzolic, sod forest, sod-carbonate soils and chernozems of the Middle Siberian flat-plateau province and the lowlands of Olkhon island and Priol'khon island with chestnut and sod forest soils. They are united in one soil district of the Southern Baikal region, which is the only one belonging to the subboreal belt and simultaneously located inside the boreal belt.

The organization of soil cover in the okrug at the microlevel is due to the paleocryorelief, the formation of which occurred at the end of the Pleistocene (Sartan time), with significant aridization of the climate against the background of severe cooling. Under periglacial conditions, an initial breakdown of the surface into polygons and cracks filled with vein ice occurred. Its full thawing continued in the Holocene, and the filling of voids in the forest zone was with the low-humus material of the collapsed crack walls, and in the steppe with the high-humus material of the upper horizons of the humus soils [7]. Soils developed under these conditions sharply differed in genesis, morphology, and properties. The hillocks were polygons, blocks of undisturbed structure of a round or oval shape with a height of 1-3.5 m and a diameter of 10-20 m. Hollows are former cryogenic cracks in which soil formation occurred in redeposited material that came as a result of its demolition from neighboring hillocks. Differentiation of the processes of soil formation under the conditions of a bumpy-lowland paleocryorelief was manifested in the form of polychronous regular-cyclic fracture complexes. The severity of climatic conditions led to low resistance of the soil cover to agrogenic effects. The soil cover complicated by the paleocryorelief significantly increased the diversity of soils, which significantly complicated their use [4, 7, 8, 10-13].

Objects and research methods

The objects of study were the main soil types of the Southern Baikal region, formed in the conditions of sub-taiga, forest-steppe, xerophilic and dry steppes, developed in automorphic, autonomous conditions, occupying elevated relief elements and microrelief (mounds) in the conditions of a hilly-low-lying paleocryorelief. Semi-hydromorphic, heteronomic soils are formed in the depressions, located in the immediate vicinity of the soils of the hillocks at a distance of 10 to 40 m. Soil sections of anthropogenically transformed soils were laid several tens of meters from their virgin varieties.

To study the functioning of soils, their temperature, moisture and humus reserves were determined [1]. Soil samples were taken from a depth of 0-20 cm on mounds and in depressions, virgin, agrogenic and post-agrogenic soils by a soil drill in 10-fold repetition. Ablation of aboveground phytomass was carried out on model sites 25 × 25 cm^2, in 5-fold repetition in the 4th decade of July and the 1st decade of August [9]. The biochemical activity of soils (BAS) was determined by the express method according to T.V. Aristovsky, M.V. Chugunova [2], the essence of which was to record the rate (in hours) of decomposition of a nitrogen-containing organic compound (urea) and a change in the pH of the air by 1.5-2.0 units due to the release of ammonia. High (I degree) BAS was characterized by a pH shift within a few minutes to 4 hours; medium (II degree) - from 4 to 8 hours; low (III degree) - over 8 hours. The research results were processed statistically by the principal component analysis (PCA) in Past 3.26.

Results and discussion

Significant areas in the soil cover of subtaiga landscapes are occupied by sod-podzolic, podzolized brown and brown residual carbonate, developed under the canopy of light-coniferous and small-leaved grass, moss-grass and lingon-grass forests located on the tops of watersheds. The tuberous-lowland microrelief is not pronounced. In the soil cover of the forest-steppe of the region, gray soils and clay-illuvial humus are widely represented. Gray soils are developed under the canopy of tall grass birch, birch-aspen forests. The chernozems are developed in the arid shade of foothill zonation, where the lack of moisture hindered the growth of forest and contributed to the development of grassy vegetation. The presence of pronounced forms of the tuberous-lowland paleocryorelief led to a sharp differentiation of the plant and soil cover, which was manifested in noticeable differences in the productivity of phyto- and agrocenoses, biological activity, hydrothermal and nutrient regimes of soils. The formation of chestnut soils on the territory of the Priolkhon Plateau proceeded under conditions of high solar radiation, low amount (less than 200 mm per year) of precipitation in the summer period, their prolonged stay in the frozen state in the absence of snow cover, which brings them closer to cryoarid soils. In the distribution area of the studied soils of the xerophilic and dry steppes, tuberous-lowland forms of the paleocryorelief are well expressed [3, 7].

Peculiarities of climatic conditions determined the specifics of the soil functioning processes, their hydrothermal and food regime, and biocenotic properties. So, in the summer months, the soils of forest landscapes (sub-taiga, forest-steppe) were most warmed up, and covered with vegetation, they were noticeably cooler than the soils of agrolandscapes by 6-9°. It is known that the forest, in addition to its screening role from solar radiation, by means of transpiration, additionally cools the soil in summer. Finding the soils of grassy landscapes

(chernozems and chestnut) for a long time (about 8 months) in the conditions of seasonal permafrost and the depth of freezing by 3-3.5 m provided them with large reserves of cold compared to their European counterparts. The reason is a long and harsh winter, the low thickness of the snow cover or even its absence due to blowing. The most cool were virgin chernozems and chestnut soils, and in the depressions their temperature is 4 ° C lower than on the hills, and the temperature of agrogenic soils was several degrees higher than virgin soils, due to the lack of natural vegetation.

Destruction of natural cover during agricultural development of the territory with a severe winter wind regime leads to partial blowing of snow from the developed areas, which causes the drying out of soils and a decrease in their heat capacity. This caused a sharp winter cooling of soils and underlying rocks, their deep and long-term freezing, therefore, the temperature regime of virgin, agro- and post-agrogenic soils is different. In arable and fallow soils, due to earlier snow cover melting, positive temperatures were established earlier than on virgin soil, where the effect of shading of the soil surface by woody vegetation was observed. Moreover, in cold weather, virgin soil cooled much less than on arable land and deposits. For the studied soils, it was found that the warmest were the soils located on the windward side of the northwestern slope. The influence of the bumpy-lowland microrelief was as follows: the bumps were frozen and thawed faster, they were frozen to a lesser depth, but the soils of the hollows thawed longer.

The temperature regime of the studied soils, namely, the existence of the soil stratum for a long time in the frozen state and its later thawing in the spring-summer period, has a great influence on their water regime. It is known that in the forest only 30% of atmospheric moisture reaches the soil surface, which is associated with the retention of a significant amount of water by the crowns of trees [7, 8, 11]. There is a significant unevenness of rainfall during the year, 85% of which falls during the growing season. Soil moisture depends on the position on the terrain, the exposure of the slopes, the particle size distribution, the humus content, and therefore the soils of the forest-steppe are less moist than sub-taiga, and the xerophilic and dry steppes are even less moist than forest-steppe. The moisture content of the soils of the depressions exceeded 1.1-3.5 times than on the mounds, which is associated with the accumulation of water in them, and the most contrasting differences were observed in the chernozems of the forest-steppe. The moisture content of agro- and post-agrogenic soils is much higher than that of virgin soils, which is explained by the absence of trees holding up to 70% of rainfall with their crowns and almost all of the moisture was absorbed by the soil. In the depressions, its values are higher than on the hillocks due to surface runoff. At the same time, differences in the moisture content between the soils of the paleocryorelief are small due to the leveling of the hilly-lowland surface during development.

When the soil is plowed, a progressive desiccation of the root habitat occurs, which is mainly due to increased moisture consumption due to increased soil temperature, increased turbulent heat and moisture exchange in the surface air layer, and an improvement in the light regime due to the destruction of the vegetation cover and a good heat and moisture insulator [7 , 12]. Therefore, the studied agrogenic soils of the mounds and depressions were less moist compared to virgin. The development of soils with a paleocryorelief during mechanical treatment led to leveling of the surface and their moisture content in agro- and post-agrogenic versions is less noticeable while maintaining the general pattern: in depressions it is wetter and colder than on mounds. Post-agrogenic soils are maximally moistened, especially in depressions, which is associated with the resumption of natural vegetation, which prevents the evaporation of moisture from the soil.

As is known, a change in climatic conditions determines a change in the space of vegetation. According to V.M. Boyarkina [5] the natural productivity of vegetation in forest landscapes averaged about 6.0 t/ha of dry weight. In the studied virgin soils, its values corresponded to 2.1–2.6 t/ha, which is 2.5–3 times lower than the average values. In the depressions, the sod process prevailed, due to the development of lush vegetation, the amount of dry phytomass in them reached 12.8 t/ha, which is more than 2 times higher than average values. Therefore, the soils of the depressions were distinguished by a greater thickness of the humus horizon, with a high content of humus and moisture. There were peculiar hydrothermal conditions that had a positive effect on the state of the vegetation, characterized by a dense high grass stand. The productivity of agrocenoses (productivity of barley, oats) was an order of magnitude lower than virgin phytocenoses. In some cases, due to the leveling of the surface, its values on the hill and in the depression differed little. In others, where the elevation between the elements of the microrelief reaches 0.5-1 m, productivity values can vary by 2 or more times. By the amount of dry phytomass, post-agrogenic soils occupied an intermediate position between virgin and agrogenic.

The productivity of phytocenoses also affected humus reserves. Their characteristics give an idea of the potential level of soil fertility, since it depends on the hydrothermal regime of soils, the amount of plant residues entering the soil, and the speed and intensity of their processing by microorganisms. According to the gradation proposed by E.L. Grishina and D.S. Orlov [6] in the virgin soils of forest landscapes they are concentrated in a small thickness of the upper 20 cm layer, and are estimated as low (<100 t/ha). An exception was virgin clay-illuvial chernozem, where they showed average values. In the depressions, humus reserves increased by 1.5–2 times compared with the mounds. When plowing, despite the process of humus degradation, these values significantly decreased 1.2-1.6 times in comparison with virgin soil. In post-agrogenic soils, humus reserves again increased noticeably, especially in depressions, compared with agrogenic and even virgin soils, and the difference between hillocks and depressions was 1.1-1.6 times.

Express method for determining the biological activity of the soil (BAS), proposed by T.V. Aristovsky and M.V. Chugunova [2] is very sensitive and allows not only to identify differences between contrasting objects in one way or another, but also to differentiate by soil biological activity with similar properties. For virgin soils of subtaiga, the average BAS for the upper 20 cm soil layer was characteristic, for the forest-steppe - medium and high, and for the xerophilic and dry steppes high. Due to excess moisture, unfavorable heat and air exchange in the soils of depressions, the rate of decomposition of urea is noticeably lower than on mounds, which was mainly a low degree of BAS. All agro- and post-agrogenic soils on the hillocks were characterized by a high degree of decomposition of urea, and both high and medium degrees were observed in the depressions, since they are cooler due to the shadow cast by the hillocks. In general, agricultural soils are much warmer than virgin soils; therefore, the rate of decomposition of urea in them is higher.

To reduce the dimension of the data array and to establish the relationship of the studied variables (factors) with the type of soil, one of the methods of multivariate statistics was used - the method of principal components (Fig.).

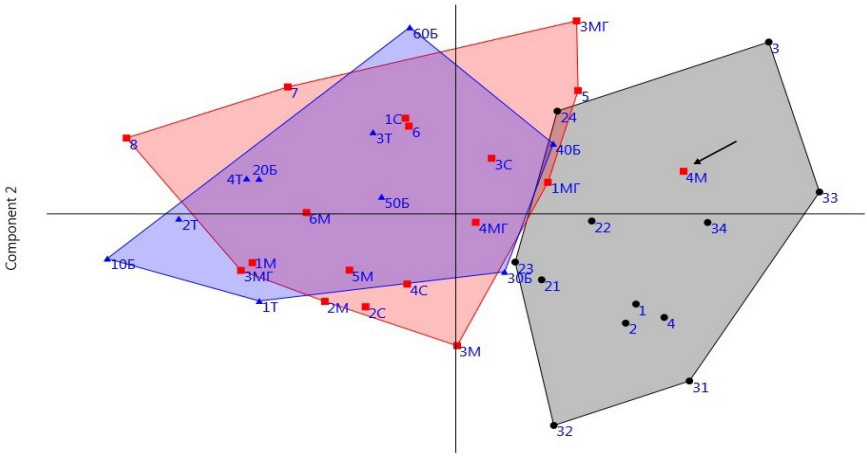

Fig. *Characteristics of the studied soils in the space of two main components*

● - sub-taiga soil (p. 31-34, 1-4, 21-24);

■ - forest steppe soil (p. 1M-6M, 1МГ-4МГ, 1С-4С, 5-8);

▲ - soils of the xerophilic and dry steppes (p. 10Б-60Б, 1Т-4Т)

In the space of the two main components, the coordinates of the points corresponding to the soils of the subtaiga differ from the localization of points related to the soils of the forest-steppe, the xerophilic and dry steppes. Moreover, the points corresponding to the soils of the forest-steppe and steppe landscapes are grouped together. The main difference lies in the humus reserves, which in the sub-taiga soils turned out to be minimal, since they are located on the elevated elements of the mesorelief. Only one point from the section of arable soil of the forest-steppe (p 4M, indicated by an arrow) with low humus reserves due to prolonged tillage, which leads to its plowing, enters the sub-taiga space. In other cases, the soils of the forest-steppe, xerophilic and dry steppes have similar and higher values of this indicator, because their formation took place mainly in the accumulative landscapes of the lower parts of the slopes and river terraces.

Conclusion

A feature of the functioning of the soils of the Southern Baikal region is a very limited period of active microbiological activity (1-1.5 months). In soils of forest landscapes (sub-taiga and forest-steppe) that are cooler and wetter, a considerable amount of formation of semi-decomposed coarse-humus residues occurs, which have not reached the stage of complete humification, a high degree of BAS is characteristic only for the uppermost soil layer of the hillocks, in the depressions there is an average and low degree of biological activity. The soils of grassy landscapes, drier and better warmed up, are characterized by increased BAS, processes of humification and humus accumulation (clay-illuvial chernozems) up to partial humus mineralization (dispersed carbonate chernozems, chestnut soils).

The reduction of vegetation during plowing up of soils leads to a tightening of hydrothermal, air, and nutrient regimes; an increase in the differentiation of soil properties is observed. The underlying infertile horizons are included in the plowing, significantly acidifying or alkalizing the arable layer, depending on the type of cultivated soil. Soils on the hillocks are degraded due to the transfer of part of the highly humified soil material to depressions. At the same time, arable soils of depressions have more favorable hydrothermal conditions for plant growth than mounds.

The post-agrogenic evolution of soils in the region as a whole is aimed at restoring the natural profile of soils. In place of the agrohorizon, the genetic horizons of the original natural soil are gradually being restored. This process of them, due to the severity of hydrothermal conditions, proceeds slowly, for a long time, preserving the signs of former plowing in the form of an even lower boundary of the arable horizon.

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基于矢量优化的工程系统建模与仿真
MODELING AND SIMULATION OF ENGINEERING SYSTEMS ON THE BASIS VECTOR OPTIMIZATION

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抽象。 这项工作的目的是基于已开发的矢量优化理论和方法，创建一种用于设计工程系统的实用方法。 工程系统的数学模型以数学编程的向量问题的形式构建，该向量问题在总体的确定性和不确定性条件下得以解决。 在模型的数值示例中，以非线性规划的矢量问题的形式，介绍了工程系统模型决策的实现。 开发了MATLAB中的软件以解决具有等价准则和准则给定优先级的向量问题。

关键词：向量优化 解决向量任务的方法； 模型操作和伪装技术系统。

Abstract. The purpose of this work consists is to create a practical methodology for designing engineering systems on the basis of the developed theory and methods of vector optimization. The mathematical model of the engineering system is constructed in the form of a vector problem of mathematical programming which is solved in the conditions of certainty and uncertainty in the aggregate. Realization of a decision making on model of an engineering system is presented on a numerical example of model, in the form of a vector problem of nonlinear programming. The software in MATLAB is developed for the solution of vector problems with equivalent criteria and with the given priority of criterion.

Keywords: Vector optimization; Methods of solution of vector tasks; Model operation and feigning technical system.

1. Introduction

Work is directed to realization of the first design stage which is bound to the choice of optimum parameters of an engineering system depending on its functional characteristics. For the solution of such class of problems vector optimization is used. Development of the theory and methods of vector optimization was carried out both in Russia [6 - 23], and in other countries [25 - 31].

The purpose of this work consists in creation of theoretical bases, methodology of projection of technical (engineering) systems on the basis of the developed

theory and methods of vector optimization. Also, the construction of a mathematical model of the engineering system in the form of a vector problem of mathematical programming. Vector problem as an engineering system is solved in terms of certainty and uncertainty in the aggregate. We conduct a research, modeling and the system choice of optimum parameters of the engineering system. The methodology includes creation of the mathematical model for an object or the system of a decision making, an algorithm and the software of the solution of a vector problem of mathematical programming. For realization of a goal in work the following problems are presented. The mathematical model of the choice of optimum parameters of an engineering system which are in the functional dependence from characteristics of this system is constructed. The mathematical model of an engineering system is presented in the form of a vector problem of mathematical programming, which was investigated in the conditions of certainty and uncertainty in the aggregate [7, 11, 15]. For the solution of such problems the theory and methods of solution of problems of vector optimization is used, [6, 10, 16]. Realization of a decision making on models of an engineering system is presented on a numerical example of model, in the form of a vector problem of nonlinear programming. We developed the software in the MATLAB [24] system for the solution of vector problems with equivalent criteria and with the given priority of criterion. Such methodology can be used in the modeling of technological processes [22, 31] and determination of the optimum structure of the material [18 - 22].

2. Methodology of optimal decision making in an engineering system with certainty and uncertainty conditions

As an object of study, consider the "Engineering system", the formulation of the problem which is performed in section three. A study of the engineering system is made, first, under certainty, when the known data about the functional characteristics of the technical system; secondly, in conditions of uncertainty, when we know the discrete values of individual characteristics; also known data about the restrictions imposed on the functioning of the system. Modeling and simulation of the engineering system is performed in accordance with the methods of vector optimization, which are presented in section three. In organizational terms, the process of modeling and simulation of the engineering system is presented in the form of a methodology: "Methodology optimal decision - making in an engineering system with conditions of certainty and uncertainty." The methodology includes a number of stages.

1. Formation of the technical specification (source data) for numerical modeling and choice of optimum parameters of a system. The initial data is formed by the designer who projects the engineering system.

2. Construction of mathematical and numerical models of the engineering system in terms of certainty and uncertainty.

3. The solution of the vector problem of mathematical programming (VPMP) – a model of the engineering system at equivalent criteria.

4. Creation of geometrical interpretation of results of the decision in a three-dimensional coordinate system in relative units.

5. The solution of a vector problem of mathematical programming – a model of the engineering system at the given priority of the criterion.

6. Geometrical interpretation of results of the decision in a three-dimensional coordinate system in physical units.

The problem of numerical modeling and simulation of a technical system in which data on a certain set of functional characteristics (conditions of certainty), discrete values of characteristics (conditions of uncertainty) and restrictions imposed on the functioning of the engineering system are known is considered [9, 12, 16]. The numerical problem of modeling a technical system is considered with equivalent criteria and with a given criterion priority.

Stage 1. Formation of technical specifications (initial data)

It is given. We're investigating the engineering system. The functioning of the technical system is determined by four parameters $X=\{x_1, x_2, x_3, x_4\}$, which represent the vector of controlled variables. The parameters of the engineering system are set within the following limits:

$$22 \le x_1 \le 88,\ 0 \le x_2 \le 66,\ 2.2 \le x_3 \le 8.8,\ 2.2 \le x_4 \le 8.8. \quad (1)$$

(Indexing formulas inside individual methods).

The operation of the engineering system is determined by four characteristics (criteria) $F(X)=\{f_1(X), f_2(X), f_3(X), f_4(X)\}$, which size of an assessment depends on a vector of X.

The conditions of certainty. For first and third characteristics of $f_1(X)$ and $f_4(X)$ functional dependence on parameters $X=\{x_j, j=\overline{1,N}, N=4\}$ is known.

$$f_1(X)=296.85-1.874*x_1-2.911*x_2+, \ldots, -0.38*x,$$
$$f_4(X)=19.25-0.0081*x_1-0.7005*x_2-, \ldots, -0.0235*x, \quad (2)$$

The uncertainty condition. For the second and third characteristic the results of experimental data are known: the values of the parameters and corresponding characteristics. Numerical values of parameters X and characteristics of $y_2(X)$ and $y_3(X)$ are presented in table 1.

Table 1. *Numerical values of parameters and characteristics of the engineering system.*

x_1	x_2	x_3	x_4	$y_2(X) \rightarrow min$	$y_3(X) \rightarrow max$
22	0	2.2	2.2	1053.8	47.7
22	0	2.2	5.5	1067.0	47.3
…	…	…	…	…	…
88	66	8.8	5.5	1342.0	44.0
88	66	8.8	8.8	1397.0	42.5
Minimum value				1053.8	40.7
Maximum value				3503.5	104.1
The index of correlation				0.7149	0.6551
Coefficient of determination				0.5111	0.4292

In the made decision, assessment size of the first and the third characteristic (criterion) is possible to receive above : $f_1(X) \rightarrow \max f_3(X) \rightarrow \max$; for the second and fourth characteristic is possible below: $y_2(X) \rightarrow \min y_4(X) \rightarrow \min$. Parameters $X=\{x_1, x_2, x_3, x_4\}$ change in the following limits:

$$x_1 \in [22.\ 55.\ 88.],\ x_2 \in [0.\ 33.\ 66.],\ x_3 \in [2.2\ 5.5\ 8.8],\ x_4 \in [2.2\ 5.5\ 8.8]. \quad (3)$$

It is required. To construct model of the engineering system in the form of a vector problem. To solve a vector problem with equivalent criteria. To choose priority criterion. To establish numerical value of priority criterion. To make the best decision (optimum) with a specified priority criterion.

Note. The author developed in the *Matlab* system the software for the decision of vector problem of mathematical programming. The vector problem includes four variables (parameters of technical system): $X = \{x_1, x_2, x_3, x_4\}$ and four criteria (characteristic) of $F(X)=\{f_1(X), f_2(X), f_3(X), f_4(X)\}$. But for each new data (new system) the program is configured individually. In the software criteria of $F(X)=\{f_1(X), f_2(X), \ldots f_6(X)\}$ with uncertainty conditions (in table 6 they are provided as a part of $y_1(X), \ldots, y_6(X)$) can change from zero (i.e. all criteria are constructed in the conditions of determinacy) to six (i.e. all criteria are constructed in the conditions of uncertainty).

Stage 2. Creation of mathematical and numerical model of the system in the conditions of definiteness and indeterminacy

2.1. Mathematical model of the system

We will present model of the system in the conditions of definiteness and uncertainty in total:

$$Opt\ F(X) = \{\mathbf{max}\ F_1(X) = \{\mathbf{max}\ f_k(X),\ k = \overline{1, K_1^{def}}\}, \quad (4)$$

$$\mathbf{max}\ I_1(X) \equiv \{\mathbf{max}\{f_k(X_i,\ i=\overline{1,M})\}^{\mathrm{T}},\ k=\overline{1, K_1^{unc}}\}, \quad (5)$$

$$\mathbf{min}\ I_2(X) \equiv \{\mathbf{min}\{f_k(X_i,\ i=\overline{1,M})\}^{\mathrm{T}},\ k=\overline{1, K_2^{unc}}\}\}, \quad (6)$$

$$G(X)=B, f_k^{\min} \le f_k(X) \le f_k^{\max}, k=\overline{1,K}, x_j^{\min} \le x_j \le x_j^{\max}, j=\overline{1,N}, \quad (7)$$

at restrictions $G(X)=B, f_k^{\min} \le f_k(X) \le f_k^{\max}$, $k=\overline{1,K}$, $x_j^{\min} \le x_j \le x_j^{\max}$, $j=\overline{1,N}$, (8) vector of operated variable (design data); $F(X)=\{F_1(X)\ F_2(X)\ I_1(X),\ I_2(X)\}$ - vector criterion (1)-(4) which everyone a component represents a vector of criteria (characteristics) of the system which functionally depend on discrete values of a vector of variables X;

$F_1(X)=\{f_k(X), k=\overline{1,K_1^{def}}\}$, $F_2(X)=\{f_k(X), k=\overline{1,K_2^{def}}\}$ - a set of the max and min functions respectively;

$I_1(X)=\{\{f_k(X_i, i=\overline{1,M})\}^{\mathrm{T}}, k=\overline{1,K_1^{unc}}\}$, $I_2(X)=\{\{f_k(X_i, i=\overline{1,M})\}^{\mathrm{T}}, k=\overline{1,K_2^{unc}}$ - set of matrixes of max and min respectively; K_1^{def}, K_2^{def} *(definiteness)*, K_1^{unc}, K_2^{un} *(uncertainty)* the set of criteria of *max* and *min* created in the conditions of definiteness and uncertainty;

in (8) $f_k^{\min} \le f_k(X) \le f_k^{\max}$, $k=\overline{1,K}$ – a vector function of the restrictions imposed on functioning of the engineering system;

$x_j^{\min} \le x_j \le x_j^{\max}$, $j=\overline{1,N}$ – parametrical restrictions

It is assumed that the functions $f_k(X), k=\overline{1,K}$ are differentiable and convex, $g_i(X), i=\overline{1,M}$ are continuous, and the set of admissible points S given by constraints (8) is non-empty and is a compact:

$$\boldsymbol{S} = \{X \in \boldsymbol{R}^N \mid G(X) \le 0,\ X^{\min} \le X \le X^{\max}\} \ne \emptyset.$$

2.2. Building a model in certainty conditions;

Construction in conditions of certainty is determined by the functional dependence of each characteristic and constraints on the parameters of the technical system. In our example, characteristics (2) and constraints (1) are known. Using data (2) we construct a two-criterion problem of nonlinear programming in conditions of certainty:

$\max f_1(X)$, $\min f_4(X)$, restrictions: $22 \le x_1 \le 88$, $0 \le x_2 \le 66$, $2.2 \le x_3 \le 8.8$, $2.2 \le x_4 \le 8.8$ (9)

These data are used further at creation of mathematical model of technical system.

2.3. Construction in the conditions of not certainty

Construction in the conditions of uncertainty consists in use of the qualitative and quantitative descriptions of the engineering system received by the principle "input-output" in table 1. Transformation of information (basic data of $y_2(X), y_3(X)$) to a functional type of $f_2(X), f_3(X)$ is carried out by use of mathematical methods (the regression analysis), [9, 12, 16].

As a result, from the original data $y_2(X), y_3(X)$ we got the functions $f_2(X)$ and $f_3(X)$. (10)

2.4. Construction of a numerical model of the system under certainty and uncertainty

For creation of numerical model of the engineering system we used: the functions received conditions of definiteness (9) and uncertainty (10); parametrical restrictions (1).

We considered functions (9) and (10) as the criteria defining focus of functioning of the system. A set of criteria K=4 included two criteria of $f_1(X)$, $f_3(X)$ →max and two $f_2(X)$, $f_4(X)$ →min. As a result model of functioning of the engineering system was presented a vector problem of mathematical programming:

$$opt\ F(X)=\{\max F_1(X)=\{\max f_1(X)\equiv 296.8-1.874*x_1-2.91*x_2+8.94*x_3+10.93*x_4+ +0.07*x_1*x_2-0.005*x_1*x_3-0.013*x_1*x_4+0.056*x_2*x_3-0.079*x_2*x_4-0.0025*x_3*x_4+ +0.01*x_1^2+0.0089*x_2^2-0.1844*x_3^2-0.3808*x_4^2 \quad (11)$$

$$\max f_3(X) \equiv 43.73+0.66*x_1+0.4493*x_2-0.3094*x_3-1.8334*x_4-0.01*x_1*x_2-0.0062*x_1*x_3+ +0.0146*x_1*x_4-0.013*x_2*x_3+0.0121*x_2*x_4-0.0004*x_3*x_4-0.0003*x_1^2-0.0002*x_2^2+ +00.0254*x_3^2+0.0939*x_4^2\}, \quad (12)$$

$$\min F_2(X)=\{\min f_2(X) \equiv 875.3+23.89*x_1-30.86*x_2-25.86*x_3-45*x_4-0.7*x_1*x_2+ +0.427*x_1*x_3+0.679*x_1*x_4-0.1167*x_2*x_3+0.2969*x_2*x_4-0.0093*x_3*x_4+ +0.0362*x_1^2+0.0331*x_2^2+2.9158*x_3^2+2.4052*x_4^2, \quad (13)$$

$$\min f_4(X) \equiv 19.253-0.0081*x_1-0.7005*x_2-0.36*x_3+0.9769*x_4+0.0126*x_1*x_2+ +0.0644*x_1*x_3-0*x_1*x_4+0.0396*x_2*x_3+0.0002*x_2*x_4+0.0004*x_3*x_4- -0.0016*x_1^2+0.0027*x_2^2+0.0045*x_3^2-0.0235*x_4^2\}\}, \quad (14)$$

$$\text{restrictions: } 22 \le x_1 \le 88,\ 0 \le x_2 \le 66,\ 2.2 \le x_3 \le 8.8,\ 2.2 \le x_4 \le 8.8 \quad (15)$$

The vector problem of mathematical programming (11)-(15) represents the model decision making under certainty and uncertainty in the aggregate.

Stage 3. **The solution of the vector problem of mathematical programming (VPMP) - model of the system at equivalent criteria.**

To solve the vector problems of mathematical programming (16)-(20), methods based on the axioms of the normalization of criteria and the principle of guaranteed results are presented, which follow from axiom 1 and the principle of optimality 1.

The solution of a vector problem (11)-(15) with was submitted as sequence of steps.

Step 1. Problems (11)-(15) were solved by each criterion separately, thus used the function *fmincon* (…) of *Matlab* system, the appeal to the function *fmincon* (…) is considered in [12-17]. As a result of calculation for each criterion we received optimum points: X_k^* and $f_k^*=f_k(X_k^*)$, $k=\overline{1,K}$ – sizes of criteria in this point, i.e. the best decision on each criterion:

$$X_1^*=\{x_1=88.0,\ x_2=66.0,\ x_3=8.8,\ x_4=2.2\},\ f_1^*=f_1(X_1^*)=-535.06;$$

$$X_2^*=\{x_1=22.0,\ x_2=0.0,\ x_3=2.83,\ x_4=6.25\},\ f_2^*=f_2(X_2^*)=1301.2;$$

$X_3^* = \{x_1=88.0, x_2=0.0, x_3=2.2, x_4=8.8\}, f_3^* = f_3(X_3^*) = -100.15;$

$X_4^* = \{x_1=22.0, x_2=62.17, x_3=2.2, x_4=2.2\}, f_4^* = f_4(X_4^*) = 12.247.$

Restrictions (15) and points of an optimum $X_1^*, \ldots, X_4^*$ in coordinates $\{x_1, x_2\}$ are presented on figure 1.

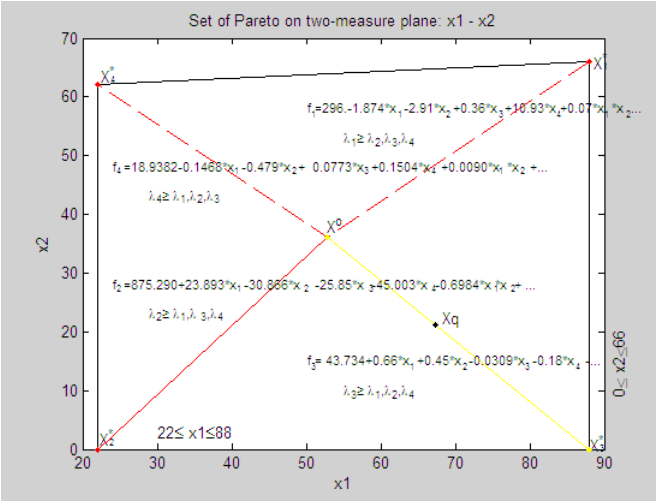

Figure 1. *Pareto's great number,*
$S^o \subset S$, X_1^*, X_2^*, X_3^*, X_4^* *in two-dimensional of coordinates* $\{x_1, x_2\}$

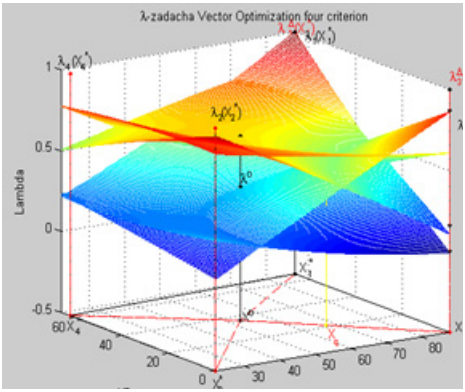

Figure 2. *The solution of λ-problem in three-dimensional of coordinates of* x_1, x_2 *and* λ

Step 2. We defined the worst unchangeable part of each criterion (anti-optimum):

$$f_1^0 = f_1(X_1^0) = 243.25; f_2^0 = f_2(X_2^0) = -3903.1; f_3^0 = f_3(X_3^0) =:$$

$$= -3903.1; f_3^0 = f_3(X_3^0) = 50.03; f_4^0 = f_2(X_4^0) = -121.83$$

Step 3. Performed system analysis of a set of points, optimum across Pareto, (i.e. the analysis for each criterion). In points of an optimum of $X^* = \{X_1^*, \dots, X_4^*\}$ sizes of criterion functions of $F(X^*) = \left\| f_q(X_k^*) \right\|_{q=\overline{1,K}}^{k=\overline{1,K}}$ determined. Calculated a vector of $D = (d_1\ d_2\ d_3\ d_4)^{\mathrm{T}}$ - deviations by each criterion on an admissible set of $\boldsymbol{S}$: $d_k = f_k^* - f_k^0$, $k = \overline{1,4}$, , and matrix of relative estimates of $\lambda(X^*) = \left\| \lambda_q(X_k^*) \right\|_{q=\overline{1,K}}^{k=\overline{1,K}}$, where $\lambda_k(X) = (f_k^* - f_k^0)/d_k$.,

where $\lambda_k(X) = (f_k^* - f_k^0)/d_k$. .

$$F(X^*) = \begin{vmatrix} 535.1 & 1731.9 & 58.1 & 117.0 \\ 317.6 & 1301.2 & 51.3 & 26.5 \\ 192.5 & 3614.3 & 100.2 & 24.6 \\ 244.0 & 2458.2 & 67.7 & 12.2 \end{vmatrix}, \quad D = \begin{vmatrix} 291.8 \\ -2602.0 \\ 50.12 \\ -109.58 \end{vmatrix}, \quad \lambda(X^*) = \begin{vmatrix} 1.0000 & 0.8345 & 0.1603 & 0.0443 \\ 0.2548 & 1.0000 & 0.0244 & 0.8697 \\ -0.1740 & 0.1110 & 1.0000 & 0.8870 \\ 0.0027 & 0.5553 & 0.3532 & 1.0000 \end{vmatrix}$$

(16)

Step 4. Creation of λ-problem is carried out in two stages: originally the maximine problem of optimization with the normalized criteria is under construction:

$$\lambda^o = \max_{x \in S} \min_{k \in K} \lambda_k(X),\ G(X) \le 0,\ X \ge 0 \qquad (17)$$

which at the second stage was transformed to a standard problem of mathematical programming:

$$\lambda^o = max\ \lambda, \text{ at restrictions } \lambda - (f_1(X) - f_1^o)/(f_1^* - f_1^o) \le 0, \dots,$$

$$\lambda - (f_4(X) - f_4^o)/(f_4^* - f_4^o) \le 0, \text{ and (15)}, \qquad (18)$$

where the vector of unknown had dimension of $N+1$: $\boldsymbol{X} = \{x_1, \dots, x_N, \lambda\}$;; the functions correspond (24)-(24) respectively. Substituting the numerical values of the functions $f_1(X), f_2(X), f_3(X), f_4(X)$, we get the λ-problem.

As a result of the solution of a vector problem of mathematical programming (11)-(15) at equivalent criteria and λ-problem corresponding to it (18) received:

$\boldsymbol{X^o} = \{X^o, \lambda^o\} = \{X^o = \{x_1 = 52.9, x_2 = 36.097, x_3 = 8.8, x_4 = 2.2, \lambda^o = 0.3179\}$, (18)

an optimum point – design data of the system, point $\boldsymbol{X}_o$ is presented in figure 1;

$f_k(X^o)$, $k = \overline{1,K}$ - sizes of criteria (characteristics of technical system):

$$\{f_1(X^o) = 336.0, f_2(X^o) = 2239.5, f_3(X^o) = 65.962, f_4(X^o) = 58.435\}; \qquad (19)$$

$\lambda_k(X^o)$, $k = \overline{1,K}$ - sizes of relative estimates:

$$\{\lambda_1(X^o) = 0.3179, \lambda_2(X^o) = 0.6394, \lambda_3(X^o) = 0.3179, \lambda_4(X^o) = 0.5785\}; \qquad (37)$$

$\lambda^o = 0.3179$ is the maximum lower level among all relative estimates measured in relative units:

$$\lambda^{o}=min\ (\lambda_1(X^o), \lambda_2(X^o), \lambda_3(X^o), \lambda_4(X^o), \lambda_5(X^o))= 0.3179.$$

A relative assessment - λ^o call the guaranteed result in relative units, i.e. $\lambda_k(X^o)$ and according to the characteristic of technical $f_k(X^o)$ system it is impossible to improve, without worsening thus other characteristics.

Stage 4. **Creation of geometrical interpretation of results of the decision in a three-dimensional coordinate system in relative units**

In an admissible set of points of $\boldsymbol{S}$ formed by restrictions (15), optimum points $X_1^*, X_2^*, X_3^*, X_4^*$ united in a contour, presented a set of points, optimum across Pareto, to $\boldsymbol{S^o \subset S}$, Figure 1.

Coordinates of these points, and also characteristics of the engineering system in relative units of $\lambda_1(X), \lambda_2(X), \lambda_3(X), \lambda_4(X)$ are shown in Figure 2 in three measured space, where the third axis of λ - a relative assessment.

Discussion. Looking at a figure 3, we can provide changes of all functions of $\lambda_1(X), \lambda_2(X), \lambda_3(X), \lambda_4(X)$ in four measured space. We will consider, for example, an optimum point of X_3^*. The $\lambda_3(X)$ function is created from the functions $f_3(X)$ with variable coordinates $\{x_1, x_2\}$ and with constant coordinates $\{x_3=8.8, x_4=2.2\}$, taken from an optimum point $\boldsymbol{X^o}$ (18). In a point X_3^* the relative assessment of $\lambda_3(X_3^*)=0.83$ – is shown in Figure 2 by a black point. But we know that the relative assessment of $\lambda_3(X_3^*)$ received from the $f_3(X_3^*)$ function on the third step is equal to unit, we will designate it as $\lambda_3^{\Delta}(X_3^*)=1$ – is shown in Figure 3 by a red point. The difference between $\lambda_3^{\Delta}(X_3^*)=1$ and $\lambda_3(X_3^*)=0.83$ is an error $\Delta=0.17$ transitions from four measured (and generally *N*-dimensional) to two-dimensional area.

The point X_1^* and appropriate relative estimates of $\lambda_1(X_1^*)$ and $\lambda_1^{\Delta}(X_1^*)$ is similarly shown.

Thus, for the first time in domestic and foreign practice transition and its geometrical illustration from N-dimensional to two-dimensional measurement of function is shown in vector problems of mathematical programming with the appropriate errors.

Stage 5. **The solution of a vector problem of mathematical programming - model of the system at the given priority of the criterion**

The methodology of decision-making with criterion priority is presented in detail in [9, 12, 16]. The system designer chooses the priority criterion and its value. In our example, the selected priority criterion $q=3$, $q \in \boldsymbol{K}$; the value of the priority criterion $f_q=80$: $f_q(X^o)= 65.96 \le f_q=80 \le 100.15=f_q(X_q^*)$, $q \in \boldsymbol{K}$. The Point of optimum priority criterion is shown in Fig.3 – 6.

Stage 6. **Geometrical interpretation of results of the decision in a three-dimensional coordinate system in physical units.**

We introduced the parameters: $\boldsymbol{X^o}=\{X^o, \lambda^o\}=\{X^o=\{x_1=52.9, x_2=36.097,$

x_3=8.8, x_4=2.2, λ^o=0. 3179}} in the two-dimensional coordinate system x_1, x_2 on the Figure 1, three-dimensional coordinate system x_1, x_2 and λ in Figure 2. We also present these parameters in physical units for each technical system characteristic (criterion): $f_1(X)$, … , $f_4(X)$.

The first characteristic of $f_1(X)$, $f_2(X)$ in coordinates x_1, x_2 show in Figure 3, 4.

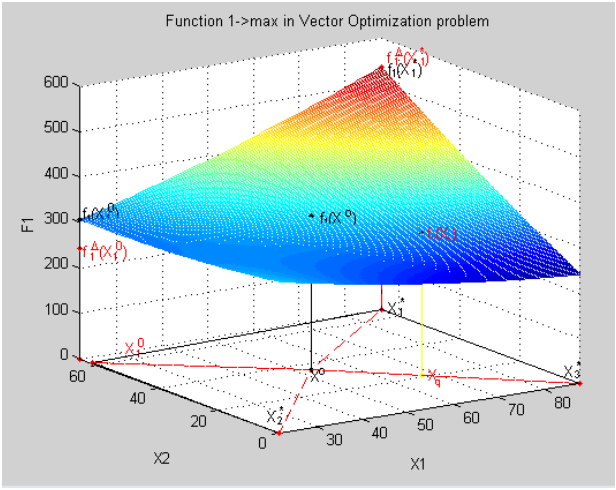

Figure 3. *The first characteristics $f_1(X)$ in coordinates x_1, x_2 in physical terms*

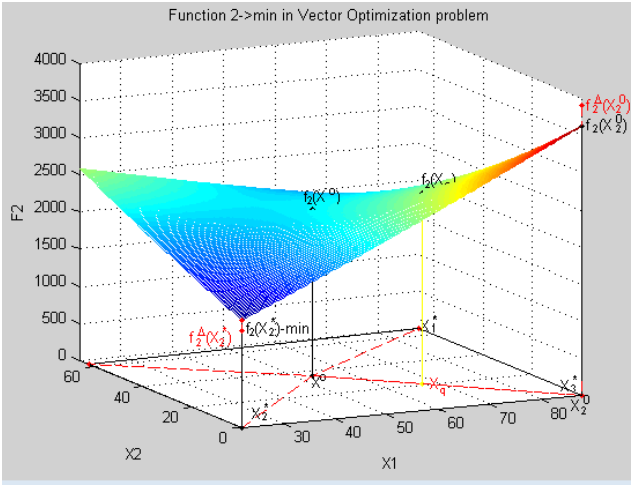

Figure 4. *The second characteristics $f_2(X)$ in coordinates x_1, x_2 physical terms*

Indicators $f_1^{\Delta}(X_1^*)$, $f_1^{\Delta}(X_1^0)$ of the first of characteristics and $f_2^{\Delta}(X_2^*)$, $f_2^{\Delta}(X_2^0)$ of the second of characteristics of the system (are highlighted in red color) define transition errors from four-dimensional $X^o=\{x_1, x_2, x_3, x_4\}$ to two-dimensional $X^o=\{x_1, x_2\}$ to system of coordinates.

The third characteristic of $f_3(X)$, $f_4(X)$ in physical units show in Figure 5, 6.

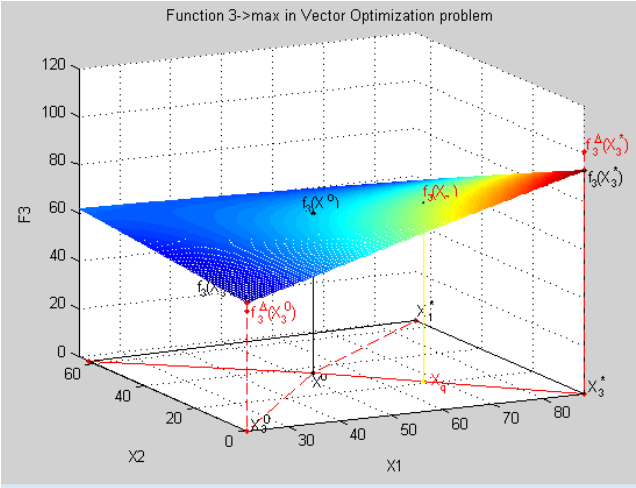

Figure 5. *The third characteristics – $f_3(X)$ of the system in natural indicator*

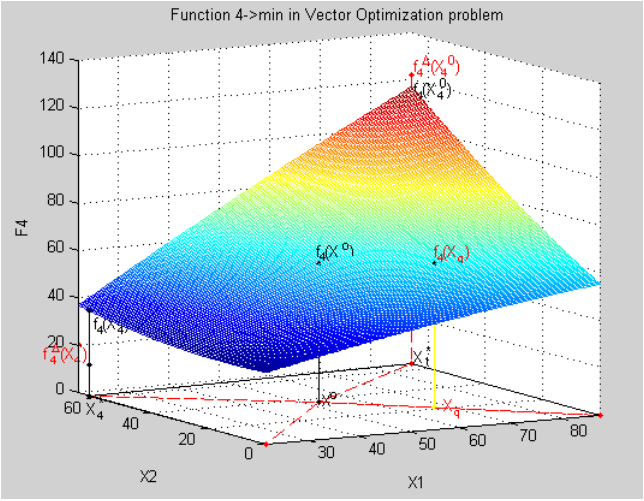

Figure 6. *The fourth characteristics $f_4(X)$ of the system in natural indicator*

Indicators of the third $f_3^{\Delta}(X_3^*), f_3^{\Delta}(X_3^0)$ and of the fourth $f_4^{\Delta}(X_4^*), f_4^{\Delta}(X_4^0)$ of characteristics of the system (are highlighted in red color) define transition errors from four-dimensional $X^o=\{x_1, x_2, x_3, x_4\}$ to two-dimensional $X^o=\{x_1, x_2\}$ to system of coordinates.

Theory of vector optimization, methods of solution of the vector problems with equivalent criteria and given priority of criterion can choose any point from the set of points, optimum across Pareto, and show the optimality of this point.

Conclusions. The problem of developing mathematical methods of vector optimization and making optimal decisions based on them in a complex engineering system for a set of experimental data and functional characteristics is one of the most important tasks of system analysis and design. The methodology of constructing a mathematical model of the engineering system under conditions of certainty and uncertainty in the form of a vector problem of mathematical programming is developed. To solve the vector problem, new methods of vector optimization based on the normalization of criteria and the principle of guaranteed results are developed. These methods of processing of the expert data and vector optimization can be used at design of the engineering systems of various branches: electro technical, aerospace, metallurgical, etc. At creation of characteristics in the conditions of uncertainty regression methods of transformation of information are used. Author is ready to participate in the solution of vector problems of linear and nonlinear programming. Mashunin@mail.ru

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能量传递和能量表现的机理

MECHANISMS OF ENERGY TRANSMISSION AND ENERGETIC MANIFESTATIONS

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抽象。物质守恒和能量转换定律是自然界所有物质变化和相互作用的基础，其中表征物质运动的能量以功的形式传播，能量以热的形式传递，光，电，磁等。有人提出在原子分子结构中存在物质。具有电和磁性能的基本“电磁粒子”，它们是基本的能量载体。化学，电气，电化学，机械和其他类型的功形式的能量转移是通过“电磁粒子”的定向运动在“工作体”的参与下进行的。工作流体是指所考虑的系统的物质对象在“电磁粒子”的影响下定向运动并参与工作。在电力工作过程中，需要一个外部电动势，一个导体和一个“工作流体”（一种电子），在电化学工作期间需要另一种电解质。化学功是反应性物质发生化学反应的过程，其中“工作介质”是“化学个体”的电子和化学元素。为了执行机械工作，需要提供在处理过程中释放的“电磁粒子”的定向运动以及在其影响下移动的宏观“工作流体”的定向运动的设备。

在所考虑的所有情况下，系统中处理前后的电子数量都是恒定的，只有基本的能量载体（“电磁粒子”）的数量在变化，严格遵守物质守恒和能量转换的一般规律。

关键词。能量，热，光，电，功，机械功，“电磁粒子”。

Abstract. *The law of conservation of matter and the conversion of energy is the basis of all changes and interactions of material objects of nature, where energy, characterizing the movement of matter, is transmitted in the form of work and energy manifestations in the form of heat, light, electricity, magnetism, etc. The presence of substances in the atomic-molecular structure is proposed. elementary*

"electromagnetic particles" *endowed with electrical and magnetic properties, which are elementary energy carriers. Energy transfer in the form of chemical, electrical, electrochemical, mechanical and other types of work is carried out by directed movements of "electromagnetic particles" with the participation of* ***"working bodies".*** *By the working fluid is meant the material object of the system under consideration moving directionally under the influence of "electromagnetic particles" and participating in the work. In the process of electrical work, an external emf is needed, a conductor and a "working fluid" - an electron, and during electrochemical work - another electrolyte. Chemical work is the course of a chemical reaction of reacting substances, where the "working medium" is the electron and the chemical elements of the "chemical individual". To perform mechanical work, devices are required that provide the directed movement of "electromagnetic particles" released during the course of processes and a macroscopic "working fluid" moving under their influence.*

In all the cases considered, the number of electrons before and after the processes in the system is constant and only the number of elementary energy carriers - ***"electromagnetic particles"*** *- is changing, strictly obeying the general law of conservation of substances and energy conversion.*

Keywords. *energy, heat, light, electricity, work, mechanical work, "electromagnetic particles".*

INTRODUCTION

t is well known that the law of conservation of mass and energy is a single law of nature and relates to the properties of matter, where mass characterizes the measure of inertia, and energy is the measure of its motion and they are inseparable from matter, not equivalent and do not turn into each other [1-4]. However, the energy determined by the motion of matter through the formulas $\varepsilon = {}^{1}/_{2}mv^{2}$; $\varepsilon = mgh$ and others mean that with a change in mass and speed of movement, their nature of manifestation changes. For example, the flow of a huge mass of water from top to bottom means the transition of the **potential** energy of water to **kinetic**, and the release of heat and light during the combustion of fuels means the manifestation of **chemical energy**, i.e., a change in **internal energy**. The conservation of heat and light of sunlight during photo - and biosynthesis in plants, animals, etc. as a part of substances in the form of internal energy clearly demonstrates their interaction passing to the constituent components [5,6]. Moreover, the interaction of elementary carriers of heat and light with elements of the atomic-molecular structure of substances leads to a change in their motion characterizing the concept of "energy", that is, to the transition of one type of motion to another with a change in the initial characteristics. *In this regard, the absorbed heat and light in substances are not detected explicitly and are in the form of a component of the internal energy of*

the system! Despite this, the mechanism of transfer of heat, light and the nature of its carriers between material objects is still debatable. In the scientific literature, an ordinary light beam transferring light and thermal energy is accepted as a stream of optical photons, and in the case of heat the question remains open or is explained by the kinetic movements of the atomic-molecular components. It should also be noted that the type of sunlight - infrared radiation is attributed to thermal phenomena [7], however, the scientifically based interpretation of the real nature of heat carriers and the quantitative assessment of the thermal state of temperature are left out of the discussion. Among these problems are carriers of electrical energy, which is closely related to thermal and other forms of energy transfer [8]. And in this paper we consider the mechanisms of energy transfer between material objects, taking into account the micro-macroscopic components of the system.

DISCUSSION

The accumulation and transfer of energy between material objects requires a scientifically based approach to clarify the relationship of the micro - macrostructure of substances in order to rationally extract and use energy resources. This requires knowledge of the structure of substances consisting of micro-constituents - atoms, where according to modern concepts a certain number of protons, neutrons, electrons and elementary particles individualize their nature. These atoms bind to each other or other atoms in the form of chemical elements and form the molecular or non-molecular structure of this compound. The presence of compounds of a nonmolecular structure led to different interpretations and this circumstance in [9] is noted as follows: "... due to the fragmentation of chemistry into many" separate "disciplines, different authors use various versions of it as the most important basic concept, such as" chemical ind ¬ type "," molecule "," chemical compound "," chemical substance ", etc." which refers to all substances formed from atoms ". And for the correct perception of objective reality where, the carriers of energy are material objects formed from atoms, then clarity should be introduced into the concept expressing the states of atoms in a chemical bond and their compounds formed. In our opinion, a ***chemically bonded atom is a "chemical element"*** [4]. If we assume that molecules are formed from chemical elements as the smallest particle of a substance possessing all its physical and chemical properties, then this definition does not include compounds of a non-molecular structure. In this regard, for a general discussion of the micro-macroscopic properties of material formations, regardless of molecular or non-molecular structure, we propose the concept of "***chemical individual***" in the following version [4]:

- "Chemical individual" represents a unit cell of the lattice of condensed matter or a minimal group of "chemical elements" connected in the form of chemical, metallic, coordination and intermolecular bonds that determine the properties of a macroscopic system "

In turn, the manifestations of the physicochemical properties of substances depend on the dimension of material objects and the structural - energy state of constituent elements and elementary particles of a given system. In this regard, the elementary heat carrier that we justified, the "**thermotrons**" as part of the "chemical individual," creates the basis for the revision of the components of atomic-molecular structures, which play an important role in the accumulation and transfer of energy between material objects [10–20]. For example, when reactive substances are activated by heat, the "**thermotrons**" acting on the constituent elements of the "chemical individuals" of the reacting substances initiate the course of a chemical reaction. They primarily have a polarizing effect on the bonds between "chemical individuals" and between chemical elements. A **potential difference** arises in the structural elements of "chemical individuals" with certain values of chemical potentials- μ_i which is expressed through partial derivatives of thermodynamic functions according to the following formulas [12]:

$$\mu_i = (\partial U/\partial n_i)_{S,V,nj} = (\partial H/\partial n_i)_{S,p,nj} = (\partial A/\partial n_i)_{T,V,nj} = (\partial G/\partial n_i)_{T,p,nj}$$

where μ_i - is the chemical potential of the "chemical individuals" of the conductor after exposure to the "thermotrons"; ∂n_i - is an infinitesimal change in the amount of the i-th type of energy carriers. An activated system tends to change chemical potentials in the direction of decreasing them and a chemical reaction proceeds. That is, chemical work is performed and the internal energy of the system is changed, which allows μ_i to be arbitrarily called "***moving potentials***" corresponding to the activation energy of Arrhenius. As a result of a chemical reaction, redistribution of electrons and elementary particles between chemical elements occurs with the formation of a new "***chemical individual***", which characterizes the magnitude of the perfect work. Similarly, in the transmission of electrical energy, electrical work is also performed, where its value (A) can be calculated by the formula:

$$A = U \cdot I \cdot t,$$

where U - circuit voltage, I – current strength, t – current passage time.

Here, the voltage and current are directly related to the movement of the electron involved in the commission of electrical and electrochemical work. However, ***so far the speed of electron movement in the transfer of electric current*** is controversial. For example, in [8], an interesting physical model of the electric current is proposed, where the carriers of the electric current are electrons connected in single complexes with the magnetic field of the conductor, that is, the presence simultaneously with the electron and magnetic substance. During its propagation, the electric field interacts with conduction electrons already in the conductor, which are paired with the magnetic field of the conductor, but the nature of the electric field propagating through the conductor remains unknown. In our opinion, the idea proposed by the author is a modified version of Maxwell's electromag-

netic theory [21]. In addition, we can take the value of the velocity of the electric field compared with the speed of light, but the speed of the electron in the lattice of the conductor causes a discussion where the author himself denies the presence of free electron gas in metals [8]. In [22], for a copper conductor under voltage in a conventional ac lighting network, the electron velocity (***v)*** was calculated by the formula:

$$v = I\mu / qdN_A S$$

where ***I*** *– current strength,* ***μ*** *– molar mass of the conductor,* ***q*** *– electron charge,* ***d*** *– density of the conductor,* N_A *– Avogadro number and* ***S*** – cross section of the conductor.

The numerical values of physical quantities were taken from the reference book characteristic for copper:

$I = 1\text{A}$, $\mu = 64$ g / mol, $q = 1{,}6\cdot10^{-19}$ Cl, $d = 8{,}94$ g / cm ^{3}, $N_A = 6{,}02\cdot10^{23}$ mol $^{-1}$, $S = 1{,}5$ mm^2 .

Substitution of numerical values and calculation gives the following value:

$v = 1\text{ A}\cdot 0{,}064\text{ kg / mol} / 1{,}6\cdot10^{-19}\text{ Cl}\cdot 8{,}94\cdot10^3\text{ kg / m}^3\cdot 6{,}02\cdot10^{23}\text{ mol}^{-1}\cdot 1{,}5\cdot10^{-6}\text{ m}^2 \approx 5\cdot10^{-5}\text{ m / s}$

As follows from the calculation, the ***electron drift velocity*** of $5\cdot10^{-5}$ m/s is insignificant. To calculate the electron velocity at constant current, we used the data of galvanizing iron with an area of 1000 cm^2 at a current strength of 2.5 A and a zinc density of 7.15 g/cm^3 given in [23]. Our calculation according to the above formula gives the following value for the electron velocity::

$$\boldsymbol{v = 2.5\cdot 0{,}0327 / 1{,}6\cdot10^{-19}\cdot 7.15\cdot10^3\cdot 6{,}02\cdot10^{23}\cdot 1\cdot10^{-1} \approx 1.1\cdot10^{-9}\text{ m/s}}$$

The observed ***electron velocity*** of $1.1\cdot10^{-9}$ m/s during electrolysis, that is, during electrochemical work, is associated with direct inhibitions of the heterogeneous heterophase chemical reaction, phase transitions, and rearrangement in the structure of metal crystal lattices. With alternating current, the structure of the "chemical individual" is preserved, that is, the electron makes a movement within the cell of the metal lattice. In this case, for alternating current with a frequency of 50 Hz, and the mean free path of an electron in a metal lattice with $2\cdot\mathbf{10^{-10}}$ **m**, the electron velocity should approximately be:

$$\boldsymbol{v = 2\cdot10^{-10}\cdot 50 = 1\cdot10^{-8}\text{ m/s.}}$$

The calculated values of the electron velocity at constant and alternating electric currents $\mathbf{1.1\cdot10^{-9}}$ **m/s** and $\mathbf{1\cdot10^{-8}}$ **m/s** respectively, are very different from the propagation velocity of an electric current close to the speed of light.

Unambiguously, the transmission of electricity is carried out by means of a conductor, which consists of chemical elements of the "chemical individual" and elementary particles. In the process, the nature of the chemical elements of the conductor does not change, and the **insignificant value of the electron velocity**, compared to the speed of propagation of the electric current, also indicates its sec-

ondary role. Therefore, the direct participants in the creation of an electric current under the influence of an external driving force should be elementary particles of a "chemical individual" possessing an "***electromagnetic nature***" (follows from the Maxwell hypothesis). Such particles are "electromagnetic particles" proposed by us in [14–20], which:

- take part in the implementation of the Coulomb electrical interaction, prevents the annihilation of nuclei with electrons and their dipole structure endowed with an electromagnetic nature under the influence of an external source, the voltage with directed orienting movements along the length of the conductor creates an ***electric current, and around it an electromagnetic field***;

- as a result of the electromagnetic nature of their structure, pulsating movements exhibit the dual nature of a wave - particles, that is, de Broglie "***standing waves***" of a discrete particle, and when directed by collective motion, they present an apparent ***traveling wave***;

- are in ***combination with electrons*** and in dynamic equilibrium with the environment determine thermal, optical, magnetic, electrical, and other properties, that is, ***photons, "thermotrons", etc.*** are varieties of these "***electromagnetic particles***" that differ in their pulsation frequency .

The existence of "***electromagnetic particles***", due to the combination of magnetic and electrical properties, resulting in a pulsating current, was expressed in a different form in the Ampere hypothesis [24], where the property of permanent magnets was explained by the existence of "molecular" currents, although at that time there was no information about nuclear electronic structure of atoms. This magnetic phenomenon in physics is explained by the movement of electrons in atoms, where each electron is received by a microscopic magnet. With this approach, the bipolar structure of any magnet is nullified, since the electron has only a negative charge.

Similarly, the appearance of an alternating induction current and emf during the interaction of elementary particles of the magnet's force field with a conductor, rotated by the mechanical energy of external forces, is based on the phenomenon of Faraday electromagnetic induction. In our opinion, under the influence of an external emf, "***electromagnetic particles***" in the nuclear-electronic structure of the conductor instantly orientates along the length of the conductor, creating an electromagnetic field and an electric current. Therefore, an electric current - *is the oriented movement of the "electromagnetic particles" causing the electrons to move along the wire, and not the speed of the electrons themselves*. An electron shifts from its stationary position until the change in the chemical potential of the "chemical individual" of the conductor is compensated by an ***external emf.*** That is, ***electric work*** is being done to redistribute the charges and "electromagnetic particles" in each link of the "chemical individual" of the conductor. In this case,

the electron as a "working medium" moves within the cell of the metal lattice, creating a potential difference of the "chemical individual" of the conductor equal to the external emf By "working medium" is meant a material object of the system under consideration moving directionally under the influence of "electromagnetic particles" and participating in the work. In the case of direct current, the electrochemical transformation proceeds at the **electrode-substrate edge** interface with a change in the "chemical individuals" and the electron's movement along the external circuit represents **the relay mode of movement between the lattice cells.**

It should be noted that in the process of chemical, electrochemical and electrical work, the number of electrons does not change. Here, the electron plays the role of a "***working fluid***" that does the work, and energy is transferred by the "***electromagnetic particles***" of the conductor under the influence of an external emf of the generator. That is, the transition of mechanical energies of the rotor in combination with the elementary components of the magnetic field lines gives rise to an alternating induction current and emf, which is transmitted using the conductor system in the form of electric current, in accordance with the law of conservation of matter and energy conversion.

M. Faraday in [25], summarizing the results of the study, concludes that regardless of the source of production (thermal, light, chemical, physiological, magnetic and mechanical), ***all manifestations of electricity*** are estimated to be completely identical, that is, the transfer of energy by heat, light or others processes have the same basis for the origin of this phenomenon. This conclusion of M. Faraday means the similarity of the nature of elementary energy carriers and serves in favor of the conclusion that ***photons, "thermotrons" and other elementary energy carriers are varieties of the same "electromagnetic particles"*** [14-20]. With this approach, one can state a certain analogy between the "***driving potential***" of a chemical reaction and the ***emf*** with Faraday electromagnetic induction arising on the "chemical individuals" of the conductor. In the first case, the ***emf*** arises as a result of the influence of " ***thermotrons*** " ("***electromagnetic particles***") on the "chemical individual" of the reacting substances, and in the second, when a ***magnetic field*** acts on the "chemical individual" of the moving conductor. In both cases, the ***emergence*** of ***emf*** occurs as a result of the interaction of elementary energy carriers from the outside with the "***electromagnetic particles***" of the substance.

According to the literature, the process of propagation of an ***electromagnetic field*** is called an "***electromagnetic wave***" [26]. In our opinion, the predominant use of the terms "***electromagnetic wave***" in the cases under consideration is associated with the use of oscillators, for example, where the change in the ***cyclic amplitude*** of an oscillating body or other physical quantity (such as the value of current or tension), which give a ***graphical dependence - a sinusoid time***, i.e. ***trajectory of the wave***. And according to a sinusoid, the characteristics of the wave are deter-

mined - length, frequency, etc. In favor of this conclusion is the experimental work of Heinrich Hertz [27], who proved the existence of "***electromagnetic waves***" and their identity with the basic properties of "***light waves***" consisting of photons. Similarly, the M. Planck hypothesis is also based on the experimental data of atomic oscillators, which determine the ***cyclic frequency*** and calculate the radiation frequency. In studying the thermal radiation of substances based on the optical and thermodynamic properties, Kirchhoff concludes: *"the ratio of the emitting and absorbing abilities does not depend on the nature of the radiating bodies and is a single function for all bodies of only the radiation frequency (wavelength) and body temperature"* [28]. Consequently, according to Kirchhoff's law, it is possible to admit the identity of "***thermotrons***" ***and photons*** exhibiting absorption and emission spectra received by waves. However, the wave is the trajectory of the motion of material particles, and the "***electromagnetic wave***" is the process of propagation of electromagnetic fields and their very nature remains open. In this regard, analysis of the available scientific and experimental data allows us to conclude on the identity of "***electromagnetic particles***" and "***electromagnetic waves***" [12,16-18].

Thus, the transfer of electrical, thermal and other types of energy is carried out by "***electromagnetic particles***", and electrical, chemical, electrochemical work is performed with the participation of the ***directional movement of electrons*** (regardless of alternating or direct current), however, under specified conditions, ***mechanical work is not performed.***

According to the definition of thermodynamics, mechanical work is performed by directed collective movement of particles when they are exposed to macroscopic bodies. That is, it follows the need to create a directed collective movement of "***electromagnetic particles***" with the participation of macroscopic assistive devices. For example, in internal combustion engines, for performing mechanical work, ***cylinders with a piston with appropriate devices*** are used to carry out the directional movement of " ***thermotrons*** " with combustion products. 64 Similarly, to obtain mechanical work from electricity, auxiliary devices are also needed. If upon receipt of alternating electric current the rotor rotates the kinetic energy of water or steam in turbine engines doing mechanical work, then using electric current to perform mechanical work, the auxiliary device is electric motors based also on the phenomenon of electromagnetic induction of M. Faraday. The flow of magnetic field lines ("electromagnetic particles") from the stator winding of the motor acts on the electric current of the rotor. The magnetic field has an orienting effect on the rotor with current placed in it, i.e. in a magnetic field, a ***mechanical torque*** acts on a conductor with current. The magnitude of the *mechanical torque* acting on the frame with the current, placed in a magnetic field, is equal to the product

$$M = P_m B \sin \alpha,$$

where P_m - is the module of the magnetic moment of the frame with current, $P_m = IS$; I - is the current strength in the frame; S - is the area of the frame; B - is the module of the magnetic field induction vector; α - is the angle between the vectors $P \rightarrow m$ and $B \rightarrow$ causing a rotational moment, which causes its shaft to rotate, whence mechanical movement occurs.

Given the foregoing and the bipolarity of the magnets, the closure of the lines of force of the magnetic field, it can be assumed that the "***electromagnetic particles***" are also elementary components of the magnetic fields. The lines of force of a magnet (a set of "***electromagnetic particles***") interacting with the "electromagnetic particles" of a conductor for which the conductor is a device for directional orientation, causing the appearance of an induction current that, when acting on the structural-energy state, creates an emf induction.

CONCLUSION

One of the possible mechanisms for the transfer of electrical energy is proposed. If there is an elementary "***electromagnetic particle***" in the atomic-molecular structure of substances endowed with electric and magnetic characteristics, which the particle represents in wave form with wave properties. They are ***elementary carriers of energy***, i.e., their movements determine the completion of work and create energy manifestations in the form of heat, light, electricity, magnetism, etc.

Energy transfer in the form of chemical, electrical, electrochemical, mechanical and other types of work is carried out by directed movements of "electromagnetic particles" with the participation of "***working bodies***". By the working fluid is meant the material object of the system under consideration moving directionally under the influence of "electromagnetic particles" and participating in the work. In the process of electrical work, an external emf is needed, a conductor and a "working body" - an electron, and during electrochemical work - another electrolyte. Chemical work is the course of a chemical reaction of reacting substances, where the "working medium" is the electron and the chemical elements of the "chemical individual". To perform mechanical work, devices are required that provide the directed movement of "electromagnetic particles" released during the course of processes and a macroscopic "working body" moving under their influence.

In all the cases considered, the number of electrons before and after the processes in the system is constant and only the number of elementary energy carriers - "***electromagnetic particles***" - is changing, strictly obeying the general law of conservation of substances and the transformation of energy.

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乙醇与碳酸二甲酯混合超临界萃取下麦秸多糖的化学转化
CHEMICAL TRANSFORMATIONS OF POLYSACCHARIDES OF WHEAT STRAW UNDER SUPERCRITICAL EXTRACTION WITH A MIXTURE OF ETHANOL AND DIMETHYL CARBONATE

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抽象。制备和开发用于生化处理的木质纤维素原料的方法是化学和化学技术的优先领域之一。最有前途的方法包括超临界乙醇分解。这项工作提供了研究甲基化试剂（碳酸二甲酯）对超临界乙醇水解过程中麦秸多糖破碎产物的产量和组成的影响的研究结果。使用浓度为20、40、60和80 vol%的乙醇，DMC及其混合物作为溶剂。已经确定，溶剂中碳酸二甲酯的存在增加了秸秆生物质破碎的效率。在用碳酸二甲酯超临界萃取中，秸秆多糖的断裂伴随着烷基化程度不同的单糖的甲基衍生物的形成，其中超过70%是葡萄糖的甲基衍生物。鉴定出的单糖的甲基衍生物的超过65%是糖苷。提出了在超临界乙醇和碳酸二甲酯的介质中使秸秆纤维素破碎的方案，表明在工艺条件下糖苷键的自由基分解。

关键词：乙醇，碳酸二甲酯，超临界萃取，多糖，麦秸，化学转化。

Abstract*. The creation and development of methods for preparing lignocellulosic raw materials for biochemical processing is one of the priority areas of chemistry and chemical technology. The most promising methods include supercritical ethanolysis. This work presents the results of a study of the effect of methylating reagent (dimethyl carbonate) on the yield and composition of the products of fragmentation of wheat straw polysaccharides during supercritical ethanolysis. Ethanol, DMC, and mixtures thereof with a concentration of DMC of 20, 40, 60, and 80 vol% were used as a solvent. It is established that the presence of dimethyl carbonate in the solvent increases the efficiency of fragmentation of straw biomass. In supercritical extraction with dimethyl carbonate, fragmentation of straw polysaccharides is accompanied by the formation of methyl derivatives of*

monosaccharides of varying degrees of alkylation, of which more than 70% are methyl derivatives of glucose. More than 65% of the identified methyl derivatives of monosaccharides are glycosides. Schemes for fragmentation of straw cellulose in a medium of supercritical ethanol and dimethyl carbonate, suggesting a radical breakdown of glycosidic bonds under process conditions, are proposed.

Keywords: *ethanol, dimethyl carbonate, supercritical extraction, polysaccharides, wheat straw, chemical transformations.*

An important role in the formation of the ligno-carbohydrate complex of wheat straw is played by intermolecular interactions of the main components, including through hydrogen bonds. It was shown in [1] that a violation of the strength of the hydrogen bond network when processing straw in an ionic liquid medium (100 °C, 1 h) provides a transition to a soluble state of about 40% of its biomass. In supercritical ethanolysis, intermolecular interaction can also be violated as a result of alkylation of the active functional groups of polysaccharides and lignin [2]. But alcohols, including ethanol, are not the best alkylating agents. Dimethyl carbonate (DMC) possesses a high alkylating ability, which is characterized by low toxicity and critical parameters close to ethanol (Tcr = 280 °C, Cld = 4.3 MPa) [3, 4].

The aim of the work was to study the effect of the addition of dimethyl carbonate to ethanol on the yield and composition of the products of the conversion of wheat straw polysaccharides under conditions of supercritical ethanolysis.

EXPERIMENTAL PART

The work was performed with samples of wheat straw with a grain size of 1–5 mm. The component composition of straw, in% on the absolutely dry mass of straw (% a.s.m.): cellulose - 41.9; lignin - 23.5; pentosans - 18.9.

The experiment was carried out under supercritical conditions for ethanol and DMC at 285 ° C (10 min) in an autoclave with a volume of 8 cm^3 made of stainless steel. The solvent used was ethanol, DMC, and mixtures thereof with a concentration of DMC of 20, 40, 60, and 80% vol.

Straw weighing 0.20-0.25 g was loaded into a metal mesh container, which was placed in an autoclave. Then 7 cm3 of solvent was poured into the autoclave, hermetically sealed and placed in a preheated ceramic furnace. The heating rate of the autoclave to 285 °C was 15 deg/min. After exposure at a given temperature for 10 minutes, the autoclave was cooled to room temperature. The cooling rate is 50 deg/min.

The undissolved part of the straw (solid product) was washed with ethanol and dried to constant weight at 105 °C. The ethanol solution was mixed with liquid extraction products. After removing the solvent on a rotary evaporator, the obtained extract was treated with hexane at the boiling point of the solvent for 3 hours to obtain a hexane extract. The hexane insoluble residue was dissolved in ethanol

and mixed with three times the volume of distilled water. Thoroughly mixed and left at room temperature for 12 hours to precipitate a fraction of ethanolignin. The water-alcohol mixture (filtrate) was distilled off on a rotary evaporator. Water-soluble compounds were extracted from the obtained water-ethanol extract by triple treatment with water at 95-98 °C, a water module of 1:10, the duration of each treatment was 1 hour. The water-insoluble portion of the water-ethanol extract was extracted with ethyl acetate at the boiling point of the solvent to isolate the ethyl acetate extract. All products isolated by fractionation of the extract were dried on a VaCo 2 freeze dryer at minus 40 °C for 12 hours and weighed.

The gas yield was determined as the difference between the loss of straw mass during extraction and the extract yield.

Acid hydrolysis of fractions of water-soluble compounds was carried out with a 2 M solution of trifluoroacetic acid [5]. A chromatographic analysis of the composition of hydrolysis products was carried out after silylation with a mixture of trimethylchlorosilane and hexamethyldisilazane in absolute pyridine [6] on a 7820 A chromatograph with an "AgilentTechnologies" HP 5975 mass spectrometric detector using a quartz column of 30,000 × 0.25 mm with a stationary phase (% dimethyl - 5% diphenylpolysiloxane). Analysis conditions for the quantitative composition of monosaccharides: 3 min isotherms at 125 °C, temperature rise to 250 °C at a rate of 6 °C/min, exposure for 10 min at 250 °C. Xylitol was used as an internal standard.

The content of methoxyl groups was determined by the Zeisel method [7]. Vanillin was used to build a calibration graph.

DISCUSSION OF THE RESULTS

Under experimental conditions for supercritical ethanolysis, the yield of the extract was 42.5% a.s. (picture 1). When DMC is added to ethanol up to 40% vol. the yield of the extract remained almost unchanged, and the content of CH_3O groups in the solid product increased from 2.2 to 4.1%. With an increase in the proportion of DMC, the total yield of extract and gases increases, reaching a maximum (about 95% a.s.m.) with its content of 60% vol. Moreover, the content of CH_3O groups increases almost three times (11.7%). No ethoxy groups were found in the solid. An increase in the methylation intensity of the functional groups of straw components under these conditions was also confirmed by IR spectroscopy of solid products. There is a decrease in the intensity of the absorption band of stretching vibrations of hydroxyl groups involved in the formation of inter- and intramolecular hydrogen bonds, as well as a shift in the absorption maximum of this band towards an energetically weaker hydrogen bond with an increase in the fraction of DMC.

With a subsequent increase in the DMC content in the solvent, the yield of the extract decreases, and the gas yield remains unchanged. Nevertheless, the yield of the extract upon supercritical extraction of DMC was obtained 15% higher than when using supercritical ethanol.

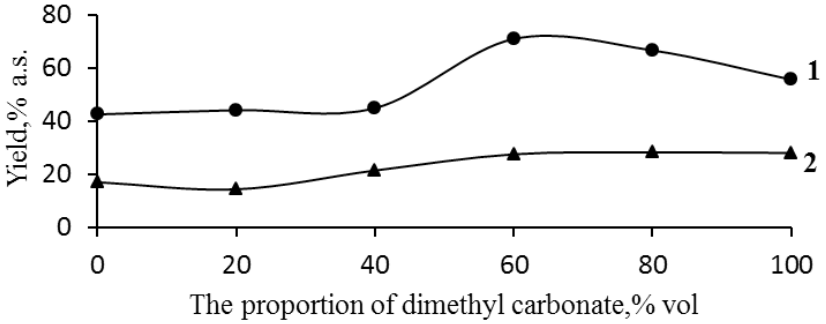
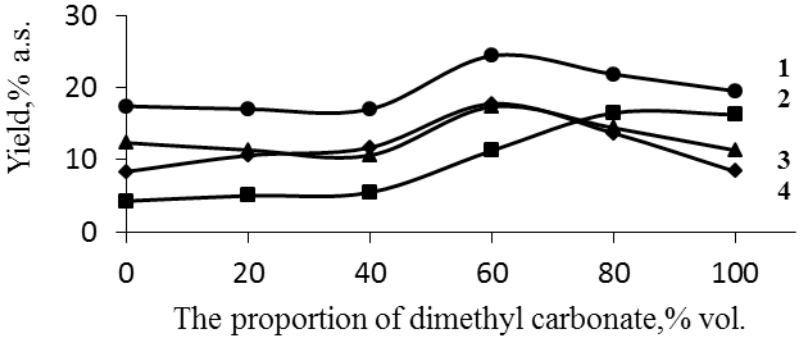


Figure 1 - *Dependence of the yield of extract (1) and gases (2) of supercritical extraction of wheat straw on the content of DMC in ethanol*

With an increase in DMC content up to 60%, the yield of the extract and all its fractions increases (Figure 2). At a higher DMC content, an increase in the yield of hexane extract is observed, primarily due to the extraction of low molecular weight lignin fragmentation products [4], and the yield of other fractions decreases.

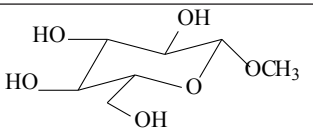
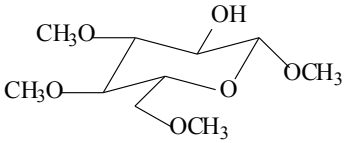
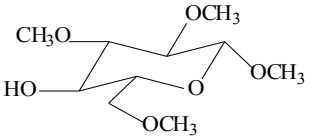
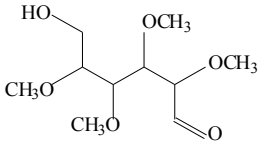
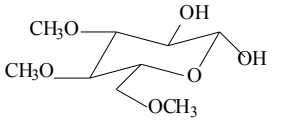
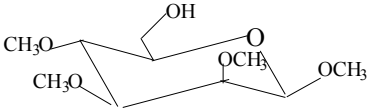
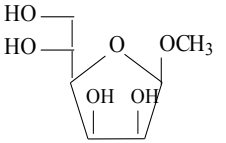


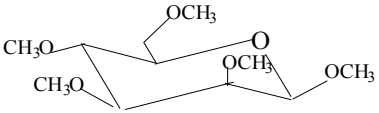
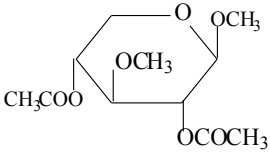
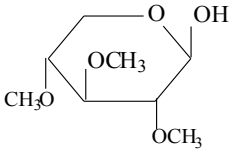
1 – ethyl acetate extract; 2 - hexane extract;
3 - ethanolignin; 4 - water soluble compounds
Figure 2 - *Dependence of the yield of fractions of ethanol extract on the proportion of DMC in ethanol*

The yield of the fraction of water-soluble compounds, which includes mainly the conversion products of straw polysaccharides, with an increase in the proportion of DMC to 60% vol. rises to 17.4% a.s.m., and then decreases to 8.4% a.s.m. The fractions of water-soluble compounds obtained by supercritical extraction with ethanol and DMC have similar yield values, but differ significantly in qualitative composition.

No free monosaccharides and ethyl glycosides were found in the hydrolyzate of the fraction of water-soluble compounds obtained from straw during supercritical extraction of DMC. Ten methyl derivatives of monosaccharides of varying degrees of alkylation were identified, of which more than 70% were methyl derivatives of glucose (table)

Table - *Composition of monosaccharides of the hydrolyzate fraction of water-soluble compounds obtained by supercritical extraction of straw DMC*

Name	Structure	% on the amount of monosaccharides
Methyl-β-D-glucopyranoside		30,68
Methyl-3,4,6-tri-O-methyl-β-D-glucopyranoside		3,41
Methyl-1,2,3,6-tetra-O-methyl-β-D-glucopyranoside		14,34
2,3,4,5-tetra-O-methyl-D-glucose		7,08
3,4,6-tri-O-methyl-β-D-glucose		17,74
Methyl 2,3,4-tri-O-methyl-β-D-mannopyranoside		9,70
Methyl β-D-mannofuranoside		11,89

Name	Structure	% on the amount of monosaccharides
Methyl-2,3,4,6-tetra-O-methyl-β-D-mannopyranoside		1,40
Methyl-2,4-di-O-acetyl-3-O-methyl-α-D-xylopyranoside		3,41
2,3,4-tri-O-methyl-α-D-xylopyranose		0,35

the range of 275-290 °C and are accompanied by intensive decomposition of carbohydrates. Since supercritical extraction with ethanol and dimethyl carbonate is carried out in this temperature range, it is possible to suggest the possibility of a radical breaking of glycosidic bonds under the process conditions. Along with temperature, methyl and methoxy radicals formed from dimethyl carbonate can initiate radical transformations of polysaccharides [8].

Considering the temperature conditions of extraction and the composition of the identified methyl derivatives of monosaccharides, a scheme of chemical transformations of cellulose under the process conditions is proposed, suggesting a radical breakdown of glycosidic bonds (Figure 3).

The radical breaking of glycosidic bonds is accompanied by the formation of radicals with different molecular weights. Upon their recombination with dimethyl carbonate radicals, methylation products of cellulose fragments are formed, including methyl β-D-glucopyranoside. Along with this, when interacting with dimethyl carbonate, the OH groups of cellulose are alkylated. Similar transformations occur, probably, with hemicellulose macromolecules.

In supercritical ethanolysis, the initiators of the radical decomposition of glycosidic bonds of polysaccharides, along with temperature, can be hydrogen and hydroxyl radicals formed from ethanol under experimental conditions [9, 10]. Cellulose transformations under these conditions proceed with the formation of oligosaccharides and glucose (Figure 4). Ethyl glycosides and monosaccharides with ethoxy groups were not found.

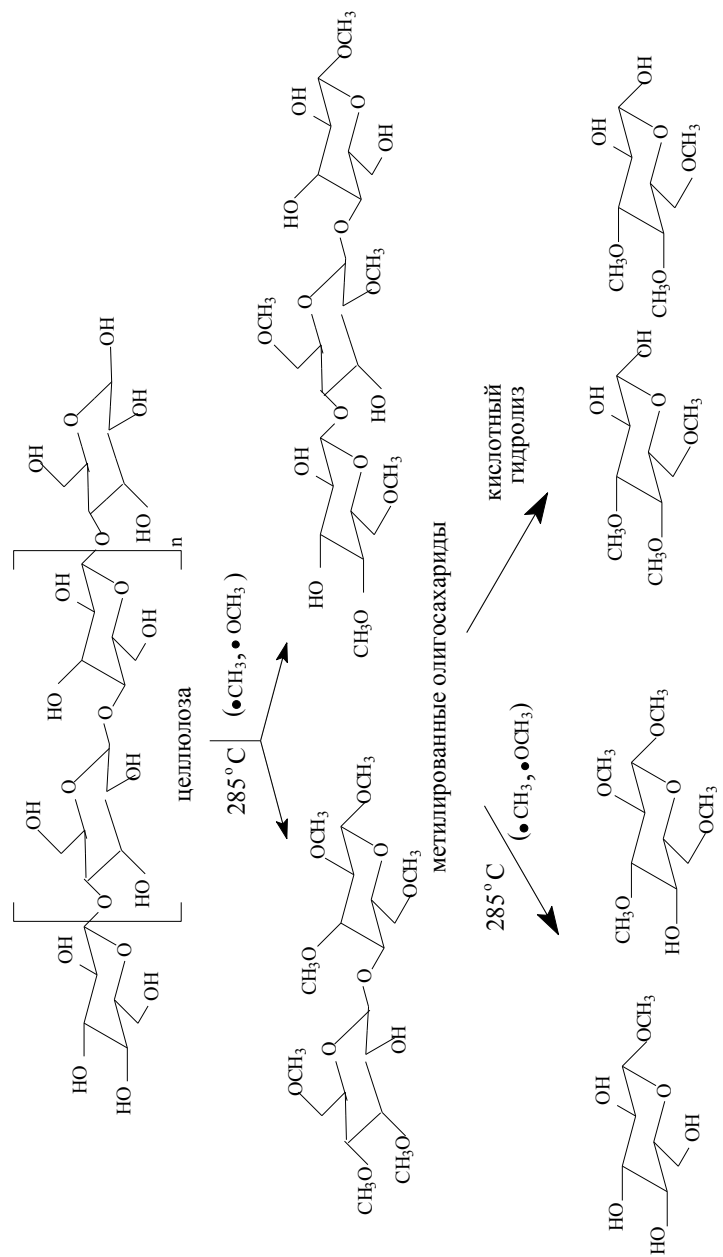


Figure 3 - *Scheme of chemical transformations of straw cellulose under conditions of supercritical extraction with dimethyl carbonate*

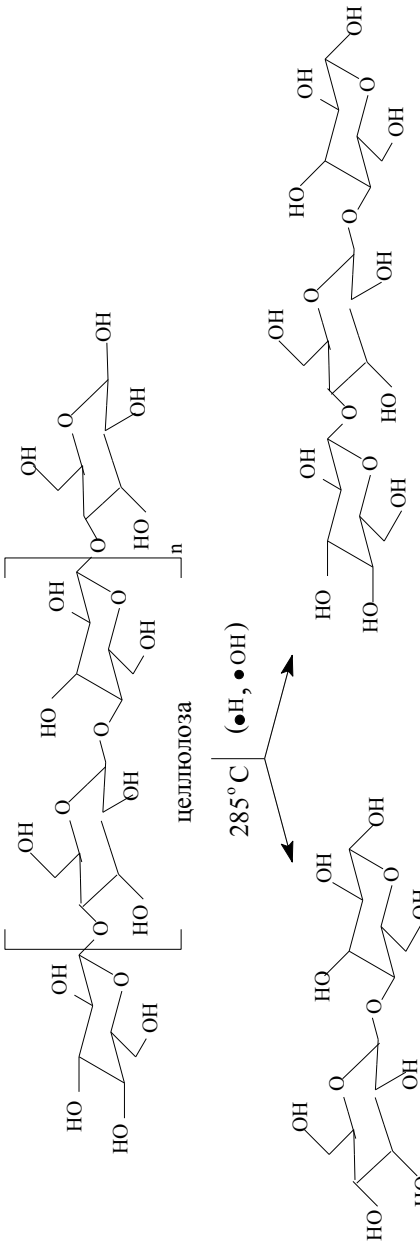


***Figure 4** - Scheme of chemical transformations of straw cellulose under conditions of supercritical ethanolysis*

CONCLUSIONS

It has been established that under the conditions of supercritical ethanolysis, the presence of a methylating reagent in the solvent increases the efficiency of fragmentation of straw biomass. The maximum yield of the extract (71% a.s.m.) was obtained using a mixture of ethanol and DMC in a ratio of 40: 60% vol.

It was shown that during supercritical extraction with dimethyl carbonate, fragmentation of straw polysaccharides is accompanied by the formation of methyl derivatives of monosaccharides of varying degrees of alkylation, among which more than 70% are methyl derivatives of glucose. More than 65% of the identified methyl derivatives of monosaccharides are glycosides.

Schemes for fragmentation of straw cellulose in a medium of supercritical ethanol and dimethyl carbonate, suggesting a radical breakdown of glycosidic bonds under process conditions, are proposed.

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保护马铃薯的生物制剂在滨海边疆区
BIOLOGICAL PREPARATIONS FOR THE PROTECTION OF POTATOES IN PRIMORSKY KRAI

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抽象。 本文介绍了基于Aversectin C的生物杀虫剂Fitoverm，KE（50 g / l），Fitoverm，KE（2 g / l）和基于Avertin的CE Akarin，CE（2 g / l）的生物有效性评估。 N保护土豆免受28污染-远东南部发现的马铃薯瓢虫（一种危险的马铃薯害虫）。

关键词：马铃薯，马铃薯臭虫，生物杀虫剂，生物有效性，生产力

Abstract. *The article presents an assessment of the biological effectiveness of bio-insecticides Fitoverm, KE, (50 g/l), Fitoverm, KE (2 g/l) based on aversectin C and Akarin, CE (2 g/l) based on avertin N to protect potatoes from 28 - Spotted potato ladybug, a dangerous potato pest in the south of the Far East.*

Keywords: *potato, potato bug, bioinsecticides, biological effectiveness, productivity*

28-spotted potato bug *Henosepilachna vigintioctomaculata* Motsch. (Coleoptera, Coccinellidae) is a serious pest of potatoes in the south of the Far East (Primorsky, Khabarovsk Territories, Amur Region, South Sakhalin, Kunashir), which is not inferior to the Colorado potato beetle in terms of harmfulness. Outside of Russia, it is known in Japan, China, Korea, and Vietnam. In addition to potatoes, *Henosepilachna vigintioctomaculata* severely damages tomatoes, cucumbers, pumpkins, watermelons, zucchini, and eggplant. Beetles and larvae are harmful. Beetles are fed on gourds in spring and autumn, and in summer, beetles and larvae feed mainly on potato leaves. The main harm to potatoes is caused by larvae of III and IV ages. In addition to the high intensity of nutrition, the harmfulness of older potato ladybug larvae is aggravated by the fact that the period of larvae harmfulness falls on the main phase of potato development - tuberization. The loss of 25%

of the leaf apparatus in the phases of budding and the beginning of flowering leads to a decrease in potato yield from 2.4 to 5.7 t / ha. Potato bug is a biotically plastic species with a high adaptive potential, both to agroclimatic conditions and to the feed base.

In the farms of the Primorsky Krai, in the fight against potato ladybugs on potatoes, 2-3-fold chemical treatments are used. The systematic use of chemicals in the region leads to the formation of resistant pest populations and is one of the most important factors in the deterioration of the ecological situation. In this regard, in recent years, preference has been given to environmentally friendly biological protection systems. The use of biological preparations helps to preserve the biodiversity of the environment, which ensures the participation of natural agents in regulating the number of harmful objects and leads to the restoration of the natural self-regulation of biocenoses. Currently, insectoacaricidal preparations based on avermectins synthesized by *Streptomices avermitilis* actinomycetes are used to protect crops from pests. Avermectins belong to neurotoxins by the mechanism of action. The principle of action is that they stimulate the release of gamma-aminobutyric acid (GABA) from nerve endings and increase the connection of GABA with receptor sites on the postsynaptic membrane of muscle cells. This leads to blocking the transmission of nerve impulses, resulting in paralysis, and then the death of insect pests [1-4]. Fitoverm (manufactured by "Farmbiomed" LLC NBC, Russia) is a new generation biological product among biological preparations based on the vital products of soil microorganisms (active substance aversectin C). The drug, penetrating into the body of the larva and beetle by contact or intestinal route, causes paralysis at the beginning, and then death [5].

Akarin - the active substance is a complex of natural avermectins produced by soil fungus - the microorganism *Streptomyces avermitilis* (Avertin N, 2 g/l). By its properties, it has an intestinal-contact action. A few hours after spraying, pests cease to feed on plant tissues, and on the second day, most insects die.

Purpose of work- is to evaluate the effectiveness of Fitoverm bioinsecticides, KE based on aversectin C and Akarin, KE based on avertin-N against potato ladybug *Henosepilachna vigintioctomaculata.*

Material and methodology

The biological effectiveness of preparations based on avermectins (aversectin C and avertin N) in the regulation of the number of potato ladybugs was assessed in 2017-2018 in the Ussuri district of Primorsky Krai on planting potatoes of the zoned cultivar Yantar. Tuber planting was carried out at the optimum time for the region - the first decade of May. The experimental options were placed randomly, in 3-fold repetition, plot area - 16.8 m^2. Plant care included hilling and regular weeding. Harvesting was carried out manually at the end of August. During vegetation, potato plants were sprayed with bio-insecticides Fitoverm, KE and Akarin,

KE with a backpack sprayer based on a working fluid consumption of 400 l/ha. Test design: Fitoverm, KE (50 g/l) and (2 g/l) - 0.07 and 1.6 l / ha, Akarin, KE (2 g/l) - 0.8 and 1.2 l/ha, control. The counts were carried out before processing and after processing on the 5th, 10th, 15th day on 10 potato plants of each repetition in accordance with the "Guidelines for registration tests of insecticides, acaricides, molluscicides and rodenticides in agriculture" [6].

Damage to potato leaves by a pest was considered on a 5-point scale:

1 point - damage is rare, less than 10% of the leaf surface is eaten;

2 points - weak damage, 10-25% of the leaf surface destroyed;

3 points - average damage (25-50%);

4 points - significant damage (51-75%);

5 points - severe damage (over 75%).

The biological effectiveness of the drugs was determined by reducing the number of pests adjusted for control and was calculated by the formula of Henderson and Tilton.

Results and discussion

Experiments to evaluate the effect of Fitoverm and Akarin on a potato ladybug were performed with a pest number exceeding the economic threshold of harmfulness, which varied from 8.8 to 16.3 ind./bush on plots with a population of 69% of the plants. Larvae of the first to third ages were present on the plants. The use of bioinsecticides led to a decrease in the number of phytophage on the 5th day after treatment by 2.5-3.9 times. Fitoverm, KE (50 g/l) showed high efficiency. In the plots treated with the drug, the number of pest larvae decreased by 3.9 times, the efficiency was 81.5% (table 1). The effectiveness of Fitoverm, KE (2 g/l) was significantly lower than the efficiency shown by Fitoverm, KE (50 g/l) against potato ladybug larvae. Akarin showed a rather high efficiency against the pest, ensuring the death of 70.4-74.4% of the larvae on the fifth day after treatment. There was no significant difference in biological effectiveness between the variants of this drug with different application rates (0.8 and 1.2 l/ha). The number of eggs laid in the control variant, as shown by the counts, averaged 13.6 pcs./plant. (from 4.5 to 25.4 pcs./plant.), while in the experiment - 1.5 - 4.7 eggs/plant., which contributed to the increase in the number of pests on the fifth day in the control of 1.2 times. By that time, larvae of the third age were already present on the plants, which accounted for 52.4% in the control, and 10-28.2% in variants using bioinsecticides.

The maximum effectiveness of the tested drugs was noted on the 10th day. The decrease in the number of phytophage when applying Fitoverm, KE (50 g/l and 2g/l) and Acarin, KE (consumption rate of 0.8 and 1.2 l/ha) was 76-9.6-5-88.0%. In the control, in comparison with the fifth day, the number of pest larvae decreased and amounted to 1.7 ind./plant. the first and second and 10.1 ind./plant. third and fourth ages, which is explained by the transition of larvae of 1-2 ages to

an older age and the departure of ladybug fourth-instar larvae to pupation. The effectiveness of the protective effect of the drugs used remained at the level of 71.2-84.6% for 15 days, which made it possible to keep the number of potato ladybug larvae below the economic threshold, so there was no need for re-processing.

Table 1 - *The effectiveness of drugs in the processing of potatoes during the growing season (average for 2017-2018)*

Test variant	Preparation consumption rate, l/ha	Biological effectiveness (days after treatment),%			Average yield, t/ha	Yield increase	
		5th	10th	15th		t/ha	%
Control	-	14,7*	11,8*	6,0*	27,6	-	-
Fitoverm, KE (2 g/l)	1,6	67,6±6,3	79,6±2,0	84,6 ±7,6	30,0	2,4	8,7
Fitoverm, KE (50 g/l)	0,07	81,5 ±2,4	88,0 ±1,3	83,0 ±5,4	32,3	4,7	17,0
Akarin, KE (2 g/l)	0,8	70,4 ±10,1	80,2 ±3,8	71,2 ±4,6	30,6	3,0	10,8
Akarin, KE (2 g/l)	1,2	74,4 ±5,3	84,2 ±3,0	79,5 ±7,8	31,3	3,7	13,4
LSD 05(t/ha)	-	-	-	-	3,5	-	-

* The number of potato ladybug larvae in control

The use of biological preparations had an impact on the potato yield; the increase in the yield of potato tubers ranged from 2.4 to 4.7 t/ha with a control yield of 27.6 t/ha (LSD_{05}=3.5 t/ha). Significant yield increases were obtained using Fitoverm, KE (50 g/l) and Acarin, KE with a consumption rate of 1.2 l / ha.

The presented results confirm the prospects of using preparations of biological origin Fitoverm and Akarin to protect potato plants from 28-spotted potato ladybug. The use of bioinsecticides will reduce the pesticidal damage on the biocenosis.

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玉米的生理状态和产量对矿质营养条件的依赖
DEPENDENCE OF THE PHYSIOLOGICAL STATE AND YIELD OF CORN ON THE CONDITIONS OF MINERAL NUTRITION

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抽象。本文介绍了不同矿物质营养水平的微量营养素非根系处理对玉米光合活性和产量的影响的研究结果。微量元素制剂刺激了玉米植物光合表面的增加。在“粒化-穗轴开花”阶段，使用矿物质营养不同背景下的微量元素制剂使叶片表面增加了9.4 … 11.3%（2.4 … 3.0千平方米/公顷）与未经治疗的选择相比。到收获期为止，最大的叶片表面被EcoFus进行叶面处理的植物保存下来，在不同的矿质营养水平下，它比对照变种高出16.4 … 19.2%或3.9 … 5.2万平方米/公顷。在未受精的背景下，含微量元素的制剂可使光合作用潜力提高6.9 … 18.3%。最大的潜力是由EcoFus和Gumostim对玉米作物进行叶面加工而形成的。在氮磷肥料的背景下，EkoFus叶面处理可达到最佳效果-233.6万平方米/公顷×天。在N120P90K60的背景下，叶面微量元素处理的光合作用潜力值比对照值高2.1 … 17.0%。通过使用Siliplant Universal和EkoFus可获得最大的效果。 Cytovit，Humate+7B和EkoFus在植物的叶面加工中获得了最高的产量-绿色量增加了3.8 t / ha的3.9 …，干物质增加了0.95 … 2.7 t / ha与对照相比，取决于土壤肥力水平。

关键词：玉米，矿物肥料，微量元素，叶面积，光合作用，产量。

Abstract. *The article presents the results of studies of the effect of non-root treatment with micronutrients at different levels of mineral nutrition on photosynthetic activity and yield of maize. Preparations of trace elements stimulated the increase in the photosynthetic surface of the maize plant. In the phase of "paniculation − cob flowering", the increase in the leaf surface from the use of preparations with trace elements against different backgrounds of mineral nutrition amounted to 9.4...11.3 % (2.4...3.0 thousand m²/ha) in comparison with options without treatment. The largest leaf surface to the harvesting period was preserved by plants with foliar treatment by EcoFus, at different levels of mineral nutrition it exceeded the control variant by 16.4 ... 19.2% or 3.9 ... 5.2 thousand m2 / ha.*

Against the unfertilized background, the preparations with trace elements allowed to increase the amount of photosynthetic potential by 6.9...18.3 %. The greatest potential was formed with foliar processing of maize crops by EcoFus and Gumostim. Against the background of nitrogen-phosphorus fertilizers, the best result was obtained with foliar treatment by EkoFus – 2336 thousand m²/ha×days. Against the background of N120P90K60, the value of photosynthetic potential from foliar treatment with trace elements exceeded the control by 2.1 ... 17.0%. The maximum effect obtained from the use of Siliplant universal and EkoFus. The highest yield was obtained in foliar processing of plants by Cytovit, Humate+7B, and EkoFus – an increase of green mass amounted to 3.9...of 8.8 t/ha, that of dry matter – 0.95...2.7 t/ha in comparison to the control, depending on the level of soil fertility.

***Keywords**:* maize, mineral fertilizers, trace element, leaf area, photosynthesis, yield.

The cultivation of corn is of great agrotechnical importance, especially its value as a fodder crop. Expansion and introduction of maize crops are dictated by the need to strengthen the fodder base in every way. Corn as a fodder crop is characterised by high yield and excellent forage advantages. However, the violation of elementary methods of cultivation of corn, in particular, the insufficient use of mineral fertilizers, results in low yields of green mass [1-5].

One of the conditions for obtaining high and stable maize yields is the improvement and introduction of a system of fertilizers with the use of trace elements [6-8]. The main elements of mineral nutrition - nitrogen, phosphorus, potassium - regulate the growth of the vegetative mass and determine the magnitude and quality of the crop, activate the growth of the root system. Microelements are required for plants in small quantities, but they have high biological activity, accelerate the passage of developmental phases, stimulate physiological processes, accelerate maturation, improve product quality and yield [9-10]. The yield level is determined by two main indicators - the total leaf area and the intensity of photosynthetic processes per leaf surface unit. At the same time, the increase in plant biomass is more closely correlated with the leaf area than with the intensity of their work [11-12].

The aim of the research was to determine the effect of foliar treatment with preparations with trace elements on the parameters of photosynthetic activity and the yield of maize at various levels of mineral nutrition.

OBJECTS AND METHODS OF RESEARCH

The research was conducted in 2016-2017 on leached medium-thick black soil with an increased content of nitrogen, phosphorus and potassium; the reaction of the soil solution is weakly acidic. The field experiment was carried out in accordance with the standard methods [13-14] in fourfold repetition by the method

of split plots according to the scheme: factor A - fertilizer rate (1 - N0P0K0; 2 - N120P90; 3 - N120P90K60); factor B - non-root treatment of plants with preparations with microelements in the phase of 6-7 leaves of maize: 1 - control (treatment with water); 2 - EcoFus (2.5 l / ha); 3 - Green Go (1.5 kg / ha); 4 - Siliplant universal (1,0 l / ha); 5 - Gumostim (0.3 l / ha); 6 - Cytovit (0.5 l / ha); 7 - Humate + 7 (0.5 l / ha). Organomineral fertilizers with trace elements (EcoFus, Gustavim, Gumat + 7) and water-soluble complex fertilizers with trace elements in chelate form (Green Go, Siliplant, Cytovit) were dissolved in water (at a rate of 200 l / ha). The area of the plots of the first order was 196 m2, of the second order - 28 m2. The object of research was early ripening hybrid of corn ROSS 199 MV (FAO 190). The sowing was carried out with a row spacing of 70 cm. Plant stand (80 thousand / ha) was formed in the phase of full shoots. The predecessor was winter wheat on a clear fallow. Mineral fertilizers (ammonium nitrate, nitroammophos, potassium chloride) were introduced before the first pre-sowing cultivation. The weather conditions of the growing season during the research years varied, but were quite favorable for the growth and development of corn.

RESULTS AND DISCUSSION

A great role in creating optimal parameters for sowing is due to the density of standing and fertilization. The role of these important agrotechnical factors in the formation of plant parameters and planting is not the same under different agroecological conditions [15, 17]. For the accumulation of the general harvest, the dimensions of the leaf area, the net productivity of photosynthesis are of great importance. The leaf area is one of the most important indicators characterizing the state of crops. In connection with this, we studied the dynamics of the formation of the leaf area of corn sowing, depending on the studied agrotechnical factors.

It was established that the introduction of mineral fertilizers improves the supply of plants with mineral nutrition and intensifies the growth of the leaf area. The measurements showed that in 2016, on average, maize plants formed a leaf surface of 12.4 ... 18.0 thousand m2 / ha against different backgrounds of mineral nutrition during the vegetative period, while the leaf surface area increased with the improvement of root nutrition conditions of plants. The average area of the assimilating surface of plants in 2017 was 16.0 ... 21.6 thousand m2 / ha, but the use of a full mineral fertilizer led to a slight decrease in the total leaf surface of the crop.

During the years of research, the leaf area reached its maximum size in the phase of "paniculation − cob flowering". The calculations carried out in 2016 in this phase showed that mineral fertilizers at a dose of N120P90 increased the photosynthetic surface of the leaves by 38.5% or 6.8 thousand m2 / ha, and the total mineral fertilizer by 7.7 thousand m2 / ha or 44.0%. In 2017, a slightly different trend was noted. Against the background of nitrogen-phosphorus nutrition, the increase was greater, the area of the assimilating surface increased by 42.4% or 10.3

thousand m2 / ha in comparison with the level of natural soil fertility, and when using fertilizers in the norm of N120P90K60, the growth of the leaf surface was less - 5,7 thousand m2 / ha or 23,5%. The observations showed that on average during the two years of research in the phase of five leaves of maize, against the background of N120P90, the plants formed a photosynthetic surface area exceeding the level of natural soil fertility by 0.37 thousand m2 / ha or 36.5%. With the introduction of full mineral nutrition, the increase was 0.74 thousand m2 / ha. It should be noted that differences in the area of the assimilating surface were gradually smoothed out as physiological changes, and in the subsequent phases of corn growth and development, the best results were obtained against a background of nitrogen-phosphorus fertilizers.

Preparations with trace elements stimulated an increase in the photosynthetic surface of maize plants. Even in the phase of 9-10 leaves, differences appeared in the options with trace elements. On average, in 2016 ... 2017 the largest leaf surface was cultivated with EcoFus foliar treatment. In the phase of "paniculation − cob flowering", an increase in the leaf surface from the use of drugs with trace elements on various backgrounds of mineral nutrition was 9.4 ... 11.3% (2.4 ... 3.0 thousand m2 / ha) in comparison with the options without preparations.

By the time of harvest, the area of the leaves naturally decreased due to the drying of the leaves of the lower tier, and the largest assimilating surface was retained by plants with EcoFus foliar treatment: at different levels of mineral nutrition it exceeded the control variant by 16.4 ... 19.2% or 3.9 ... 5.2 thousand m2 / ha. Against the background of natural soil fertility, Gumostim, Tsitovit and Humate + 7 promoted a significant increase in the leaf area by 12.3, 10.5 and 9.4%, respectively, in comparison with the untreated variant. The action of Green Go, and Siliplant Universal was approximately equal - the increase was 5.5 and 6.6%. When N120P90 was added, the formation of the leaf surface was most affected by the treatment of Siliplant universal, Gumostim and Green Go, which contributed to the growth of the assimilation apparatus by 10.9, 9.0 and 8.3%, respectively. The greatest effect against the background of N120P90K60 was obtained with foliar treatment with Siliplant universal, Humate + 7 and Tsitovit. The increase was 18.1, 14.4 and 9.4%, respectively, compared to the variant treated with water.

90 ... 95% of the dry mass of plants consist of organic compounds, the source of formation of which is photosynthesis - a process which not only the quantity but also the quality of the crop depends on. An important factor in the formation of high yield is the optimal level of photosynthetic potential (PP). This is provided by the duration of the functioning of the leaves and the total area of the leaf surface [16]. The agrotechnical methods had a different effect on the PP of maize crops. On average,during the two years of research, the improvement of soil fertility allowed to increase the PP of crops using nitrogen-phosphorus

fertilizers and full mineral nutrition by 38.7 and 46.0% respectively. Against an unfertilized background, the preparations with trace elements allowed to increase the value of PP by 6.9 ... 18.3%, and the greatest potential was formed with foliar treatment of maize crops with EcoFus and Gumostim. Against the background of nitrogen-phosphorus fertilizers, the best result was obtained with foliar treatment with EcoFus - 2336 thousand m 2 / ha × day. The formation of the PP under the action of Green Go, Siliplant Universal and Gumostim was approximately equal, the increase was 8.7 ... 9.6% or 170 ... 188 thousand m 2 / ha × day in comparison with the untreated option. Against the background of N120P90K60, the amount of PP from foliar treatment with drugs with trace elements exceeded the option without the use of trace element preparations by 2.1 ... 17.0%. The maximum effect was obtained from the use of the Siliplant Universal and EcoFus.

The net productivity of photosynthesis (NPP), like the photosynthetic potential of crops and the average leaf area is in closest connection with the yield of maize. As a result of the studies, a significant influence of agrotechnical and agrometeorological factors on the value of NPP of maize crops was revealed. It was revealed that maize crops were most productive in 2016, with a favorable combination of hydrothermal conditions of vegetation. A greater efficiency was noted against the background of nitrogen-phosphorus fertilizer application, where the net productivity of photosynthesis was 11.5 g / m2 × day on average. In the variant without fertilizers and improving the conditions of root nutrition due to N120P90K60, the efficiency of photosynthetic activity decreased by 6.5 and 10.1%, respectively.

In conditions of 2017, with good moistening and moderately low temperatures in the first half of the vegetation period, the established NPP values were 1.6 ... 2.1 times less in comparison with the previous year. Leaves "worked" more productive with the addition of fertilizers with potassium, NPP exceeded the parameters of options without fertilizers and using nitrogen-phosphorus fertilizers by 0.85 and 0.8 g / m2 × day, respectively.

On average in 2016-2017 the maximum accumulation of dry matter in the process of photosynthetic activity against the background of natural fertility was noted during foliar treatment of maize plants with Cytovit and Humate + 7, the increase was 10.2-12.1% in comparison with the option without the preparation. Against the background of the application of nitrogen-phosphorus fertilizers, the application of Humate + 7 was effective, the increase of dry biomass was 10.7%. A positive result was also obtained by treatment with Cytovit. Improving the conditions of mineral nutrition with the addition of potassium fertilizers contributed to an increase in the value of the PPS in the treatment of crops with preparations with microelements, on average, by 5.1 ... 5.9% or 0.42 ... 0.48 g / m2 × day compared with the agrophone N120P90 and unfertile options. When applying full mineral fertilizer, the best results were obtained when processing with Cytovit, Green Go

and Gumostim, the increase was 9.1, 7.1 and 4.5%, respectively, compared with the variant without drugs treatment.

Studies have shown that the yield of green mass varies considerably depending on the moisture availability, the weather conditions of the growing season of corn and the studied technological methods.

The record of the harvest showed that in conditions of high humidity against a background of moderate temperatures in the first half of the vegetation period in 2017, the yield of green mass was higher in comparison with the indicators of 2016. However, the lack of active temperatures during vegetation adversely affected the accumulation of less dry matter by plants. The greatest yield of dry biomass from a unit of planting area was obtained under conditions of a more favorable combination of temperature and humidity conditions in 2016 due to a higher dry matter content in the phytomass and a sufficiently high yield.

According to the obtained experimental data, on average for 2016-2017, with an improvement in the conditions of root nutrition, the yield of the vegetative mass increased by 13.9 ... 16.6 t / ha or 38.7 ... 46.0%. The increase from the use of complex preparations with trace elements varied from 3.0 to 8.8 t / ha, while the best results were obtained against the background of N120P90K90. It is possible to note the advantage of processing with Cytovit, which contributed to the growth of the yield of green mass by 5.5 ... 8.8 t / ha, depending on the background of the mineral nutrition in comparison with the options without treatment.

On average, over the years of research under the influence of mineral fertilizers, the yield of dry maize biomass increased by 39.3 ... 44.2%, the best results were obtained with the application of N120P90. Treatment with complex preparations was more effective when using full mineral fertilizer. Against the background of natural soil fertility and N120P90, options with foliar treatment with Cytovit and Humate + 7 were isolated, an increase of 2.7 and 2.3 t / ha, 2.3 and 1.5 t / ha, respectively, was obtained. With the introduction of full mineral nutrition, the treatment of corn plants by Cytovite and EcoFus made it possible to get additional 2.6 and 2.2 t / ha of dry biomass.

CONCLUSIONS

1. Preparations with trace elements stimulated the increase in the photosynthetic surface of maize plants.

2. In the phase of "paniculation − cob flowering" the increase in the leaf surface from the use of preparations with trace elements against various backgrounds of mineral nutrition was 9.4 ... 11.3% (2.4 ... 3.0 thousand m2 / ha) in comparison with variants without treatment.

3. By harvesting the largest leaf surface was preserved by plants with foliar treatment by EcoFus. At different levels of mineral nutrition it exceeded the control variant by 16.4 ... 19.2% or 3.9 ... 5.2 thousand m2 / ha.

4. Without the use of mineral fertilizers, preparations with trace elements made it possible to increase the amount of seeding photosynthetic potential (PP) by 6.9 ... 18.3%, and the largest total leaf surface for vegetation was formed with foliar treatment of corn sowings by EcoFus and Gumostim.

5. Against the background of nitrogen-phosphorus fertilizers, the best result was obtained with foliar treatment by EcoFus - 2336 thousand m2 / ha day.

6. Against the background of N120P90K60, the value of PP from foliar treatment with preparations with trace elements exceeded the control by 2.1 ... 17.0%. The maximum effect was obtained from the use of Siliplant Universal and Eco-Focus.

7. The highest yield was obtained by foliar treatment of plants with Cytovit, Humate + 7 and EcoFus - the increase of green mass depending on the level of soil fertility was 3.9 ... 8.8 t / ha, of dry matter - 0.95 ... 2.7 t / ha compared to options without preparations with trace elements.

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NOTES

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