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

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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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影响轧管企业经济安全水平的因素
FACTORS OF INFLUENCE ON THE LEVEL OF ECONOMIC SECURITY OF PIPE-ROLLING ENTERPRISES

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抽象的。 本文介绍了为确保管道行业企业的经济安全而制定的组织和经济机制的成果。 确定了商业环境和国家经济监管的代表对确保所研究企业经济安全的过程的影响。 分析了对企业经济安全的威胁及其中和的可能性

关键词: 经济安全 发展 投资 管业

Abstract. *The article presents the results of the development of an organizational and economic mechanism for ensuring the economic security of enterprises in the pipe industry. The influence of representatives of the business environment and state regulation of the economy on the processes of ensuring the economic security of the enterprises under study is determined. Analyzed the threats to the economic security of enterprises and the possibility of their neutralization*

Keywords: *economic security, development, investment, pipe industry*

Introduction

The pipe-rolling industry is a strategic branch of the Russian economy. The implementation of large-scale projects in the energy sector, infrastructure development and other areas involves the use of significant volumes of pipe products. Increasing the economic security of these projects requires import substitution of pipe products and the development of fully domestic production, which will reduce the risks of implementing large-scale projects.

It should also be taken into account that the pipe industry is the sub-sector of metallurgy with the largest value added. This is one of the most technological productions of high metallurgical processing. Stable growth and development of pipe-rolling production is largely determined by investments in the industry, which in turn are determined by the level of achieved economic security of enterprises - objects of investment.

The issues of the economy of the pipe-rolling industry and the development of enterprises in this industry were identified as the subject of research, the results of which are presented in the works of Bondarenko E.V., Zaionchik L.L. [1], Makarova E.V., Zemtsova E.M. [2], Samarina V.P., Ryabchukova O.Yu. [3], Yuzova O.V., Sedykh A.M., Petrakova T.M. [4], Bolgarina P.N., Ilyashenko S.N. [5], Pinchuk A.V., Kondratova L.A. [6], Oborsky V.B. [7], Ushakova A.S., Kondratova L.A. [8], Gurova S.A. [9; 10], Zhdankina N.A., Yatmanova A.V. [11]. Despite a wide range of issues resolved within the framework of the studies published in these papers, the problem of developing constructive tools to ensure the economic security of pipe-rolling enterprises has not received significant development at the level of individual scientific studies.

Organizational and economic mechanism of management tools

The results of assessing the level of economic security of Russian pipe-rolling enterprises, as well as an analysis of its individual parameters and factors, determine the need to develop specific management tools. This toolkit is aimed primarily at creating conditions for neutralizing threats and taking into account the dynamics of environmental factors that determine the prospective decline in economic security indicators of the enterprises under study.

The solution to the issue of developing such a toolkit is primarily associated with the formation of an organizational and economic mechanism with the aim of systematically solving a fairly wide list of interrelated and interdependent problematic issues of the organizational, financial, economic, administrative and managerial plan. It should also take into account the fact that this mechanism should be aimed at creating conditions for effective counteraction and neutralization of threats to the economic security of enterprises that are formed in the external environment, are of an objective nature and are actually exogenous factors of influence that are not amenable to corrective and preventive actions from the enterprise.

The organizational component of the mechanism involves the creation of an effective system for managing the interaction of internal and external stakeholders (as well as contact audiences) in order to achieve maximization of the results of using the competitive advantages and strengths of the enterprise, as well as minimizing external factors of adverse impact. The solution of these issues is based on the correct goal-setting, decomposition of goals into tasks and substantiation of the functions corresponding to these tasks and the principles of their implementation.

The economic component of the developed mechanism is aimed at solving the issues of finding sources of resource support, its mobilization and distribution in the areas of counteracting threats to economic security, characterized by the greatest risk of adverse economic consequences for the enterprises under study. Within the framework of the economic block of the mechanism, it is necessary to assess and analyze the main parameters of the functioning of the system for ensuring the

economic security of an enterprise, as well as to carry out analytical work with information flows on the current and forecast state of the main external and internal factors influencing economic security. Among the tasks of the economic block, one should also mention the issues of planning measures to increase the level of economic security of enterprises.

The functioning of the organizational and economic mechanism is based on its information support. In this case, it should be noted the need for prompt provision of information that removes any uncertainty from the key parameters of the economic security of the enterprise, as well as the current and forecast state of the factors of influence. The processing of information (based on specific methodological support) and the adoption of appropriate decisions based on it should be defined as intermediate results of the functioning of the mechanism that determine the solution of the tasks underlying it and the subsequent achievement of its goal.

To diagnose the main factors influencing the state of economic security of an enterprise, it is justified to use the SWOT analysis methodology, which allows you to classify factors into endogenous and exogenous with their subsequent division into threats and opportunities (depending on the nature of the current impact and interaction with the external environment), as well as strengths and weaknesses [12].

Fig. 1 shows the organizational and economic mechanism for ensuring the economic security of enterprises in the pipe industry.

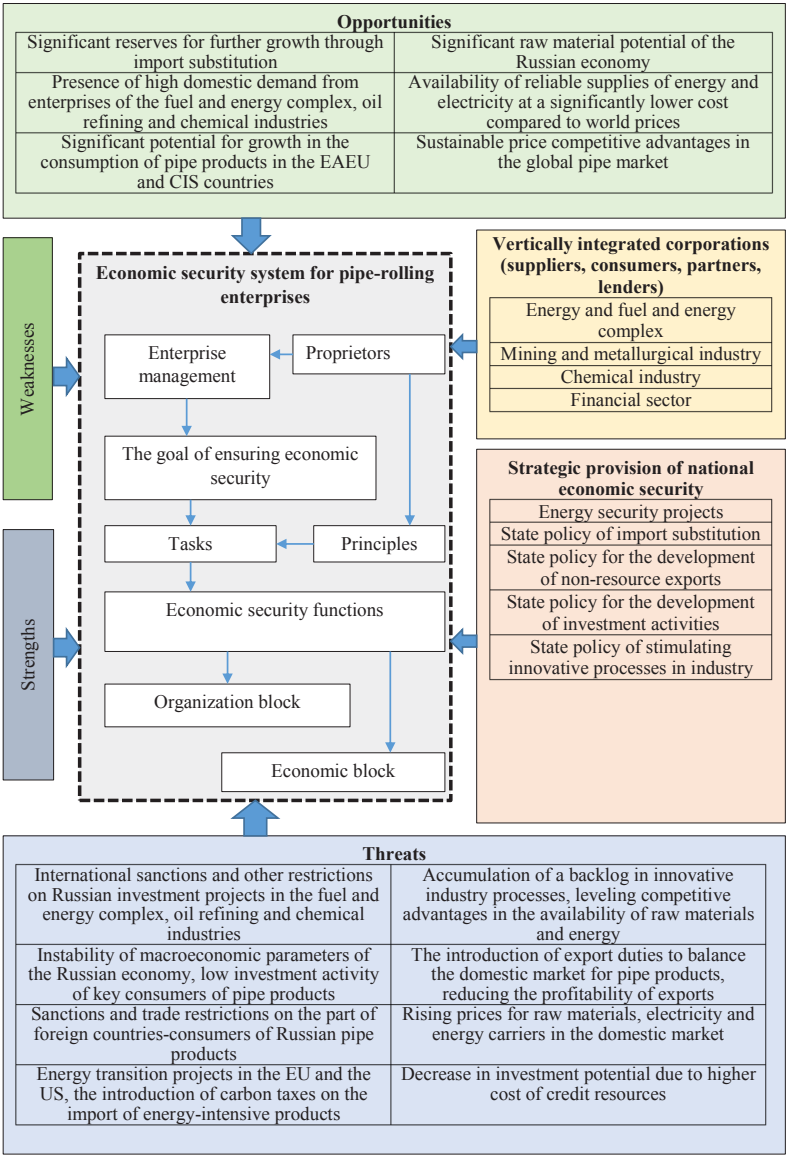

Figure 1. *Organizational and economic mechanism for ensuring the economic security of pipe-rolling enterprises*

Source: compiled by the author

The presented mechanism schematically displays the interaction between the internal and external environment of the pipe-rolling industry enterprise. The external environment is represented by objectively existing factors of influence, the dynamics of changes in the parameters of which directly affects the level of economic security of enterprises.

In the external environment, two groups of subjects have been identified that have a significant impact on the level of economic security of enterprises: the state and the business environment.

The state exercises direct influence through the implementation of the strategic provision of national economic security. In this case, we are talking about: the implementation of energy security projects; state policy of import substitution; state policy for the development of non-commodity exports; state policy for the development of investment activities; state policy of stimulating innovative processes in industry.

The subjects of external influence from the business environment are vertically integrated corporations (suppliers, consumers, partners, lenders) that operate in the following industries: energy (supplier) and fuel and energy complex, mining and metallurgical industry (supplier), chemical industry (consumer), financial sector (creditor).

The internal environment of enterprises is characterized by their strengths and weaknesses, which characterize the following parameters:

- financial condition (efficiency of economic activity; availability of liquid assets; ratio of own and borrowed capital, etc.);
- operational efficiency (production and logistics processes);
- availability of resources (material, labor, financial, energy, etc.).

The purpose of the functioning of the organizational and economic mechanism for ensuring the economic security of enterprises in the pipe-rolling industry is the timely identification, constant monitoring and prompt neutralization of threats to the security of enterprises. The mechanism is aimed at creating conditions for the long-term neutralization of threats from the external environment and maximizing economic benefits from the use of opportunities for solving the following tasks:

- ensuring a stable expanded reproduction process at enterprises through the use of strengths and opportunities that materialize in the external environment (in the national and global economy);
- expanding the range of manufactured products, substituting import supplies, ensuring production growth at the expense of the reserves of the domestic market and the markets of the EAEU countries;
- formation and development of competitive advantages, maximization of the results of their use in the direction of stabilizing the position in the national and world market for pipe products.

Among the principles of the organizational and economic mechanism, the following should be highlighted::

- consistency (taking into account the mutual influence of the parameters of the internal environment of enterprises and the characteristics of the impact on them from environmental factors);
- adaptability (creation of conditions for ensuring the efficient economic activity of enterprises in adverse conditions, including: strengthening of international sanctions, critical changes in market conditions, etc.)
- constructiveness (focus on expanding production, the range of products, deepening the processing of domestic raw materials);
- complexity (taking into account a wide range of risk factors, as well as parameters of the internal environment and resources for neutralizing threats);
- objectivity (taking into account objectively existing factors of influence and using the opportunities for making timely decisions in relation to objects that are amenable to corrective and preventive actions);
- novelty and originality (the use of new management tools that allow making effective and non-trivial management decisions in the course of neutralizing threats and maximizing economic benefits from the use of emerging opportunities).
- In order to solve the problems of the developed organizational and economic mechanism, on the basis of the principles defined above, the following list of functions is implemented:
- timely identification of threats, assessment and analysis of risks associated with them;
- forecasting key parameters of the internal and external environment of enterprises from the point of view of ensuring economic security;
- neutralization of factors of negative influence, reduction of risks of materialization of threats to the economic security of enterprises;
- monitoring weaknesses and vulnerabilities, ensuring timely application of corrective and preventive actions.

Conclusion

The practical application of the developed organizational and economic mechanism for ensuring the economic security of pipe-rolling enterprises makes it possible to neutralize the threats generated in the external environment, reduce risks in the operational, investment and financial spheres of economic activity. All of the above results determine a higher degree of probability of making positive investment decisions in relation to pipe rolling enterprises and a corresponding increase in the scale of their business activities.

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农村地区发展的优先方向（以阿穆尔州为例）

PRIORITY DIRECTIONS FOR THE DEVELOPMENT OF RURAL TERRITORIES (BY THE EXAMPLE OF THE AMUR REGION)

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注解。 所选研究主题的相关性是毋庸置疑的。 眼下，随着乡土声望的不断提高，无法建立乡土发展机制的模型，对本研究的兴趣有所增加。 本文研究的目的是制定农村地区发展的优先计划。 观察对象是阿穆尔地区。 该研究的主题是阿穆尔地区的农村地区。 研究的结果是为阿穆尔地区农村地区的发展选择最佳方案的开发方案。

关键词：农村地区； 阿穆尔地区； 农村地区发展、投资项目、创新、旅游、农业、人力资源的措施。

Annotation. *The relevance of the chosen research topic is beyond doubt. Right now, with the growing prestige of rural territories, the inability to build a model of the mechanism for the development of rural territories, interest in this study has increased. The purpose of the study in this article will be the formation of priority plans for the development of rural territories. The object of observation is the Amur region. The subject of the study is the rural territories of the Amur region. The result of the research was the developed scenarios for choosing the most optimal option for the development of rural territories of the Amur region.*

Keywords: *rural territories; Amur region; measures for the development of rural territories, investment projects, innovations, tourism, agriculture, human resources.*

The fulfillment of the most important tasks of the socio-economic system of any country, which is to ensure both food and national security, is determined by the functional features of rural territories. The conditions for the formation of an

objective basis for a more sustainable development of rural territories are diverse and directly depend on the efficient use of resources, an increase in the level of employment, ensuring the positive dynamics of demographic processes and infrastructural changes in the countryside, and, as a result, achieving an adequate level and quality of life for the rural population. At the same time, the socio-economic characteristics of rural territories are most influenced by the natural factor, primarily the resource value and spatial distribution of the land mass, and, as a result, the location of the basic industry - agriculture and anthropogenic objects that determine the way of life in the countryside.

The development of the agricultural economy, the formation of the Russian agri-food market, as well as the sustainable development of rural territories in the context of the current foreign economic sanctions and the Russian food embargo, is now becoming an imperative of the progressive economic policy of the state. The growing complications occurring in the systems of socio-economic, demographic and environmental processes in the countryside, as well as the need to counter the various challenges of the external environment, establish the importance of research aimed at solving the problems of substantiating priority areas for the sustainable development of rural territories.

During the analysis of scientific works of domestic scientists who have studied the issues of sustainable development of rural territories, it's possible to identify and form the most priority factors and goals of sustainable development of rural territories.

Natural and climatic, historical and cultural features, as well as socio-economic, environmental factors, the factor of the production potential of the agricultural sector and human capital are singled out as priority factors for the development of rural territories. At the same time, the approach to considering and highlighting the factors of priority development of rural territories should be comprehensive, and the entire set of factors should be implemented systematically, taking into account the sectoral characteristics of agriculture, as a priority in the format of rural territories of the economic sphere.

Based on this, the rural territory can be represented as a socio-ecological-economic-institutional resource territorial system, including production, demographic, social, economic and environmental components, acting as resources, factors and results of its functioning and providing an increase in the quality, standard of living of the population and food security of the country.

The existing model is based on an integrative approach, which is based on considering the rural area as an integral system of its main elements (demographic, environmental, institutional, social and production), which underlie the formation of conditions for sustainable development, which is based on the heterogeneity and inconsistency of these elements of rural territories.

One of the main factors that determines the promising directions for the development of rural territories is the transformation of the structure of the agrarian sector of the economy [7].

Figure 1 graphically shows the shares of individual regions of the Far Eastern Federal District that contributed to the production of agricultural products (in current prices) based on the results of 2020.

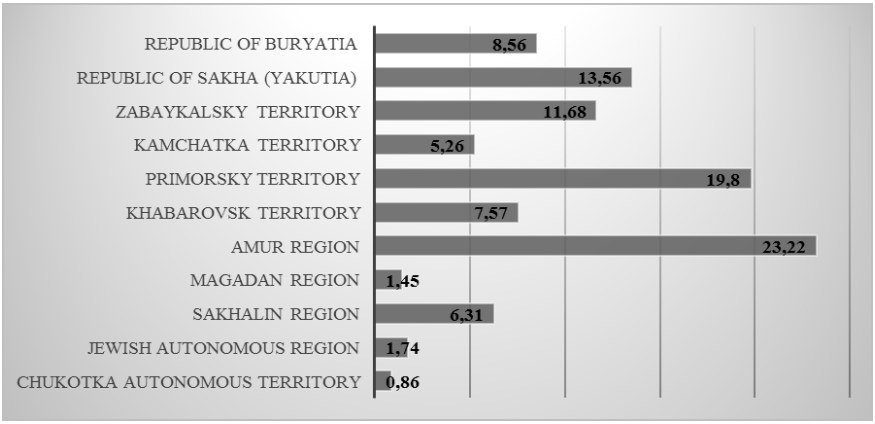

***Figure 1**. The share of the entities of the Far Eastern Federal District in the gross value of agricultural products in 2020, %*

As can be seen from Figure 1, the leading positions in terms of the gross value of agricultural products in 2020 were occupied by the Amur region, Primorsky Territory, the Republic of Sakha (Yakutia) and the Zabaykalsky Territory. It should also be noted that the share of these regions in 2020 increased compared to 2019. However, despite all of the above, the structure of the agrarian sector in these regions is very different. So, for example, in the Republic of Sakha (Yakutia) in 2020, the share of agricultural enterprises in the value of agricultural products produced in the region was 25.22%, in the Amur region this figure was 28.68%, in the Zabaykalsky Territory - 18 .76%, and in Primorsky Territory - 31.28% [4, 5].

According to the Spatial Development Strategy of the Russian Federation, for the period up to 2025, approved by the Decree of the Government of the Russian Federation of February 13, 2019 No. 207-r, the Amur region is included in the list of priority geostrategic territories of the Russian Federation. Increasing the competitiveness of the economy of the Amur region is associated with the development of industries with promising economic specialization, including mining, agriculture, electric power, forestry and food industries, and tourism [1].

Three territories of advanced socio-economic development have been created in the region, with agro-industrial, gas-chemical and industrial-logistic specializations, the only civilian cosmodrome in Russia is operating (cosmodrome Vostochny). Five international investment projects are being implemented in the region. The main socio-economic indicators of the Amur region for 2020 (table 1).

Table 1.

Main socio-economic indicators of the Amur region / Far Eastern Federal District for 2020

Indicators	**Russian Federation**	**Far Eastern Federal District**	**Amur region**
GDP, %	96,9	98,1	103,6
Industrial production index,%	97,1	95,1	95,4
Investments in fixed assets	95,9	93,5	94,3
Unemployment rate	3,7	3,2	3,2
Average monthly nominal wages,%	105,3	105,3	108,6
Export, %	79,3	83,5	134,7

In this case, as practice has shown, six key areas reflected in the long-term development strategy of the region can be noted:

- gas processing;
- gasification;
- agriculture;
- transport logistics;
- development of the northern territories;
- zones of the Baikal-Amur Mainline;
- tourism;
- energetics.

For each priority area, investment projects are being implemented and new facilities are being created. As of January 1, 2021, there are 9 urban districts and 20 municipal districts in the Amur region. The region also includes 8 cities of regional subordination, 2 cities of district subordination, 15 urban-type settlements, 242 villages, 601 rural settlements. The average population density is 2.2 people per 1 sq. km. kilometer is a low figure [4, 6].

Currently, the State Program for the Development of Territories is in effect [2]. As part of its action, we will formulate the main activities that should be carried out for the development of rural territories:

- construction, reconstruction (modernization), overhaul of facilities in rural territories;

- purchase of equipment, technical means;
- transfer of apartment buildings to individual heating, construction of boiler houses;
- development of tourism, construction or repair of existing tourist facilities.

Achieving the goal in the development of rural territories of the Amur region is possible if:

- the population actively participates in various programs and projects. Support for youth, in terms of grants, as well as other programs for the development of rural territories;
- to mobilize own material, labor and financial resources of all associations;
- exercise control over the targeted use of budget funds aimed at the development of rural territories;
- to form and develop civil society institutions in rural territories that contribute to the creation of conditions for the integrated development of rural territories;
- investment attractiveness, creation of high-tech jobs in rural territories;
- development of interest in the culture of rural life among young people;
- subsidizing under the programs of the "Programs of Regional Assistance";
- rural staffing. Attracting young people to work in rural territories;
- development of the agro-industrial complex of rural territories;
- allocation of investments for training farmers, soft loans, the possibility of purchasing equipment at a low cost;
- use the experience of other countries;
- support for the export activities of rural enterprises.

As a rule, the investment attractiveness of rural territories of the Amur region, as well as any areas, is an urgent issue of their development. Therefore, it is important to support investment projects in this area.

This paper notes the need to strengthen investment support for rural territories. We have identified the main directions and forms of development. We believe that more active involvement in cooperation within the framework of investment projects will help become an additional incentive to increase the efficiency of rural development.

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在精神，道德和爱国教育相结合的基础上，为国家和市政官员的专业活动准备未来的管理者

PREPARATION OF FUTURE MANAGERS TO THE PROFESSIONAL ACTIVITY OF STATE AND MUNICIPAL OFFICIALS ON THE BASIS OF UNITY OF SPIRITUAL, MORAL AND PATRIOTIC EDUCATION

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注解。本文讨论了在精神、道德和爱国教育的条件下为未来的单身汉准备专业活动的问题。这项任务在俄罗斯联邦到 2025 年的教育发展战略和俄罗斯公民的精神和道德人格概念中得到批准。应该澄清的是，现代的学士学位准备过程是一项复杂的教学任务，它不仅解决了教育领域政策规定的问题，而且代表了现代俄罗斯社会的实际需求，表现出灵性的下降，精神和道德价值观的变形。为了解决这个问题，提出了方法论工具：有希望实施基于跨学科的计划，不仅整合科学知识，而且整合先进的教育教学实践，学士积极参与公共生活，精神、道德和爱国教育的统一.

关键词：学士学位，精神、道德和爱国教育的价值方面，跨学科性，对人的价值态度

Annotation. *The article deals with the problem of preparing future bachelors for professional activity in the conditions of spiritual, moral and patriotic education. This task finds approval in the Strategy of the development of education of the Russian Federation for the period up to 2025 and the Concept of the spiritual and moral personality of a citizen of Russia. It should be clarified that the modern process of bachelor's degree preparation is a complex pedagogical task that solves the problem not only stated by the policy in the field of education, but also represents an actual need of modern Russian society, demonstrating a decline in spirituality, deformation of spiritual and moral values. To solve the problem, methodological tools are proposed: promising implementation of a program based on interdisciplinarity, integration of not only scientific knowledge, but also*

advanced pedagogical practice of education, active participation of bachelors in public life, unity of spiritual, moral and patriotic education.

Keywords: *bachelor's degree, value aspect of spiritual, moral and patriotic education, interdisciplinarity, value attitudes towards a person*

The events of the present time confirm that in the training and upbringing of future bachelors, significant characteristics of the production process are: responsible attitude to work, spiritual and moral acceptance of national values, a developed sense of patriotism, awareness of oneself as a citizen of Russia. However, the devaluation of spiritual values creates additional difficulties in revealing the nature and content of the relationship between the spiritual, moral and patriotic in the education of future bachelors and their professional activities. The success factor of a bachelor is professional self-determination and social formation of a professional [1, p.104].

Proceedimg from the fact that "spiritual and moral education in common is the purposeful formation of moral consciousness, the development of moral feelings and the development of skills and habits of moral behavior" [1, p.105], we should consider that this process cannot be abstract. The modern educational ideal for a bachelor is a highly moral, creative, competent citizen of Russia, accepting the fate of the Fatherland as his personal, aware of responsibility for the present and future of his country, rooted in the spiritual and cultural traditions of the multinational population of the Russian Federation. Spiritual, moral and patriotic self-determination of the future bachelor takes place in real or simulated life situations, the diversity of which creates a expanse for unified pedagogical interaction of educational subjects, their joint searches and projects. In such situations, the unity of spiritual, moral and patriotic consciousness and feelings is formed, skills and adequate behavior are developed. This is indicated by a significant amount of research on the activity (V.M. Gordon, A.V. Karpov, E.G. Yudin, V.V. Tarasenko), which fix the inconsistency of the provisions of its theory. At the same time, there are a number of general provisions on the activities adopted by the scientific community (V.P. Zinchenko, A.N. Leontiev).

These provisions retain their significance for the concept of "professional activity". Scientists consider professional activity as part of V.T. Shapko's professional culture [3, pp.66-72]. Moreover, the first, and many believe that the main, block of culture is axiological, includes a system of values that determine the attitude of an individual to work as a system of social relations. The value context is also important in the interpretation of the concept of "profession". In the broadest sense, "profession means any areas of activity other than domestic, subsistence farming, which are a source of livelihood" [2, p. 4]. The analysis of different definitions allows us to assert that in the profession there are always norms of profes-

sional behavior that have a spiritual and moral nature.

It is also important that the profession as a social phenomenon is carried out only through a specific activity, and therefore is inextricably linked with professional activity. The social meaning of professional activity is connected with the fact that its subject must meet the requirements of the profession. It should also be taken into account that although any activity is carried out by a subject, it is the object of professional activity that determines its content. At the same time, the content of professional activity "includes the degree of responsibility and complexity of work, the ratio of executive and managerial functions, the degree of diversity of professional functions, independence, etc." [2, 7]. It should also be taken into account that "professional values exist within a certain profession and play the role of its regulatory mechanism" [2, p.8].

So, the analysis allows us to consider the available options for the correlation of spiritual, moral, patriotic education and professional activity in relation to future bachelors.

The scientific literature by the consideration of spiritual, moral and patriotic education as the basis of professional activity is dominated. Such personal qualities as diligence, conscientiousness, responsibility, sense on duty and other moral qualities of a person are considered as universal values for any professional activity. That is why in the spiritual, moral and patriotic education of future bachelors, any type of activity (artistic, labor, sports, volunteer) is considered acceptable and desirable for building up the spiritual and moral potential of an individual. To a certain extent, such an attitude to the spiritual, moral and patriotic perfection of the individual as a factor in the future professional activity of the bachelor represents the realization of the well-known idea of the comprehensive development of the individual as a fundamental task of professional pedagogy.

A meaningful characteristic of the interrelated vectors of spiritual, moral and patriotic education of bachelors is presented on scheme (Fig. 1).

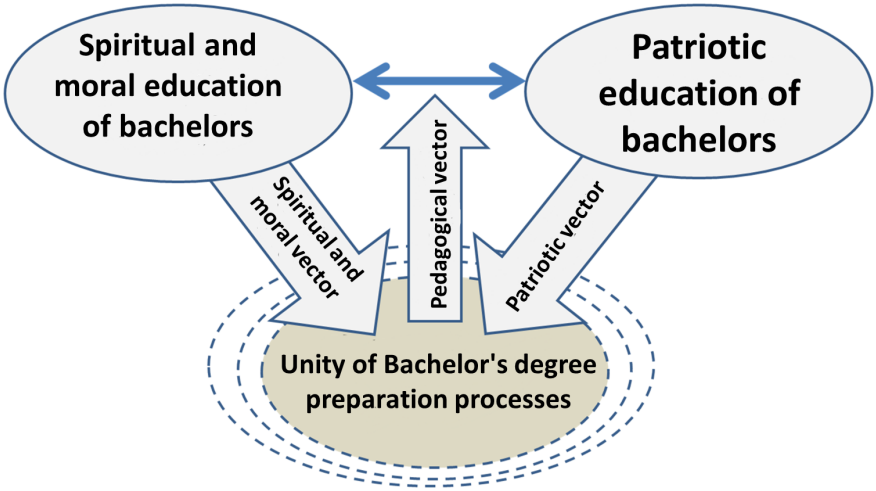

Figure 1. *The process of integration of spiritual, moral and patriotic education of bachelors*

It is no coincidence that modern employers, when hiring future employees, in particular bachelors, focus on the moral character of applicants. At the same time, believing that if professional skills can be subsequently taught in the workplace, then moral patriotism, love for one's homeland, people, attachment to the place of one's birth, devoted to the interests of a cause, ardently loving something, if it is possible to correct, then with great expenditure of effort and time. The integrity of an employee in professional activity is valued by employers more than special skills. Such attitudes are shared by teachers, believing the high spiritual, moral and patriotic potential of young bachelor graduates to be an enduring value for any professional activity.

The influence of professional activity on patriotism and spiritual and moral education, as a connection opposite to the previously described one, is considered much less in the scientific literature. Meanwhile, any professional activity requires one's own personal values, assumes ranking of personality qualities according to the degree of significance for the work performed. For example, there is a well-known division of professions into normative and creative, each of which, in addition to universal spiritual and moral attitudes, presupposes special personal qualities. When preparing future bachelors, professional activity allows, when updating its spiritual, moral and patriotic content, to minimize the time spent on educating the personal qualities of bachelors. This is an important condition, since it is necessary to take into account the limited resources for the educational process of future bachelors. It must be said that the insufficient development of the specialty

passport with a description of working conditions and requirements for the employee complicates the reverse influence of professional activity on the spiritual, moral and patriotic education of future bachelors. That is why the industrial practice of future bachelors, as the most realistic way to introduce them to professional activity, needs to study and improve the ways of unity of the spiritual, moral and patriotic potential of the bachelor.

Since the possibilities of future bachelors to engage in professional activities are limited, there is a need to expand their space of professional self-determination and the development of the spiritual and moral sphere in personal professional self-improvement. It is possible to solve such a pedagogical task when creating situations (real, simulated, educational, predictive) of designing, discussing, solving spiritual and moral conflicts of professional activity.

Projects of creating and implementing situations in the pedagogical process are considered in numerous publications. After analyzing the results of the study [4], it can be established that any situation is a unity of circumstances and states, the interaction of which creates a life problem, the solution of which is possible when the subject chooses his own act in the proposed circumstances. In relation to the spiritual and moral education of future bachelors in professional activity, it is possible to vary circumstances and conditions. Thus, the circumstances of professional activity (working conditions, availability of tools and materials, the nature of industrial relations and other circumstances) should be correlated with the conditions (mainly psychological) of the participant in occupational relations. Changing the set and significance of circumstances allows you to create many situations that require their subjects to be in the right state.

The use of situations as a mechanism for coordinating the processes of spiritual, moral and patriotic education and professional activity of future bachelors allows solving a number of pedagogical problems. The most obvious of them are: creation of conditions for future bachelors to design professional behavior in future activities; discussion of decision-making options in situations of industrial uncertainty; exchange of life and professional experience by subjects of education in solving situations.

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表现主义诗学在G. Trakl诗歌《De profundis》汉译中的反思
REFLECTION OF EXPRESSIONIST POETICS IN THE TRANSLATION OF G. TRAKL'S POEM "DE PROFUNDIS" INTO CHINESE

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抽象的。 本文涉及德国表现主义作词家特拉克尔的原诗及其中文译文。 分析了作者在表现主义诗学的原著和特点中使用的技巧，以及它们在译文中的接受程度。

关键词：表现主义，诗学，翻译。

Abstract. *The article deals with the original poem of the lyricist of German expressionism G. Trakl and its translation into Chinese. The author's techniques used in the original and characteristic of expressionist poetics, as well as their reception in the translated text are analyzed.*

Keywords: *expressionism, poetics, translation.*

The poem "De profundis" [1, p. 86] of Georg Trakl, one of the most important expressionist poets, was published during the author's short and tragic lifetime, and was included in his first and only lifetime collection, published in 1913.

The name refers us to the eponymous 130th psalm (in Catholic numbering) from the Psalter. This psalm is a prayer of repentance. The one who reads it cries out to the Lord "from the depths" of his sin, his fall and asks for condescension and liberation from sins. In the Catholic tradition, it is used for prayers of departure, read over the dying. In European culture, this psalm often became an impulse for many composers to create various musical works: cantatas, symphonies; the Latin incipit of the psalm was used by Oscar Wilde when he named his prison notebook, and so on.

Consider the text of the poem "De profundis":

Es ist ein Stoppelfeld, in das ein schwarzer Regen fällt.
Es ist ein brauner Baum, der einsam dasteht.
Es ist ein Zischelwind, der leere Hütten umkreist –
Wie traurig dieser Abend.
Am Weiler vorbei
Sammelt die sanfte Waise noch spärliche Ähren ein.
Ihre Augen weiden rund und goldig in der Dämmerung
Und ihr Schoß harrt des himmlischen Bräutigams.
Bei ihrer Heimkehr
Fanden die Hirten den süßen Leib
Verwest im Dornenbusch.

Ein Schatten bin ich ferne finsteren Dörfern.
Gottes Schweigen
Trank ich aus dem Brunnen des Hains.
Auf meine Stirne tritt kaltes Metall.
Spinnen suchen mein Herz.
Es ist ein Licht, das meinen Mund erlöscht.
Nachts fand ich mich auf einer Heide,
Starrend von Unrat und Staub der Sterne.
Im Haselgebüsch
Klangen wieder kristallne Engel.

Most likely, the actions in the poem take place in early autumn. "Stoppelfeld" ("stubble") tells us about this, i.e. a field where the rye is already harvested, and the fact that an orphan is picking up the remaining ears ("sparliche Ähren ein"). Time of day - sunset, twilight "der Dämmerung"). The poem is "impregnated" with religious themes. "Himmlischen Bräutigams" ("heavenly groom") and "süßen Leib" ("sweet/sweetest body") can be interpreted as Jesus Christ. "Dornenbusch" ("thorn"), which may refer us to the crown of thorns. There are also such expressions as "Gottes Schweigen" ("silence of God") and "kristallne Engel" ("crystal angels").

The motif of death is traced in the poem. "Brauner Baum" - "brown tree", means a tree without foliage, it withered, died. The light that went out ("Es ist ein Licht, das in meinem Mund erloscht"), as well as twilight, can serve as symbols of the end of life, lack of hope and faith in the future. And the most obvious is the rotting body in the thorn bush ("den süßen Leib // Verwest im Dornenbusch"). A lone tree ("Es ist ein brauner Baum, der einsam dasteht"), empty huts ("leere Hütten"), an orphan ("Waise"), tell us about the presence of the motive of loneliness in the verse.

Post-apocalyptic notes are also traced here: "schwarzer Regen" ("black rain"), which can speak of a thunderstorm (association with clouds), Zischelwind ("whispering wind"), "auf einer Heide" ("wasteland"), "Unrat und Staub der Sterne" ("garbage and dust from the stars").

Having considered the main motives and themes touched upon in the poem, let's move on to a more detailed analysis of some lines of the work.

Let's start with the third line of the first stanza. The author uses the neologism "Zischelwind" (lit. "hissing wind"). The hissing sound conjures up images of a snake, i.e. something sinister. However, in Christianity, the snake symbol can mean both Christ and the devil in his chthonic incarnation, personifying the evil that a person must overcome in himself.

Let's look at the second stanza. Here, special attention is paid to the eyes of the orphan. They are wide open and golden ("rund und goldig"), which makes them look like the sun. At the same time, describing the girl, Trakl used the word "sanfte" ("short"). The combination of this characteristic with a radiant look adds something unearthly, divine to the image of an orphan. It should be noted that when describing the girl's eyes, the poet used the word "weiden" with the meaning "graze(s)", which is used when talking about animals grazing in the meadow. The first thing that comes to mind is a sheep, the image of which in Christianity denotes innocence, meekness, timidity. Also in the fourth line, the word "Schoß" is used, which translates as knees, but in this context it means "bosom".

Let's turn to the fourth stanza. The "drinking" of God's silence from the spring ("Brunnen des Hains" - literally "wells of groves") can be interpreted as an appeal (probably repentance) to God, but without an answer.

Let's move on to the fifth stanza. The second line mentions the image of a spider. In Christianity, he was identified with Satan and evil, because he lures and kills the victim (a sinner who has gone astray, entangled in his trap). Therefore, the spider here is a symbol of inner evil - doubt, anxiety, fear. And by "cold metal", perhaps, the cross is meant. The third line is composed in an unusual way. It translates as "this is the light that extinguishes my mouth," but this option is also allowed: "this is the light that goes out in my mouth". And then, depending on the translation, it can be interpreted in different ways.

Let us proceed to the interpretation of the entire poem, taking into account all the symbols and images. Of course, there are many interpretation options, but we adhere to the version that all actions in the work take place inside, in the soul of the lyrical hero.

There is an expression in Christianity, the meaning of which is that God is in each of us. Here, "God" refers to the good principle that is present in all people. Shepherds are what helps a person to get on the right path - virtues. The orphan, picking up the ears, symbolizes the remnants of goodness in the soul of the hero, which he "kills" in himself (a sweet body rotting in the blackthorn). The shadow is the evil, negative beginning of the hero. He decides to repent to the Lord (hence the name), but does not hear an answer from Him. The spider looking for the heart is an internal evil that almost swallowed the soul of the hero. The last stanza describes the Last Judgment that is being performed on him. It turns out that this psalm is read over the lyrical hero, over his "dead" soul.

And now let's move on to comparing the original with the Chinese translation "出自深处" [2]:

有一片落着一阵黑雨的留茬的田地。
有一株孤零零竖着的棕色树。
有一阵围着空茅屋丝丝吹着的风。
这个黄昏多么凄凉。
村落那边
还有瘦小的孤儿在拾些许的落穗。
她的眼睛圆圆的金灿灿地盯着暮色，
她的胸怀期待着漂亮的新郎。
在回家的路上
教人发现甜蜜的身体
腐烂在刺丛里。

我是一个影子远离阴沉的村落
我从林苑的水井里饮着
上帝的沉默。
在我的额头是冰冷的金属。
蜘蛛寻找着我的心。
有一盏灯在我的口中熄灭了。
夜间我发现自己在荒原上，
上面堆满了星星的垃圾和尘埃。
在榛属丛林里
又一次响起了透明的天使。

The title has been translated into Chinese, and not left in Latin, which changes the perception of the work, as it deprives it of a religious connotation.

1-st stanza. The structure of the beginning of the first three lines is observed: Es ist ein - 有一片\株\阵. In the original, the first line uses the word "Stoppelfeld" with the meaning "stubble", in the Chinese translation 田地 – "cultivable land", "arable land", i.e. agricultural land where cereals are not necessarily compressed. The second line contains "竖着" with the main meaning vertical, vertical, which is not in the original.

2-nd stanza. The first 2 lines of this stanza correspond significantly to the original, so let's move on to the third. In the original, it sounds like this: "Ihre Augen weiden rund und goldig in der Dämmerung" ("Her eyes are wide open and golden in the twilight"). The verb "weiden" is used here with the main meaning "graze(s)". The Chinese version of the line translates as "her eyes are wide with a golden-bright and dazzling gaze, gaze intently into the twilight." There is no verb at least close in meaning to the word "graze(s)" here. The 4th line in the original uses the word "Schoß" (in this context - the bosom). In Chinese, the translator used the word "胸怀" - soul, heart, poet. breast. Also, the expression used here is "漂亮的新郎" ("beautiful groom"), but in the original "himmlischen Bräutigams" ("heavenly groom"). This discrepancy is really significant, because can change the meaning of what is written. The "heavenly bridegroom", as mentioned above, can be interpreted as the Lord, Jesus Christ, while the adjective "handsome" can only speak of the good external data of the expected bridegroom. This inaccuracy may have arisen due to differences in culture and religion in China and Europe.

3-rd stanza. We are interested in the 2nd line. The original is: "Fanden die Hirten den süßen Leib". ("The shepherds found a sweet body.") In the Chinese translation, the word "shepherds" does not exist in principle. Instead, the translator used "教人" - "teach people". Perhaps the word "教" is used here with the meaning "faith, religion". Then this expression can be interpreted as "believing people", "religious people". However, you still cannot make "shepherds" out of this. Perhaps "教人" refers to shepherds who take care of their flock, as shepherds look after a flock of sheep. Then the line makes sense.

4-th stanza. In the original, the lyrical hero drank God's silence from "Brunnen des Hains" (forest spring, lit. grove well). In Chinese translation it is from "林苑的水井", which is quite difficult to translate. Either from the "well in the imperial hunting grounds" or from the "well in the forest garden". One way or another, there is no atmosphere of abandonment or untouched place, as in the original.

5-th stanza. The first line says: "Auf meine Stirne tritt kaltes Metall". (Cold metal steps on my forehead.) Here the metal interacts with the forehead (comes, touches), and in the Chinese version it is directly located (exists) in the forehead.

6-th stanza. In the original, the lyrical hero "find himself" in the wasteland (although literally translated as "find himself"), in the Chinese translation, he "discovers himself" ("发现自己") there. Moreover, the verb used is the same as in the 3rd stanza (教人发现甜蜜的身体).

As we can see, there are quite a lot of deviations from the original in the Chinese translation. At the same time, the reader may have an idea about this text as a religious poem, and about the author as a deeply churched Christian. However, this is not quite true.

Around the religiosity of Trakl, there are still disputes. Some researchers of his life and work are united by the desire to present Trakl as a "homo religiosus" or, more specifically, as a "Christian person". However, Martin Heidegger in his work "Georg Trakl. Eine Erörterung seines Gedichtes" expressed doubt about the Christian religiosity Trakl expressed, considering the poet through the prism of pagan archaism. The opinion of S. Averintsev also deserves attention, who presented the work of Trakl in the paradigm of a special cultural and psychological formation les poètes maudits (damned poets), which is characterized by an attraction to the transcendent, infernal, as well as sympathy for the folk tradition of piety.

In this discussion, it should become important for the translator that the religious, God-seeking features of Trakl's metaphysics are not questioned by any of the debating parties.

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重症监护对婴儿重度烧伤毒血症血流动力学和呼吸参数的影响
INFLUENCE OF INTENSIVE CARE ON HEMODYNAMIC AND RESPIRATORY PARAMETERS IN SEVERE BURN TOXEMIA IN INFANTS

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抽象的。 17.9±8.6 月龄重度热烧伤，2-3A 度面积 46.7±8.3%，3B 度 - 17.2±7.2%，第一天 IF 73.4±9.6 个单位，交感神经反应增加 60%，心肌需氧量降低40%，心动过速综合征、高动力型血流动力学均显露。到烧伤毒血症的第 26 天，偏差的严重程度平均显着降低了 10%，但相对于治疗第一天的指标仍然升高。随着葡萄糖溶液、氨基酸溶液的引入，出现了一种减少高动力、心动过速、高交感神经反应、心肌需氧量和呼吸频率降低的有利趋势。所揭示的昼夜节律 BR 中脉变化的趋势是由于随着输液治疗量的增加、溶液类型的数量和毛细血管血流量的增加而增加肺循环压力的趋势。引入细胞黄素和肝素。多巴胺对 BR 的直接刺激作用的倾向可能是由于血管升压作用，不排除多巴胺的中枢作用机制。

关键词：血流动力学，呼吸，烧伤，婴儿

Abstract. *With severe thermal burns at the age of 17.9±8.6 months, 2-3A degree area 46.7±8.3%, 3B degree - 17.2±7.2%, IF 73.4±9.6 units on the first day, an increase in sympathotonic response by 60%, myocardial oxygen demand by 40%, tachycardia syndrome, hyperdynamic type of hemodynamics were revealed. By the 26th day of burn toxemia, the severity of deviations significantly decreased by an average of 10%, but remained elevated relative to the indicators on the first day of treatment. A favorable trend towards a decrease in hyperdynamia, tachycardia, hypersympathotonic reaction, myocardial oxygen demand and a decrease in respiratory rate was noted with the introduction of glucose solutions, amino acid solutions. The revealed trends in changes in the mesor of the circadian rhythm BR are due to the tendency to increase pressure in the pulmonary circulation with an increase in the volume of infusion therapy, the number of types of solutions, and an increase in capillary blood flow to the introduction of cytoflavin and heparin. The inclination of the direct stimulatory effect of dopamine on BR may be due to vasopressor action, not excluding the central mechanism of action of dopamine.*

Keywords: *hemodynamics, respiration, burn, infants*

Relevance

With extensive burns, the prognosis is always serious and is especially unfavorable when 50% of the body surface or more is affected. Burns that occupy an area of more than 1/3 of the body surface are life-threatening for the child. Mortality among children with body burns has recently decreased to 1.86%; it remained relatively high in children under 3 years old - 6.8% [1-4]. Due to the ambiguous approach to the feasibility of a complex introduction of a multidirectional mechanism of action of drugs, the doctor often makes a decision without a clear understanding of the dynamics and characteristics of the pathogenetic mechanisms of the development of organ failure in burn disease in children.

Objective

To study and evaluate the effect of intensive therapy on hemodynamic and respiratory parameters in severe burn toxemia in infants.

Material and research methods

The clinical material is presented by hourly monitoring of body temperature, hemodynamic parameters: heart rate (HR), impact volume (IV), cardiac output (CO), general peripheral vascular resistance (GPVR), estimation of vegetative tone (EVT), the need of myocardium in oxygen (TNMO), breathing rate (BR), saturation with oxygen (SO) in 8 children admitted to the republican scientific center for emergency medical care (RSCEMC) due to thermal burns at the age of 9 months to 3 years. In children under 3 years of age, hemodynamic parameters were calculated using the following formulas:

CO= reduc. BP* HR/1000,

Where reduc . BP=PBP* 50/av BP,

Where MBP= PBP/3+DBP.

GPVR=SBP*5/CO*10, l/min, dyn.s.cm^{-}□m. (V.V. Kurek, 2006).

To assess the activity of the autonomic nervous system (ANS) (Arkhipova E.I., et al. 2001), a formula for calculating the index of cardiac output (AAT) was proposed - an assessment of autonomic tone.

AAT= BP amplitude*HR/normal BP amplitude*norm. HR,

MVP=HR*SBP/100,

Where MVP reflects the state of ANS and its increase indicates the predominance of sympathetic tone, it closely correlates with myocardial oxygen consumption. The main feature that determined the study of this group was age, severity of the condition, duration of intensive care in the intensive care unit (ICU), due to the severity of the burn disease. In the study group, the monitoring data of the studied parameters and the volume of intensive care in 8 children (more than 21 days 24.6±2.4) were considered. This paper presents an assessment of the volume

of intensive care in children aged 17.9±8.6 months with a thermal burn of 2-3A degree with an area of 46.7±8.3%, 3B degree of 17.2±7.2%, the severity of the condition according to IF scale 73.4±9.6 units. The duration of intensive care in the ICU was 24.6±2.4 days (tab. 1). The studies were carried out with the provision of 100% physiological need by enteral administration throughout the entire period of study of burn toxemia.

Table 1.

Characteristics of patients in group 3 aged 7 months to 3 years

Age, months	2-3A degree,%	3B degrees, %	IF, units	Days in the ICU	weight, kg	Height, cm
17.9±8.6	46.7±8.3	17.2±7.2	73.4±9.6	24.6±2.4	9.1±0.9	68.5±3.3

Results and discussion

Table 2.

Dynamics of the studied parameters in the period of severe toxemia

days	SV in 3 gr up to 3 years (8bh)	CO, l/min	GPVR, dyn.s.cm^5	MVP, %	AAT, units	HR per minute	BR per minute	oxygen saturation,%
1	41.2 ±6.5	6.2 ±0.7	897 ±155	140 ±7	1.62 ±0.12	148 ±6	33.3 ±1.1	97.5 ±0.4
2	48.2 ±1.4	7.0 ±0.3	786 ±38	140 ±4	1.71 ±0.08	145 ±3	31.5 ±0.5	97.4 ±0.3
3	49.2 ±2.0	6.7 ±0.4	789 ±32	137 ±4	1.72 ±0.09	139 ±3	32.1 ±0.5	97.7 ±0.2
4	49.5 ±2.3	6.8 ±0.3	800 ±44	135 ±2	1.70 ±0.06	138 ±2	33.5 ±0.3	97.9 ±0.2
5	50.9 ±3.0*	7.1 ±0.4	746 ±46	134 ±3	1.74 ±0.08	139 ±2	32.7 ±0.4	97.8 ±0.2
6	51.0 ±2.4*	7.0 ±0.3	761 ±43	136 ±2	1.77 ±0.07	137 ±2	32.5 ±0.3	97.8 ±0.1
7	48.0 ±3.0	6.6 ±0.4	861 ±69	137 ±4	1.67 ±0.08	139 ±2	32.1 ±0.5	98.0 ±0.2
8	46.5 ±1.6	6.7 ±0.3	820 ±36	143 ±2	1.72 ±0.06	144 ±2	32.5 ±0.4	97.7 ±0.2
9	46.3 ±2.6	6.3 ±0.4	878 ±44	143 ±2	1.56 ±0.08	137 ±1*	32.0 ±0.5	97.8 ±0.2

10	46.4 ±2.1	6.2 ±0.3	847 ±54	131 ±2	1.57 ±0.07	135 ±1*	31.9 ±0.4	97.8 ±0.2
11	46.8 ±2.3	6.3 ±0.3	862 ±43	131 ±2	1.57 ±0.06	134 ±1*	31.2 ±1.0	98.0 ±0.2
12	47.6 ±1.6	6.4 ±0.2	875 ±29	134 ±2	1.62 ±0.06	135±1*	30.6 ±0.6*	97.8 ±0.1
13	48.0 ±2.8	6.5 ±0.4	833 ±48	135 ±2	1.67 ±0.08	136 ±1*	30.9 ±0.3*	97.8 ±0.2
14	46.6 ±1.7	6.1 ±0.2	851 ±43	129 ±4	1.54 ±0.06	132 ±3*	30.6 ±0.3*	97.8 ±0.2
15	45.6 ±1.2	6.2 ±0.2	866 ±53	131 ±3	1.56 ±0.05	136 ±2*	30.3 ±0.4*	97.8 ±0.2
16	45.0 ±2.3	6.0 ±0.3	908 ±45	130 ±1*	1.52 ±0.06	134 ±1*	30.2 ±0.4*	97.9 ±0.2
17	44.4 ±1.3	6.0 ±0.2	872 ±35	132 ±3	1.54 ±0.07	135 ±2*	30.3 ±0.5*	97.7 ±0.2
18	43.8 ±2.9	5.6 ±0.3	947 ±42	122 ±2*	1.41 ±0.06	130 ±2*	29.2 ±0.4*	97.8 ±0.2
19	46.3 ±2.2	6.1 ±0.3	876 ±44	132 ±3	1.58 ±0.07	131 ±1*	29.4 ±0.5*	97.8 ±0.2
20	45.8 ±1.9	6.0 ±0.2	929 ±51	128 ±2*	1.54 ±0.06	131 ±1*	29.3 ±0.4*	97.6 ±0.4
21	43.7 ±2.0	5.7 ±0.3	996 ±78	131 ±2	1.48 ±0.07	131 ±1*	29.7 ±0.8*	97.9 ±0.2
22	42.5 ±2.7	5.6 ±0.4	955 ±59	131 ±2	1.46 ±0.09	132 ±2*	28.9 ±0.6*	97.8 ±0.2
23	52.1 ±2.1*	7.2 ±0.3	736 ±49	141 ±3	1.65 ±0.06	138 ±1*	30.7 ±0.5*	97.6 ±0.2
24	53.1 ±3.6*	6.9 ±0.5	783 ±67	135 ±5	1.63 ±0.11	130 ±3*	29.8 ±0.3*	97.9 ±0.2
25	51.1 ±3.1	6.6 ±0.5	794 ±82	127 ±7	1.56 ±0.10	128 ±5*	29.2 ±0.7*	97.8 ±0.2
26	50.4 ±3.4	7.1 ±0.6	739 ±42	136 ±5	1.68 ±0.13	136 ±2*	29.2 ±0.9*	97.9 ±0.4

*-significant change relative to the indicator on the first day

On the first day, deviations of the mesors of circadian rhythms were characterized by an increase in sympathotonic influences by 62%, heart rate and respiratory rate by 30%, an increase in myocardial oxygen demand by 40%, and a hyperdynamic type of the circulatory system (increased CO with a tendency to decrease

GPVR). A significantly significant increase in the mesor of the circadian rhythm of the SR was detected on days 6, 7, 23, 24 by 23%, 27%, 26%, 28% ($p<0.05$, respectively). Despite the decrease on days 9-26 by 7-12% ($p<0.05$), the dynamics of the mesor of the circadian rhythm HR indicated a persistent tendency to tachycardia syndrome despite ongoing drug support for the function of the cardiovascular system. Considering the compensatory value of tachycardia in severe intoxication, systemic inflammatory reactions, and a tendency to tissue hypoxia, it may not be advisable to strive for "absolute normalization" of heart contractions. Despite the decrease in the mesor of the circadian rhythm MVP by 10%, 18%, 12% on days 15, 18, 20 ($p<0.05$, respectively), the indicator remained increased by 36% on day 26 of burn toxemia until the end of the observation. Under conditions of severe toxemia, it makes sense to effectively correct and replenish a severe energy-deficient state in order to prevent irreversible changes in intracellular structures, including the mitochondrial system responsible for tissue respiration. The latter determines the indications for effective metabolic therapy, the introduction of vitamins, cytoflavin in adequate doses corresponding to a significantly increased need for cofactors of the enzymatic activity of the cellular system. It is especially important to take into account the negative effect of secondary complications that significantly aggravate the condition of patients in the later stages of severe burn toxemia. A significantly significant decrease in the mesor of the circadian rhythm BR was observed on days 12-26 by 8-12% ($p<0.05$), amounting to 29.2±0.9 breaths per minute on the 26th day of observation.

Table 3.

Correlations of the studied parameters with the volume of intensive care

Parameters	**SV, ml**	**CO, l/min**	**GPVR, dyn.s.cm^5**	**HR per minute**	**AAT, units**	**MVP,%**	**BR per minute**	**oxygen saturation, %**
kcal/day	-0.28	-0.53	0.47	-0.55	-0.59	-0.52	-0.56	0.28
iv infusion, ml/day	0.08	0.39	-0.27	0.65	0.54	0.44	0.75	-0.24
amino acids, ml/day	0.02	-0.17	0.12	-0.44	-0.16	-0.33	-0.29	0.45
proteins, ml/day	0.32	0.48	-0.42	0.41	0.55	0.40	0.47	-0.15
number of types/day	-0.34	-0.18	0.24	0.36	0.15	0.19	0.51	-0.13
painkillers, multiple/day	-0.39	-0.30	0.35	0.20	-0.02	0.00	0.44	0.17

anti-inflammatory, multiple/day	-0.04	0.15	-0.11	0.45	0.22	0.25	0.56	-0.20
AB, multiple/day	-0.18	-0.24	0.27	-0.06	0.04	-0.07	0.10	0.18
heparin, multiple/day	0.29	0.44	-0.36	0.47	0.65	0.43	0.74	0.08
vitamins, multiple/day	-0.06	0.00	0.00	0.19	0.25	0.14	0.47	0.39
cytoflave, ml/day	0.23	0.31	-0.29	0.30	0.48	0.30	0.66	0.22
vasodilation, multiple/day	-0.04	-0.08	0.11	0.04	0.13	-0.03	0.25	0.15
dopamine, multiple/day	-0.19	0.17	-0.07	0.75	0.33	0.48	0.66	-0.56

A direct strong relationship was found between BR and the volume of infusion therapy (0.75), as well as with the frequency of administration of heparin (0.74), cytoflavin (0.66), dopamine (0.66). A moderately negative correlation between the frequency of administration of glucose and CO (-0.53), HR (-0.55), AAT (-0.59), MVP (-0.52), respiratory rate (-0.56) characterized a favorable trend towards a decrease in hyperdynamia, tachycardia, hypersympathotonic reaction, myocardial oxygen demand and a decrease in respiratory rate with the introduction of glucose solutions even in small amounts (120-170 kcal/day) as part of additional nutritional parenteral support (fig. 1). A positive effect on hemodynamics was noted by a negative correlation between the amount of amino acids and the circadian rhythm mesor HR (-0.44). There are known indications that have not only corrective, but also vital replenishment of hypoproteinemia in severe burns. Depending on the amount of introduced protein media, a direct correlation was found with the mesor CO (0.48), AAT (0.55), MVP (0.1), BR (0.47), and inverse with GPVR (-0.42) (fig. 2). That is, an increase in the intravenous administration of protein preparations caused a tendency to increase the stress reaction through hypersympathotonia, a tendency to a hyperdynamic type of blood circulation, an increase in myocardial oxygen demand, and increased respiration (tab. 3).

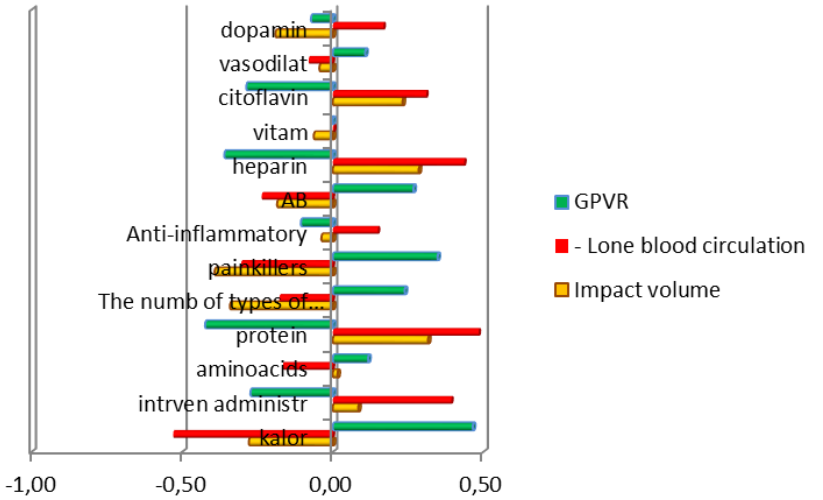

Figure 1. *Correlations of central and peripheral hemodynamic parameters with intensive care indicators*

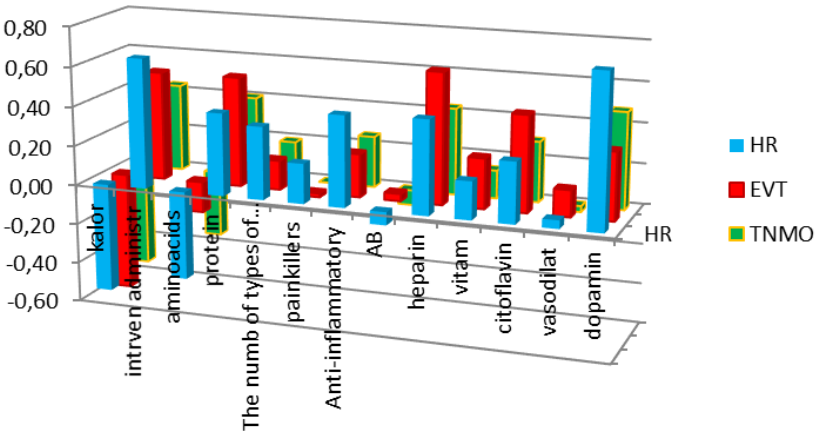

Figure 2. *Correlations of parameters of autonomic tone, myocardial oxygen demand, heart rate with indicators of intensive care*

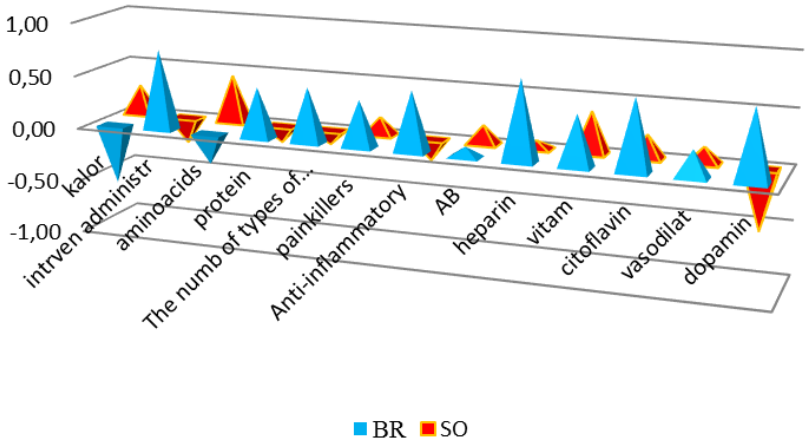

Figure 3. *Correlations of respiratory parameters with indicators of intensive care*

As shown in fig. 3 and tab. 3), a favorable effect on the respiratory system was exerted by the introduction of glucose (-0.56), a negative effect was an increase in the volume of intravenous fluids (0.7), an increase in the frequency of administration of heparin (0.74), an increase in the amount cytoflavin (0.66), dopamine (0.66), the number of types of solutions (0.51). It is possible that the revealed correlations of changes in the mesor of the circadian rhythm BR are evidence of a tendency to increase pressure in the pulmonary circulation with an increase in the volume of infusion therapy, the number of types of solutions, and an increase in capillary blood flow to the introduction of cytoflavin and heparin. The inclination of the direct stimulatory effect of dopamine on BR may be due to vasopressor action, not excluding the central mechanism of action of dopamine.

Conclusion

In severe thermal burns in children aged 17.9±8.6 months, 2-3A degree area 46.7±8.3%, 3B degree - 17.2±7.2%, IF 73.4±9.6 units on the first day revealed an increase in sympathotonic response by 60%, myocardial oxygen demand by 40%, tachycardia syndrome, hyperdynamic type of hemodynamics. By the 26th day of burn toxemia, the severity of deviations significantly decreased by an average of 10%, but remained elevated relative to the indicators on the first day of treatment. A favorable trend towards a decrease in hyperdynamia, tachycardia, hypersympathotonic reaction, myocardial oxygen demand and a decrease in respiratory rate was noted with the introduction of glucose solutions, amino acid solutions. The

revealed trends in changes in the mesor of the circadian rhythm BR are due to the tendency to increase pressure in the pulmonary circulation with an increase in the volume of infusion therapy, the number of types of solutions, and an increase in capillary blood flow to the introduction of cytoflavin and heparin. The inclination of the direct stimulatory effect of dopamine on BR may be due to vasopressor action, not excluding the central mechanism of action of dopamine.

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3.1~7岁中度烧伤毒血症治疗对血流动力学和呼吸参数的影响
INFLUENCE OF TREATMENT ON HEMODYNAMIC AND RESPIRATORY PARAMETERS IN BURN TOXEMIA OF MODERATE SEVERITY AT THE AGE OF 3.1-7 YEARS

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抽象的。 中度热烧伤（2-3A 度，面积 37.3±14.7%），3B 度 3.1±0.4%，IF 42.5±15.7 个单位，ICU 重症监护时间 4.7±1.3 天 0.8 年，昼夜节律中枢烧伤毒血症第一天的变化 CO、TPVR 对应于血流动力学的高动力型，交感神经反应增加 49%，MOD 增加 17%，心率增加 30 %，在每日平均体温的正常水平下，相对于年龄标准，呼吸增加 25%。 在复杂的强化镇痛、抗生素治疗、血管舒张、抗凝、代谢、输液治疗的背景下，揭示了具有主要补偿性质的生理方向的器官和系统的功能增加。

关键词：血流动力学，烧伤毒血症，治疗，3.1-7岁儿童。

Abstract. *With thermal burns of moderate severity (2-3A degree with an area of 37.3±14.7%), 3B degree 3.1±0.4%, IF 42.5±15.7 units, duration of intensive care in the ICU 8.1±1.3 days in children aged 4.7±0.8 years, changes in the first day of burn toxemia of mesors of circadian rhythms CO, TPVR corresponded to the hyperdynamic type of hemodynamics, increased by 49% sympathotonic response, with an increase in MOD by 17%, an increase in heart rate by 30%, an increase in respiration by 25% relative to the age norm at a normal level of the average daily body temperature. Against the background of complex intensive analgesic,*

antibiotic therapy, vasodilating, anticoagulant, metabolic, infusion therapy, an increase in the function of organs and systems of a physiological orientation of a predominantly compensatory nature was revealed.

Keywords: *hemodynamics, burn toxemia, treatment, children from 3.1 to 7 years old.*

Relevance

With extensive burns, the prognosis is always serious and is especially unfavorable when a large area of the body surface is affected. Children have thinner skin than adults. Therefore, burns in children are deeper; the child is helpless at the moment of injury, does not immediately react, is not able to help himself. Because of this, exposure to the traumatic agent may be longer, which deepens the injury. Burn shock in children can occur with a smaller burn surface than in adults. Burns that occupy an area of more than 1/3 of the body surface are life-threatening for a child [1-3]. Due to the insufficient knowledge of changes in hemodynamics, respiration, volume and effectiveness of intensive therapy in dynamics with burn toxemia of moderate severity in children aged 3.1-7 years, the goal was set based on monitoring the response of the studied parameters to assess the effect of treatment on the studied indicators of this category of patients.

Purpose of the study

To study and assess the correlations of intensive care with hemodynamic and respiratory parameters in case of burn toxemia of moderate severity in children of preschool age.

Material and research methods

The clinical material is presented by hourly monitoring of body temperature, hemodynamic parameters: heart rate (HR), stroke volume (SV), cardiac output (CO), total peripheral vascular resistance (TPVR), autonomic tone assessment (ATA), myocardial oxygen demand (MOD), respiratory rate (RR), oxygen saturation index in 9 children admitted to the republican scientific center for emergency medical care (RSCEMC) due to thermal burns at the age of 3.1 months to 7 years 4.7±0.8 years. The main feature that determined the study of this group was age, severity of the condition, duration of intensive care in the intensive care unit (ICU), due to the severity of the burn disease. In the study group, the monitoring data of the studied parameters and the volume of intensive care in 9 children who were in the ICU for less than 10 days (8.1±1.3 days) were considered. The studies were carried out with the provision of 100% physiological need by enteral administration throughout the entire period of study of the studied indicators of burn toxemia.

Results and its discussion

The paper presents an assessment of the volume of intensive care in children aged 4.7±0.8 years with a thermal burn of 2-3A degree with an area of 37.3±14.7%,

3B degree 3.1±0.4%, the severity of the condition on IF scale 42.5±15.7 units, duration of intensive care in the ICU 8.16.8±1.3 days (tab. 1).

Table 1.

Characteristics of patients admitted with thermal burns at the age of 3.1-7 years

Groups	Age	Burn area 2-3A degree in %	3B degree	IF, units	In ICU, days
1	4.7±0.8 y.o.	37.3±14.7	3.1±0.4	42.5±15.7	8.1±1.3
2	4.0±0.1	47.9±17.1	18.1±12.2	85.1±28.7	13.1±1.9
3	4.4±0.6	59.2±12.2	36.7±13.3	127.5±33.3	27.3±3.2

As shown in table 2, antibiotic therapy significantly increased by 3, 4 and almost doubled by 6, 7, 8 ($p<0.05$). Anticoagulant therapy was started according to the indications from the first day, with an increase by 89% on the 2nd day ($p<0.05$). The introduction of ascorbic acid was increased by 2, 3, 5 days. Thus, the volume of analgesic, antibacterial, anti-inflammatory therapy during the first 9 days was increased according to indications. The intensity of analgesia, anti-inflammatory therapy, the number of different types of solutions was reduced only on days 7-8, while other areas of therapy: AB, heparin, metabolic, vasodilating correction, dopamine continued in the original volume throughout the entire period of toxemia. The increase in the amount of administration of ascorbic acid by 2,3,5 days, antibiotics by 161% by 9 days is due to the dynamics of the systemic inflammatory reaction, intoxication.

Table 2.

Intensive therapy of burn toxemia in children of the 1st group at the age of 3.1-7 years

Days	number of solutions	Anest., frequency of administration	Anti-inflammatory, frequency	A/B, frequency	Heparin frequency	Ascorbic acid, frequency	Cytoflavin, ml/day	Vasodilator, frequency	Dopamine, frequency
1	4.1 ±0.2	6.5 ±2.1	6.6 ±2.5	1.8 ±0.6	1.9 ±0.9	1.1 ±0.7	0	2.4 ±1.5	0.4 ±0.2
2	4.3 ±0.4	8.2 ±3.0	7.9 ±3.7	3.2 ±1.0	3.6 ±0.7*	2.3 ±1.0*	1.7 ±2.6	3.8 ±1.4	0.4 ±0.2
3	5.2 ±0.9	7.7 ±1.8	6.9 ±2.3	3.7 ±0.9*	3.1 ±1.2	2.6 ±0.7*	2.8 ±1.7	3.9 ±1.5	0.3 ±0.1

4	5.0 ±0.7	7.3 ±1.9	6.1 ±3.0	3.8 ±0.9*	2.9 ±1.3	2.3 ±0.7	2.2 ±1.0	3.8 ±1.2	0.2 ±0.1
5	5.0 ±0.7	6.4 ±2.3	6.0 ±2.2	3.4 ±1.1	3.1 ±1.4	2.7 ±0.7*	2.2 ±1.0	4.0 ±1.3	0.4 ±0.1
6	4.7 ±0.9	7.1 ±2.1	6.0 ±2.9	4.3 ±0.6*	2.3 ±1.3	2.1 ±1.0	2.1 ±1.1	4.4 ±1.2	0.6 ±0.1
7	4.8 ±0.6	5.8 ±2.2	3.8 ±1.9	3.8 ±0.9*	2.3 ±1.7	2.0 ±1.0	0	3.8 ±1.2	0.3 ±0.1
8	4.6 ±0.88	4.4 ±1.12	3.8 ±1.52	3.8 ±1.04*	3 ±1.2	1.6 ±0.48	0	4.2 ±1.12	0.4 ±0.1
9	5.3 ±0.9	5.3 ±0.9	3.3 ±0.9	4.7 ±1.8*	3.0 ±2.0	2.0 ±0.7	0	4.3 ±1.8	0.3 ±0.1

*-the change is significant relative to the indicator on the first day.

Table 3.

Infusion therapy

Days	Calories/day	intrav. fluid, ml/day	Amino acids, ml/day	Proteins, ml/ day
1	107.5±32.5	1387.5±296.9	0	0
2	160.0±17.8	1478.3±290.7	108.9±145.2	0
3	140.0±44.4	1626.7±334.4	213.3±100.7	79.4±53.0
4	151.1±43.5	1274.0±166.2	285.6±55.3	100.0±46.7
5	153.3±50.4	1460.6±204.0	272.2±63.5	62.8±69.8
6	168.6±86.5	1315.0±281.4	178.6±132.7	35.0±50.0
7	156.7±82.2	1206.7±293.9	208.3±125.0	15.8±26.4
8	184±86.4	1268±255.6	300±80	0
9	226.7±115.6	1381.7±342.2	333.3±111.1	63.3±42.2

There was a tendency to increase the volume of parenterally administered glucose by almost two times by the 9th day, the amount of amino acids up to 333 ml/ day (tab. 3), with an almost stable daily volume of the amount of infusion therapy. The largest amount of protein media was administered on the 4th day (100.0±46.7 ml/day) due to the need to correct hypo-, dysproteinemia.

Table 4.

Changes in hemodynamic parameters in burn toxemia at the age of 3.1-7 years

Days	CO, l/min	TPVR, dyn.s.cm^{5}.	ATA, units	MOD,%	SBP, mmHg	DBP, mmHg.	RR, per min-ute	HR per min-ute	T°C
1	5.2 ±0.9	757 ±107	1.49 ±0.13	117±6	99.9 ±4.2	58.7 ±3.8	28.1 ±1.4	133.0 ±9.4	36.6 ±0.17
2	5.1 ±0.2	753 ±23	1.66 ±0.06	116±2	104.0 ±1.3	59.0 ±1.2	27.8 ±0.4	129.7 ±2.1	36.9 ±0.08
3	4.6 ±0.2	830 ±31	1.52 ±0.05	112±2	103.4 ±1.1	61.0 ±0.9	26.2 ±0.5	124.9 ±2.8	36.9 ±0.09
4	4.5 ±0.2	838 ±49	1.53 ±0.05	114±2	103.3 ±1.3	61.3 ±1.7	26.2 ±0.4	126.6 ±2.0	37.0 ±0.08
5	4.5 ±0.2	822 ±32	1.56 ±0.05	116±2	104.9 ±1.3	61.4 ±1.3	25.0 ±0.3	126.3 ±1.2	36.9 ±0.06
6	4.5 ±0.2	831 ±35	1.58 ±0.06	122±3	106.3 ±1.4	63.5 ±1.4	26.6 ±0.4	131.4 ±1.7	37.0 ±0.05
7	4.6 ±0.3	794 ±40	1.68 ±0.08	119±5	106.8 ±1.4	61.8 ±1.6	24.9 ±0.5	130.2 ±1.8	37.1 ±0.05
8	4.8 ±0.3	771 ±37	1.75 ±0.10	124±5	107.1 ±2.3	61.1 ±1.7	26.5 ±0.4	132.3 ±2.7	37.1 ±0.13
9	5.0 ±0.5	825 ±47	1.62 ±0.08	124±2	106.4 ±1.5	64.2 ±1.6	25.6 ±0.7	131.7 ±3.7	37.0 ±0.11

Changes in the first day of burn toxemia of mesors of circadian rhythms CO, TPVR corresponded to the hyperdynamic type of hemodynamics, increased sympathotonic response by 49%, with an increase in MOD by 17%, an increase in heart rate by 30%, and an increase in respiration by 25% relative to the age norm at a normal level of the average daily body temperature indicator (tab. 4).

Table 5.

Significantly significant correlations of the components of intensive care and hemodynamics

kcal/MOD	0.71	anest/ MOD	-0.75	AB/ SBP	0.84	vit C/ CO	-0.62	pro-teins/ CO	-0.59
kcal/SBP	0.78	anest/an-ti-inflam-matory	0.90	AB/ DBP	0.88	vit C/ TPVR	0.61	pro-teins/ TPVR	0.89
kcal/DBP	0.75	anest/cy-toflavin	0.76	AB/TC	0.85	vit C/cy-tophil	0.80	CO/ TPVR	-0.76
number of solutions/ TPVR	0.85	anti-inflam-matory/ MOD	-0.74	AB/ amino acids	0.81	vit C/ proteins	0.64	CO/RR	0.68
number of solutions/ DBP	0.73	anti-inflam-matory/ SBP	-0.69	AB/ vasodi-lating	0.94	cytofla-vin/CO	-0.58	TPVR/ DBP	0.73
number of solutions/ RR	-0.77	anti-inflam-matory/ DBP	-0.64	amino acids/ DBP	0.70	cyto-flavin/ MOD	-0.66	TPVR/ RR	-0.63
number of solutions/ AB	0.75	anti-in-flamma-tory/TC	-0.61	amino acids/ RR	-0.75	vasodi-lating/ SBP	0.88	SBP/ MOD	0.65
number of solutions/ amino acids	0.80	anti-in-flammato-ry/amino acids	-0.62	amino acids/ TC	0.76	vasodi-lating/ DBP	0.76	SBP/ ATA	0.77
number of solutions/ proteins	0.82	anti-inflam-matory/ cytoflavin	0.67	amino acids/ vasodi-lating	0.78	vasodi-lating/ TC	0.84	SBP/T	0.91

Of all the studied correlations, table 5 presents only identified significantly significant indicators.

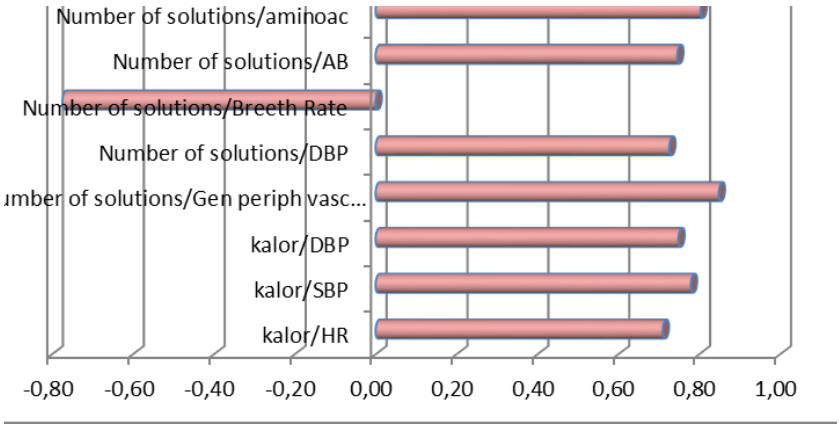

Figure 1. *HR correlations*

As shown in fig. 1, the feedback of HR with metabolite therapy drugs turned out to be significantly significant, that is, we can assume a stress-protective effect of ascorbic acid and cytoflavin. An increase in MOD was found with increased tachycardia.

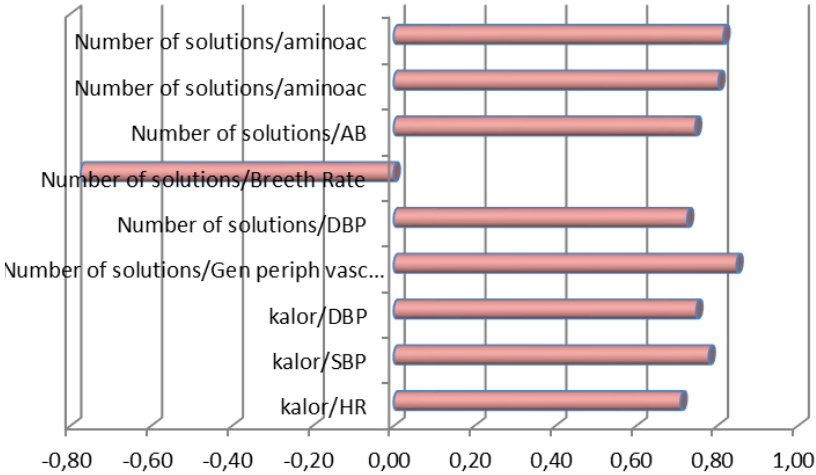

Figure 2. *Glucose infusion correlations*

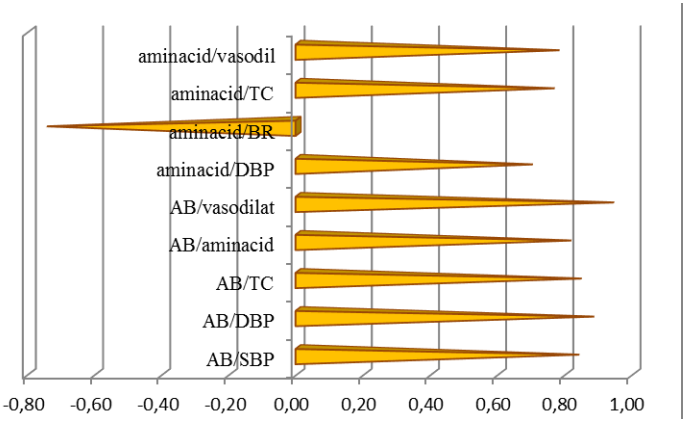

Figure 3. *Influence on hemodynamics of anesthesia, anti-inflammatory therapy.*

A decrease in MOD was found with an increase in the frequency of administration of painkillers (fig. 3). We regarded the feedback of anti-inflammatory and hemodynamic parameters SBP, DBP, MOD, T°C as a favorable stress-protective effect (tab. 5).

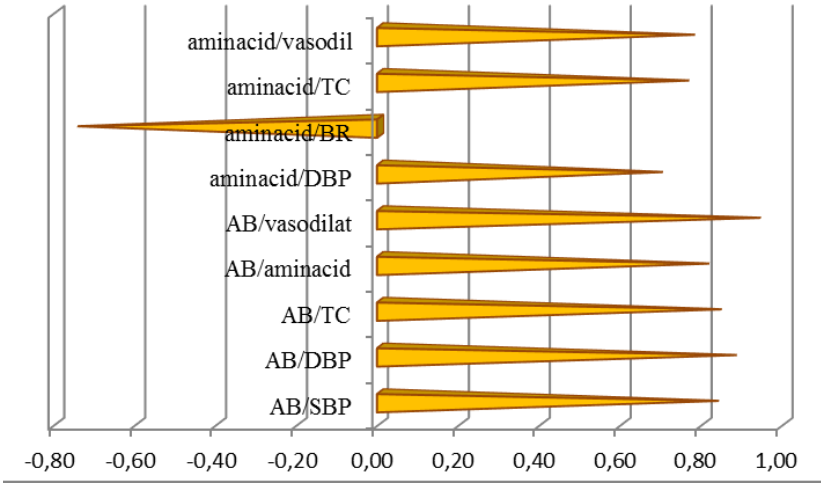

Figure 4. *Correlations of antibiotic therapy*

The introduction of amino acids was accompanied by the need to increase vasodilatory therapy, as it increased DBP and caused a tendency to hyperthermia within normal body temperature values (fig. 4). An increase in the frequency of administration of AB was accompanied by an increase in vasodilating correction, a tendency to an increase in DBP, SBP, and temperature response.

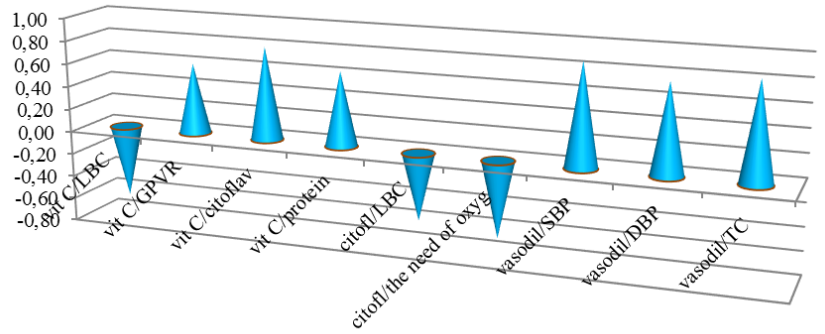

Figure 5. *Correlations of vasodilator and metabolic therapy*

There was a tendency to increase the frequency of administration of vasodilators against the background of a tendency to increase SBP, DBP, T°C (fig. 5, tab. 5).

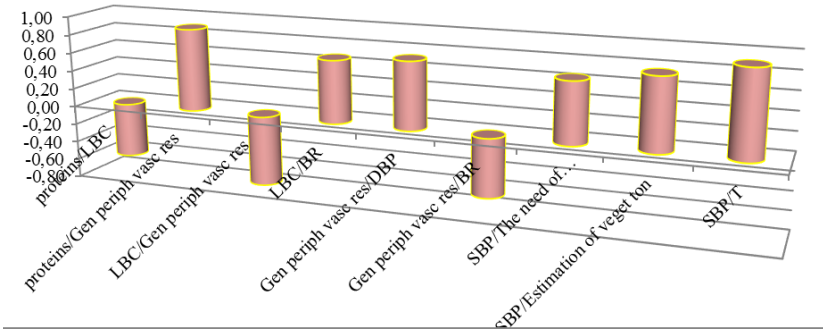

Figure 6. *Correlations of administration of protein preparations*

A direct relationship was found between the volume of protein transfusion and the dynamics of TPVR, an increase in the volume of albumin administered in a 10-20% solution favored an increase in TPVR (fig. 6). An increase in the level of

the mesor of the circadian rhythm SBP was observed with a tendency to increase body temperature, a tendency to hypersympathotonia, and an increase in MOD. A direct moderate relationship between changes in TPVR and DBP was found, and an inverse correlation between CO and TPVR is a natural response of central and peripheral hemodynamics to stress. The increase in the mesor of the circadian rhythm CO was accompanied by a tendency to increase respiration, which is a physiological compensatory response of the respiratory system to an increase in CO (fig. 6). Thus, in this contingent of children with a burn injury of moderate severity (2-3A degree with an area of 37.3±14.7%), 3B degree 3.1±0.4%, IF 42.5±15.7 units, the duration of intensive care in the ICU for 8.1±1.3 days revealed the predominance of increased function of organs and systems of a physiological orientation of a compensatory nature.

Conclusion

With thermal burns of moderate severity 2-3A degree area 37.3±14.7%, 3B degree 3.1±0.4%, IF 42.5±15.7 units, duration of intensive care in the ICU 8.1±1.3 days in children aged 4.7±0.8 years, changes in the first day of burn toxemia of mesors of circadian rhythms CO, TPVR corresponded to the hyperdynamic type of hemodynamics, increased sympathotonic response by 49%, with an increase in MOD by 17%, increased heart rate by 30%, increased breathing by 25% relative to the age norm at a normal level of the average daily body temperature. Against the background of complex intensive analgesic, antibiotic therapy, vasodilating, metabolic, infusion therapy, an increase in the function of organs and systems of a physiological orientation of a predominantly compensatory nature was revealed.

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下颌骨成釉细胞瘤 – 诊断和治疗的特点
AMELOBLASTOMA OF THE MANDIBLE - FEATURES OF DIAGNOSIS AND TREATMENT

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抽象的。 成釉细胞瘤是年轻人中最常见的牙源性肿瘤之一。 尽管该病的诊断看似简单且发表了大量文章，但在成釉细胞瘤的鉴别诊断、检查策略和手术治疗方面存在许多争议点。 本文讨论了X线和组织学检查诊断肿瘤的问题以及手术治疗的个体化方法。

关键词：成釉细胞瘤，放射学诊断，组织学。

Abstract. *Ameloblastoma is one of the most common odontogenic tumors in young people. In spite of the seeming simplicity of diagnosis and a large number of publications concerning this disease, there are many controversial points in differential diagnosis, examination tactics and surgical treatment of ameloblastoma. The article discusses the problems of the neoplasm diagnosis by X-ray and histological examination and the individual approach to surgical treatment.*

Keywords: *ameloblastoma, radiological diagnosis, histology.*

Among true benign odontogenic neoplasms of the jaws, ameloblastoma ranges from 1-18% to 31% [1,2,3]. Ameloblastoma, a benign odontogenic tumor of epithelial origin, is considered, after odontoma, the most common odontogenic tumor in people in Central Asia. Being the most common, it ranks second among the odontogenic neoplasms in the Kyrgyz Republic [2]. Most often it is localized in the lower jaw region and it develops asymptomatically for a long period of time and is discovered by chance during radiological examination in young and middle-aged people between 15 and 40 years of age [4].

The relevance of its study [5] is determined by its ability to late active infiltrating local destructive growth, as well as the probability of recurrence after surgical

intervention. The tumor develops as a result of enamel organ cell proliferation in the bone tissue of the jaw in the form of a central neoplasm. Its favorite localization is the corner and branch of the lower jaw. Radiological manifestations of ameloblastoma are variable and often similar to those characteristic of keratocysts, follicular cysts, and can also mimic the radiological appearance of a radicular cyst (monocystic ameloblastoma structure). Despite the high prevalence of this pathology and the apparent simplicity of differential diagnosis, the discrepancy between clinical and radiological data and morphological findings can be as high as 77.2-84.3% [6].

Aim of the study: to compare radiological data characteristic of ameloblastoma with the results of morphological examination as well as bone defect repair with a titanium implant.

Materials and methods of research

We have carried out the resections and partial resections of the lower jaw in 26 patients in the maxillofacial surgery of the Osh Interregional Joint Clinical Hospital concerning the benign tumor (ameloblastoma) of the lower jaw. When analyzing the radiological manifestations of ameloblastomas of different histological variants we failed to identify certain regularities. The leading role in the differential diagnosis of ameloblastoma is played by histological examination of biopsy material. Differentiating ameloblastomas by the type of histological structure is extremely important in terms of prognosis and choice of treatment tactics, but this task is not always solved by pathomorphologists when describing tumor tissue. Based on the diagnosis of ameloblastoma, in the majority of cases the standard treatment method of surgical resection of the jawbone is applied. After removing the tumor we managed to restore the formed bone defect of the lower jaw with a titanium implant. To restore the bone defect we made an 8-10 cm incision in the submandibular region, we resected the skin and subcutaneous tissue layer by layer, exposed the edge of the lower jaw, bluntly detached the periosteum and exposed the lower jaw tumor, which was resected to the healthy bone, or resected to the healthy bone tissue. The resulting bone defect was repaired by placing a titanium implant, and the bite was restored in the correct position. The wound was sutured in layers and an aseptic dressing was applied.

The patients received antibiotic therapy, general strengthening therapy and were discharged from the hospital for 10 days and further outpatient observation. Additional diagnostics were computed tomography, orthopantomography of the lower jaw before and after surgery.

Results of the study and discussion

We analyzed the prevalence of neoplasms by length and height. For this purpose, orthopantomography and 3D computed tomography of the lower jaw lesion areas were performed using "Photoshop CS" program. According to the X-ray images, the length of bone lesions with ameloblastoma ranged from 3.1 cm to 8.4

cm and from 3.42 cm to 10.04 cm. In length the neoplasm spreads along the course of the cancellous layer and along the canal of the neurovascular bundle, and the height spread is limited from below by a pronounced cortical layer. The height of the bone lesion with ameloblastoma according to the X-rays was from 2.05 to 4.03 cm. These values can be taken into account to evaluate the radiographs and make differential diagnosis of ameloblastomas among cyst-like masses in the maxillofacial region. In addition to the parameters with numerical values, there are those that will help increase the accuracy of the examination, such as the evenness of the neoplasm contours, tooth root displacement and tooth resorption. This study was conducted to improve the accuracy in the diagnosis of ameloblastomas (especially at the preoperative stage) and timely treatment. Since the treatment tactics for these neoplasms, ameloblastoma and cyst are similar in their radiological manifestations, but different in the type of growth and structure, which should be considered in the differential diagnosis. No pathognomonic signs have been identified according to the radiographic data, which are characteristic only for ameloblastoma. The only reliable sign to decide on the treatment tactics is the morphological report. When choosing the method of surgical intervention and defect replacement, we mainly proceeded from the circumstances related to the wishes of the patients and their relatives. The defects were replaced with reconstructive titanium plates and an endo TMJ prosthesis of the Russian Konmet system.

We performed lower jaw resection with articular head enoculation as well as partial resection followed by implantation with a titanium implant. According to the nature of the surgical interventions performed, the patients were distributed as follows (Table 1).

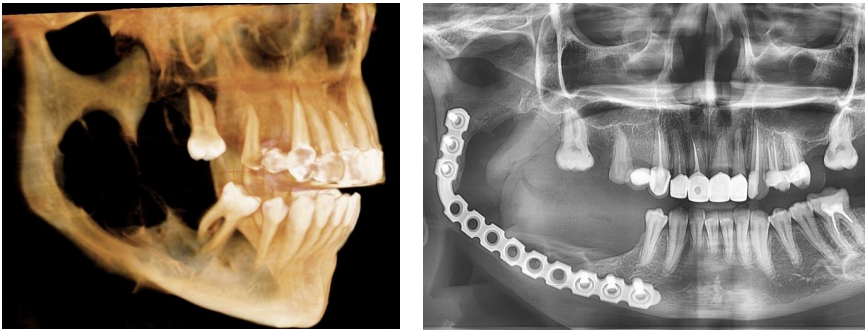
Table 1.

Types of surgical interventions to replace defects and deformities of the lower jaw according to their own clinical material

№	Type of the surgery	Patient quantity (%)
1	Lower jaw resection with replacement of bone defect, reconstructive titanium plate	9 (34,6%)
2	Lower jaw resection with replacement of bone defect, titanium plates and endo TMJ prosthesis	11 (42,3%)
3	Partial resection of the lower jaw with replacement of the defect with titanium plates	6 (23,1%)

In this work we used the surgical material of the maxillofacial surgery of the Osh Interregional United Clinical Hospital for the period from 2018 to 2021. 26 patients (11 men and 15 women) aged from 15 to 48 years after removal of ameloblastomas were examined. Identified morphological variants of ameloblastomas: acanthomatous - in 11 people; follicular - in 8; plexiform - in 4; granular-cell - in 3;

Here are some clinical examples:



1 2

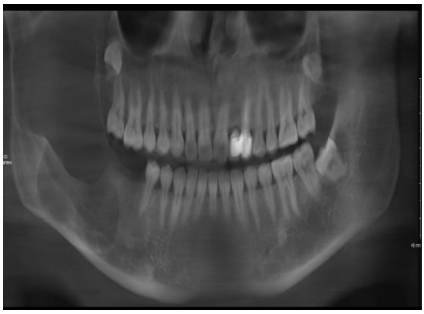
Patient A. Branch and body tumor of the lower jaw: 1 before surgery, 2 after surgery with placement of titanium implant.

1 2

Patient B. Mandible body tumor: 1 before the surgery, 2 after.

1 2

Patient C. Mandible body tumor on the left side: 1 before the surgery, 2 after.



1

2

Patient D. Tumor of the body and branch with girth of the articular head of the lower jaw: 1 preoperatively, 2 postoperatively

The immediate and separated follow-up results within 1.6-3 years after replacement with reconstructive plates and TMJ endo-prosthesis showed high efficacy. All patients' wounds healed with primary tension, sutures were removed after 8 days. Movement of the lower jaw was full, painless, the bite was not disturbed, the achieved facial symmetry was satisfactory to a certain extent. On the 10th day a control orthopantomogram was performed and the patient was discharged from the clinic for outpatient observation.

Thus, there is no unequivocal answer to the question of choosing the optimal method of treatment for patients with ameloblastoma in the jaw bones. Proponents of radical surgery motivate their choice by the high recurrence rate of these diseases. However, the quality of further life of the patient depends on the type of surgical intervention, that is why we studied that, each case requires individual consideration. One-stage restoration of bone defect after removal of lower jaw tumor, its replacement with standardized titanium plate is a promising direction. The use of titanium plate showed high efficiency, restoration of bite and TMJ.

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确定猪肠道微生物群的物种多样性，以创建用于处理有机污染物废水的微生物联合体

DETERMINATION OF THE SPECIES DIVERSITY OF THE INTESTINAL MICROBIOME OF PIGS IN ORDER TO CREATE A CONSORTIUM OF MICROORGANISMS FOR WASTEWATER TREATMENT FROM ORGANIC POLLUTANTS

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抽象的。确定了猪肠道微生物组的物种多样性。本研究使用 Ion Torrent PGM 平台上的测序进行。猪的肠道由门代表：厚壁菌门 – 53.1%，拟杆菌门 – 21.9%，变形菌门 – 15.6%，放线菌门 – 6.3%，疣微菌门 – 3.1%；已鉴定出7类微生物。类杆菌属和梭菌属微生物占优势。对微生物组的目级分析表明，在猪胃肠道 (GIT) 中发现的 12 个细菌目中，以颤螺菌目、拟杆菌目和毛螺菌目为代表。猪微生物组的一般多样性由 32 种细菌代表。在猪胃肠道中普遍存在的普氏菌属和瘤胃球菌科中，粪杆菌属和普氏菌属的细菌数量最多。根据获得的实验数据，选择了埃希氏菌属、变形杆菌属、葡萄球菌属、固氮菌属的代表，以创建用于污染废水处理的微生物联盟。

关键词：猪胃肠道微生物组，微生物群落，废水处理。

Abstract. *The species diversity of the porcine intestinal microbiome was determined. This study was performed using sequencing on the Ion Torrent PGM platform. The intestines of the pig are represented by phyla: Firmicutes – 53.1%, Bacteroidota – 21.9%, Proteobacteria – 15.6%, Actinobacteriota – 6.3%, Verrucomicrobiota – 3.1%; 7 classes of microorganisms have been*

identified. Microorganisms of the class Bacteroidia and Clostridia predominate. An analysis of the microbiome at the order level showed that of the 12 orders of bacteria found in the gastrointestinal tract (GIT) of the pig, representatives of Oscillospirales, Bacteroidales and Lachnospirales predominate. The generic diversity of the pig microbiome was represented by 32 bacteria. Of the families Prevotella and Ruminococcaceae prevailing in the GIT of the pig, bacteria of the genera Faecalibacterium and Prevotella were the most abundant. Based on the experimental data obtained, representatives of the genera Escherichia, Proteus, Staphylococcus, Azotobacter were selected to create a consortium of microorganisms used in wastewater treatment from pollution.

Keywords: *microbiome of the GIT of the pig, a consortium of microorganisms, wastewater treatment.*

Enterprises of the agro-industrial complex (AIC) (meat processing) are sources of concentrated and highly concentrated wastewater. More than 70% of pollution is accounted for by protein-fat complexes (colloids - 10%, suspensions - 20%, soluble - 50%, precipitating impurities - 20%) [1]. The total flow of meat processing complexes contains suspended solids, fats, organic matter in the form of pieces of animal tissues, blood, hair, bristles. Technological processes use salt, nitrates and nitrites, so there are a lot of chlorides, waste solutions of nitrates and nitrites in the drain. Detergents are used in large quantities, additionally clogging wastewater with phosphorus (P_2O_5), soda ash (Na_2CO_3) (tab.2) [2].

For urban wastewater treatment plants, the influx of large concentrations of organic impurities with insufficient pre-treatment of wastewater can reduce the growth of activated sludge. Reducing the concentration of incoming wastewater substances from meat and poultry processing enterprises will make it possible to activate the saprophytic microflora of the activated sludge biocenosis. This will improve the quality of wastewater treatment and minimize the burden on aquatic ecosystems.

In connection with the above, the aim of the study was to create a consortium of microorganisms based on the microflora of the gastrointestinal tract (GIT) of animals for the processing of organic waste present in the wastewater of meat processing complexes.

An analysis of a wide range of studies on the composition of the GIT microbiome of cattle, pigs and birds allowed us to conclude that the pig microbiome is more diverse than the species composition of GIT bacteria in cattle and poultry.

It should also be noted that the GIT consortium of micro-organisms is planned to be used in the wastewater treatment of meat processing plants to reduce the burden on municipal wastewater. And in the effluents of these enterprises, protein and fat impurities predominate. In addition, the production of pork in Russia sig-

nificantly prevails over the production of beef [3]. Consequently, there will also be more waste in the form of GIT content, which is supposed to be used to create a consortium of microorganisms, after pork processing. Therefore, further studies to determine the species composition of the microbiome were carried out with pig GIT.

The pig gut microbiome was studied using sequencing on the Ion Torrent PGM platform. For these purposes, the hypervariable region V3 of the 16S rRNA gene was chosen. This gene is present in all representatives of bacteria, contains sufficient phylogenetic information and is characterized by pronounced genetic variability in prokaryotic organisms, due to which it is widely used for phylogenetic analysis, derivation of phylogenetic relationships between taxa, and is also used to compare species of the same genus.

The ratio of phyla in the pig intestine was as follows: *Firmicutes* - 53.1%, *Bacteroidota* - 21.9%, *Proteobacteria* - 15.6%, *Actinobacteriota* - 6.3%, *Verrucomicrobiota* - 3.1%. 7 classes of microorganisms were established (fig. 1).

Representatives of *Coriobacteriales* ferment glucose with saccharolytic species, but species in the *Eggerthellales* family are found that are unable to constantly ferment glucose and are asaccharolytic [4]. Bacteria of this class have been little studied. As a result of the research, it was found that representatives of the *Bacteroidia* and *Clostridia* classes dominate in pig GIT.

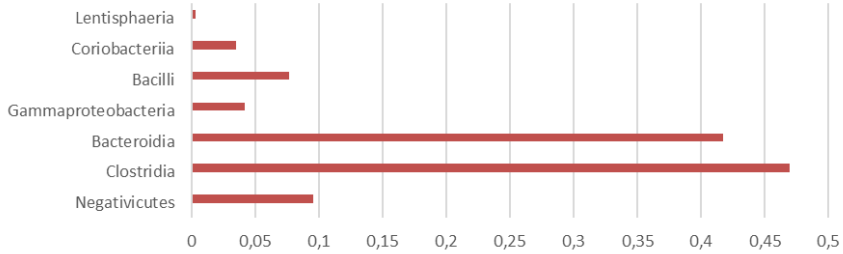

Figure 1. *Taxonomic profile of the porcine GIT microbiome, determined to class level, %*

Analysis of the microbiome at the level of orders showed that out of 12 detected bacterial orders, representatives of *Oscillospirales*, *Bacteroidales*, and *Lachnospirales* predominate in the GIT (fig. 2).

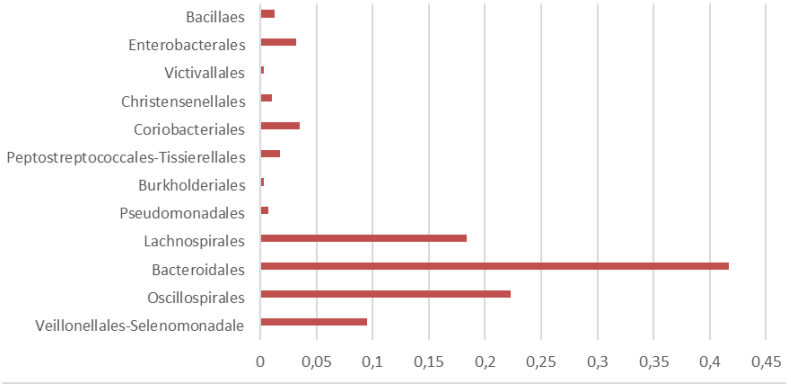

Figure 2. *Taxonomic profile of the porcine GIT microbiome, determined to the order level, %*

An analysis of the porcine intestinal microbiome at the family level showed that *Prevotella*, *Ruminococcaceae*, and *Lachnospiraceae* predominate in the porcine GIT (fig. 3).

It is interesting to note that representatives of the *Ruminococcaceae* and *Lachnospiraceae* families were previously found only in the rumen of ruminants [5].

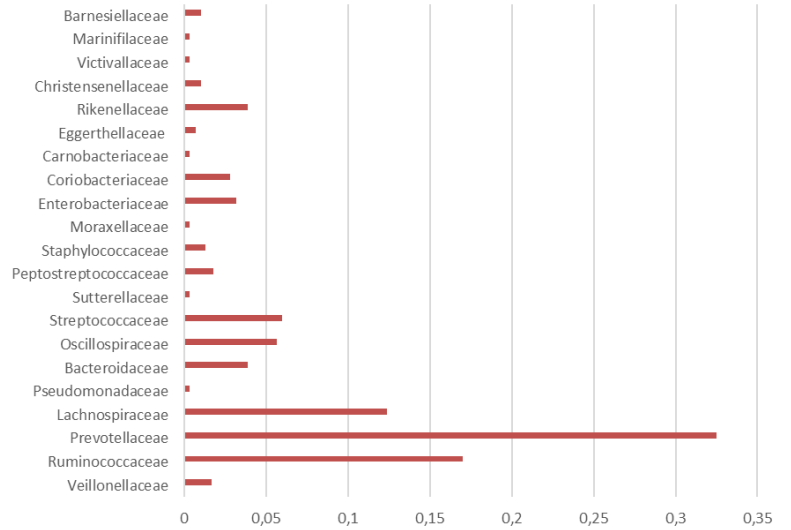

Figure 3. *Taxonomic profile of the porcine GIT microbiome, determined to the level of families, %*

The generic diversity of the pig microbiome was represented by 32 representatives. Of the families *Prevotella* and *Ruminococcaceae* predominating in the GIT of the pig, bacteria of the genera *Faecalibacterium* and *Prevotella* were the most abundant (Table).

For further research, it was necessary to find out which of the bacteria identified in the GIT microbiome will be able to function in the presence of oxygen, since their use will be associated with the use of treatment facilities as part of the activated sludge.

From the data presented in table 1, it can be seen that in the GIT microbiome, these include: *Escherichia, Proteus, Staphylococcus, Azotobacter, Lactococcus, Acinetobacter, Streptococcus, Trichococcu , Victivallis.*

Table 1.

Taxonomic profile of the porcine GIT microbiome, determined to the level of the genus,%

Genus	Pig GIT
Veillonella (anaerobe)	0.0177
Faecalibacterium (anaerobe)	0.1201
Prevotella (anaerobe)	0.3074
Blautia (anaerobe)	0.0565
Escherichia (selective anaerobe)	0.0250
Proteus(selective anaerobe)	0.0067
Azotobacter (aerobe)	0.0035
Staphylococcus(selective anaerobe)	0.0129
Bacteroides (anaerobe)	0.0389
Fusicatenibacter (anaerobe)	0.0035
Ruminococcus (anaerobe)	0.0247
Pseudobutyrivibrio (anaerobe)	0.0530
UCG-002 (anaerobe)	0.0565
Subdoligranulum (anaerobe)	0.0212
Lactococcus (selective anaerobe)	0.0283
Sutterella (anaerobe)	0.0035
Paeniclostridium (anaerobe)	0.0177
[Eubacterium] hallii group (anaerobe)	0.0071
Acinetobacter (aerobe)	0.0035
Collinsella (anaerobe)	0.0283

Dialister (anaerobe)	0.0777
Streptococcus(selective anaerobe)	0.0318
Trichococcus (selective anaerobe)	0.0035
Eggerthella (anaerobe)	0.0071
[Eubacterium] eligens group (anaerobe)	0.0035
Alistipes (anaerobe)	0.0177
Paraprevotella (anaerobe)	0.0177
Christensenellaceae R-7 group (anaerobe)	0.0106
Barnesiella (anaerobe)	0.0106
Rikenellaceae RC9 gut group(anaerobe)	0.0212
Odoribacter (anaerobe)	0.0035
Victivallis (selective anaerobe)	0.0035

Representatives of the genera *Escherichia*, *Proteus*, *Staphylococcus*, *Azotobacter* were selected to create a consortium of microorganisms.

After the identification of *Escherichia*, *Proteus*, *Staphylococcus*, *Azotobacter* bacteria, the isolated colonies were sown on agar slant to isolate pure cultures of microorganisms.

Since the studied microbiome is supposed to be used for the fermentation of animal waste in order to reduce the pollution of this profile in the general effluents of meat processing industries, it was necessary to determine the presence of the corresponding enzymes in pig GIT bacteria, namely ammylases, lipases, proteinases.

From the data presented in table 2, it can be seen that lipolytic and amylolytic activities are already manifested after 24 hours of cultivation. The accumulation of lipolytic activity by the consortium of bacteria is most intensive. On the 2nd day of biosynthesis, its level reaches its maximum value. Then there is a gradual decrease and by 5 days 67.5% of the maximum is preserved.

Table 12.

Dynamics of accumulation of enzymatic activity

Indicators	**24 h**	**48 h**	**72 h**	**96 h**	**120 h**
PA, u/cm^3	0	0.87	1.5	3.8	3.6
LA, u/cm^3	240	400	360	300	270
AA, u/cm^3	27.1	33.6	70.2	57.1	42.9
Biomass, g/dm^3	4.14	4.28	6.46	8.16	6.53

The highest value of amylolytic activity (AA) was noted on the 3rd day of cultivation. On the 5th day of cultivation, 61% of AA is retained. Proteolytic activity reaches its maximum level only by 96 hours of biosynthesis. By this time, the highest value of biomass was noted. By day 5, biosynthesis slows down, as evidenced by the decrease in the enzymatic activity of microorganisms.

Based on the evaluation of the relevant enzyme systems in the porcine GIT microbiome, it can be concluded that this microbiome can be used for the hydrolysis of organic wastewater.

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基于复合电镀镍镍粉的碱性电解液电化学电容器正极

POSITIVE ELECTRODE OF ELECTROCHEMICAL CAPACITOR WITH ALKALINE ELECTROLYTE BASED ON COMPOSITE ELECTROPLATING NICKEL-NICKEL POWDER

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抽象的。这项工作的目的是研究用氢氧化镍填充镍粉复合涂层的多孔结构获得的电极的特性。进行的研究表明，氧化镍电极：镍–镍–粉–氢氧化镍复合涂层是一种可逆的法拉第电极。电极的恒流比电容取决于镍粉含量与氢氧化镍质量之比。在复合涂层中镍粉含量为 43% 时，获得的相关性最大值为 574 F/g。基于所提出的技术，有可能开发出许多具有所需特性的碱性电解质的电化学电容器，包括根据所应用的操作模式结合电池和电化学电容器的特性的电容器。

关键词：碱性电化学电容器，复合材料，氢氧化镍，电极，充放电特性，镍粉，伏安法

Abstract. *The aim of this work is to study the characteristics of electrodes obtained by filling the porous structure of the nickel-powder composite coating with nickel hydroxide. Conducted studies have shown that nickel oxide electrode: nickel-nickel-powder-nickel hydroxide composite coating is a reversible faraday electrode. Constant current specific capacitance of the electrode depends on the ratio of the content of nickel powder to the mass of nickel hydroxide. The dependence obtained has a maximum of 574 F/g at a nickel powder content in the composite coating of 43%. Based on the proposed technology, it is possible to develop a number of electrochemical capacitors with an alkaline electrolyte with the required set of properties, including those combining the characteristics*

of a battery and an electrochemical capacitor in accordance with the applied operating mode.

Keywords: *alkaline electrochemical capacitors, composite, nickel hydroxide, electrode, charge-discharge characteristic, nickel powder, voltammetry*

Introduction

Alkaline electrochemical capacitors (AEC) with a nickel oxide positive electrode are currently a mass-produced chemical current source [1]. The nickel hydroxide electrode is produced on a porous steel base [2], which is then filled with nickel hydroxide formed electrochemically by alkalizing the near-electrode layer, which is deposited in parallel with the formation of nickel powder particles in the pores, which provides the required electrical conductivity. The problems with this technology are the inconsistent distribution of the amounts of nickel powder and nickel hydroxide. Known application in the electrochemical capacitor hydroxide-nickel electrode extruded design [3]. Nickel hydroxide electrode is produced by pressing an active material with a high content (16-23 wt.%) of an electrically conductive additive from carbon-graphite materials onto a current collector [4]. AEC technologies also use an active-material-optimized nickel hydroxide-nickel electrode with mesoporous (nano-porous) nickel hydroxide obtained by screen synthesis, which consists in the chemical precipitation of nickel hydroxide from an aqueous medium of a homogeneous self-organizing liquid crystal template - LCT, after removal of which a porous structure is obtained, containing channels of uniform diameter located in a hexagonal lattice [5]. The nanoarchitecture of nickel hydroxide provides very good electronic contact and contact with the electrolyte, so this electrode has outstanding power characteristics, but, like all nickel hydroxide electrodes containing a large amount of oxidizing carbon-graphite additive in the active material, it has a resource limitation. It is known to use an optimized sintered nickel hydroxide electrode in an electrochemical capacitor [6]. The electrode of this design meets a wide range of requirements for power and resource characteristics, but the method of manufacturing electrodes of this design is rather energy- and material-intensive and therefore expensive, which is a significant drawback for the AEC technology. Promising are developments in which the manufacture of a porous current collector, the synthesis of an active material, and the filling of a porous current collector with an active material are carried out simultaneously by alternating anodic and cathodic electrochemical treatment of a base consisting essentially of nickel in an aqueous solution containing chloride ions [7]. According to this method, a thin electrode with a thickness of 100-200 microns and a capacity of up to 0.15 $A \cdot h/cm^3$ is obtained. In general, capacitors with metal-powder electrodes have a number of advantages compared to other types of oxide-nickel electrodes [8], mechanical strength, an increase in capacity

during cycling up to the transition at low current densities to the battery operation mode, increased power due to the high electrical conductivity of the electrode [9,10]. Previously, it was reported [11] about the possibility of creating a positive electrode based on ultrafine nickel powders. The electrode was made with a binder, deposited on a nickel substrate, dried, and rolled. The characteristics of the electrodes corresponded to the presence of both the Faraday and double-layer components of the total capacitance. Of great interest is the approbation for AEC electrodes of the technology of composite electrochemical coatings with nickel powder as a dispersed phase, similar to known composite nickel coatings [12]. Obtaining high capacitive characteristics for such electrodes is possible due to the synergistic combination of ultrafine powders with nickel hydroxide nanoparticles. The purpose of this work is to study the characteristics of electrodes obtained by filling the porous structure of a nickel–nickel powder composite coating with nickel hydroxide.

Experimental technique

Nickel electrolytic powder was obtained on a titanium cylindrical cathode, in an electrolyte obtained by anodic dissolution of nickel in a one-molar ammonium chloride solution, with the addition of (0.8) g/l (alkyltrimethylammonium chloride) [4]. As a material for the manufacture of a composite coating, a proportion of 10 g of powder per 1 liter of electrolyte containing nickel sulfate with a concentration of 0.5 mol/l at a temperature of 40°C was used. Coatings were obtained at different current densities (fig. 1). The amount of powder in the coating was determined from the difference between the theoretical and practical masses of the coating. Nickel hydroxide was applied to the resulting composite coating from an electrolyte containing nickel ions at a concentration of 3.5 mol/l in the presence of nitrate ions at a concentration of 0.15 mol/l at a temperature of 32°C. The amount of nickel hydroxide obtained for the samples is given in tab. 1

Table 1.

Current density for obtaining composite coatings

Sample	Nickel powder content, %	Current density for obtaining a composite coating, A/cm^2	Weight of nickel hydroxide, g
1	15.72168764	0.01	0.073
3	43.44150532	0.03	0.069
4	62.00102167	0.04	0.083
5	83.37258596	0.05	0.086

Tests of the obtained electrodes were carried out in an electrolyte of the composition potassium hydroxide 400 g/l, lithium hydroxide 20 g/l in two types of modes:

1) cyclic sweep (sweep rates were 4, 10, 20, 50, 100 mV/s) in the voltage range of ±1500 mV. In this case, the specific capacity was determined by the formula:

$$C = \frac{I}{U_{sweep} \cdot (m_2 - m_1)} \quad (1)$$

where:

I – current, U_{sweep} – sweep speed, m_1 and m_2 – electrode weight before and after nickel hydroxide deposition.

2) charge-discharge of the electrode by currents: 4, 10, 20, 50 and 100 mA. At the same time, 300 seconds were given for each charge period. The discharge was carried out with the same current as the charge, the discharge termination conditions: the period lasted 300 seconds or the electrode potential reached zero.

The galvanostatic capacitance was calculated by the formula

$$C = \frac{Q}{(U_1 - U_2) \cdot (m_2 - m_1)} \quad (2)$$

where

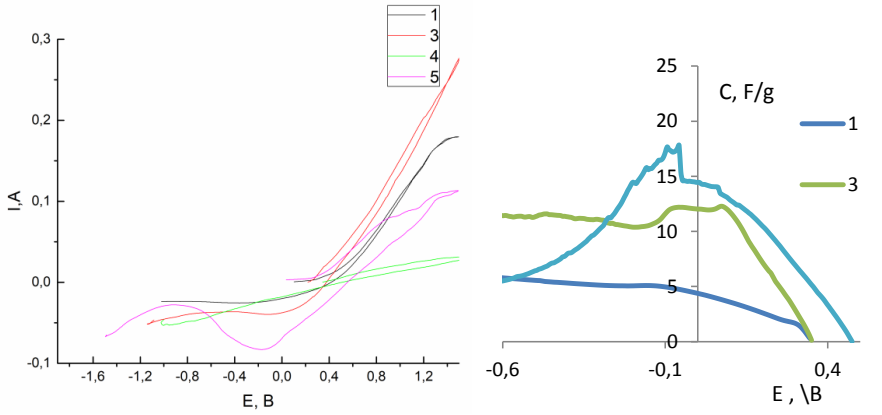
Q – working charge

U_1 and U_2 – electrode potential at the beginning and end of the discharge

m_1 and m_2 – electrode weight before and after nickel hydroxide deposition.

Results and its discussion

Cyclic voltammetric dependences of the studied electrodes (fig. 1) reveal different kinetic patterns of cathodic and anode processes. The greatest reversibility takes place for electrode 5 with the maximum content of nickel powder in the composite coating. The voltammetric specific capacitance of the electrode has a maximum at a potential of about -0.1 V and is 15 F/g. Electrode 1 with a minimum content of nickel powder is characterized by a minimum limiting cathode current and a minimum voltammetric specific capacitance. The observed trends are associated with the mechanism of the cathodic process, the reduction of nickel hydroxide, the rate of which depends significantly on the possibilities of providing electronic contact between its individual grains. With a higher content of nickel powder in the electrode, a more porous structure is created, which provides such a current supply. Voltammetric capacitances have relatively small values, which indicates the predominantly Faraday nature of the process and the small contribution of the capacitive component.



a *b*

Figure 1 *Cyclic voltammetric dependences of electrodes (a) and dependences of specific voltammetric capacitance on potential (b)*

The charge-discharge characteristics of the electrodes (fig. 2) are consistent with cyclic voltammetric dependences, electrode 5 has the maximum capacitance and energy. When charged for 300 s, this electrode is characterized by a specific capacity of more than 120 F/g at a minimum current density and maintaining performance at a current density of 25 mA/cm^2 (fig. 3). The specific capacitance for the direct current mode significantly exceeds the voltammetric one, which is additional evidence of the Faraday nature of the processes.

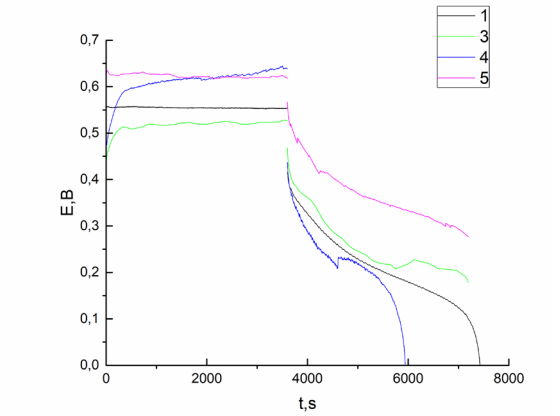


Figure 2 *Charge-discharge characteristics of electrodes at a charge time of 3600 s and a current density of 2 mA/cm^2*

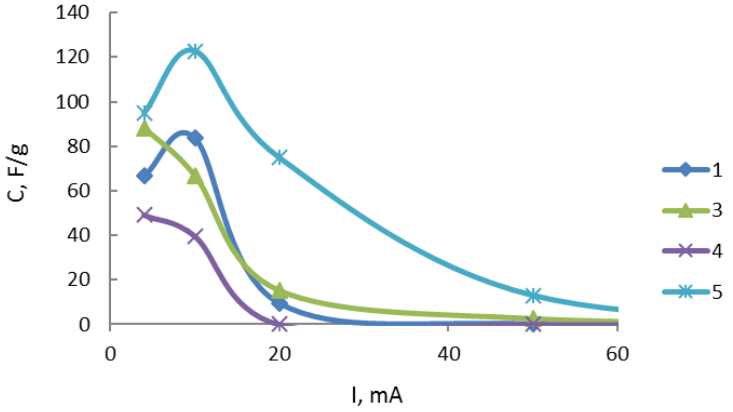


Figure 3. *Dependence of the specific capacitance of the electrodes on the discharge current during charging for 300 s*

The dependences of the specific direct current capacity on the charge time (fig. 4) show that with an increase in the charge depth, electrode 5 tends to decrease in capacity, which is associated with the formation of irreversible phases, while electrode 4 tends to increase in capacity, which is associated with the duration of its study when charging. The data obtained mean that for the maximum efficiency of the electrodes under study, some optimal ratio of the content of nickel powder in the composite coating to the mass of nickel hydroxide is necessary.

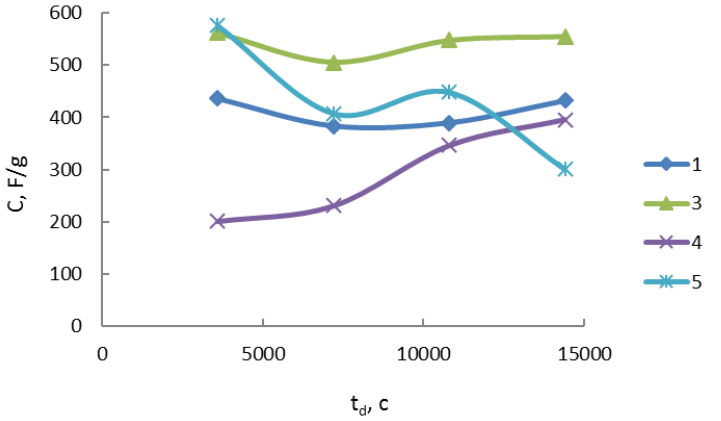


Figure 4. *Dependence of the specific direct current capacity on the charge time at a current density of 2 mA/cm²*

This assumption is confirmed by the data in fig. 5, according to which a nickel powder content of 43% corresponds to a maximum capacity of 574 F/g. By changing the ratio of the content of nickel powder in the composite coating and nickel hydroxide, it is possible to achieve various required properties of electrodes, resistance to overcharging, increased discharge current densities, and maximum capacity. This creates the basis for the development on the basis of the proposed technology of a number of electrochemical capacitors with an alkaline electrolyte with the required set of properties, including those combining the characteristics of a battery and an electrochemical capacitor in accordance with the applied operating mode.

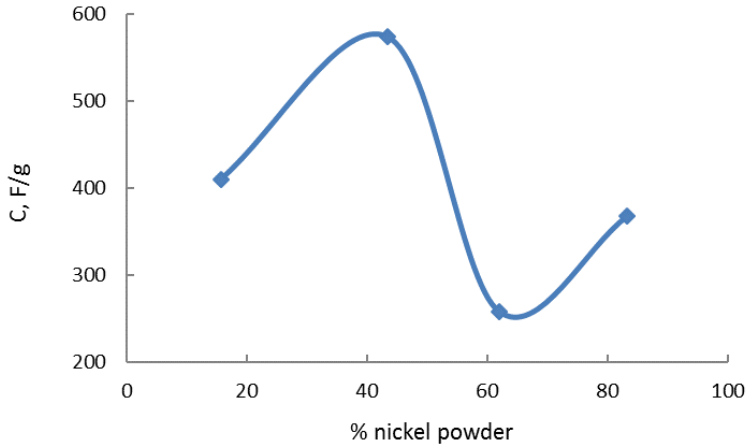


Figure 5. *Dependence of the maximum specific capacitance of electrodes on the content of nickel powder in the composite coating*

Conclusions

1. Nickel oxide electrode composite coating nickel-nickel powder-nickel hydroxide is a reversible faraday electrode.

2. The constant current specific capacitance of the electrode depends on the ratio of the content of nickel powder to the mass of nickel hydroxide. The dependence obtained has a maximum of 574 F/g at a nickel powder content in the composite coating of 43%.

3. Based on the proposed technology, it is possible to develop a number of electrochemical capacitors with an alkaline electrolyte with the required set of properties, including those combining the characteristics of a battery and an electrochemical capacitor in accordance with the applied operating mode.

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关于确定带背压气动弹性元件特性的问题
ON THE QUESTION OF DETERMINING THE CHARACTERISTICS OF PNEUMATIC ELASTIC ELEMENTS WITH BACK PRESSURE

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抽象的。必须解决寻找其弹性元件特性的问题，确保在开发运输车辆的新悬架时满足指定的战术和技术要求。由于缺乏适用于确定各种设计实现的弹性悬挂元件特性的准确和通用的分析依赖关系，这项任务受到了极大的阻碍。与一些工厂的交互经验表明，设计人员无法定性地计算弹性特性，采用选择和类比的方法，进行了大量的台架试验，结果选择了所需的充气量和压力。具有背压的悬架特别困难，因为不仅最终特性，而且整个组件的性能取决于反相操作的两个腔室的体积和压力的组合：一个加载时，另一个卸载，反之亦然。分析依赖的使用将减少花在设计上的时间；在一定程度上参数化悬架的运动学，获得悬架等效刚度的值，并且能够开发用于各种重量类别机器的气动液压弹簧模型范围的特性.

本文提出了一种分析测定带背压气动弹性元件特性的方法。文章中提出的相关性使得获得各种多变参数的弹性特性成为可能，并且适用于为各种目的设计轮式和履带式机器的悬架。

关键词：履带式机器，轮式车辆，悬架，气动液压弹簧，悬架系统。

Abstract. *It is necessary to solve the problem of finding the characteristics of its elastic element, ensuring that the specified tactical and technical requirements are met when developing new suspensions for transport vehicles. This task is greatly hampered by the lack of accurate and universal analytical dependencies suitable for determining the characteristics of elastic suspension elements of various design implementations. The experience of interaction with some plants shows that designers, not being able to calculate qualitatively the elastic characteristics, use the method of selection and analogy, conduct numerous bench tests, the results of which select the required charging volume and pressure. Suspensions with back pressure are of particular difficulty, since not only the final characteristic, but also the performance of the entire assembly depends on the combination of volumes and pressures of two chambers that operate in antiphase: when one is loaded, the other is unloaded, and vice versa. The use of analytical dependencies will reduce the time spent on design; to parameterize to a certain extent the kinematics of the*

suspension, to obtain the values of the equivalent stiffness of the suspension, and also to be able to develop the characteristics of the model range of pneumatic-hydraulic springs for machines of various weight categories.

This article presents a method for the analytical determination of the characteristics of pneumatic elastic elements with backup pressure. The dependences presented in the article make it possible to obtain elastic characteristics for various polytropic parameters and are suitable for designing suspensions for wheeled and track-type machines for various purposes.

Keywords: *track-type machines, wheeled vehicles, suspension, pneumatichydraulic spring, suspension system.*

Introduction

The use of suspensions with pneumatic elastic elements, in particular, with pneumatichydraulic springs (PHS), is a promising way to improve the suspension systems of transport vehicles. This is noted in many works, for example, in [1 - 6], and the ways to achieve this goal are presented in the theses of a number of Russian scientists, for example, [7 - 11]. At the same time, the issues of analytical determination of the design parameters of the PHS are often not considered in detail, although the parametrization of the elastic characteristic, taking into account the kinematic relations between the PHS and the support wheel, is an urgent task.

The article [12] presented a method for determining the characteristics of an elastic suspension element for the case of using a PHS. The dependences shown in the article are suitable for obtaining the characteristics of an elastic element, in which the polytropic index n remains unchanged. In particular, the case with n = 1.4 was considered. However, in real conditions, a polytropic index different from unity is characteristic only for the mode of movement of the machine, when the compression and expansion of the gas occur fairly quickly. When the machine is in a stationary position, the gas heated due to compression completely gives off excess energy to the environment. Slowly flowing processes of compression-expansion can be considered isothermal. In this case, the polytropic index n is equal to one, and the calculated charging pressure according to the dependences in [12] will be insufficient to provide the given static suspension travel. In this regard, the concepts of static and dynamic elastic characteristics of the PHS are separated. The static elastic characteristic of the PHS is understood as the dependence of the gas resistance force on the valve rod travel, when the polytropic index n = 1. The dynamic elastic characteristic is the dependence at which the polytropic index n is different from unity.

The determination of the main parameters of the PHS should be carried out for two cases: when n = 1 and when $n \neq 1$. This article presents the dependences that allow obtaining the main design parameters, as well as the static and dynamic

elastic characteristics of the PHS of various configurations.

Initial data

The initial data for determining the main parameters of the PHS [12, 13] are the following:

- values of the power transfer function u(β) at the initial β_0, static $\beta_{ст}$ and maximum βmax angular positions of the balancer;
- static $f_{ст}$ and full $f_{полн}$ suspension travel, m, corresponding to the static and maximum angular positions of the balance-beam;
- static $x_{ст}$ and full $x_{полн}$ travel of the rod, m, corresponding to the static and maximum angular positions of the balance-beam;
- static force per one track roller $P_{ст}$, N;
- effective area of the main piston $S_п$, m;
- dynamism factor for suspension $K_{дин}$ and dynamism factor for PHS. $K'_{дин} = K_{дин} u(\beta_{ст}) / u(\beta_{max})$.

Single-piston single-chamber PHS without backup pressure

In general terms, the static elastic characteristic of the PHS can be expressed by the well-known dependence [12, 13]:

$$P_{шт}(x_{шт}) = \left(\frac{V_0}{V_0 - S_п x_{шт}} \right) p_0 S_п, \quad (1)$$

where $P_{шт}$ is the gas elastic resistance force reduced to the PHS rod, N;

$x_{шт}$ – valve rod travel, m;

V_0 is the charging (initial) volume of the pneumatic chamber, m^3;

p_0 is the charging (initial) gas pressure in the PHS, Pa.

The dynamic elastic characteristic is built relative to the static position achieved at a given temperature. Accordingly, the expressions for the static and dynamic elastic characteristics at other temperatures T will take the form

$$P_{шт.}(x_{шт}, T) = \frac{T}{T_{зар}} \left(\frac{V_0 - S_п x_{шт}(\beta_T)}{V_0 - S_п x_{шт}} \right)^n \frac{P_{ст}}{u(\beta_T)}, \quad (b)$$

For static elastic characteristics $n = 1$, for dynamic - $n = 1.4$.

The initial volume of the pneumatic chamber V_0 for a single-piston single-chamber PHR is determined by the formula [12, 13]

$$V_0 = \frac{\left(x_{полн} \sqrt[n]{K'_{дин}} - x_{ст} \right) S_п}{\sqrt[n]{K'_{дин}} - 1}, \quad (2)$$

in this case, n = 1.4, since the required dynamic coefficient must be provided for the dynamic elastic characteristic.

Then, you should determine the charging pressure of the gas in the PHS $p0_{зар}$, that is, the pressure to which the gas is charged in the PHS. It is necessary to ensure the required static position of the rod (track roller). To construct a dynamic elastic characteristic, we will use a different value - the initial pressure $p0_{нач}$.

The charging pressure can be calculated, knowing the static travel of the rod, according to the formula

$$p_{0зар} = \left(\frac{V_0 - S_п x_{ст}}{V_0} \right) \frac{P_{ст}}{S_п u(\beta_{ст})} \quad (3)$$

When the temperature changes to some arbitrary, conditionally taken as working $T_{раб}$, the pressure values in the PHS and as a result, the static valve rod travel will change. The new value of the static valve rod travel at a temperature $T_{раб}$ $x_{шт}(\beta_Т)$ is determined through $\beta_Т$ - the angle of rotation of the balance-beam, at which equality is ensured $P_{шт}(\beta_T, T) = P_{ст} / u(\beta_T)$ [13, 14].

Single-piston single-chamber PHS with backup pressure

A characteristic feature of PHS with backup pressure is the fact that the backup pressure chamber unloads the rod. This allows you to provide any value of the force on the rod at its zero travel, including zero and negative (that is, use as a bump stop). It is convenient to make the calculation, assuming that for the static elastic characteristic, the force at zero travel of the rod will be equal to zero. This is possible if the forces acting on the rod from the side of the main pneumatic chamber and from the backup pressure pneumatic chamber are equal. Let us introduce the concept of zero pressure in the pneumatic chamber, which is achieved for the static elastic characteristic at zero travel of the rod (and the minimum volume of the backup pressure pneumatic chamber $V_{min.b.d.} = V_{0bp} - S_{b.p.} \cdot V$r.full):

$$p_{0п.д} = \frac{p_{0зар} S_п}{S_{п.д}}, \quad (4)$$

where $S_{п.д.}$ is the effective area of the piston from the side of the backup pressure chamber, m^2.

Dependence for the initial volume of the backup pressure chamber

$$V_{0п.д} = \frac{p_{0п.д} S_{п.д} x_{шт.полн}}{p_{0п.д} - p_{min}}, \quad (5)$$

$$p_{min} = \frac{1000}{0,25\pi \cdot 0,04^2} \cdot \frac{T_{зар}}{223} = 3570 T_{зар}. \quad (6)$$

Since the backup pressure chamber unloads the PHS rod, it is necessary to correct (increase) the charging pressures in the pneumatic chambers:

$$p'_{0\text{зар}} = p_{0\text{зар}}\left(1+\left(\frac{z}{1-z}\right)^n \cdot \left(\frac{u(\beta_{\text{ст}})}{u(\beta_0)}\right)^{1/n}\right)^n,\ p'_{\text{п.д.зар}} = p_{\min}\left(1+\left(\frac{z}{1-z}\right)^n \cdot \left(\frac{u(\beta_{\text{ст}})}{u(\beta_0)}\right)^{1/n}\right)^n, \quad (7)$$

$$z = \left[\frac{x_{\text{шт.полн}}\left(x_{\text{шт.полн}} - x_{\text{ст}}\right)\sqrt[n]{K'_{\text{дин}}}}{\left(x_{\text{шт.полн}}\sqrt[n]{K'_{\text{дин}}} - x_{\text{ст}}\right)\left(x_{\text{шт.полн}} + x_{\text{ст}}\left(\sqrt[n]{p_{0\text{п.д}}/p_{\min}} - 1\right)\right)}\right]^n, \quad (8)$$

It is also necessary to correct (increase) the charging volume of the main pneumatic chamber. The degree of increase is defined somewhat differently:

$$V'_0 = V_0 \cdot \delta V, \quad \delta V = \sqrt[n]{\frac{u(\beta_{\text{ст}})}{u(\beta_0)}} \cdot \sqrt[n]{1+\left(\frac{z}{1-z}\right)^n \cdot \left(\frac{u(\beta_{\text{ст}})}{u(\beta_0)}\right)^{1/n}} \quad (9)$$

Expressions (11) - (13) are valid for charging and operating temperatures and ensure the preservation of the static travel. They are also suitable for further calculations of PHS of other designs. However, their disadvantage is the discrepancy between the dynamics coefficients for PHS with and without backup pressure.

When the temperature changes to $T_{\text{раб}}$, the pressures in the pneumatic chambers increase accordingly, and the new value of the static travel of the rod can be determined numerically from the expression

$$\frac{P_{\text{ст}}}{u(\beta_{\text{т}})\, p_{0\text{зар}} S_{\text{п}}\left(1+z/(1-z)\cdot\left(u(\beta_{\text{ст}})/u(\beta_{\max})\right)^n\right)} \cdot \frac{T_{\text{зар}}}{T_{\text{раб}}} = \left[\left(\frac{V'_0}{V'_0 - S_{\text{п}} x_{\text{шт}}(\beta_{\text{т}})}\right) - \left(\frac{\left(p_{0\text{п.д}} + p_{\min}\right)x_{\text{шт.полн}}}{\left(p_{0\text{п.д}} + p_{\min}\right)x_{\text{шт.полн}} - p_{\min} x_{\text{шт}}(\beta_{\text{т}})}\right)\right], \quad (10)$$

Static and dynamic elastic characteristics will take the form:

$$P_{\text{шт}}(x_{\text{шт}}, T) = \frac{T}{T_{\text{зар}}}\left[\left(\frac{V'_0 - S_{\text{п}} x_{\text{шт}}(\beta_{\text{т}})}{V'_0 - S_{\text{п}} x_{\text{шт}}}\right)^n p_{\text{ст.1}} S_{\text{п}} - \left(\frac{V_{\text{min.п.д}}}{V_{\text{min.п.д}} + S_{\text{п.д}} x_{\text{шт}}}\right)^n p_{\text{ст.1.п.д}} S_{\text{п}}\right],$$
$$p_{\text{ст.1}} = \left(\frac{V'_0}{V'_0 - S_{\text{п}} x_{\text{шт}}(\beta_{\text{т}})}\right) p_{0\text{зар}}, \quad p_{\text{ст.1.п.д}} = \left(\frac{V_{\text{min.п.д}}}{V_{\text{min.п.д}} + S_{\text{п.д}} x_{\text{шт}}(\beta_{\text{т}})}\right) p_{0\text{зар}}. \quad (11)$$

Single-piston two-chamber PHS with backup pressure

For a two-chamber single-piston PHS with backup pressure at the same charging pressures, all dependences coincide with those for a single-piston single-chamber PHS with backup pressure, and the initial volumes of pneumatic chambers of

high and low rigidity are calculated according to [12], but taking into account the coefficient δV.

If the charging pressures are different, they are calculated according to (22), and the result is then multiplied by $1+z\left(u\left(\beta_{ст}\right)/u\left(\beta_{max}\right)\right)^{n}/\left(1-z\right)$. The initial volume of the high rigidity pneumatic chamber is calculated according to [1], and the initial volume of the low rigidity pneumatic chamber is $V_{0низ.пд}=V_0'-V_{0выс}$.

Implementation of the elastic characteristics of the suspension

Let us consider as an example a tracked vehicle weighing 36.700 kg.

The static and dynamic elastic characteristics of various types of PHS are presented on fig. 1 – 2.

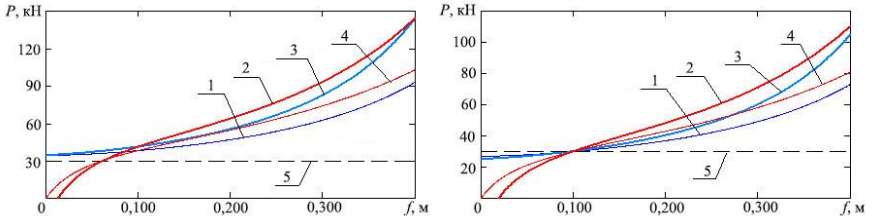
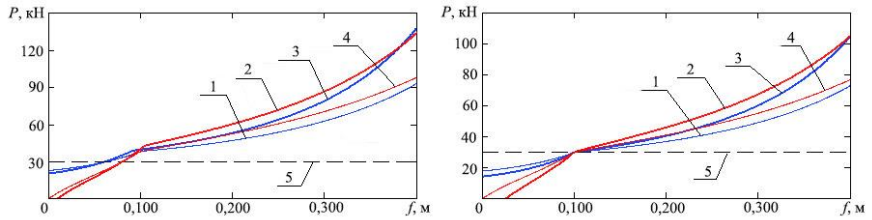


Figure 1. *Static (1, 4) and dynamic (2, 3) suspension characteristics with a single-chamber single-piston PHS at operating (a) and charging (b) temperatures*

1, 3 - static and dynamic, without backup pressure; 4, 2 - static and dynamic, with backup pressure; 5 - level of static force



a) b)

Figure 2. *Static (1, 4) and dynamic (2, 3) suspension characteristics with a two-chamber single-piston PHS at operating (a) and charging (b) temperatures: 1 - 5 - see fig. 1*

In addition, the type of transfer function will also affect the actual value of the dynamic factor. It should be taken into account that with a significant change in the values of the power transfer function, the discrepancies between the dynamic coefficient and the theoretical value for a load-bearing load without backup pressure will also increase.

Conclusions

The dependences presented in the article make it possible to obtain the main design parameters of a backpressure PHS. An increase in the range of values of the power transfer function will lead to deviations of the dynamic coefficient from the calibrated value. Thus, in order to use corrective dependencies, it is necessary to select first the kinematic parameters to obtain a successful (rational) form of the power transfer function.

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在农业消防飞艇的帮助下实现粮食安全的协同效应
SYNERGETICS OF FOOD SECURITY WITH THE HELP OF AGRO FIRE AIRSHIPS

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抽象的。本文提出了借助农用消防飞艇保障农业地区食品和消防安全问题的解决方案。由于现代世界每年都将最新的精准农业技术和概念引入农业，因此提出了一种将各种方法的优势整合到一个综合体中的解决方案。建议使用一种创新的专利大气氮气灭火方法来解决减少新出现的草原和森林火灾造成的损失的紧迫问题。在农用火力飞艇上安装这样的灭火系统时，可以快速响应火灾，并降低灭火成本。所述解决方案的应用允许实现以下结果：火灾探测的准确性高达 90%；估算可燃材料体积的准确度高达 95%；多光谱分析指标精度高；定位测绘精度高；点喷涂化学成分的可能性；使用大气中的氮气作为灭火剂，因此无需用水或其他灭火剂加油；在空中寻找农用火力飞艇并在领土上巡逻的最低成本，以及配备所有必要设备的可能性；适用于各种情况的自动和手动操作模式。

关键词：农业技术、无人机、农业航空、消防航空、薄膜和热磁纳米技术、安全技术与农业技术的整合

Abstract. *This article proposes a solution to the problem of ensuring food and fire safety in agricultural regions with the help of agro-fire airships. Since the latest technologies and concepts of precision farming are being introduced into agriculture every year in the modern world, a solution is proposed that integrates the advantages of various methods into one complex. It is proposed to solve the urgent problem of reducing damage from emerging steppe and forest fires using an innovative patented method of extinguishing fires with atmospheric nitrogen. When installing such a fire extinguishing system on an agro-fire airship, it is possible to quickly respond to a fire, as well as reduce the cost of fighting a fire. The application*

of the described solutions allows achieving the following results: the accuracy of fire detection up to 90%; the accuracy of estimating the volume of combustible materials up to 95%; high accuracy of multispectral analysis indicators; high accuracy of positioning and mapping; the possibility of spot spraying of chemical compositions; the use of atmospheric nitrogen as an endless extinguishing agent, and therefore no need to refuel with water or other extinguishing agent; minimal costs for finding an agro-fire airship in the air and patrolling the territory in combination with the possibility of equipping with all necessary equipment; automatic and manual modes of operation for various situations.

Keywords: *agrotechnologies, unmanned aerial vehicles (UAVs), agricultural aviation, fire-fighting aviation, membrane and thermomagnetic nanotechnologies, integration of safety technologies and agricultural technologies*

Introduction

In the modern world, observation of agricultural lands, forests and steppe areas is carried out with the help of aviation, namely airplanes, helicopters, hang gliders; satellites, as well as by visual observation when bypassing fields. Unmanned aerial vehicles (UAVs) for agriculture are gaining popularity. Precision farming technologies are also widely used in this industry. The first methods of yield management were proposed back in the USSR by academician VASKHNIL Shatilov I. S. [1].

Since agriculture is characterized by seasonality, the intensity of work on fields and lands increases significantly from the beginning of spring and decreases only in autumn. At this time, the average daily temperature also increases and dry periods may occur. The human factor is also becoming a frequent cause of accidents. The combination of these factors leads to an increase in the risk of fires.

The possibility of early detection of a fire and response before the fire spreads over a large area would significantly reduce the damage and costs of fighting fires in farmland and woodlands.

The purpose of the study: ensuring food and fire safety with the help of agro-fire airships.

According to statistics, approximately 48% of commercially used UAVs were used in agriculture in various countries. There are forecasts of foreign analysts, according to which by 2026 this share will grow to about 80%. Currently, the Skycision company, whose head office is located in the USA, carries out orders to study the state of agricultural crops in farmers' fields using UAVs and infrared spectrometers to detect plant diseases and pest infestations. With the help of hardware and software, the operator conducts aerial photography of the area, after which he builds maps with visual characteristics of the condition of plants. One of these indicators is the amount of chlorophyll, which is determined using the Chlorophil Visual Index (CVI). This index will allow you to assess the condition of plants and

remove areas affected by the disease or areas with insufficient watering. There are studies that make it possible to predict yields using various visual indices, which allows for more accurate financial planning, as well as timely application of crop protection measures.

The manufacturer of the UAV "DJI"– is a Chinese company, which is one of the world leaders in the industry, has agricultural drones in its line, the capabilities of which allow spraying fields, scanning according to the most well-known algorithms. In conditions of a shortage of skilled workers in rural areas, such a solution makes it possible to increase the productivity of small farms. According to various marketing studies, DJI occupies about 70% of the global commercial UAV market. At the same time, the share of industrial UAVs in the segment of the global commercial UAV market is more than half, and according to rough estimates is estimated at 9 billion US dollars.

The results of the use of UAVs in agriculture in India are also known. One of the main directions there is the mapping of irrigated lands and monitoring their condition to optimize irrigation. In farms, crop condition studies, site size assessment, crop classification, terrain mapping, chemical composition spraying, as well as yield forecasting and site management quality assessment based on the results of data analysis obtained during scanning are also in demand. All this makes it possible to significantly reduce crop losses, as preventive measures help to avoid serious problems [2].

Separate complexes allow the scaring of rodents and birds in the fields to reduce the likelihood of crop destruction.

All the described possibilities accelerate the introduction of precision farming in agriculture in most countries, which leads to an intensification of the use of agricultural land and an increase in crop quality, and most importantly – to more accurate forecasting and financial planning.

The technologies mentioned above are developing quite quickly, but often represent disparate solutions. The greatest efficiency can be achieved by synthesizing a comprehensive solution that would combine individual parts of precision farming technologies.

A sufficiently economical and versatile platform for integrating precision farming technologies is the airship. Modern models have a significant carrying capacity, and the aerostatic effect inherent in airships allows them to stay in the air for a long time with minimal energy consumption. Such aircraft can be equipped with all the necessary equipment and carry out a continuous flyby of a given territory [3]. They can be managed centrally and serve a large number of farms, which makes it possible to solve the problem of finding highly qualified personnel on the ground and reduce the costs of individual farms for the introduction of modern technologies.

Provided that the agricultural airship is in the air for a long time and processes a significant area, it is possible to combine agricultural and fire-fighting functions in it. Such a solution will satisfy the production needs of the agricultural industry and increase the level of fire safety in the region. This is especially important in regions with a high probability of forest and steppe fires.

A common disadvantage of existing methods and devices for extinguishing fires is the high cost of both the equipment itself and its operation. As a result, it can only be used centrally across the country or in large regions of Russia. At the same time, when extinguishing fires, contradictory tasks arise, for example, a contradiction between ensuring timely replenishment of fire extinguishing agents to reduce damage in the absence of water sources, and high costs for extinguishing with the help of fire aviation [4-9].

The problem of replenishing water reserves can be solved by using a patented extinguishing method using nitrogen released from the air by a nitrogen membrane installation. This method makes it possible to eliminate the time spent on returning, for example, a helicopter to an airfield or its flight to the nearest reservoir to replenish water supplies [8]. At the same time, the ability of the airship to hover in one place opens up the possibility of refueling in the air without stopping fire extinguishing.

The principle of extinguishing is that the nitrogen stream is cooled by Azarov vortex modules and fed into the fire at supersonic speed. This makes it possible not only to lower the concentration of oxygen, which forms a flame (low-temperature plasma), in the fire zone, but also to cut off the plasma from the fire surface, i.e. from the source of its formation [6-8]. The nitrogen membrane installation container can be fixed to the airship and also perform the functions of a mooring or landing device. It can be supplemented with structures for the transportation of firefighters and evacuation of people. At the same time, the airship can hover over the fires until they are completely localized and eliminated, moving from one to another (Fig. 1).

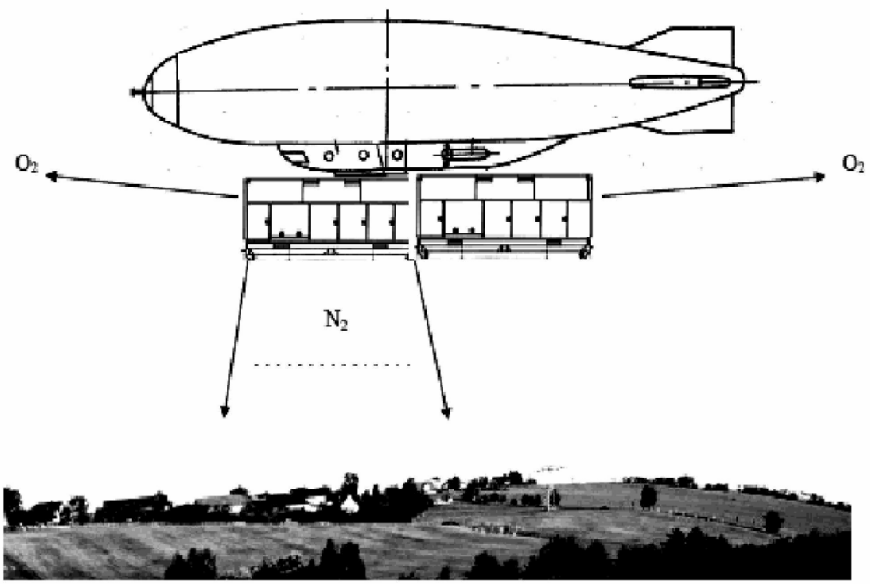

Figure 1. *The use of an agro fire airship to extinguish a forest fire*

The container of the nitrogen membrane installation (NMI) [7] can be the "1st floor" of the rigid suspension complex, which, due to its weight and size characteristics (dimensions - 6.0 × 2.5 × 3.6 m, weight - 11500 kg), can completely replace the necessary "mooring devices", and on the "2nd floor" the cockpit and other necessary compartments can be mounted for the implementation of technological and auxiliary functions.

If the transportation of irrigation water or spraying solutions, fertilizers or machinery is necessary to perform agrotechnical or rescue tasks, then the obvious solution is to dock the AMU container with a similar container for these purposes, without increasing operating costs (within the carrying capacity of the airship).

Thus, a solution is proposed to place equipment and devices in the cabin and containers of the airship to perform the following tasks [8]: accurate positioning; terrain mapping; multispectral analysis; spraying of chemical compositions; detection of fires, including with the help of a neural network with visible and infrared cameras; application of an algorithm for assessing the content of combustible materials on the ground and 3D cartography; nitrogen separation from the air and suppression of fire foci using it, using a container membrane station; equipping a local area network with high performance, for real-time data processing and control of the specified equipment, as well as for communication and data transmission (Fig. 2).

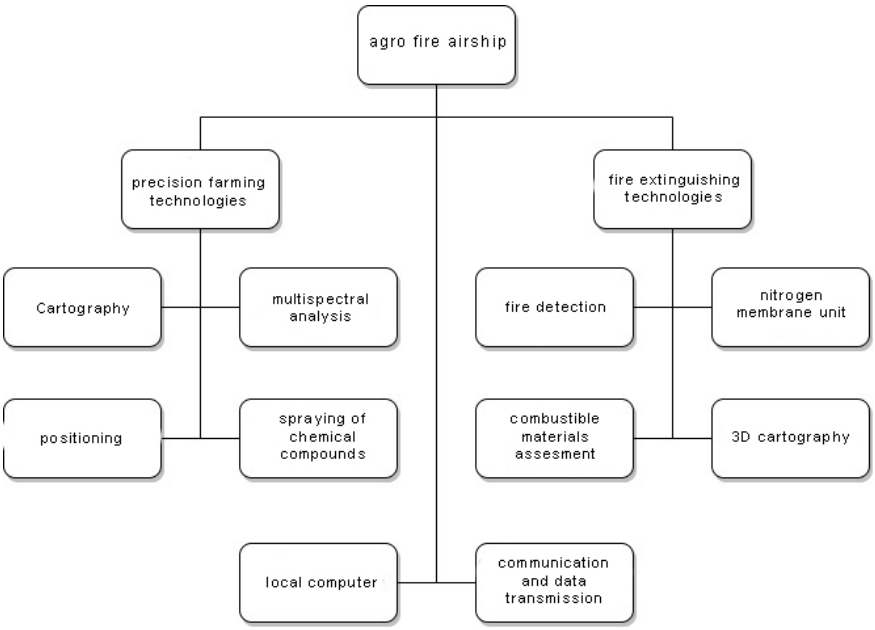

Figure 2. *Equipment and technologies of the agro-fire airship*

Conclusion

The study showed that the existing works of third-party authors cannot be used in their pure form for a comprehensive solution to the problems of precision farming and fire protection of farmland. The planned research will ensure the integration of individual results and the achievement of the goal by synthesizing a solution devoid of known shortcomings.

The application of the described solutions allows achieving the following results: the accuracy of fire detection up to 90% [4]; the accuracy of estimating the volume of combustible materials up to 95% [5]; high accuracy of multispectral analysis; high accuracy of positioning and mapping; the possibility of spot spraying of chemical compounds; the use of atmospheric nitrogen as an infinite extinguishing agent, and therefore no need for refueling with water or other extinguishing agent; minimum costs for maintaining an agro-fire airship in the air and patrolling the territory in combination with the possibility of installing all the necessary equipment; automatic and manual modes of operation for various situations.

The results of the system synthesis of models of integration of agrotechnical and fire-fighting tasks have shown their high efficiency [12-19]:

- first of all, because of the possibility of equipping the airships any diagnostic instrument of the environment and the underlying surface that is impossible to put on the drone, and it is difficult to adapt to on-Board options for helicopters and planes

- secondly, because of the possibility comfortable (without a parachute) "landing" of arespecialized and/or fire rescue employees with the necessary technical tools anywhere in the tour of the airship, not only for UAVs, but also for airplanes and all helicopters except the MI-26,

- thirdly, because of the efficiency movement and simplicity "hovering and landing" of the airship out of necessity while on patrol along the route, including watering, spraying of fertilizers and chemicals protection

- fourth, in the absence of duplication and the possibility of cost-effective creation and maintenance of real-time unified database of farmland, Prairie and woodlands,

- fifth, the possibility of round-the-clock patrol and emergency response at the optimal routes of the territory of all regions of Russia, including remote and mountainous areas, it is impossible not existing vehicle or UAV, or services (MES, Rosles, agriculture) because of the limited material and human resources,

- sixth, do not require the construction of a special "mooring funds",

- seventh, in the emergence of such a synergistic system that provides fire, and food security.

It should also be noted that the relevance and novelty of the described approach and methods are confirmed by patents of the Russian Federation [5-8].

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NLQ2SPARQL：基于领域本体的语义查询转换算法
NLQ2SPARQL: SEMANTIC QUERY CONVERSION ALGORITHM BASED ON DOMAIN ONTOLOGY

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抽象的。 需要特殊的查询语言以语义方式检索信息，以便应用于庞大的网络和数据库。 通常，所有用户查询都是使用自然语言（NL），可以使用传统的搜索引擎技术进行搜索，用户会对结果感到满意。 据用户称，用自然语言查询数据库是获取他们想要的信息的一种简单方法，但机器可能难以解释 NL 查询。 因此，本文清楚地展示了如何将自然语言查询 （NLQ） 转换为可应用于数据库以检索准确语义结果的简单协议和 RDF 查询语言 （SPARQL）。 在本文中，引入了一种将 NLQ 转换为 SPARQL 的算法来检索语义结果，并将其与传统搜索引擎进行比较。

关键词：领域本体、信息检索、资源描述框架（RDF）、语义网、SPARQL、Web本体语言（OWL）。

Abstract. *The special query language is required to retrieve the information in a semantic manner in order to apply on the huge web and database. The existing information retrieval methodologies generally have problems on keyword-search problem. To overcome this problem, the researchers attempted to add semantic sense in traditional IR. The users need to know the semantic query to get the semantic results instead of Natural Language Query (NLQ). But they only know the natural language query. Hence, in this paper, an algorithm is presented to fill the gap between semantic query and user' NLQ query, and effort to make resources machine-understandable format. Domain ontology can be used to improve information retrieval from traditional level based on keyword to the lay based on knowledge (or concept) and change the process of retrieval from tradition-*

al keyword matching to semantics matching. Our algorithm uses concept based approach (ontology) and metadata case base because the information about the concepts and relations of the multiple data sources represented in RDF is stored in Ontology. SPARQL as the standard query language can only access the data sources represented in RDF format. Thus, this paper clearly shows how to convert a Natural Language Query (NLQ) into semantic query language such as Simple Protocol and RDF Query Language (SPARQL) using domain ontology.

Keywords**:** *Domain Ontology, Information Retrieval, Resource Description Framework (RDF), Semantic Web, SPARQL, Web Ontology language (OWL).*

Introduction

The process of retrieving relevant information from a huge dataset is known as Information Retrieval (IR). To retrieve semantic information relevant to the user query from the semantic data source stays difficult in traditional IR system. Therefore, IR is moving towards the semantic by using semantic web technology such as Ontology, Resource Description Framework (RDF) and Sample Protocol and RDF query language (SPARQL) [3].

In semantic IR system, the RDF framework is used to describe the meta data of context of document by triplet patterns. Ontology can also retain the information about the concepts and relations of the multiple data sources represented in RDF.

In order to access the data sources represented in RDF, SPARQL as the standard query language is used. [1] The most end users used IR system usually query the information with Natural Language Query (NLQ). Therefore, the algorithm converted from NLQ to SPARQL is needed for semantic IR system.

Related Work

The researchers' study to reduce the gap between semantic query and user' NLQ query, and effort to make resources machine-understandable format.

Haemin Jung [2] presented a method of interpretation that reflects the structure and meaning of query to build conceptual an automated conversion methodology from NLQ to SPARQL. Their research is a method of interpretation that reflects the structure and meaning of query to build conceptual graphs.

An article has been proposed to use the query pattern leading the interpretation of the users' NLQ and its translation into a formal graph query by S Mahaboob Hussain [6]. That paper presented the approach and designed to allow end-users to query graph-based KBs. That approach mainly characterized by the use of query patterns leading the interpretation of the user NL query and its translation into a formal graph query.

Khin Kyawt Kyawt Khaing, Moe Moe Hlaing [4] have presented an article to extract the specific triplets from incoming query and to add the necessary information for supporting SPARQL query generating process in a time-saving manner.

Unlike the approaches of the previous research work, the proposed algorithm approach avoiding the use of parser to parse the input sentence. Instead the subject groups, object groups and the set of predicates related to the corresponding subject or object by using the semantic ontology. Then the triplets pattern from the input sentence will be extracted with the help of domain specific ontology (Digital Library) by detecting only noun form of words.

Creating Domain Ontology (Digital Library)

Ontology is the collection of concepts based on already defined finite sets of terms and concepts used in information integration and knowledge management [5]. The particular meaning of terms and concept in a specific domain are defined by domain ontology.

In our research work, domain ontology for digital library is built using web ontology language in protégé editor which has graphical user interface. The process of constructing ontology includes building file, class, class hierarchy, and producing attribute, the effective value of attribute, and adding examples. There are 39 classes, 21 object properties, 28 data properties, and 69 individuals, constituting 562 axioms.

NLQ2SPARQL Query Conversion Algorithm

There are four steps in proposed query conversion algorithm namely: preprocessing step, resource mapping step, triplet extraction step and query conversion step as shown in figure 1. The

detail explanation of each step is presented in the next section.

Our algorithm is also a component of semantic information retrieval system provided a common framework that allows data to be shared and reused across application, enterprise, and community boundaries.

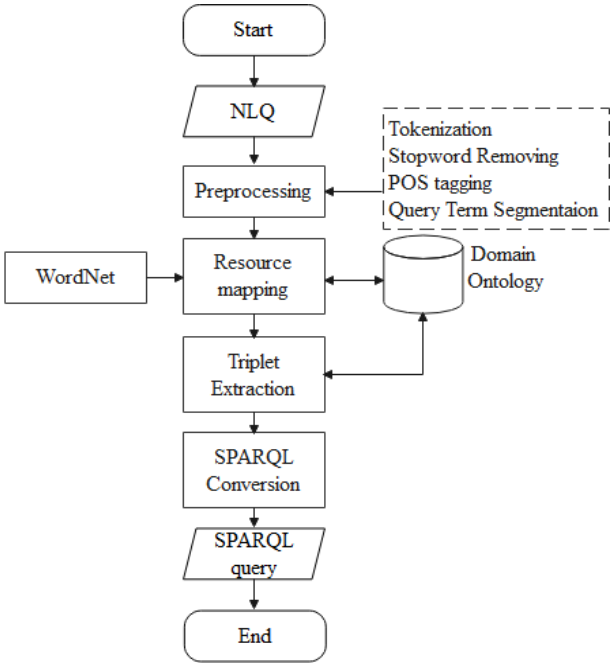

Figure 1. *Flow Diagram of Query Conversion Module*

A. Pre-processing Step

Pre-processing step includes two tasks: lexical analysis such as tokenization, stopword removing, POS tagging and domain word extraction namely: Query term segmentation. These tasks are performed only once, and their results are used later for resource mapping and triplet extraction respectively.

Firstly, the proposed algorithm splits the natural language query into tokens. All special characters from each token are removed in stopword removing process. To reduce the size of indexing file and improve the overall efficiency and makes effectiveness, POS tagging process detect the word forms of token for later usage in resource mapping step. Query term segmentation process combine the possible domain word from POS tagging process in bi-grams. The more specific position of the resources from ontology can be retrieved by getting domain words.

B. Resource Mapping Step

In this step, extracted words from preprocessing step are mapped with the predefined concepts of domain ontology (DL) such as classes, object properties, data properties, and individuals. If these extracted words do not map with any of concept, they are defined as constraints. The mapped concepts are used in triplet

extraction step to form triplet pattern.

If the word extracted from the input sentence is similar to class type of concept in ontology, this word is defined as *Class*. If the word from the input sentence is similar to the *Property*, this word is defined as property and to the NamedIndividual, it is defined as *Range* as shown in figure 2.

```
Algorithm: Resource Mapping
INPUT: user_query, pos_tag
OUTPUT: word_attribute
BEGIN
    local variables:  word, pos_tag, word_attribute
    word = user_query(tokenization)
    pos_tag = getPostTag()
    set word_attribute = " "
    function mapping-Class returns a solution, or failure
        word[class] ← word found in class position of ontology
        classAttributes ← extract-attributes(class)
        result ← word[class] + classAttributes
        word_attribute = result
    function mapping-Properties returns a solution, or failure
        word[property] ← word found in class position of
                         ontology
        propertyAttributes ← extract-attributes(property)
        word_attribute += word[property] + propertyAttributes
    function mapping-Range returns a solution, or failure
        word[range] ← word found in class position of ontology
        rangeAttributes ← extract-attributes(range)
        word_attribute += word[range] + rangeAttributes
if word_attribute ≠ failure then return word_attribute
else return failure
End
```

Figure 2. *Algorithm of Resource Mapping Step*

C. Triplet Extraction Step

The work of triplet extraction is to form triplet pattern according to the mapped concepts getting from resource mapping process. A triplet is normally formed in a pattern involved Domain, Property and Range. If we get a concept with pos attribute (NN) and type attribute (Class), this resource is defined as a *Domain*. When property is taken, it may be from object and individual. Therefore, if a type attribute of resource is DataProperty, the domain of this resource is defined as a *Property*. Afterward, if the type attribute of resource is NamedIndividual, property of this resource is defined as a *Property*. As soon as the finding of Domain and Property is accomplished, Range have been to find again. If we get a resource with range attribute, this resource is defined as a *Range*. In this way, we find out the sets of triplet.

After forming the sets of triplet, we need to consider that the type of a domain and the type of a range have any relationship or not. If domain is not a class of range in a triplet pattern, there is no relationship between them. The new relation is created between the actual class of domain and the range. Example, in a user query like (book about of software engineering) has a relationship because book is a class of individual (software engineering) and software engineering being an individual is directly connected with his own class (book). In a user query such as (author of software engineering), software engineering is an individual of book class. Hence, it has not any relationship with class (author).

A filter pattern must be considered to retrieve information relevant to the NLQ. There are two types of filter pattern namely: string and numeric. If the number is

more bigger or smaller than the range variable and equal or not equal, the comparison operators is needed to use in filter pattern.

The last one thing to complete our triplet extraction step is to change the range variable in accordance with the relationship of triplet set. If a triplet has directly relationship with another triplet in set of triplet, the range variable does not change in filter pattern. But if a triplet has not relationship directly, the range variable from the last triplet is defined as a variable to filter pattern. An output to provide a creation of SPARQL query string is executed from an algorithm shown in figure 3.

```
Algorithm: Triplet Extraction
INPUT: user_query, word_attribute
OUTPUT: triplets
BEGIN
  local variables: type, dataProperty, rangeProperty, individual,
   join, word_attribute
  set triplet_list = " "
  key_words = tokenize(user_query)
    IF word_attribute[pos] is NN and word_attribute[type] is Class
    THEN
        type = word_attribute[domain]
    END IF
    IF word_attribute[type] is DatatypeProperty THEN
        dataProperty = word_attribute[domain]
    END IF
    IF word_attribute[type] is NamedIndividual THEN
        Property = word_attribute[property]
        range = word_attribute[range]
        range_type = word_attribute[type]
    END IF
    IF type is not equal range_type THEN
        join = "?var1 ?any ?var2"
    ELSE
        join = " "
    END IF
    set triplets = "?var a ". type
    IF join is nothing THEN
        triplets += join. "?var " . rangeProperty . "?var1
    END IF
  IF join is any property THEN
        triplets += join."?var2 " . rangeProperty . "?var3
    END IF
    IF key_words is string and join is nothing THEN
        triplets += "FILTER REGEX (str(?var1) ' ". range. " ', i)"
    END IF
    IF key_words is numeric and join is nothing THEN
        IF key_words is the smallest possible quantities THEN
            triplets += "FILTER REGEX (?var1 ' .' > '. range . ")"
        ELSE
            triplets += "FILTER REGEX (?var1 ' .' = '. range . ")"
        END IF
    END IF
    IF key_words is string and join is any property THEN
        triplets += "FILTER REGEX (str(?var3) ' ". range. " ', i)"
    END IF
    IF key_words is numeric and join is any property THEN
        IF key_words is the largest possible quantities THEN
            triplets += "FILTER REGEX (?var3 ' .' < '. range . ")"
        ELSE
            triplets += "FILTER REGEX (?var3 ' .' = '. range . ")"
        END IF
    END IF
    RETURN triplets
END
```

Figure 3. *Algorithm of Triplet Extraction Step*

D. SPARQL Conversion Step

A SPARQL query in SELECT form consist of two clauses: select and where. The SELECT clause specifies with variables by assigning to be searched. The WHERE clause contains a triplet set, and each triplet is a condition that restricts the targets to be searched. Moreover, to define the domain class, triplet using the rdf:type property is also added to the WHERE clause.

When NL query can contain functional keywords such as ‘how many’, ‘the total number’ such as ‘earliest’ and ‘oldest’ etc., COUNT, MIN, and MAX functions must be used in SPARQLthat cause the final SPARQL. According to those functional keywords, the type of query pattern is choosen. If the functional keyword is as ‘how many’, the count function (count(?var) as count) is used in query structure. If the function keyword is the smallest possible quantities such as ‘min’, ‘oldest’, the minimization function (min(?var) as min) is used in query structure.

As a substitute if the largest possible quantities such as ‘max’, ‘earliest’, the maximization function (max(?var) as max) is used in query structure

If the functional keywords does not contain, the basic SPARQL structure is used to construct. But the both of keyword contain in keyword token, all possible corresponding ranges is need to define in query structure. The following algorithm given an output as a SPARQL query string is for query conversion step.

```
Algorithm: SPARQL query conversion
INPUT: user_query, triplets
OUTPUT: sparql_query
BEGIN
        local variables:    function_keywords, prefixes, triplets, join_keyword, all_ possible_range_of_book,  sparql_query
        keywords = tokenize(user_query)
        prefixes = getPrefix()
        triplets = getTripletExtraction()
        join_keyword = getTripletExtraction()
        all_possible_range_of_book = getAllRangeofBook()
        set sparql_query = prefixes +
        IF function_keywords is quantifiers key words THEN
            sparql_query = "SELECT ?var (count(?var) as ?count) WHERE {{SELECT * WHERE {". triplets . "} GROUP BY(?var)"
        END IF
        ELSEIF function_keywords is the smallest possible quantities key words THEN
            sparql_query = "SELECT (min(?var) as ?min) WHERE{{SELECT * WHERE {". triplets . "}"
        END ELSEIF
        ELSEIF function_keywords is the largest possible quantities key words THEN
            sparql_query = "SELECT (max(?var) as ?max) WHERE{{SELECT * WHERE {". triplets . "}"
        END ELSEIF

        ELSEIF join_keyword is nothing and function_keywords is nothing  THEN
            sparql_query = "SELECT * WHERE{{SELECT * WHERE {". triplets . "}"
        END ELSEIF
        ELSEIF join_keyword is something and function_keywords is nothing  THEN
            sparql_query = "SELECT". all_possible_range_of_book ."WHERE{{SELECT * WHERE {". triplets . "}"
        END ELSEIF
        RETURN sparql_query
END
```

5. Experimentation

The proposed query conversion algorithm is implemented in a prototype system using PHP programming language. Jena API is used to access domain ontology (DL). DL application is developed to apply the proposed algorithm. If a NL query is inputted, the proposed algorithm convert it to the SPARQL query.

To retrieve the semantic results, the converted SPARQL query is executed on the Apache Fuseki Jena Server. For example, it can be found that the NL query such as NLQ (Who is the author of software engineering book?) has been converted to SPARQL form as shown in figure 4. Then, NL query consists of COUNT function has also been experimented as (How many book published in 2021?). It’s converted SPARQL Query is shown in figure 5.

```
SELECT ?author
WHERE {
            ?author a my:author.?author my:write ?book. ?book my:hasTitle ?title
            FILTER (?title = “software engineering”)
    }
```

Figure 4. *Basic SPARQL Query*

```
SELECT ?date (count(?date) as ?count)
WHERE {
            ?book a my:Book.?book my:published ?date FILTER (?date = 2021)
      }GROUP BY(?date)
```

Figure 5. *SPARQL query with COUNT function*

The semantic results in triplet form of proposed approach based on domain ontology as a knowledge base are retrieved as in the Table 1. From Table 1 results displayed in a semantic way and every possible specification declared in a triplet tabular form. Natural language is one of the most natural ways of communication and it is difficult to represent complex queries human users will be able to search linked RDF data without having to learn the complex SPARQL language.

Table 1.

The result of SPARQL query

Published Date	Total number of book
2021^^xsd:integer	1^^xsd:integer

Conclusion

There are some issues that need to be resolved. One of the problems of our methodology is that the constraints have limitations. The number of candidates is impacted by the number of uncertain terms.

Second, the quality of the design of the target ontology has a significant impact on the performance of our semantic search. The ontology labels, in particular, have an impact on resource mapping. The probability of identifying the relevant pattern and transforming it to the appropriate SPARQL query are high if the necessary resources are identified through proper labeling. Many more domain ontologies require extensive testing. A variety of further tests should be performed for a more efficient method.

Our proposed algorithm is to perform a semantic search that converts normal user defined queries into machine understandable formal logic. Users inquire the system in natural language, without having any knowledge about SPARQL syntax or the system of the domain ontology. There are some challenges faced by domain ontology-based IR systems. Our main important issue is the difficulty in transforming end-users queries..

Acknowledgement

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使用基于氧化镍（NiO）纳米颗粒的爆炸蒸气传感器检测季戊四醇四硝酸酯（PETN）炸药

DETECTION OF PENTAERYTHRITOL TETRANITRATE (PETN) EXPLOSIVE BY USING NICKEL OXIDE (NIO) NANOPARTICLES BASED EXPLOSIVE VAPOR SENSOR

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抽象的。 本研究论文主要针对六水合硝酸镍 (Ni (NO3)2•6H2O) 纳米氧化镍颗粒的微波法制备和传感特性的研究。 作为一项研究，包括传感器和爆炸物的一些历史背景。 本文选用六水硝酸镍(Ni(NO3)2•6H2O)和氢氧化钠(NaOH)作为主要前驱体。 氧化镍纳米粒子是 p 型半导体，可以涂覆在氧化铝基板上，用于组装爆炸性蒸汽传感器。 通过改变 PETN 的量来检测纸质样品对季戊四醇四硝酸酯 (PETN) 的传感行为。 将讨论用于国土安全应用的 PETN 爆炸物蒸气的传感特性研究。

关键词：氧化镍，微波法，纳米粒子，爆炸性蒸汽传感器，PETN

Abstract. *This research paper mainly has been presented for preparation and investigation of sensing properties on nanoscale nickel oxide particles from nickel nitrate hexahydrate (Ni $(NO_3)_2 \cdot 6H_2O$) by using microwave method. As a study, some historical background of sensors and explosive were included. In this paper, nickel nitrate hexahydrate (Ni $(NO_3)_2 \cdot 6H_2O$) and sodium hydroxide (NaOH) were selected as main precursor. Nickel oxide nanoparticles are p-type semiconductor and can be coated on alumina substrates for assembly of explosive vapour sensor. Sensing behavior of papered samples on pentaerythritol tetranitrate (PETN) was*

detected by varying the amount of PETN. The investigation of sensing properties on PETN explosives vapour for homeland security application will be discussed.

Keywords: *Nickel Oxide, Microwave method, Nanoparticles, Explosive vapour sensor, PETN*

Introduction

Preparation and investigation of different metal oxide (NiO, CuO, ZnO, SnO_2 and MgO) nanostructures for chemical sensing are widely presented by various researchers. The applications of p-type (NiO) and n-type (CuO, SnO_2, ZnO and MgO) metal oxide nanoparticles were also grown on alumina substrates using evaporation–condensation, thermal oxidation and hydrothermal techniques. Furthermore, different batches of sensors have been prepared and their sensing performances towards ammonia, toluene and nitrogen dioxide as gas sensor and explosive vapour sensor have been explored.

Chemical sensors play a vital role in all sensing applications. Although metal oxides were the first to be commercialized as conductometric chemical sensors in form of thick. In the present day, tube type semiconducting metal oxide sensors were developed and now they are the most promising materials for sensing. Metal oxide nanoparticles sensors are more stable and reproducible compared to organic sensor. [1]

A number of explosive characteristics can be used as samples in explosive vapour detection (such as vapor emissions). Hydrogen, Nitrogen, Carbon and Oxygen are the main components in an explosive. The concentration of explosives can be divided into three groups: high, medium, and low vapor pressure. Explosives with a vapor pressure less than 1 ppb (RDX, PETN and HMX) cannot be detected without preconcentrators. Vapors and traces are currently detected by means of electronic/ chemical sensors, optical sensors and biosensors. [2]

Among the various explosive materials, PETN is, main components of many commercial and military explosive, very stable, relatively safe to use and one of the most powerful explosive. It can be used either as a powder or mixed with phlegmatizing materials to form shaped charges, such as the plastic explosive semtex. The physical and chemical properties of PETN were presented in table 1.

Table 1.

Specifications of PETN explosive [3]

No	Physical and Chemical Properties of PETN	
1	Moisture	max: 0.20%
2	**Acidity**	max: 0.02%
3	**Nitrogen Content**	min: 17.5%
4	**Melting Point**	141 ± 2°C
5	**Appearance**	Pure White Crystal
6	**Density**	1.77 g/cm^3
7	**Chemical Formula**	$C_5H_8N_4O_{12}$

Preparation of Nickel Oxide (NiO) nanoparticles

In this paper, NiO nanoparticles samples were synthesized by microwave method. Nickel nitrate hexahydrate (Ni $(NO_3)_2 \cdot 6H_2O$) was selected as main precursor and sodium hydroxide was used as precipitant. All of the samples employed in this preparation were analar grade. Firstly, Nickel nitrate hexahydrate solution and sodium hydroxide were separately prepared with deionized water. To dissolve completely in DI water, the solution containing nickel nitrate hexahydrate (Ni $(NO_3)_2 \cdot 6H_2O$) was stirred thoroughly by means of magnetic stirrer at room temperature. While stirring, sodium hydroxide solution was added drop by drop. When the pH of solution was reached pH 7, the samples were put into microwave oven and heated at 250°C for 5 minutes. And then, the solution was aged for 4hours. After aging, Nickel oxide hero-gel was obtained. The obtained nickel oxide hero-gel was filtrated with filter paper and washed with deionized water and ethanol to remove undesired species. The obtained precipitates were dried at 80°C for 4 hours at muffle furnace and calcinated at 550°C carbolated for 2 hours to obtain sample of NiO nanoparticles samples.

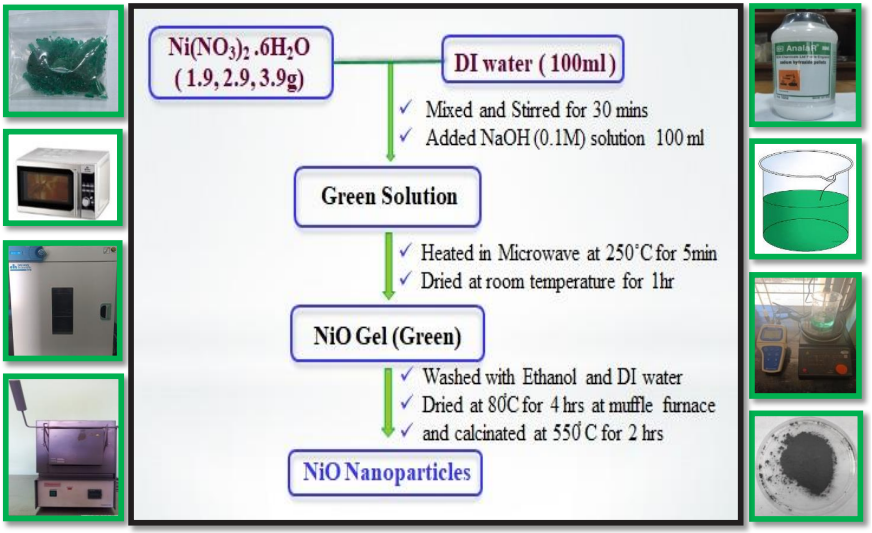
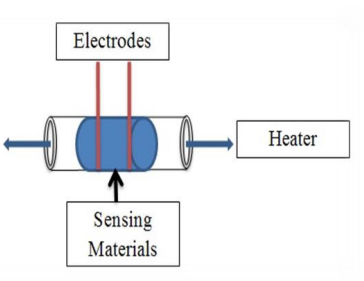


Figure 1. *Preparation of Nickel Oxide (NiO) Nanoparticles*

Fabrication of Sensor Head

NiO nanoparticles cannot be employed directly for sensing applications. Therefore, the samples must be mixed with a suitable binder in order to apply it to surface of substrate such as tubular ceramic Al_2O_3 substrate. Tubular ceramic Al_2O_3 substrate are constructed with gold coated copper plating Au electrode and the heaters are Ni-Cr alloy heater coil.



1	Gas Sensing Layer	NiO
2	Electrode	Copper plating Au
3	Heater Coil	Ni-Cr alloy
4	Tubular ceramic	Al_2O_3
5	Shieldcover	Plastic net
6	Tube Pin	Copper plating Au

Figure.2 *Constructed Tubular ceramic Al_2O_3 substrate*

NiO nanoparticles were mixed with 1% polyvinyl acetate powder to form slurry. Then NiO nanoparticles were coated on tubular ceramic Al_2O_3 substrate carefully and dried at 175º C for 2 hours.

Sensor testing system (static environmental method)

To investigate the sensing properties of prepared NiO nanoparticles, it is necessary to assemble sensor chamber. The chamber composed of a sensing material, substrate, heaters and 11800 ml glass box with openable/closable lid. The multi-pins put on the bottom of the chamber allow the electrical connection to attach the electrodes. The multi-meter of type U1232A True RMS with Keysight Handheld Meter Logger Software is used to record the variation of the sensor resistance exposed to predetermined air-PETN vapour mixing ratio. The chamber can be evacuated using fans.

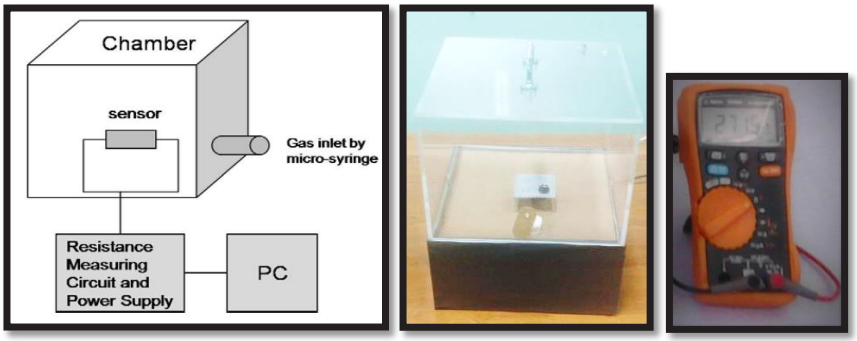


***Figure 3**. Explosive testing system chamber and multi-meter*

Results and Discussion

1. Aspect on Preparation of Samples and Sensing Device

Among the various preparation methods, microwave method was chosen because of its unique advantages. By using this method, the sizes and properties of samples can be changed and can be prepared in short time.

The sensor was assembled with chamber so as to prevent the disturbance of undesired species. Additionally, it is small size, easy to integrate into measurement circuitry, fast response time and high sensitivity.

2. Sensing characteristics of NiO nanoparticles sensor for PETN explosive

Fig.4, Fig.5 and Fig.6 depict the responses and recovery times of NiO sensor sensitivity to 100 ppm, 300 ppm and 500 ppm of PETN explosive. The response and recovery times were about 34 s and 200 s for 100 ppm PETN explosive, 25 s and 281 s for 300ppm PETN explosive and 78 s and 322 s for 500 ppm PETN explosive respectively. Among the sensing results, the response time of 300 ppm was better than the other two. According to literature, the more amount of testing explosive, the longer recovery time.

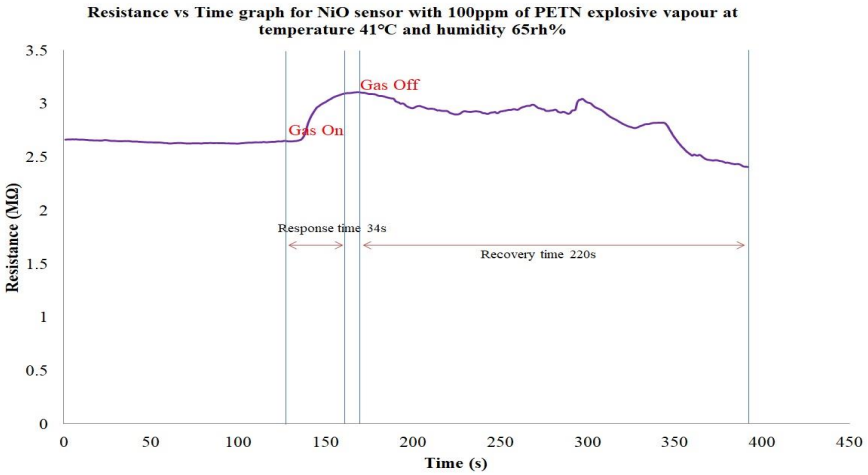


Figure 4. *Switch behavior of NiO nanoparticles sensor with 100ppm of PETN explosive*

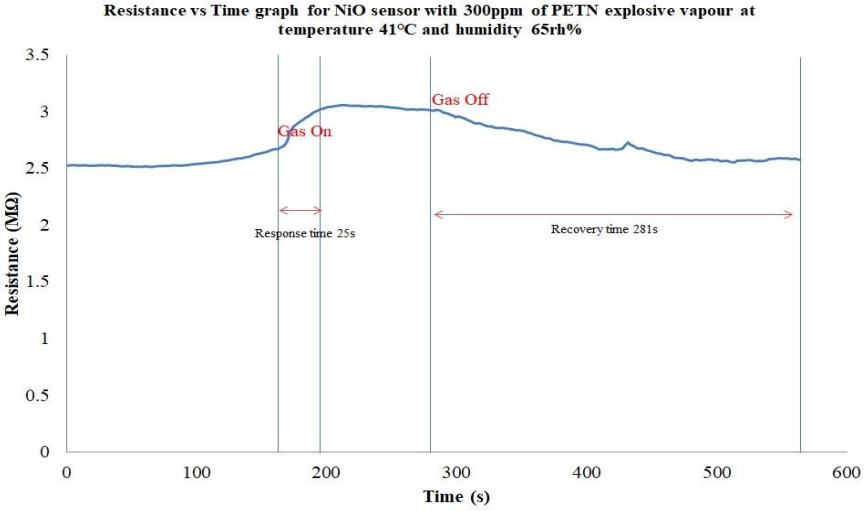


Figure 5. *Switch behavior of NiO nanoparticles sensor with 300ppm of PETN explosive*

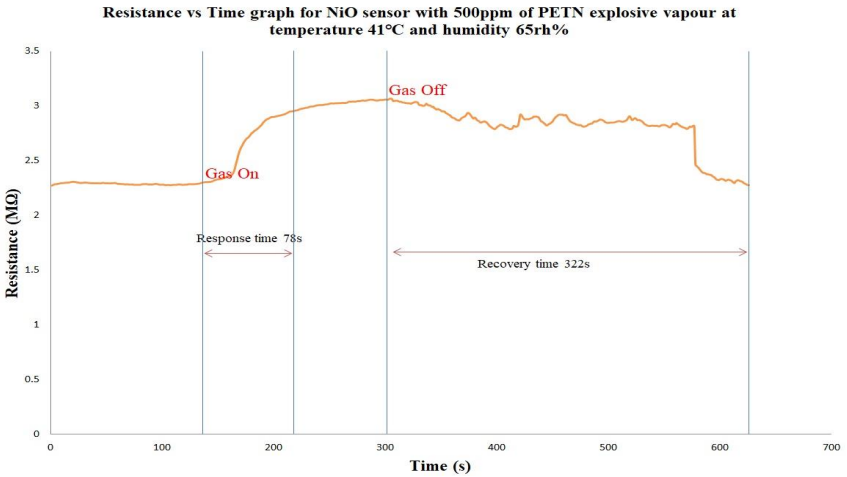


Figure 6. *Switch behavior of NiO nanoparticles sensor with 500ppm of PETN explosive*

Conclusion

In this paper, NiO nanoparticles were selected as the sensing materials to assemble PETN sensing device. NiO nanoparticles samples were chosen in this paper because NiO is most suitable than other in PETN sensing. According to detection of response time, NiO explosive vapour sensor can detects faster in 300ppm of pentaerythritol tetranitrate (PETN) explosive, when compared with other concentration. So it was chosen as optimum and can be used for explosive Array sensor device after required investigation and characterization.

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施工自动化与生产过程术语词典中的限制性专业词汇及其分类
RESTRICTED PROFESSIONAL VOCABULARY AND ITS CLASSIFICATION WHEN USED IN THE TERMINOLOGICAL DICTIONARY OF CONSTRUCTION AUTOMATION AND PRODUCTION PROCESSES

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抽象的。 文章包含对受限专业词汇在建筑自动化与生产过程词典中的作用和位置的研究分析结果。

关键词：俄语词汇、借用词汇、施工自动化、生产过程自动化。

Abstract. *The article contains the results of the analysis of the study of the role and place of restricted professional vocabulary in the dictionary of construction automation and production processes.*

Keywords: *Russian vocabulary, borrowed vocabulary, construction automation, automation of production processes.*

The relevance of this work lies in the fact that restricted professional vocabulary occupies an important place in the language and is constantly changing. In connection with this, compiling new dictionaries and updating existing ones is an important activity in applied lexicology.

The purpose of this work is to explore the role and place of narrow professional vocabulary in modern Russian language.

In connection with this goal, the following tasks were set:

- explore the main components of the vocabulary of the Russian language;
- consider narrowly professional vocabulary as one of the lexical layers;
- compose a terminological dictionary of construction automation and production processes.

The object of the study is restricted professional vocabulary.

The subject of the research is the role and place of restricted professional vocabulary in the modern Russian language.

Research methods - analysis, synthesis, comparison, empirical method.

The theoretical and methodological basis for the study was research in the field

of lexicology and terminology.

The practical significance of this study lies in the fact that in the course of the study a terminological dictionary of construction automation and production processes was compiled, consisting of 9800 lexical units.

Vocabulary is a set of words of a particular language, part of the language. Vocabulary is the central part of the language, naming, forming and transmitting knowledge about any objects, phenomena.

As the vocabulary of a language, vocabulary consists of lexical units-words and phraseological units (set phrases).

The word, in turn, is the basic unit of language. It can act as a complex response, and in this case, a person in his/her speech expresses his/her own thoughts. And also, the word can be represented by a complex stimulus. In this case, it is understood and perceived by a person orally or in written form. In addition, the word has a graphic and sound form.

The graphic form allows you to recognize the word when reading and use it correctly in written form. To master a word means to master its meaning, form (sound and graphic), be able to use it in context [4, p.58].

Since the word is the central unit of the vocabulary, it is important for us to consider the components of the lexical meaning of the word.

To correctly use a particular word in context, you need to understand the lexical meaning of the word. Lexical meaning - the ratio of the sound shell of the word with the corresponding objects or phenomena of objective reality. The lexical meaning of a monoseme (a word that has one meaning) or one of the meanings of a polysemic word (a word that has several meanings) consists of atomic components of the meaning - semes. The semes are the minimal components of the lexical meaning of a word that form the seme structure of the lexical meaning.

The meaning of a word conveys an idea of an object or phenomenon, that is, it is the correlation of the word with the object or phenomenon that it denotes. There are several components of the lexical meaning of a word: denotative, connotative, pragmatic. The denotative meaning of a word conveys a general lexical concept. The connotative meaning conveys additional emotional and evaluative shades of the word. The pragmatic meaning conveys part of the information about the situation of communication.

From the standpoint of the sphere of use, two main lexical layers can be distinguished, these are:

- common words
- words whose use is limited to a certain style.

Special vocabulary includes words that are used only in special areas of human activity, for example, in the field of science, technology, art, medicine and agriculture. Basically, these words are used in their colloquial speech by people of a

particular profession, so they are called "professionalisms". For example, among sailors the word "cook" is used to refer to a cook, the word "rim" to a driver is used to refer to a steering wheel. In publishing and printing business the word "general covering head" is used in the sense of a large headline of a table or article [6, p.75].

Also, the composition of the special vocabulary includes words-terms that are used to accurately designate various definitions in the field of science, art, technology. As an example, we can cite terms from linguistics: morpheme, syntax, suffix. As a rule, terms are characterized by monosemy - the presence of only one meaning.

There are also jargonisms. These are words and expressions that are used by certain closed groups of people due to the fact that these people occupy a certain position in society, exist in a certain environment. There are such terms as jargon, slang and argot, their semantics differ slightly. Jargon is a term that is used to refer to the speech of representatives of certain professions, for example, it can be the jargon of programmers and doctors.

Slang is a kind of youth jargon, it is typical for a certain age group - youth, and is incomprehensible to adults. Youth jargon is characterized by a tendency to play on words, rich in emotional and expressive coloring.

Slang also performs a differentiating function, it helps young people to distinguish “inside men” from “strangers”.

In fiction, elements of slang vocabulary can be used to characterize the speech of certain characters, while the author of the work must know these words well himself/herself. Therefore, in some cases, the authors have to work with dictionaries of special vocabulary.

It should be noted that the vocabulary of the language is constantly evolving, new words appear, and old ones, on the contrary, gradually fall out of use and become archaisms or historicisms. This process is quite long, so it should be noted that there are two large groups in the vocabulary at once - an active and a passive vocabulary, or word stock.

The active dictionary of the Russian language includes words that are familiar to everyone and are used by people in their everyday speech.

The passive dictionary of the Russian language includes the following words:

- their uses that have come out, which have become archaisms or historicisms;
- new words that have not yet become widely used (neologisms).

Obsolete words are divided into two groups - historicisms and archaisms. Historicisms are words denoting disappeared phenomena that have not already existed. For example, these can be words that denote certain phenomena of social and political life, the names of organizations and institutions that no longer exist at the moment, the names of certain professions and activities. Historicism differs from archaism in that it has no synonyms in the modern language, since the very phe-

nomenon associated with this word has disappeared from everyday life.

Archaisms are mean the words that have synonyms in modern Russian, for example, this word “ochi” as a synonym for the word “eyes” or the word “viya” as a synonym for the word “neck”.

Neologisms are new words that have appeared in the language relatively recently, they have not yet become part of the active vocabulary. Neologisms appear as new objects, new concepts, qualities and phenomena appear in everyday life. They gradually become common, but over time, many of them become archaisms or historicisms, this is a natural process of language.

The development of the lexical composition of the language is continuous, and words that were previously considered neologisms are gradually becoming part of the active vocabulary (cosmonaut, tractor driver, socialism). At the same time, some words that quite recently were still neologisms are already moving into the composition of historicisms (for example, Council of People's Commissars, tax in kind).

Neologisms are also authorial. They are created by the author of a literary work in order to describe a certain phenomenon or character. For example, N. M. Karamzin introduced the word "industry", M. Lomonosov - the words "mine", "attraction", F. M. Dostoevsky - "efface oneself". In some cases, author's neologisms can perform a figurative and expressive function, for example, this often happens in poetry, where the role of author's neologisms is especially great [10, p.35].

Thus, lexicon as a vocabulary of the language is not homogeneous, it includes a large number of various layers of the Russian language, which can be divided into several groups. The use of the vocabulary of a particular group in fiction is largely determined by the author's intention.

Part of the restricted professional vocabulary refers to jargon. There is also another group of restricted professional vocabulary, this vocabulary does not belong to jargon, but at the same time it is not commonly used either. Researchers refer to restricted professional vocabulary expressions and words that are used to denote concepts from various spheres of a person’s professional activity, from various fields of knowledge. However, these words are not included in the circle of commonly used vocabulary. They are used only by people who are united by a common profession, for example, doctors, mathematicians, geologists or physicists.

Professional vocabulary, since it is not common vocabulary, is not included in explanatory dictionaries.

Professional vocabulary includes words that are used to name concepts from a certain field of knowledge, while the content of these words is known only to narrowly focused specialists. It should be noted that there is a differentiation between the concepts of special and professional vocabulary. Special vocabulary is a broader concept, it covers not only narrow professional terms, but also terms re-

lated to the social sciences, for example, terms related to philosophy. In this case, only restricted professional concepts, for example, from the sphere of mathematics, medicine or linguistics, are included in the scope of professional vocabulary [7, p.11].

Regarding the place of terms in the lexical system of the Russian language, there is no consensus among researchers. Some researchers believe that terms are part of the literary language, others believe that the terms are outside the literary language and represent a type of social dialect. There are also researchers who consider terminology to be a special functional type of literary language, the language of science.

Restricted professional vocabulary is specific in its meaning, because it has a connection not with everyday concepts, but with the concepts of their professional activity. For restricted professional vocabulary, first of all, unambiguity is characteristic. For example, with regard to terms, the concept is monosemantic, but its meaning may narrow or expand slightly. Terms are used to express certain concepts, they do not have synonyms and antonyms, they have only generic and denotative connections.

Also, the terms are characterized by a lack of figurativeness or evaluativeness. Some terms are formed by figurative transfer (for example, a mountain cap, a water artery), and some terms are also formed by a subjective judgment about an object or phenomenon (butterfly chrysalis, car slider). But in this case, imagery and emotional coloring are completely lost.

All terms are limited to one or another sphere of use. But they do not have the same prevalence. Terms can be restricted professional, which are known only to specialists in a particular field. An example is terms in linguistics: epenthesis, phoneme, lexeme. There are also terms that are known to a relatively wide range of native speakers, because these terms are studied at school, used in the media, have a general philosophical or general political nature. Example: triangle, area, vaccine [9, p.13].

The scientific style always uses terminology, including highly specialized vocabulary, and this is what distinguishes the scientific style from other styles of the Russian language. Restricted professional vocabulary that refers to a particular area of human professional activity is a kind of metalanguage that forms its own specific isolated system of terms, and it does not intersect with other systems of terms.

It should be noted that restricted professional vocabulary is quite often used in fiction in order to create a kind of “professional flavor”. This is a means of stylization that allows you to describe more vividly the life of sailors, teachers, doctors or representatives of any other profession [8, c.43].

Vocabulary is a set of words of a particular language, part of the language.

Vocabulary is the central part of the language, naming, forming and transmitting knowledge about any objects, phenomena.

And also, the word can be represented by a complex stimulus. In this case, it is understood and perceived by a person orally or in written form. In addition, the word has a graphic and sound form.

The graphic form allows you to recognize the word when reading and use it correctly in a written form. To master a word means to master its meaning, form (sound and graphic), be able to use it in context.

Professionalisms in Russian are divided into two groups - lexical and semantic. In lexical professionalism, the term is the whole word, while in semantic professionalism, only one of the meanings is special.

Professional vocabulary includes words that are used to name concepts from a certain field of knowledge, while the content of these words is known only to narrowly focused specialists. It should be noted that there is a differentiation between the concepts of special and professional vocabulary. Special vocabulary is a broader concept, it covers not only restricted professional terms, but also terms related to the social sciences, for example, terms related to philosophy. In this case, only restricted professional concepts, for example, from the sphere of mathematics, medicine or linguistics, are included in the scope of professional vocabulary.

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金属表面样品发射率的实验研究
EXPERIMENTAL INVESTIGATION OF METALLIC SURFACE SAMPLES EMISSIVITY

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抽象的。 考虑了确定材料发射率的方法。 提出了一种利用热像仪测定金属样品表面发射率的方法，给出了实验装置的设计，并给出了测量结果。

关键词：发射率、辐射传热、实验装置、热像仪。

Abstract. *Methods for determining the emissivity of materials are considered. A method for determining the emissivity of the surface of metal samples using a thermal imager is proposed, the design of the experimental setup is presented, and the results of measurements are given.*

Keywords: *emissivity, radiant heat transfer, experimental setup, thermal imager.*

Introduction

Ensuring fire safety at nuclear facilities is of fundamental importance not only directly for nuclear power plants, but also when transporting goods with high radioactivity (spent nuclear fuel) due to the potential risk of damage to people, the environment and property during transportation, execution of cargo-handling operations and intermediate storage.

Safety during the transportation of nuclear fissile materials is ensured by the fulfillment of many conditions, including the provision of containers with emergency protective equipment, fire extinguishing, radiation monitoring, etc. One of the causes of an emergency is non-compliance with the thermal regime of fuel elements (TFE) located in the container. Exceeding the required temperature level of TFEs as a result of residual heat releases can cause a fire and release of radioactive substances into the environment.

To maintain the temperature of the fuel elements within the allowable values during transportation, it is necessary to use a temperature control system (TCS). The reliability of information on the intensity of heat transfer processes on the heat-releasing surfaces of fuel elements is of great importance in the development of TCS.

In the temperature range in which the studied samples of fuel elements are operated (+350 °C ÷ +380 °C), the contribution of the radiant component of heat transfer can become comparable or even prevail over the convective one. Therefore, to calculate the temperature control system of samples, it is necessary to know the emissivity of their surfaces.

The degree of emissivity of materials depends on factors such as roughness and surface treatment, temperature, wavelength, coating. In reference publications [1, 2], data on the emissivity of most materials refer to the middle of the last century, and taking into account all the above factors, data are not given, and for some materials they contradict each other [1, 2]. In addition, the emissivity of surfaces can change significantly due to the oxidation of materials, especially when they are kept for a long time at elevated temperatures, due to environmental influences (surface contamination, etc.).

Theoretical methods for determining the emissivity of materials cannot fully take into account the totality of these factors. Thus, the aim of this work is to determine experimentally the emissivity of the surfaces of zirconium tubes. Material, diameter and quality of processing of tubes exactly correspond to industrial designs.

Overview of emissivity measurement methods

Currently, there are a number of methods for measuring the emissivity of structural materials [4-10]. The most widely used methods of measurement, based on which the assessment of the emissivity of the surface under study is carried out by comparison with a reference surface, the emissivity of which is known in advance with high accuracy. In particular, in [4], the reference and test surfaces are formed by applying appropriate coatings. Measurements are carried out in stationary mode. The disadvantage of this method is the impossibility of its application to study clean surfaces of samples.

The methods proposed in [5, 6] are aimed at measuring several thermophysical properties of the material of the sample under study in the course of one experiment. This significantly complicates the design of experimental setups. In addition, in [5], the emissivity is estimated based on the measurement of the value of a complex thermophysical parameter - thermal diffusivity, and can lead to a significant measurement error.

It should be noted the method of measuring [7] emissivity in a non-stationary mode. The evaluation of the degree of emissivity is carried out on the basis of the

rate of change in the temperature of the test and reference samples using radiation from a black body. This makes it possible to significantly reduce the measurement process in comparison with stationary methods. The disadvantage of this method is the need to measure the rate of change in the temperature of the samples at times when the temperatures of both samples are the same.

There are known methods for determining the thermophysical characteristics of materials, including the determination of the degree of surface emissivity based on the calometric method using one or more contact means for measuring surface temperature [8–10]. As a rule, all of them have common disadvantages, such as: heat loss from the contact of temperature sensors with the sample surface, violations of the structure of the surface material, as well as high sensor error due to the large number of measuring elements.

In addition, the works of foreign [11–13] authors who conducted research on this topic were considered.

It follows from the review that, in order to solve the problem under consideration, preference should be given to the stationary method of measuring emissivity, based on a comparison of the radiation intensity from the reference and test surfaces.

In this work, an experimental stand has been developed to conduct an experimental study of the emissivity. The basis of the stand design is a sample in the form of a tube with a diameter of 10 mm and a length of 100 mm, mounted in a horizontal position on a tripod 4 (Fig. 1). One half of the surface of the specimen is coated with a known high emissivity 1 (soot was used), while the other half, whose emissivity is to be determined (surface 2), is left blank.

A heating element is installed inside the experimental sample, which is connected via a terminal connector to power supply 3. The power supply allows you to set different values of current and voltage on the heater, thus providing different temperatures on the sample surface in the required range.

The temperature of the sample under study is measured by thermocouples 5 and a thermal imager 9. The thermocouples are connected to the cold junction block and then through the switch 7 to the voltmeter 8. The thermal imager is installed at some distance from the sample, with its help the radiation temperatures of surfaces 1 and 2 are measured.

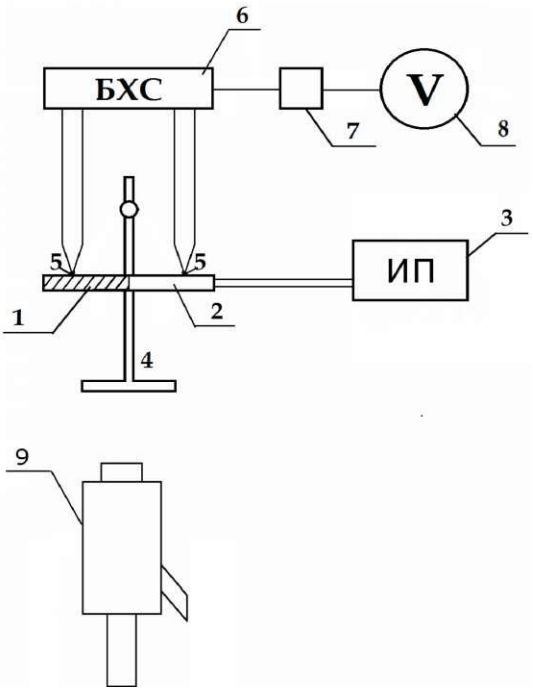


Figure 1. *Experimental stand for determining the degree of emissivity of zirconium tubes (1 - surface with a known degree of emissivity; 2 - surface under study; 3 - power supply; 4 - tripod; 5 - thermocouples; 6 - cold junction block; 7 - switch; 8 - millivoltmeter; 9 - thermal imager)*

The general view of the experimental setup is shown in fig. 2. To improve the accuracy of determining the degree of emissivity of the samples under study, the uniformity of the temperature field of the sample is important.

To reduce heat removal through the mounting parts of the installation and reduce the non-isothermality of the temperature field, the sample under study is fixed on a tripod 5 with the help of insulating thermocouple wires (Fig. 2).

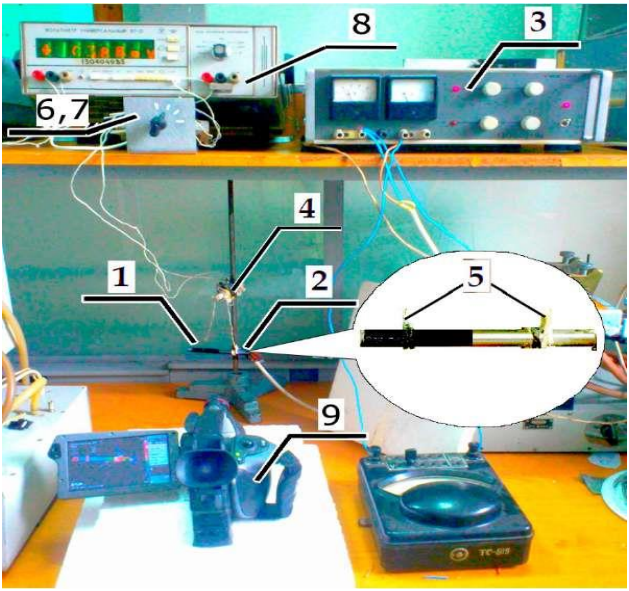
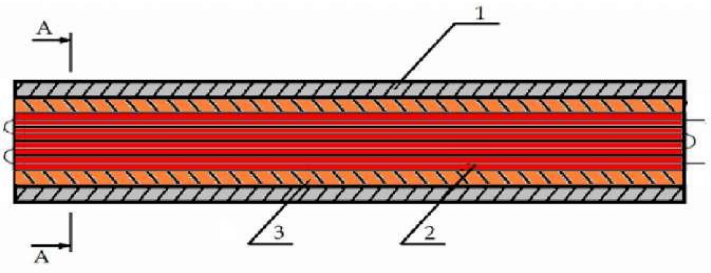


Figure 2. *General view of the experimental setup*

To equalize the temperature field on the test surface of sample 1, a copper hollow tube 3 is inserted into it so that the outer surface of the copper tube is in close contact with the inner surface of the zirconium tube along the entire length of the sample (Fig. 3). Several turns of the heater (nichrome wire) are evenly laid inside the copper tube. Ceramic tubes 2 are used to insulate electrically the heater coils



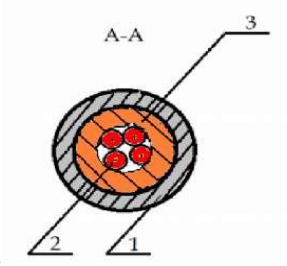


Figure 3. *Heating element sample (1 - test sample; 2 - nichrome heater in a ceramic tube; 3 - copper tube)*

In the course of work, after the onset of the stationary thermal regime of the test sample, the following parameters were recorded:

- readings of thermocouples fixed on the sample;
- ambient temperature;
- radiation temperatures of the studied and soot-covered sections of the sample, measured using the Flir SC620 thermal imager.

The radiation flux recorded by a thermal imager is the sum of the body's own radiation flux and the reflected radiation flux of third-party objects:

$$P_{meas} = P_{sob} + P_{otr} \quad (1)$$

Based on this, using the Stefan-Boltzmann law [3], expression (1) can be represented as:

$$\varepsilon_{meas}\sigma T_{meas}^4 = \varepsilon_{body}\sigma T_{body}^4 + (1-\varepsilon_{body})\sigma T_{otr}^4, \quad (2)$$

where T_{meas} – radiation temperature of the object, K; T_{body} - true temperature of the object, K; T_{otr} – ambient temperature, K; σ – Stefan-Boltzmann constant; ε_{meas} – the degree of emissivity specified in the settings of the non-contact temperature measuring instrument; ε_{body} – the desired degree of emissivity.

Then the degree of emissivity of the surface under study can be obtained from the relation:

$$\varepsilon_{body} = \frac{\varepsilon_{meas} T_{meas}^4 - T_{omp}^4}{T_{body}^4 - T_{omp}^4} \quad (3)$$

The thermogram of the observed sample as an example is shown on fig. 4. The radiation temperatures indicated on it were obtained by averaging the temperature over the observed area in the Flir QuikReporter 1.2 software supplied with the thermal imager.

T_{otr} can be taken equal to the ambient temperature of 25 °C, since the area of the experiment was limited from the impact of powerful heat sources.

T_{meas} is determined from the readings of the thermal imager (t_{ik1}) for a clean surface.

T_{body} is determined from the readings of the thermal imager (t_{ik2}) for a surface with soot (ε=1). Measurements are carried out under the condition that the object under study is isothermal (controlled by thermocouples) and the emissivity of the coating ε_{meas}. is correctly set in the settings of the thermal imager.

During the experiment, two types of tests were carried out:

1) Measurement of the degree of emissivity at temperatures from 100 °C to 500 °C (exposure of each point for 20 minutes) (Tables 1-3).

Table 1.

Sample No.1

U,V	E_1,mV	E_2,mV	t_{ik1}, °C	t_{ik2}, °C	E_{body}	$T_{бхс}$
9	5,12	5,29	37	97	0,13	25°C
14	11,8	12,5	63	200	0,11	25°C
19	21,2	20,3	95	285	0,12	25°C
24	24,6	25,8	105	330	0,10	25°C
32	32,2	34,4	175	430	0,14	25°C
35	37	38,3	222,6	495	0,15	25°C

Table 2.

Sample No.2

U,V	E_1,mV	E_2,mV	t_{ik1}, °C	t_{ik2}, °C	E_{body}	$T_{бхс}$
9	5,45	5,52	40	105	0,14	25°C
14	12,61	12,56	66,8	199	0,13	25°C
19	20,5	20,3	98,1	292	0,12	25°C
24	23,6	24,8	133,5	345	0,14	25°C
32	33,0	35,4	181,6	440	0,14	25°C
35	37,5	38,6	205	470	0,15	25°C

Table 3.

Sample No.3

U,V	E_1,mV	E_2,mV	t_{ik1}, °C	t_{ik2}, °C	E_{body}	$T_{бхс}$
9	6,12	6,4	40,6	110,2	0,13	27°C
14	12,56	12,61	58,4	193,6	0,11	27°C
19	18,45	20,15	80,6	274,9	0,1	27°C

24	23,0	25,6	108	331,5	0,11	27°C
32	33,39	35,08	179	438,5	0,14	27°C
35	34,7	36,9	206	454,2	0,16	27°C

2) Measurement of the degree of emissivity at a temperature of 350 °C for 36 hours. (Table 4).

Table 4.

Sample No.4

Time	**0,5 h**	**3 h**	**6 h**	**10 h**	**13 h**	**19 h**	**23 h**	**29 h**	**36 h**
E_1, mV	25,5	25,8	25,5	26,1	26,5	25,9	25,9	26,0	25,7
E_2, mV	24,15	25,16	24,4	24,2	24,3	23,6	23,3	23,6	23,7
t_{ik1}', °C	99,2	107	110	114	114	115	119,2	119	120
t_{ik2}', °C	318	320	340	340	344,3	337	341	340,5	336
E_{body}	0,1	0,1	0,1	0,11	0,11	0,12	0,12	0,12	0,13

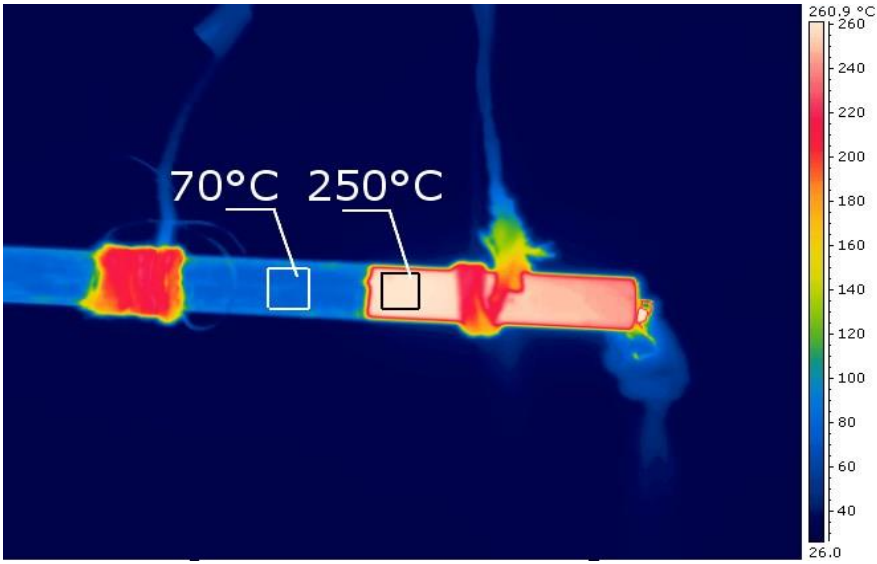


Figure 4. *Sample thermogram*

Analyzing the results of the measurements, it can be noted that with an increase in temperature, as well as with a long stay of the samples at an elevated temperature, the degree of emissivity of the samples increases due to the oxidation processes on their surface. The obtained research results formed the basis for calculating the thermal regime of fuel assemblies during the transportation of spent nuclear fuel from nuclear power plants.

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SYNERGETIC PROTECTION SYSTEM AGAINST COUNTERFEIT PACKAGED LIQUID PRODUCTS

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抽象的。 液体包装食品市场上存在假冒商品的部分原因是用于控制质量和安全参数的方法和手段效率低下。 因此，为了提高液体产品的质量控制效率和安全性，开发了一种快速方法，其本质是在包装阶段引入传感器盖，可以测量数量 在不破坏包装密封性的情况下对液体的电物理参数进行分析，从而形成所研究液体的“图像”，并将其与“标准图像”进行比较。

关键词：仿冒品，对比分析，传感器覆盖，移动综合体，产品形象，表达方式。

Abstract. *The presence of counterfeit goods on the market of liquid packaged food products is partly due to the low efficiency of the methods and means used to control quality and safety parameters. Therefore, in order to improve the efficiency of quality control and safety of liquid products, an express method was developed, the essence of which is that, with the introduction of a sensor-lid at the packaging stage, it becomes possible to measure a number of electrophysical parameters of the liquid without breaking the tightness of the package, and thereby form an "image" of the liquid under study and compare it with the "image of the standard".*

Keywords: *counterfeit, comparative analysis, sensor-cover, mobile complex, product image, express method.*

In accordance with the Decision of the State Commission for Combating Illicit Trafficking in Industrial Products [1], Roskachestvo, together with Rosaccreditation, Rospatent, Rosstandart and Rosselkhoznadzor, conducted an unprecedented study of the Russian market of bottled drinking water, including mineral canteen, medical and medical canteen. More than two hundred trademarks purchased in seven federal districts of the country (Central, NorthWestern, Volga, Southern, North Caucasus, Ural, Siberian) were investigated for quality, chemical safety and falsification [2]. The results of the inspection are alarming: for example, 59 brands

showed signs of counterfeit products; 6 brands had nitrates and nitrites in elevated concentrations, indicating problems with water treatment; residual chlorine was found in drinking water of natural origin of one brand, and in another (medical canteen) - an increased content of manganese. More than 40 brands of mineral water contained an indication of mineralization groups, but at the same time, being manufactured not according to the State standard, they misled the consumer [2], i.e., in fact, these brands do not have the declared therapeutic effect.

In addition, the methods and means currently used to control the quality and safety of bottled drinking water are ineffective and require additional non-production and time costs, such as removing the finished product from the places of sale, transportation, storage and laboratory testing [3], and the selective control method does not guarantee the quality of each product in the entire batch, which, in our opinion, requires a radical change in the policy of supervision and controls: it is necessary to develop and implement automated systems of continuous output control and effective express methods and means of input parameter control [3].

In this article we will talk about a fundamentally new approach to the implementation of the above tasks, in relation to liquid packaged food products (LPFP) using the method of comparative analysis and a portable automated complex (PAC) implementing it, protected by a patent of the Russian Federation [4], the use of which is potentially capable of completely eliminating the adulteration of bottled waters, as well as becoming an appropriate subsystem in the "National Food Quality Management System" [3].

As our research has shown, liquid packaged food products are sold in various containers (polymer, glass, etc.), filling into which, as a rule, is carried out by automated lines and installations, and their compliance and quality, in addition to determining the chemical composition, can be identified by density, kinematic and dynamic viscosity, freezing point and flash (self-ignition), alkaline and acid number, color, transparency and turbidity, dielectric permittivity, conductivity, characteristic oscillation frequency, etc. [3, 4]. Also, recently, ready-made solutions based on comparative analysis have become increasingly popular, i.e. using the method of comparing "images" (acoustic, electrical, mechanical, etc.) of the standard and the manufactured product, or/and finding relationships between various parameters, in particular, bottled water [5].

For example, the portable safety device "Latest 3.0", using the method of quasi-static electro-field tomography, makes it possible to assess the spatial distribution of the electrical properties of the medium and, thereby, determine the characteristics of the liquid in a closed non-metallic vessel without violating its tightness [6]. Potentials are induced on the measuring electrodes of the device, the magnitude of which depends on the voltage source, the distance between the active electrode and the measuring electrodes and the complex dielectric permit-

tivity of the medium, which, together with the conductivity, makes it possible to unambiguously assess its danger [6].

In addition to determining the dielectric properties of the medium, one of the most important positions is occupied by density meters, including ultrasonic density meters, since the density of a liquid determines such important indicators as the composition and properties of a substance. The principle of operation of the ultrasonic analyzer is based on the fact that ultrasonic vibrations are passed through the sample and ultrasound characteristics are recorded depending on the concentrations of substances in liquid media and the temperature of the sample, after which the closest dependence of the ultrasound propagation velocity on temperature is selected from a family of pre-established calibration dependencies and this velocity is calculated according to the formula [7, 8]:

$$V_i = k_i T_m + q_i,$$

where V_i is the velocity of ultrasound propagation for each dependence; T_m is the measured temperature of the liquid under study; k_i and q_i are constant coefficients for each liquid from the entire class, and the determination of absolute deviations by the formula:

$$\Delta V_i = |V_m - V_i|,$$

where ΔV_i is the absolute deviation of the ultrasound propagation velocity for each dependence; V_m is the measured ultrasound propagation velocity.

Further, the two smallest deviations ΔV_i and ΔV_{i+1} will determine the nearby dependencie V_1 (T) and V_2 (T) from the family of pre-established dependencies, and the recalculation of the ultrasound propagation velocity into the density of the liquid is performed according to the theoretically established dependence [8]:

$$\rho = \left(a_1 \frac{\Delta V_2}{\Delta V_1 + \Delta V_2} + a_2 \frac{\Delta V_1}{\Delta V_1 + \Delta V_2}\right) V_m + \left(b_1 \frac{\Delta V_2}{\Delta V_1 + \Delta V_2} + b_2 \frac{\Delta V_1}{\Delta V_1 + \Delta V_2}\right),$$

where a_1, a_2, b_1, b_2 are constant recalculation coefficients for two nearby dependencies V_1 (T) and V_2 (T); ΔV_i и ΔV_2 are absolute values of velocity deviations calculated from the previously established dependencies V_1 (T) and V_2 (T)

It is possible that the ULICOR can be modified for a non-contact method (without sampling) and these methods and means of comparative analysis are able to determine the type and density of the packaged liquid in a few seconds, without opening the container. At the same time, it is essential that they have high mobility, measurement accuracy, do not require highly qualified personnel, and, thanks to the presence of communication interfaces, they can exchange data with a computer.

However, to create a national quality assurance system for liquid packaged foods, determining only the type and density is not enough. It is necessary to form

a system of continuous output control at the manufacturing enterprise and input control at the places of sale of the product, which will be able to determine the quality parameters of liquid packaged foods. That is why the method of weight impedance electrometry (WIE) was developed and protected by the patent of the Russian Federation for the invention [3, 4].

The essence of the method of weight impedance electrometry lies in the fact that, with the introduction of a sensor-lid at the stage of packing, it becomes possible to measure the electrophysical parameters of the liquid (density, conductivity, dielectric permittivity, characteristic frequency, etc.) without breaking the tightness of the package, i.e. to determine the "image" of the liquid under study, compare it with the "image of the standard" and calculate the similarity criteria (electrodynamic, electromagnetic, dielectric, electro-inductive and electric capacity) [3, 4].

To implement such a comparative analysis of liquid packaged foods, a portable automated complex (PAC) was developed, the block diagram of which is shown in figure 1.

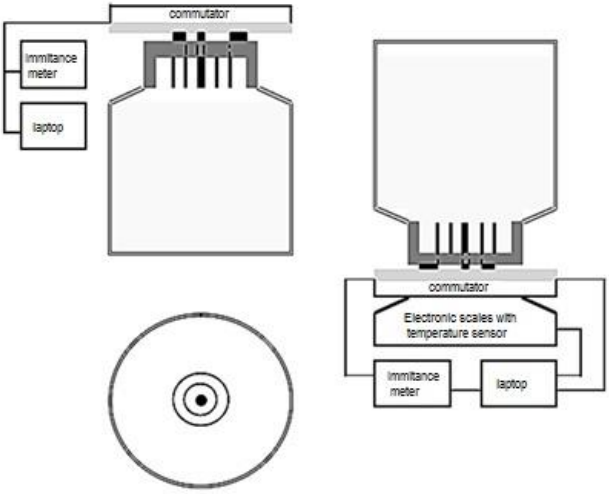

Figure 1. *Block diagram of the PAC*

The installation for the implementation of the express analysis method consists of a laptop with connection to it via the appropriate interfaces of electronic scales and an E7-25 immitance meter (frequency range from 1 Hz to 1 MHz) [9], which is connected to a contact platform, for connection to a lid sensor that clogs PET containers where water is packaged, and with the help of appropriate software

controlled by a laptop, performing liquid identification and determination of its quality within ten seconds, by comparing the measured and calculated parameters with the entered/stored in memory parameters of the standards. At the same time, the stationary automated continuous monitoring complex of the water manufacturer has the same structure, except for the use of the E7-29 immitance meter, which has a range from 50 kHz to 15 MHz [10], which allows determining the characteristic frequency of the liquid under study [11], by measuring the electrical conductivity of the liquid for two different temperatures in the range from boiling point to freezing point (Fig.2), thanks to the design of the sensor-cover (Fig. 3), which allows heating of the test liquid inside a sealed package.

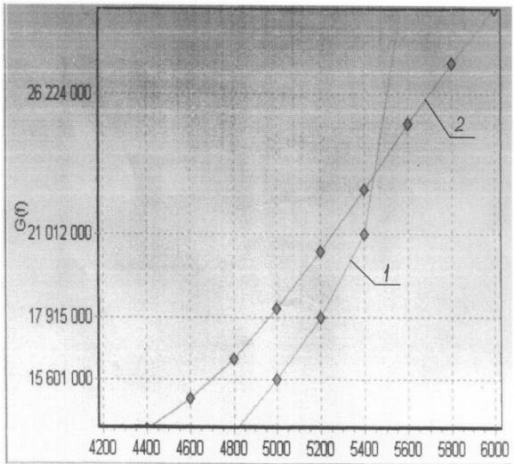

Figure 2. *Conductivity of tap water from the frequency of electromagnetic oscillations*

Further, under computer control, an immitance meter connected to the lid sensor measures first the parameters of the gas medium inside the container, and after the bottle is turned over, the liquid parameters: capacitances (Cp), resistances (Rp), electrical conductivity (Gp), tangents of loss angles (tgδ) and leakage currents (I) at fixed frequencies [10].

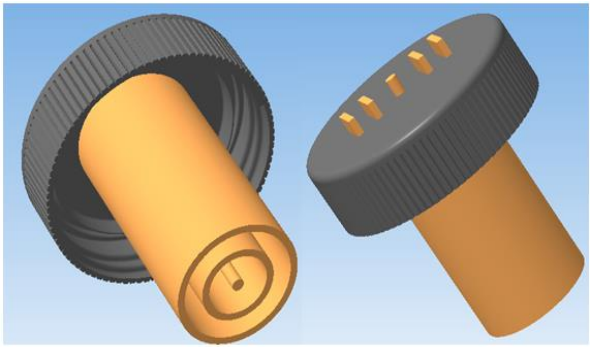

Figure 3. *3D model of the prototype sensor-cover.*

In this case, the obtained data form spectra of values that are used for the subsequent calculation of the relative permittivity (ε) according to formula (1), macroscopic relaxation time (τ) according to formula (2), molecular relaxation time (τ_μ) according to formula (3), dynamic viscosity (η_0) according to formula (4) [3, 4]:

$$\varepsilon = C_m / C_0, \tag{1}$$

$$\tau_{1,2} = \frac{\varepsilon - 1}{4\pi f \operatorname{tg} \delta} \pm \sqrt{\frac{(\varepsilon - 1)^2}{16 f^2 \pi^2 \operatorname{tg}^2 \delta} - \frac{\varepsilon}{4\pi^2 f^2}}, \tag{2}$$

$$\tau = \frac{3\varepsilon\tau_\mu}{2\varepsilon + 1}, \tag{3}$$

$$\eta_0 = {}^{\tau_\mu \eta_э}/_{\tau_э}, \tag{4}$$

where C_0 is the capacity of the sensor in the gas medium, pF; C_m is the capacity of the sensor in the liquid, pF; f is the frequency, Hz; $\eta_э$ and $\tau\_э$ are tabular data of the gas medium loaded into the computer.

And, thanks to the data from the temperature sensor and electronic scales, the density (ρ) and kinematic viscosity (ν) of bottled water are calculated according to the following formulas [3, 4]:

$$\rho(t) = \rho_{20°C} - \Delta t \cdot (t - 20°C), \tag{5}$$

$$\nu = \eta_0 / \rho(t) \tag{6}$$

where $\rho_{20°C}$ is the density of the liquid at 20°C, kg/m^3; Δt =(18,31-13,233·$\rho_{20°C}$)· · 10^{-4} – temperature correction to density by one degree; t – current temperature, °C.

The kinematic viscosity of drinking water (ν) packaged in a container varies depending on temperature, and it is also calculated using Walter's formulas [3, 4]:

$$\lg\lg(\nu + 0.8) = a + b\lg T, \tag{7}$$

$$a = \lg\lg(\nu + 0.8) - b\lg T_1, \tag{8}$$

$$b = \frac{\lg[\lg(\nu_1 + 0.8)/\lg(\nu_2 + 0.8)]}{\lg\frac{T_1}{T_2}}, \tag{9}$$

where a and b are empirical coefficients; T_1 and T_2 are the standard temperature of liquid and viscous media.

To identify liquid and viscous products by solidification temperature, the Walter formulas are used, with a kinematic viscosity value of 10000 mm²/s [3, 4]:

$$\lg\lg(10000 + 0.8) = a + b\lg T \rightarrow T = 10^{\left[\frac{\lg(10000+0.8)-a}{b}\right]} \tag{10}$$

Accordingly, in order to verify the readings of the stationary automated complex (SAC), a portable safety device "LQtest 3.0" and an ultrasonic density meter ULICOR "Clover-2M" will be used in this study. A summary table of the measured parameters is given in Table 2.

The determination of the characteristic frequency in the PAC will be carried out by calculating the approximating formulas for the frequency of 1 MHz in the event that the remaining parameters of the "image" will have a significant variance. A summary table of the "image" of water is given in Table 1.

Table 1

№	Name of the parameter	Designation	Dimension	Range of variation
1	Product weight	m	kg	0,25 - 20
2	Product scope	V	m^3	$(0,25 – 20) \cdot 10^{-3}$
3	Product density	ρ	kg/m^3	990-1000
4	Electrical conductivity	G	S	0,000001-0,2
5	Resistance	R	Ω	$5 - 10^6$
6	Leakage current	I	A	10^{-6}-0,2
7	Capacity (with a capacitive sensor)	C	pF	$10^{-3} - 10^{12}$
8	Inductance (at induct. sensor)	L	nH	30 - 120
9	Temperature	T	°C	1 - 50
10	Measuring equipment	tgδ	-	10^{-6}-5^{-3}
11	Specific electrical conductivity	σ	mkS/cm	50-1500
12	Magnetic permeability	μ	H/m	$(8 – 9) \cdot 10^6$
13	Complex resistance module	|Z|	Ω	900 - 9500

14	The shear angle of the complex resistance.	φ	°	minus 180°- plus 180°
15	Kinematic viscosity	ν	m^2/s	$(0,3 – 1,8)\cdot10^{-6}$
16	Dynamic viscosity	η	$N\cdot s/m^2$	$(0,3 – 1,8)\cdot10^{-3}$
17	Frequency	f	Hz	$10 - 10^6$
18	Dielectric constant	ε	-	60-90
19	Characteristic frequency	F_x	kHz	2500-5450

The presence of counterfeit goods on the market of liquid packaged products is partly due to the low efficiency of the methods and means used to control quality and safety parameters. The development and implementation of express methods of comparative analysis and automated systems of continuous output and input control is potentially capable of completely eliminating the adulteration of Liquid packaged food products, bottled water in particular, and thus becoming an appropriate subsystem in the "National Food Quality Management System".

To carry out express diagnostics of liquid packaged food products, without opening containers and sampling, it is necessary, firstly, the introduction of sensor-covers at the packaging stage, secondly, the formation of a unified database of "images" of standards using manufacturers' data, thirdly, the organization of appropriate subsystems (manufacturers, trade enterprises and state supervision bodies).

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确保 AK-50T1 飞机压缩机的可维护性
ENSURING THE MAINTAINABILITY OF THE AK-50T1 AIRCRAFT COMPRESSOR

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抽象的。 本文考虑了保持 AK-50T1 飞机压缩机的可维护性问题。
关键词：AK-50T1，轴承，组合轴承，增加使用寿命。

Abstract. *The paper considers the issue of maintaining the maintainability of the AK-50T1 aircraft compressor.*

Keywords: *AK-50T1, bearing, combined bearing, increasing the operating life.*

In aviation, various units and products are used. They differ both in their purpose and in the technology of production and manufacture. One of these units is an aircraft compressor designed to pump air pressure for a pneumatic system.

This unit has found wide application in the military industry from ground transport to the most complex aviation equipment. The only difference is that it is used in various modifications with the same circuit diagram.

I took the Aircraft compressor (in the open marking AK-50T1) for consideration, analysis of structural problems.

The unit is an aircraft air compressor and is designed to compress air used in the maintenance of various pneumatic devices.

The compressor has established itself as a reliable and unpretentious compressor, which is prepared for service by means of a mechanical transmission. Its lubrication is carried out by supplying oil under pressure from the unit on which the compressor stands. The oil is drained through a special drain hole, thus showing a closed lubrication system.

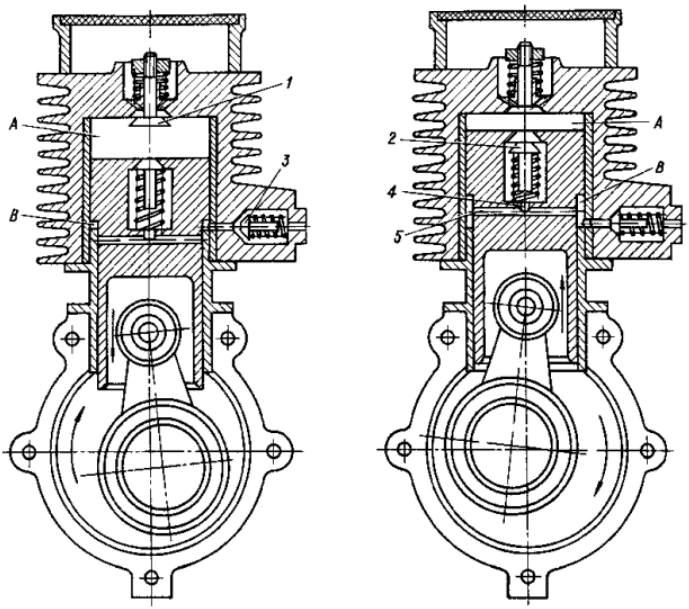
AK-50T1 (Fig. 1) consists of the following main units: crankcase, eccentric roller, connecting rod, piston with rings, first stage cylinder, second stage cylinder and air filter.

The scheme of compressor operation is as follows. The rotation of the eccentric roller causes the piston to reciprocate. When the piston moves down, the vol-

ume of chamber “A” of the first stage cylinder increases and a vacuum is created in it, as a result of which the suction valve (1) opens and air is sucked into the first stage cylinder from the atmosphere through the felt filter. At this time, the volume of chamber "B" of the second stage cylinder decreases and the pre-compressed air in the chamber is compressed. The compressed air in chamber "B" opens the pressure valve (3) and flows into the cylinder.

When the piston moves upwards, the volume of chamber "A" decreases, and the air that enters it is compressed, it increases into the volume of chamber "B" and a vacuum is created in it.

Under the influence of the pressure difference in chambers "A" and "B", the bypass valve (2) opens, and the air compressed in chamber "A" of the first stage cylinder enters chamber "B" through channels (4) and (5) in the piston second stage cylinder. With the subsequent downward movement of the piston, the bypass valve closes and again the air is compressed in chamber "B" of the second stage cylinder and forced through the air duct into the cylinder.



A - Cavity of the first stage; B - cavity of the second stage;

1- Suction valve; 2- Bypass valve; 3- Delivery valve; 4-Channel for supplying air to the second stage; 5- Channel for supplying air to the second stage.

Figure 1. *Scheme of the AK-50T1 aircraft compressor*

With long-term use of the unit, piston seizure in the compressor sleeve is possible. To avoid such situations, the manufacturer has set restrictions on use over a certain operating time, after which it should be sent for repair.

If the compressor piston is seized, the compressor eccentric shaft splined to the parent unit will break the bearing with O-ring on the parent unit. As a result, the lubrication system is depressurized, which is under high pressure. Due to the depressurization of the system, oil enters the compressor at high speed which is unable to withstand such pressure begins to pass the lubricating fluid into the outside. After a chain of these incidents, the lubrication fluid starvation occurs at the parent unit, after the failure (seizure occurs).

The reason why the compressor piston is stuck lies in the needle bearing, which is located at the junction of the eccentric roller and connecting rod.

More precisely, the reason is not in the bearing itself, but in the assembly technology of the unit.

The outer ring of the bearing (or, as they are also called, the cages) has a groove on the working surface - a rolling track, along which the rolling elements roll. The shape of the rings of rolling bearings determines the angle of contact of the rolling elements with the raceway and, accordingly, affects the value of the axial or radial load capacity of the bearing.

The distribution of the radial load between the rolling elements located in the loaded zone (limited by an arc of no more than 180˚) is uneven due to contact deformations of the rings and various rolling elements. The size of the loading zone and the uneven distribution of the load are influenced by the size of the radial clearance in the bearing and the rigidity of the housing.

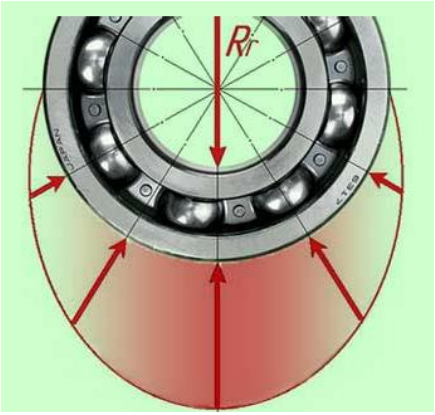


Figure 2. *Scheme of the distribution of the radial load between the rolling elements in the bearing*

Such loading occurs when the outer ring of the bearing does not rotate with respect to the load. This problem can be avoided during the build process, i.e. making changes to the process.

Let's choose a fit for the bearing. We know that we are running out on the outer ring, to avoid this phenomenon, a transitional landing is necessary. At which a uniform load is ensured in the process of work, respectively, and a uniform output. It provides us with radial runout of the eccentric shaft and axial runout of the compressor piston, which prevents mechanical damage to the compressor liners and, accordingly, prevents the piston from seizure in the compressor.

But knowing that several loads will act in the node we have taken. Therefore, it is proposed to develop new landing dimensions on the connecting rod and eccentric roller.

Next, consider the well-known types of bearings. They offer a huge variety. But all bearings have both strengths and weaknesses to carry loads. Therefore, one of the available bearing options is suitable for us i.e. these are combined bearings.

Combined bearings (fig. 3) consist of rings, two or more sets of rolling elements moving along the tracks and cages that fix these bodies in the working position. Manufacturers also produce such bearings with sealing elements, protected from external negative factors such as dirt, dust, moisture. The sealing washers also keep grease inside the mount and allow for less or no maintenance.

Figure 3. *Combined bearing*

There are many variations of combined bearings, among which the most common are:

- Needle radial with roller thrust;
- Needle radial with ball thrust;
- Needle radial with angular contact ball;
- Needle radial with four-point ball;
- Radial roller cylindrical with angular contact conical.

Combined bearings are not only reliable and durable, but also take up less space in the mechanism than separate rolling bearings of different types. It also greatly simplifies and accelerates the installation of such supports in the conditions of existing production. That is why many manufacturers of equipment have switched to using these parts, instead of specialized ones.

Advantages of combined bearings:

- ability to withstand heavy loads of various types;
- ease of installation (using a welding bolt);
- interchangeability of constituent elements;
- long term of use;
- Availability of reliable guide profiles for constant and variable capacities.

A combination bearing with needle and ball bearing rolling elements is suitable for our task. This combination of two types of rolling elements is considered optimal in terms of loads and destination (Fig. 4).

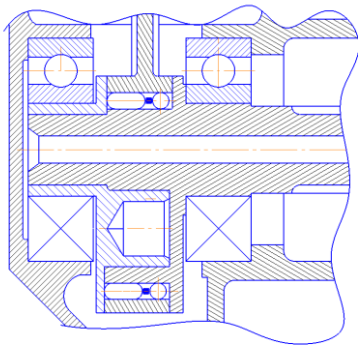


Figure 4. *Local cut at the place of bearing replacement*

This version of the bearing allows you to withstand greater loads than with the previous version. Frictional losses from the added rolling elements can be neglected, since they are negligible due to abundant lubrication.

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用改性吸附剂从污水污泥和锯末中生物修复土壤

BIOREMEDIATION OF SOILS WITH A MODIFIED SORBENT FROM SEWAGE SLUDGE AND SAWDUST

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抽象的。 研究了来自污水污泥和木材废料的生物吸附剂对草甘膦土壤修复的影响。 用改性生物吸附剂处理后，土壤中除草剂的浓度降低了 5 倍。 用生物吸附剂处理土壤有助于激活土壤微生物群。 在 SS 和锯末的组合吸附剂的土壤中，土壤微生物群落的最大生长被注意到。 除草剂处理15天后，微生物数量增加13.5倍。

关键词：生物吸附剂，土壤修复，污水污泥，除草剂。

Abstract. *The effect of biosorbents from sewage sludge and wood waste on soil remediation from glyphosate was studied. The concentration of herbicide in the soil after treatment with a modified biosorbent is reduced 5 times faster. Soil treatment with biosorbents contributed to the activation of soil microbiota. The maximum growth of soil microflora was noted in the soil with a combined sorbent of SS and sawdust. 15 days after herbicide treatment, the number of microorganisms increased by 13.5 times.*

Keywords: *biosorbent, soil remediation, sewage sludge, herbicides.*

Currently, glyphosate-based herbicides occupy a leading position and are considered champions among herbicides in terms of mass application. There is conflicting evidence about the dangers of glyphosate. Some note that glyphosate-based herbicides have a negative impact on soil fertility. The active use of the herbicide led to serious negative changes in the soil microbiome. The substance destroys beneficial microorganisms that form humus. As a result of the use of glyphosate, the absorption of iron chelates by plants is disrupted, they accumulate

in the upper soil layer, and this contributes to the development of erosion [1]. When plants are treated with preparations based on glyphosate, the susceptibility of weakened plants to pests increases significantly; the germination of plants decreases with a significant accumulation of herbicide residues, the decomposition of glyphosate occurs with the stimulation of the growth of pathogenic mold fungi of the Fusarium genus. [2].

According to GreenMedinfo.com, glyphosate is responsible for some serious diseases: infertility in women and low testosterone in men; congenital genetic anomalies of various kinds (dwarfism, albinism, dementia, etc.); hormonal failure in children at puberty; susceptibility to meningitis [1].

At the same time, the European Chemicals Agency, on the contrary, found that glyphosate is not a carcinogen and mutagenic substance. The active substance has low toxicity for animals and humans. But the herbicide harms plants and is more dangerous than other pesticides for soil microflora [3].

To reduce the negative effects of the herbicide on the soil, it is necessary to carry out regular soil remediation. However, the problems of soil restoration from herbicides on a large scale are practically not addressed. For these purposes, biotechnologies may be the most appropriate. Therefore, the use of new generation sorbents (biosorbents) is promising and environmentally justified. Numerous scientific works[4,5] show the positive effect of biosorbents on soil processes and humus formation.

In Russia, more than 1.3 million tons of sewage sludge is produced annually. In connection with their classification as waste of IV and V hazard classes according to the Federal Classification Catalog of Waste, approved by the Order of Rosprirodnadzor dated 22.05.2017 № 242, there are big problems in the disposal of such waste. Enterprises are required to fulfill many environmental and sanitary and epidemiological requirements: to obtain permits (licenses, passports), submit reports, pay for the negative impact on the environment during their placement, etc. [6].

But subject to certain requirements, users of natural resources can attribute them to products and avoid complex procedures for obtaining permits. One of these conditions includes: the use of sewage sludge in one's own production process as fertilizer, soil or selling it for the same purposes to others.

At the same time, the resulting waste from the timber industry has recently been actively used as biofuel. But most manufacturers of such a product are oriented towards the West. About 90% - sent to Europe. Only 5% is sold on the domestic market. The reason for this imbalance is the lack of effective technologies and established traditions among the population. However, in 2019, biofuel from wood waste was not included in the list of high-tech products, the export of which was supported by the Russian government [7]. Delivery of such a product abroad becomes unprofitable, as the cost of delivery rises sharply.

Based on the above, the aim of the study was to create a modified biosorbent from sewage sludge and wood waste.

The objects of the study were sewage sludge from the Levoberezhny Voronezh treatment facilities, sawdust 2-5 mm in size. Sewage sludge (humidity 90-95%) and sawdust in a ratio of 3:1 were loaded into a steel retort, placed in an autoclave and kept at a pressure of 2 MPa and a temperature of 180-200°C for 4 hours. Upon completion of the process, the autoclave was cooled to room temperature and the modified biosorbent was unloaded.

The influence of the obtained biosorbent on the soil microflora was carried out on model soil samples. For this, we used leached low-humus medium-thick medium-loamy chernozem with a pH of 6.0–6.2, a humus content of 4.3–5.0%, and a total moisture capacity (TMC) of 30%. Soil samples were taken in the field from a depth of 0-15 cm, sieved through a sieve (3 mm) and moistened to 60%. 0.5 kg of soil samples were placed in plastic containers and an aqueous suspension of the herbicide was added at the recommended dose. "Agrokiller" was used as a preparation containing glyphosate. Biosorbents were applied in the amount of 5% by weight of the soil. The treated soil samples were placed in a thermostat and kept at 26°C. The concentration of glyphosate was determined by liquid chromatography. The total number of microorganisms was determined on meat-peptone agar (MPA) after 15, 30 and 60 days.

The chemical composition of biosorbents is presented in tab. 1. Organic matter was determined according to GOST 27980-88 "Organic fertilizers. Methods for determination of organic matter" thermogravimetrically. Total nitrogen was determined according to GOST 26715-85 "Organic fertilizers. Methods for determination of total nitrogen". Carbon - on the elemental analyzer "Elementar Vario Macro Cube".

Table 1.

Chemical composition of biosorbents

Indicators	Sawdust	SS	Sawdust + SS
Organic matter,%	70.2	83.02	85.8
Total nitrogen, %	0.03	4.50	4.52
Carbon,%	47.3	86.5	87.8

The introduction of various modifications of the biosorbent unequally affected the rate of degradation of the herbicide in the soil (tab. 2).

Table 2.

The rate of decomposition of the herbicide in the soil

Option	Decomposition time, days	
	To 50 %	To 90 %
Control	25	90
SS	12	23
Sawdust	15	26
SS + sawdust	7	18

The best results on the decomposition of the herbicide in the soil were noted with the use of a combined biosorbent from SS and sawdust. After 7 days, its content in the soil decreased by 2 times from the initial concentration, which is 72% faster than in the soil without the use of a sorbent. It should be noted that the introduction of any of the sorbents used in the experiment had a positive effect on reducing the herbicide concentration in the soil.

Thus, when using a bioproduct from SS, the decrease in the concentration of herbicide in the soil to 50% occurred 2 times faster than in the control sample. Biosorbent from sawdust showed lower results. The decrease in the concentration of herbicide in the soil was 12% lower than when treated with a combined biosorbent. But in comparison with the control, the content of the herbicide decreased 1.7 times more intensively.

The same dynamics persisted with further exposure to biosorbents. The decrease in the content of the herbicide in the soil up to 10% when using the combined bioproduct was achieved after 18 days, which was 5 times higher than the control. The decrease in the herbicide concentration to 10% when treated with a sorbent from SS proceeded almost 4 times more intensively, from sawdust - 3.5 times faster in comparison with the control experiment.

Microbiological analyzes of soil samples showed that soil treatment with biosorbents contributed to the activation of soil microbiota, despite the negative aftereffect of the herbicide (tab. 3). The maximum growth of soil microflora was noted in the soil with a combined sorbent of SS and sawdust. At 15 days after the herbicide treatment, the number of microorganisms increased by 13.5 times in the samples with SS and sawdust in comparison with the soil exposed to glyphosate. The sharp activation of the soil microbiota is explained by the positive effect of the sorbent on the decrease in the herbicide concentration.

Table 3.

Changes in soil microflora after treatment with biosorbents

Option	The number of microorganisms in 1g. of soil, mln.		
	15 days	**30 days**	**60 days**
Soil without herbicide treatment	10.3	10.5	14.2
Soil after herbicide treatment	0.8	4.0	6.7
Soil after herbicide treatment + SS	8.6	12.9	14.0
Soil after herbicide treatment + sawdust	5.7	6.8	8.8
Soil after herbicide treatment + (SS+ sawdust)	10.8	13.8	14.8

Particularly active reproduction of microorganisms was observed 2 months later in all experiments after soil treatment from the herbicide with sorbents. Their number increased by an average of 1.5 times 45 days after contact with biosorbents.

An ecologically safe method for bioremediation of polluted soils has been proposed. The conducted studies have shown that the use of biosorbents from sewage sludge and wood waste stimulates the vital activity of soil microorganisms, enhances the biodegradability of the herbicide in the soil.

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俄罗斯南部退化的牧场及其恢复方式
DEGRADED PASTURES IN THE SOUTH OF RUSSIA AND WAYS OF THEIR RESTORATION

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抽象的。天然草原的退化是俄罗斯南部面临的一个严峻问题。这个问题对于卡尔梅克共和国的领土来说尤其紧迫，那里超过 70% 的牧场都在退化。这些领土是由于不受控制的放牧和单位面积数量的增加而形成的。由于经济活动不受控制，天然牧场在自然和人为因素的影响下失去了物种多样性，开始变成沙漠。本文介绍了通过使用来自高度适应的草品种的各种倾倒和未倾倒的耕作和草混合物进行彻底改善来恢复天然牧场的结果。已经确定，由黄苜蓿、阔耳小麦草、灯芯草和灰榻草组成的四组分草混合物播种的三高翻耕变种形成了牧场的最高产量。在 solonetz 上这种耕作和草混合物的组合，产量为 1.07 吨/公顷，在轻栗色土壤上 - 1.33 吨/公顷。

关键词：天然牧场，卡尔梅克共和国，草混合物，耕作，彻底改良。

Abstract. *The degradation of natural grasslands is an acute problem for the south of Russia. This problem is especially urgent for the territories of the Republic of Kalmykia, where over 70% of pastures are subject to degradation. These territories were formed as a result of uncontrolled grazing and an increase in its number per unit area. As a result of uncontrolled economic activity, natural pastures lost their species diversity under the influence of natural and anthropogenic factors and began to turn into deserts. The article presents the results of the restoration of natural pastures through their radical improvement using various dumped and undumped tillage and grass mixtures from highly adapted grass varieties. It has been established that the highest yield of pastures is formed on the variants of three-high ploughing with the sowing of a four-component grass mixture consisting of yellow alfalfa, broad-eared wheatgrass, rushwort and gray couch grass. On this combination of tillage and grass mixture on solonetz, the yield is 1.07 t/ha, and on light chestnut soil - 1.33 t/ha.*

Keywords: *natural pastures, Republic of Kalmykia, grass mixtures, tillage, radical improvement.*

Introduction

One of the main global problems of the modern world is land degradation and desertification, which leads to environmental, social and economic problems, such as hunger and migration [1]. Drylands today occupy over 41% of the planet's territory, which is home to over two billion people. Most of these lands are degrading, mainly due to human activity, which can ultimately lead to a complete loss of their biodiversity and productivity by these territories - to desertification [2].

In Russia, the most significant losses in the productivity of agricultural land are in the Southern Federal District. Republic of Kalmykia, Rostov, Volgograd and Astrakhan Oblasts are potentially dangerous in these territories, as well as certain areas of Stavropol, Krasnodar Krai, Dagestan, etc. [3].

On pastures in Kalmykia and the Astrakhan Oblasts, degradation of the vegetation cover was noted over an area of over 60 thousand square kilometers. At the same time, in Kalmykia, the processes of degradation and desertification of natural grasslands are the greatest. According to a number of scientists, the first man-made desert in Europe was created here for the first time [4-6].

For these territories, the restoration of the productivity of natural pastures is the main most urgent task that can be solved, including using methods of radical improvement.

The purpose of the study was to assess the impact of various methods of basic cultivation of light chestnut soils in combination with solonets soils in the radical improvement of natural pastures in the dry steppe zone of Kalmykia.

Material and research methods

The experiments were laid according to generally accepted methods in the western natural and agricultural zone of the Republic of Kalmykia.

In the experiment, 2, 3 and 4-component grass mixtures (Factor A) were studied, which were placed on various tillage (Factor B) dumped - PN-4-35 (control), PTN-3-40A, PPN- 50, undumped - BDT-3.0 (control), KPG-2-150, PCh-4.5, plow with SRIME stilts.

The experiment was repeated three times, the plot area was 250 m^2, the accounting area was 25 m2.

The study was carried out on 2 types of soils: 1) light chestnut with spots of solonetzes, medium loamy with phosphorus content - 0.93 ... 2.7 mg/100 g of soil, potassium - 26.5 ... 40.1 mg/100 g of soil and humus 1.45…1.70%. 2) light loamy solonetz, with a predominance of calcium in the composition of absorbed bases - 10.7 ... 11.4 mmol-eq/100 g of soil, exchangeable sodium - 14.3 ... .40…1.67%

In terms of climate, this area is characterized by a sharply continental climate.

Here, summers are predominantly hot and very dry, and winters with little snow, often with great coldness. The duration of the warm period is 240…275 days. Average air temperatures in the summer months reach +23.5…+25.5 °C, and on some days up to +40.0…+44.0 °C. At the same time, in winter, the average air temperatures are -7.0 ... -12.0 °C, on some days up to -35.0 ... -40.0 °C. The number of sunny days per year is 280. Droughts and dry winds are frequent in this area, which can last up to 120 days a year. The amount of precipitation per year does not exceed 210...340 mm [7-8].

Research results and discussion

As a result, it was found that the methods of basic processing have a significant impact on the physical, water-physical and chemical properties of the studied soils.

Evaluation of soil blockiness after carrying out various treatments showed that after plowing a natural pasture in order to radically improve it, the largest area under the blocks was in the variants with dumped tillage with PTN-3-40A and PPN-50 implements - 8910 ... 9350 cm^2/m^2 on solonetz and 7240…7400 cm^2/m^2 on light-chestnut soil, the smallest number of clumps on control PN-4-35 was 7690 and 6550 cm^2/m^2, respectively. During the main tillage with undumped implements, the soil surface was even more blocky. The largest area under blocks on solonetzes was noted in the variant with flat-cutting treatment KPG-2-150 (h=0.25-0.27 m) - 9980 cm^2/m^2 on solonetzes and 8350 cm^2/m^2 on light chestnut soils. The best option was also the BDT-3.0 control, where the area of the blocks did not exceed 540 cm^2/m^2 on solonetz and 380 cm^2/m^2 on light chestnut soil.

Measurements of soil hardness and the dynamics of its change during the life of perennial grasses showed that the most effective is soil tillage PTN-3-40A. In this variant, as can be seen from the table, both solonetze and light chestnut soil had the lowest indicators, which did not exceed 29.9 kg/cm^2 even by the fourth year of grass life.

Table.

Soil resistance to compression, depending on the options for experience, kg/cm^2

Tillage and life span of perennial grasses		**solonetz**	**light chestnut soil**
Virgin soil (before processing)		38,4	33,6
Dumped processings			
PN-4-35 (h=0.20-0.22 m)	direct action	31,7	31,9
	2 year of aftereffect	37,4	34,4
	4 year of aftereffect	36,9	35,3

PTN-3-40A (h= 0.40-0.42 m)	direct action	20,6	18,5
	2 year of aftereffect	27,7	26,8
	4 year of aftereffect	29,9	28,6
PPN-50 (h=0.40-0.42 m)	direct action	22,9	20,0
	2 year of aftereffect	29,6	28,7
	4 year of aftereffect	31,0	29,3
Undumped processings			
BDT-3.0 (h=0.15-0.20 m) - control	direct action	37,1	30,7
	2 year of aftereffect	39,7	33,2
	4 year of aftereffect	40,6	34,6
KPG-2-150 (h=0.25-0.27 m)	direct action	30,6	28,6
	2 year of aftereffect	34,6	30,4
	4 year of aftereffect	37,2	32,0
PCh-4.5 (h=0.25-0.27 m)	direct action	27,3	25,5
	2 year of aftereffect	33,2	30,5
	4 year of aftereffect	36,1	30,5
Plow with SRIME stilts (h=0.25-0.27 m)	direct action	29,4	28,4
	2 year of aftereffect	36,2	30,9
	4 year of aftereffect	38,7	28,9

As can be seen from the table, in contrast to deep dumped tillage, the hardness of the studied layers of solonetz and light chestnut soils in the direct action and aftereffect of undumped tillage was significantly greater. The best among the variants with undumped tillage was the variant PCh-4.5.

Also, the studied methods of basic cultivation had a significant effect on the density and porosity of the soil, which determine such important conditions for plant growth as the air capacity of the root layer, water-holding capacity and water permeability. Here, the advantage of deep dumped treatments also has been established.

The density of the seed layer of soil (0-0.10 m) had an optimal level in direct action on the PTN-3-40A variant both on solonetz - 1.17 g/cm^3, and on zonal light chestnut soil - 1.14 g/cm^3. Similar indicators were noted on the PPN-50 variant - 1.20 and 1.17 g/cm^3, with a density on virgin soil of 1.41...1.38 g/cm^3. By the fourth year of life of perennial grasses, the soil density on the PTN-3-40A variant increased on the solonetz in the 0-0.30 m layer to 1.22-1.32 g/cm^3 and to 1.17-1.32 g/cm3 per light chestnut soil. Optimum parameters of porosity were noted on the PTN-3-40A variant only in a layer of 0-0.10 m in direct action.

Variants with tillage with dumped implements were much inferior to dumped tillage in terms of soil density and porosity. The optimal values of these indicators were not achieved.

Studies of the dynamics of water-resistant aggregates under the influence of dumped plowing of light chestnut soil showed that in the direct action and after-effect of treatments, an increase in the amount of determined soil fractions occurs. On the zonal light chestnut soil, in all variants of the experiment, the indicators of water-stable aggregates were higher than on the solonetz.

The largest number of water-stable aggregates (particles larger than 0.25 mm) in direct action on solonetz and zonal soil was noted in the variant with PTN-3-40A (h = 0.40-0.42 m), and with undumped tillage in the variant with PCh-4.5 (h=0.25-0.27 m).

The assessment of water-physical properties showed that the highest water permeability in total for four hours of observations on solonetz in the direct action of plowing was on the PTN-3-40A variant - 4.74 mm, on light chestnut soil - 1.55 mm. Close indicators - 4.61 mm and 0.78 mm were on the PPN-50 variant and significantly lower - 3.64 mm and 4.27 mm on conventional dumped plowing.

Under the influence of various basic tillage and perennial grasses, the chemical properties of the studied soils also changed. In the variants with conventional dumped plowing, in the 4th year of life of perennial grasses, there was a slight decrease in the exchange-absorbed sodium, which is explained by the ameliorative effect of the grass root system. That is, their phytomeliorative influence took place. On three-layer and plantation plowing, these processes were expressed especially clearly, which manifested itself in a significant decrease in the sodium content in the soil-absorbing complex, both in direct action and after-effect of plowing. As a result, over a four-year period, the content of exchange-absorbed sodium in the solonetz horizon itself decreased from 17.1 (virgin soil) to 11.9% in the fourth year after the three-level plowing.

In the variants with undumped tillage, the dynamics of the exchange-absorbed sodium was insignificant, which is connected to a greater extent not with the effect of treatments, but with the phytomeliorative role of perennial grasses.

Ultimately, the main indicator of ongoing measures to improve natural pastures is the yield of growing grass mixtures. The accounting of the yield of the air-dry mass of grasses showed that various tillages have a significant impact on their productivity. The highest yield was observed on variants with deep dumped plowing, primarily on the PTN-3-40A variant - 0.74 ... 1.07 t/ha on solonetz and 1.15 ... 1.33 t/ha on light chestnut soil. The yield was slightly lower in the variant with PPN-50 - 0.66 ... 1.02 t/ha on solonetz and 1.12 ... 1.29 t/ha on light chestnut soil (Fig.).

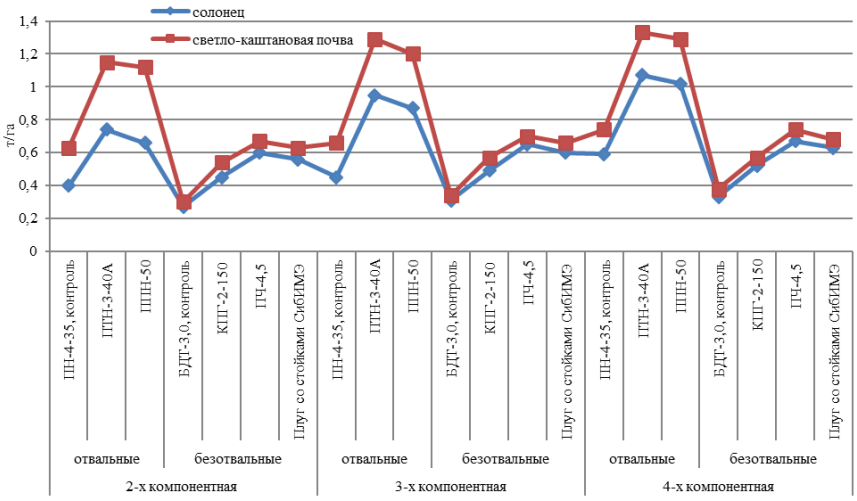

Figure. *Productivity of perennial grasses depending on the options of experience*

On variants with undumped tillage, a variant with Pch-4.5 was distinguished with a yield of 0.60 ... 0.67 t/ha on solonetz and 0.67 ... 0.74 t/ha on light chestnut soil.

Conclusions

Thus, the study showed that the most effective way to improve radically the natural pastures of light chestnut in combination with solonets soils in the arid zone of the Republic of Kalmykia is the main tillage PTN-3-40A to a depth of 0.40-0.42 m, which contributes to the most a radical improvement in the physical, water-physical and chemical properties of the studied soils, as well as a 3-fold increase in the yield of sown grass mixtures, compared with virgin natural herbage, and 1.9 times than with conventional dump plowing. At the same time, with an increase in the number of components of the grass mixture, the yield increases.

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