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ARCHITECTURE

ON THE PROBLEM OF MEDIEVAL ARCHITECTURE OF AZERBAIJAN. LANDSCAPE AND STRUCTURAL ELEMENTS OF BUILDINGS IN CARPETS

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К ПРОБЛЕМЕ СРЕДНЕВЕКОВОГО ЗОДЧЕСТВА АЗЕРБАЙДЖАНА. ЛАНДШАФТ И КОНСТРУКТИВНЫЕ ЭЛЕМЕНТЫ СТРОЕНИЙ В КОВРАХ

Амензале Р.

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Abstract

Carpets are an exceptionally important component - both functional and artistic (art object) - of any size interior - from a poor shack to luxurious palace apartments. They were an integral part of the interiors of various social strata of society. Carpets covered the floors of religious, memorial and civil buildings, thus becoming associated with the very concept of architecture. The carpets are characterized by a clear compositional structure, the idea of the rhythm of divisions, color, ornaments (geometric, floral), features of decorative design, subordinated to architectonics, technical tricks, and all this contributed to the emergence of the unparalleled beauty of carpets - high-quality works of decorative and applied art

The article focuses mainly on the carpets from Azerbaijan, in particular from Tabriz carpet weaving school, the so-called "narrative" carpets.

Аннотация

Ковры являются исключительно важной составляющей – как функциональной, так и художественной (арт-объект) – интерьера любого размера – от бедной лачуги до роскошных дворцовых апартаментов. Они были неотъемлемой частью интерьеров различных социальных слоев общества. Ковры покрывали полы религиозных, мемориальных и гражданских зданий, тем самым становясь ассоциированными с самим понятием архитектуры. Коврам свойственна четкая композиционная структура, идея ритмики делений, цвета, орнаментов (геометрических, растительных), особенностей декоративного оформления, подчиненных архитектонике, технических приемов, и все это способствовало возникновению непревзойденной красоты. ковров - высококачественные произведения декоративно-прикладного искусства

В статье основное внимание уделяется коврам из Азербайджана, в частности Тебризской школы ковроткачества, так называемым «нарративным» коврам.

Keywords: Azerbaijan, medieval architecture, subject carpets, monumental buildings, structures, gardens and parks

Ключевые слова: Азербайджан, средневековая архитектура, сюжетные ковры, монументальные строения, конструкции, сады и парки

Ковры - исключительной значимости компонент - и функциональный и художественный (артобъект)- любой величины интерьера – от бедной лачужки до роскошных дворцовых апартаментов. В самом деле, ковры считались неотъемлемым предметом интерьеров самых разных социальных слоев общества. Ковры устилали полы культовых, мемо-

риальных и гражданских строений, становясь таким образом связанными с самим замыслом архитектуры (3,с.44-51). Весьма выразителен пример ковра «Шейх Сефи ад Дина», сотканного для мечети Гандилхана в Ардебиле (ковер «Шейх Сефи», 1539 г., музей Виктории и Альберта, Лондон), который в точности соответствует размерам его молельного зала.

























Коврами любуются неизменно, им характерен четкий композиционный строй, идея ритма членений колорит, орнаменты (геометрические, растительные), особенности декоративной разработки, подчиненные архитектонике, беспримерной красоты цветовой ряд, технические приемы, и ,все это способствовало появлению беспримерной красоты ковров -высококачественных произведений декоративно – прикладного искусства.

К рассмотрению привлечены в основном ковры Азербайджана, в основном Табризской ковроткаческой школы, так наз. сюжетные ковры, имеющие широкое распространение. Тематика этих ковров неисчерпаема, и, именно они содержат нескончаемый визуальный ряд сценок повседневной жизни народа, это - сюжеты на произведения восточной поэзии средневековых классиков, портреты правителей, ландшафты страны, сценки трудовых свершений народа, исключительной красоты произведения архитектуры. К рассмотрению привлечены в основном ковры Азербайджана, и, в частности Табризской ковроткаческой школы, так наз. сюжетные ковры, имеющие широкое распространение. Тематика этих ковров неисчерпаема, и, именно они содержат нескончаемый визуальный ряд сценок повседневной жизни народа, это - сюжеты на произведения восточной поэзии средневековых классиков, портреты правителей, ландшафты страны, сценки трудовых свершений народа, исключительной красоты произведения архитектуры. Автором рассмотрены ковры с, которые возможно подразделить на три группы: 1) ковры с архитектурными объектами, 2) ковры с элементами архитектуры, 3) ковры с «чарбагами». Ковры первой группы, в свою очередь можно сгруппировать на а) ковры с четко обозначенными осями симметрии всей композиции, б) ковры со «свободным» или живописным расположением архитектурных строений. Ковры второй группы содержат конструктивные элементы архитектурных сооружений, в том числе арки, купола, колонны, и пр. К коврам третьей группы можно отнести ковры с «чарбагами», условно изображающими архитектурно распланированные парки, неотъемлемые составные части как отдельно стоящих зданий и сооружений (кешки, культовые и др.), так и архитектурных комплексов (культовые, дворцовые, гражданские).

Изучение этих групп, ковров убеждает зрителя о глубокой осведомленности и ясном представлении талантливых ковроделов на восприятие явлений как единого целого, знаниях об основах зодческого искусства, средствах гармонизации композиции монументальных строений,, в том числе пропорциях, метре и ритме, масштабности, цвете. В то же время это эмоционально насыщенные величественные полотна результат созидательного коллективного труда безвестных героев, соэдававших гениальные произведения искусства. Исследование миниатюрной живописи и ковров, их научный анализ представляет «выдающийся интерес для выяснения общей картины архитектуры и связанных с

ней областей творчества» отмечает проф. А. Саламзаде (1,209). Именно подобный подход правомерен для представления панорамной картины конкретной исторической среды, связей архитектурных строений с эпохой, отражающей объективные закономерности социальных и духовных процессов с политическими реалиями, с культурой, с исламом, сложной религиозно — философской системой.

Как отмечалось, среди ковров первой группы можно выделить а) композиции построенные на осях композиции и б) живописные композиции. Композиция ковров, под названием «Времена года» в) строится на осях композиции, место их пересечения подчеркнуто крупными медальонами разных конфигураций.(овал, многогранник, круг – цветочный венок либо круг охваченный знаками зодиака, центр которого канонически занимает картинка рандеву прелестной женщины и мужчины. Основная часть ковра расчленена на четыре самостоятельные идентичные части, объединенные общей логически последовательной сюжетной линией. В каждой из них основное место занимает монументальное строение, вместе с тем существуют ковры, в которых строение наличествует лишь в двух из них, и, где также выдерживается принцип мягкого перетекания в природное окружение. В коврах «живописной» или свободной композиции строениям не «заданы» ограничивающие рамки, в них композиция - поразительно целостна, архитектура и ландшафт имеют паритетное начало. К этой же группе можно отнести ковры, в которых центральное место занимает единственное строение, заключенное в рамку иных конфигураций, «выступающее» среди буйной листвы деревьев, цветочных гирлянд и пр. Для этих ковров особенно характерна визуальная и физическая связь, единение с природой. Живописный ландшафт, замечательная флора - разнообразная пышная растительность соответствующая времени года, фауна - птицы, животные и рыбы, группы крестьян – и все это вместе взятое составляет контекст для монументальных строений имеющих особую живость восприятия. Бордюры ковров -особая, интереснейшая тема, где задается собственный алгоритм повествования - орнаментального, цветочно-лиственного, антропометрического (погрудное изображение). Наиболее часты в подобных коврах Гей – мечеть (Табриз, Юж. Азербайджан), мавзолей Ольджайту (Султание, Юж. Азербайджан), дворец Аали – Капу (Исфахан), дворец Ктесифон (на терр. Ирака), фрагменты дворцового комплекса Персеполя (одна из столиц империи Ахеменидов), словом, выдающиеся строения, возведенные в разные временные отрезки, яркие и зрелые образцы типологически общих групп архитектурных зданий и сооружений. Как истинные произведения зодческого искусства они обладают эстетической ценностью выходящей далеко за рамки эпохи и страны. В них прослеживаются опережавшие свое время новаторские разработки, раскрывшиеся в последующие эпохи, традиции, отвечавшие поставленным задачам, элементы и мотивы ставшие универсальными.

Композиционная разработка ковров, в которых дается тот или иной конструктивный узел или часть строения имеет богатое разнообразие примеров - колонны, арки, купола, сталактиты, подкупольные конструкции. Именно конструкции дают возможность понять неистощимость идей и многообразие инженерно — технических приемов, а их усовершенствование непременно влекло изменения в пространственном решении строений, будучи непосредственным источником художественно — образного воздействия....

Богатство модификации куполов определялось типом строения, избранной конструктивной системой - с целым комплексом задач, эстетическими воззрениями эпохи, мастерством зодчего. В выборе купольного перекрытия существенное значение приобретали подкупольные конструкции, которым придавалось исключительное внимание, как важному звену всей конструктивной системы, тектонике здания, от которой зависит устойчивость строения, его надежность. Переход от стен корпуса строения к купольному перекрытию осуществляется посредством подкупольных конструкций, среди них можно выделить несколько основных ведущих линий, имеющих многообразие вариантов тромпы, сталактитовые и щитовидные паруса, перекрещивающиеся арки. Новаторские тенденции в области подкупольных конструкций существенным образом пополняли и обогащали круг их вариантов, состоявший из архитектурных идей эпохи.

Вся изысканность выведения купола, покоящегося на подкупольных конструкциях передается столь же насыщенными декоративными средствами в целом ряде ковров. В большом числе ковров «намазлыг» (молитвенные) композиция решается посредством изысканно прорисованных арок, опирающихся на колонны без или - с базами и капителями, изображения которых зачастую несколько далеки от реальных, с висящей по центру «ləmpə» - лампой вазообразной прорисовки. Иной вариант - спаренные арки(2) или же три арочки, где средняя - несколько шире симметричных, и, также опирающиеся на тонкоствольные опоры, зачастую спаренные. Их разнообразие в коврах определяется не только прорисовкой, но и большей насыщенностью декоративного решения, а это обилие пышноцветущих растительных мотивов, «древо жизни», хотя встречаются и другие варианты – зооморфные элементы, схематизированные строения (мечеть), фигура мужчины в полный рост. Вместе с тем встречаются и более сложные образцы композиции (Гарабахский молитвенный коврик, кон.XIX нач.ХХ вв).

В архитектурной застройке городов- в комплексах и в сооружениях, строившихся на тщательно выверенной плановой основе огромное место уделялось садово-парковым комплексам. Разработка композиции «Садово- парковых) ковров («garden carpets») в высшей степени строга, лаконична и немногословна. В них схематично изображается композиция «чарбаг» с ясными линейными границами и определенно очерченными компонентами, базирующимися на принципах эстетического

восприятия и архитектурного творчества, вследствие чего достигалась исключительная парадность художественного образа. Регулярный тип пространственного построения «чарбаг» характеризуется геометризованной разработкой с применением осевых систем. Принцип симметричного построения композиции связанный с пространственно — временной концепцией эпохи есть одно из выражений канонического образа чарбага, с собственной системой параметров и атрибутов, выдвижением основных требований к участку, предназначенному для разбивки парка.

Принципы пространственной организации многочисленных садово - парковых комплексов основаны на симметрии членений, на рациональных масштабных соотношениях с ритмами размещения его компонентов, вместе с тем они были лишены монотонности и скучности восприятия. Уникальность парковых комплексов была обусловлена конкретностью условий места и времени, основанной на постоянно меняющейся изменчивости природы, в динамике ритмов и этапов многолетнего формирования ландшафта. Композиция ковров отвечает реалиям веками формировавшегося канонизированного типа садово -парковой композиции, хотя вариантов множество. Композиция садов слагалась из последовательного чередования лужаек, сочетавшихся с живописными перспективами аллей, вечнозелеными, широколиственными и фруктовыми купами деревьев, и благоухающего моря цветов, затейливых прудов с водоплавающей дичью, с расположенным в центре сада кешком (загородный павильон), четко воспринимающимся в гуще изумрудной листвы. Основное поле этих ковров (продолговатое, реже квадратное) имеет крестообразную композицию с розеткой (квадратные, с усеченными углами, прямоугольными) в центре - на пересечении осей. Если композиция четырехчастна, то срединный медальон – розетка довольно крупная, зачастую подразумевается затейливой конфигурации водоем. Подобная схема условно передает симметричность пространственной композиции, ее многочастность (части «нанизаны» на главную ось) указывает на масштабы парка, что и послужило основополагающей базой для ковроделов. В организации их внутреннего пространства канонически сложившимися приемами и символами условно обозначены дерево, куст, цветы, водное пространство, и, даже рыбки плавающие в них.

Использованный материал не исчерпывает избранной темы, она исключительно богата замечательными образцами сюжетных ковров, число которых может быть значительно увеличено.

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BIOLOGICAL SCIENCES

MECHANISMS OF ACTION OF NIO NANOPARTICLES IN THE HUMAN BODY IN COMBINATION WITH GREEN SYNTHESIS

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Abstract

Nanoparticles are small particles ranging in size from 1 to 100 nanometers (nm). Due to their size, nanoparticles have unique physical and chemical properties that differ from their counterparts. The synthesis and properties of nickel oxide nanoparticles (NiO NPs) constitute an important area of research due to their superior ferromagnetic properties and chemical stability. It is used as an inexpensive catalyst due to its natural abundance and ability to control reactions in alternative ways. They have countless biomedical applications, including magnetic resonance imaging, cell separation, drug delivery, biomedical detection, and more. In addition to these, in recent times, with the development of nanotechnology, the Green nanotechnology method has been used in the synthesis of nanoparticles. In this method, nanoparticles are synthesized using various biological systems, including yeast, algae, and bacteria.

Keywords: Nanoparticles (NP), metal and metal oxide nanoparticles, Ni and NiO nanoparticles

Nanoparticles are small particles ranging in size from 1 to 100 nanometers (nm). Due to their size, nanoparticles have unique physical and chemical properties that differ from their counterparts. Of these, the unique feature of energy storage is widely used in the development of electronics and biomedical fields (1). One of the most important advantages of nanoparticles (NPs) is their high surface-to-volume ratio, which increases their reactivity and catalytic activity. Physical and chemical, color or optical properties of NPs depend on their size and shape. The melting and phase transition temperatures of NPs are low, and the band gap increases as the size of NPs decreases. In addition, the small size of nanoparticles allows them to cross biological barriers such as cell membranes, making them highly effective in drug delivery and medical imaging applications. Also, their optical and electronic properties make them useful in electronics and energy storage applications (2).

Despite their beneficial properties for their application, nanoparticles can also pose potential risks to human health and the environment. For example, their small size may facilitate their entry into the human body through inhalation or ingestion, leading to their ability to interact with biological systems in ways that are not yet fully understood (Auffan et al., 2009).

Nanoparticles can be synthesized from a variety of materials, including metals, metal oxides, polymers, and carbon-based materials, using a variety of methods such as chemical synthesis, physical precipitation, and biological methods. The choice of material in the synthesis method can significantly affect the properties of the resulting nanoparticles (3).

Top-down and bottom-up synthesis protocols are accepted for nanoparticle synthesis methods. In addition, Green nanotechnology method has been used in the synthesis of nanoparticles with the development of nanotechnology in recent times. In this method, nanoparticles are synthesized using various biological systems including yeast, algae, and bacteria (Salem, 2023).

The synthesis mechanism of metal and metal oxide nanoparticles with plant extract occurs in three stages: activation stage, growth stage and termination stage. In the activation phase, metal ions are reduced and reduced metal atoms become nuclei. During the growth phase, small NPs aggregate together to form larger nanoparticles. In this process, called Ostwald ripening, the thermodynamic stability of nanoparticles increases. In the finishing stage, the nanoparticles take their final form. The final product is air dried or air calcined to produce the metal oxide. NiO NP is also used for research in this field.

Nickel nanoparticles are a new product with many properties such as high surface energy, high magnetism, low melting point, high surface area, high reactivity, biocompatibility, resistance to bacteria, anti-inflammatory properties and environmental compatibility, low flash point. Nickel nanoparticles are widely used in modern industries such as catalysts, sensors, electrocatalysts, photocatalysts, biosensors, heat exchangers, and electronic applications (Zhang et al., 2003; Sivulka, 2005). Their widespread use in humans and the environment increases the potential risk associated with their toxicity. Meanwhile, NPs are used in numerous biomedical fields, including cell isolation, drug

delivery, magnetic resonance imaging, biomedical diagnostics, etc. Anhydrous and aqueous nickel nanoparticles prepared by sonication, radiolytic and chemical reduction, and freeze-drying reactions can react chemically in environments.

It is important to produce nickel nanoparticles at an affordable cost that is environmentally sustainable, economically viable, and socially compatible. In the production of nanometals, green synthesis is considered faster and cheaper.

Metal nanoparticles produced by green synthesis have different sizes and morphologies. Organic functional groups in plants play an active role as reducing, protecting and stabilizing agents in the production of nanoparticles (4). Nanomaterials prepared by this method have high polydispersity, well-defined dimensions and thermodynamic stability. Green-based synthesis methods such as leaf extract, stem bark, root, and plant exudates are thought to be more suitable for the synthesis of metallic nanomaterials (5).

Nanobiotechnology - This rapidly growing field is widely applied at various commercial levels, namely agriculture, cosmetics, catalysis, food, bioremediation, optics, cancer treatment, drug delivery, genetic engineering, and many others (6). Metal oxide nanoparticles (MONPs) produced by green synthesis have attracted much attention due to their safe, energy-efficient, environmentally friendly, and reproducible properties (7). Nanosized particles are considered effective for research due to their variability, physical, optical, mechanical, magnetic, sensing and electrical properties compared to their bulk counterparts (8). Nickel oxide nanoparticles (NiONPs) are widely used in research due to their remarkable intrinsic properties such as chemical stability, p-type semiconductor, nanodevice fabrication, electron transfer potential, sensing, electro-catalysis, optoelectronic capabilities, and drug delivery. So far, NiONPs have been studied for their anti-inflammatory, cytotoxic, and pollutant adsorption properties(9).

Recently, NiONPs have been prepared by phytochemical means and explored for various biological applications. It should be noted that many plants, viz. Agathosma betulina (10), Gerinium wallichianum (11), Bergenia ciliate (12), Rhamnus virgata (6), Nephelium lappaceum (13), Berberis balochistanica (14) and Tamarix (15) were used for the synthesis of NiONPs.

E. angustifolia(ElA) is reported to alleviate several serious diseases such as jaundice, cancer, asthma, inflammation, osteoarthritis, diarrhea, gastrointestinal problems and rheumatoid arthritis. According to ethnobotanical data, various ElA extracts have shown antimicrobial, anti-inflammatory, antioxidant and wound healing properties (16). In this study, EIA-based NiONPs were characterized and screened for anticancer, antileishmanial, antimicrobial, antioxidant, enzyme inhibition potential and biocompatibility analysis.

Green synthesis with NiO E. Angustifolia gives very important results as an enzyme inhibitor in diseases such as cancer and diabetes, which are very important to treat today. Also, L. tropica causes an infectious disease, leishmaniasis. Leishmaniasis is an NTD

(neglected tropical infection) that is mainly spread by sand fly bites. In this study, different concentrations of EIA-NiONPs (range: 3.91-500 $\mu g/mL)$ were tested against amastigotes and promastigotes of L. tropica and showed significant positive results.

Also, synthesis of nickel oxide nanoparticles using plant extract and their antibacterial effects on Streptococcus mutans were evaluated. Tooth decay is known as the most common infectious disease of people in the world. The increasing index of dental caries in the world shows the failure of prevention of oral diseases. Streptococcus mutans bacteria produce acid over time, causing tooth damage and decay. Nanomaterials with appropriate functionality, high conductivity, extremely large surface area, significant reactivity, unique mechanical properties, and non-bacterial resistance can be considered promising tools for antimicrobial and antiviral applications. In this study, nickel oxide (NiO) nanoparticles with a size between 2 and 16 nm were synthe sized by a simple method with the environmentally friendly Stevia natural sweetener. In addition, their different concentrations were studied on S. mutans bacteria by applying the broth dilution method. The results showed that these spherical NiO nanoparticles have effective bacteriostatic activity on gram-positive cocci (17).

The synthesis and properties of nickel oxide nanoparticles (NiO NPs) constitute an important area of research due to their superior ferromagnetic properties and chemical stability. It is used as an inexpensive catalyst due to its natural abundance and ability to control reactions in alternative ways. They have countless biomedical applications, including magnetic resonance imaging, cell separation, drug delivery, biomedical detection, and more. (Jaji et al., 2020) Klebsiella pneumoniae; Significant antibacterial properties against Pseudomonas aeruginosa, Bacillus subtilis, S. Aureus and more bacteria have been studied (Yulizar et al., 2021, Iqbal et al., 2019). Uddin et al. (2021) reported antifungal activity of NiO NPs against Aspergillus Niger, Alternaria altemata and Fusarium oxysporum. Many studies have successfully tested the anticancer and antiparasitic properties of NiO NPs. These include cytotoxicity study against A549 cell culture, effect of NiO NPs on Hela cancer cells, MCF-7 cancer line models and HepG2 cells (Lingaraju et al., 2020, Ariyanta et al., 2021, Angel Ezhilarasi et al., 2018, Ramalingam et al., 2019). Igbal and others. showed that NiO NPs can be antiparasitic against strains of Amastigotes, promastigotes and Leishmania tropica He also reported that NiO NPs have compatibility with macrophages and RBCs (IC50 value more than 200 ug/ml). As a result of research, NiO NPs have also been found to have antioxidant properties (Iqbal et al., 2019) (18).

NiO NPs have advantages as well as disadvantages in many application areas. Thus, various factors affect environmental pollution in the world. These factors include inorganic ions, organic pollutants, radioactive isotopes, gaseous pollutants and nanoparticles. Heavy metals enter the human body in four ways: through contaminated food; occurs due to inhalation of

air from the atmosphere, ingestion of contaminated water, skin contact in pharmaceutical, agricultural, residential and industrial areas.

Hepatotoxicity of Ni lin poses a great threat to health by changing biochemical functions in the body. (Das et al., 2008).

Ni nanoparticles are widely used in industry. For this reason, in the body

the resulting problems cause concern to the world population.

Nickel as a low molecular density lipophilic compound in the gastrointestinal tract

It is absorbed through various ligands and ions of nickel located in the intestine

helps absorption. Nickel has a wide range of carcinogenic mechanisms.

Another disadvantage is that activation of ATF-1 by Nickel leads to increased angiogenesis and stimulate the growth of tumor cells (19).

One of the most common disadvantages of nickel nanoparticles is skin

allergies, it is also an immunotoxic agent in the human body. Such reactions are from soil to nickelcontaining metal objects from water and metal

can occur from direct contact with jewelry. Nickel-based Factory workers are constantly exposed to nickel fumes and dust Research shows that constant breathing of nickel dust and nickel fumes causes various respiratory diseases (bronchitis, asthma). In addition, lung and nose cancer are more common in people working in such factories (20). Research has shown that the causes of nickel-related cancer are genetic, epigenetic factors and oxidative stress. Some nickel compounds cause cell proliferation, which can lead to mild DNA mutations. Drinking water from nickel-contaminated basins can cause many effects - dizziness, headache, general weakness (21).

Thus, NiONPs are applied to inhibit various in vitro, microbial, cancer and leishmanial cells. Synthesized NiO NPs have been examined spectroscopically and microscopically with plant and fruit extracts in many research areas and found to be helpful in preventing harmful substances. Nanosized particles made using natural NPs are considered to be bio-safe in nature. However, side effects are also inevitable. The environment is heavily polluted with metals, which affects human health. All the researched materials make us aware of the negative effects caused by these metals, the symptoms that have arisen. Thus, new researches should be continued to overcome the adverse effects of metal pollution, metal NPs.

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CHEMICAL SCIENCES

THE USE OF FAT-SOLUBLE CO₂-EXTRACTS FROM SPICES WITH HIGH CONTENT OF BIOLOGICALLY ACTIVE SUBSTANCES IN THE FABRICATION OF DRESSINGS

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Abstract

The article presents organoleptic characteristics and physicochemical parameters (including lycopene content) in fat-soluble CO₂-extracts from tomato waste with high content of biologically active substances.

As a result, recipes were developed and samples of dressings for salads were produced with the addition of fat-soluble CO₂-extracts from tomato waste. The amount of fat-soluble CO₂-extract from tomato waste in the product is reasoned.

Keywords: tomato waste, fat-soluble CO₂-extracts, biologically active substances, dressings.

Introduction

Currently, several technologies for the fabrication of bioactive components and their use in functional nutrition are known. The world interest in biologically active substances (BAS), which are contained in the raw material characteristic for a certain region, and in food products fortified with BAS has increased significantly in the last 10-15 years.

During the last years, through state and international programs, scientists from countries such as France, Germany, Switzerland, the USA have contributed considerably to the development of a new class of food, pharmaceutical and cosmetic products with biologically active substances, namely CO₂-extracts from raw materials of plant origin.

CO₂-extracts from plant raw materials can be used for the purpose of enriching food products with SBA, fat-soluble vitamins, natural antioxidants, natural taste and flavors and other complexes that are missing in refined products.

Fat-soluble CO₂—extract from tomato waste obtained in the process of supercritical extraction from the secondary raw material of plant origin, contains biologically active substances (BAS), such as fat-soluble vitamins: carotenoids, including lycopene; tocopherols; polyphenolic substances and polyunsaturated fatty acids.

A possibility of perspective use of fat-soluble CO_2 -extract from tomato waste is in the preparation of dressings for salads or other culinary products (snacks, appetizers) in which vegetable oil is included, this fact directing to the expansion of the assortment of traditional products.

Salad dressing sauces are a slightly acidic combination of vegetable oil and water, seasoned and spiced, which have been used to increase the attraction to a

product by improving the taste of fresh or prepared vegetables, fruits, meat, fish, cheeses, eggs and various combinations of them. In certain food cultures, salads with dressing are an important part of menus [1].

Dressings (oil-in-water emulsions), such as mayonnaise and salad sauces, are an important segment of the salad dressings market, which enjoys wide use [1].

Dressings can be prepared before the time of use, but most often they are manufactured as finished products for retail, catering enterprises and other food directions. A growing use is for the production of chilled salads, for restaurants and fast food establishments [1].

Materials and methods

Research will be focused on:

- production in laboratory conditions of fat-soluble CO₂- extracts from tomato waste with high content of biologically active substances;
- determination of organoleptic and physicochemical parameters of fat-soluble CO_{2^-} extracts from tomato waste:
- elaboration of recipes and production in laboratory conditions of dressings fortified with CO_2 extract from tomato waste with high content of biologically active substances;
- determination of organoleptic, physicochemical and microbiological parameters of dressing fortified with fat-soluble $\rm CO_2$ extracts from tomato waste.

Determination of organoleptic and physicochemical parameters of fat-soluble CO₂- extracts from tomato waste with high content of biologically active substances were carried out according to the current regulatory documentation:

- Method of determining the acidity index, according to GOST 5476-80;
- Method for determining the peroxide index, according to GOST 26593-85;
- Lycopene content was determined at the spectrophotometer model Spekol 1500 Analytik Jena (Food Quality Control laboratory, IP ISPHTA).

Lycopene from CO_2 -extracts from tomato waste was extracted using the mixture of hexane: ethanol:acetone (2:1:1) (v/v). The absorbance was measured at 502 nm, as a reference substance (ethanol, standard) using hexane.

The determination of the organoleptic and physicochemical parameters of the dressings fortified with CO₂-extract from tomato waste with high content of biologically active substances were carried out according to the current regulatory documentation:

- Method for determining soluble dry substances, according to GOST 28562-90;
- Method of determination of titrable acids, according to Ms SR EN 12147-2002;
- Method for determining titrable acids, according to GOST 26188-84.

Results and discussion

The industrial tomato waste (JSC "Orhei-Vit") was used for the research, which was dried, shredded and mixed.

At the installation for CO₂-supercritical extraction, model HA 120-50-01, five samples of fat-soluble CO₂- extracts from tomato waste with high content of biologically active substances were obtained at 5 supercritical extraction regimes (Table 1).

Table 1.

Regimes of CO₂ supercritical extraction from tomato waste

regimes of collaboration from comment waste									
The name of the parameters		Nu	Number of extraction regime						
		I	II	III	IV	V			
	Temperature, °C	60	57,9	60	63,5	39,6			
Extractor	Pressure, MPa	30	30,7	30	30	32,1			
	Time, min	90	75	75	75	120			
	CO ₂ flow, l/h	45-58	34,1	37	38	35			
Compandon I	Temperature, °C	70	69,5	70	54,9	49,9			
Separator I	Pressure, MPa	10,9-11,2	10,3	11	10,6	11,7			
Separator II	Temperature, °C	30	30,2	30	31,2	31,3			
	Pressure, MPa	5,3-5,6	5,1	5,0	5,6	5,1			











Extract 1

Extract 2

Extract 3

Extract 4

Extract 5

Pic. 1. Samples of fat-soluble CO2-extracts from tomato waste, Separator I and II

The organoleptic parameters of the fat-soluble CO₂-extract from tomato waste are presented in table 2.

Table 2

The organoleptic parameters of the fat-soluble CO2-extract from tomato waste

No.	Organoleptic parameter	Characteristics
1	External appearance and consistency	Fat-soluble liquid or oily mass with a homogeneous consistency, from fluid to buttery, with or without waxy substances, without other impurities. Stored in the cold, it shows an uneven distribution of waxes in the volume of the product, which disappear easily after mixing
2	Transparency	Translucent
3	Color	Natural color, characteristic of tomatoes, from light red-orange to a dark brick shade
4	Flavor and taste	Pleasant flavor, characteristic of tomatoes; pleasant, strongly pronounced taste of tomato. Taste remanent weak bitter.

The fat-soluble CO_2 -extract from tomato waste has a very viscous consistency, which would make it difficult to use it in the food industry. For a more fluid consistency, it is necessary to heat the CO_2 -extract from tomato waste.

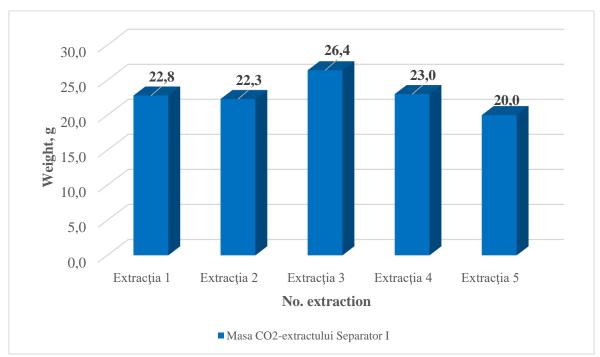
The physicochemical parameters of fat-soluble CO_2 -extracts from tomato waste from Separator I were determined and are presented in table 3.

The physicochemical parameters of fat-soluble CO2-extracts from tomato waste

Table 3

The name of the newspare		Number of sample							
The name of the parameters	I	II	III	IV	V				
Acidity index, mg NaOH/g	-	11,35	10,68	9,78	7,61				
Peroxide index, mmol O2 activ/kg	-	18,15	17,80	16,97	12,58				
I vacanana aantant ma/100 a	82,32	92,52	95,06	55,58	76,77				
Lycopene content, mg/100 g	77 95	86.06	93.28	51.69	47 87				

The weight of fat-soluble CO_2 -extracts from tomato waste obtained in separator I varied from 20.0 to 26.4 g. The weight data of fat-soluble CO_2 -extracts from tomato waste specific to each supercritical extraction are indicated in picture 2.

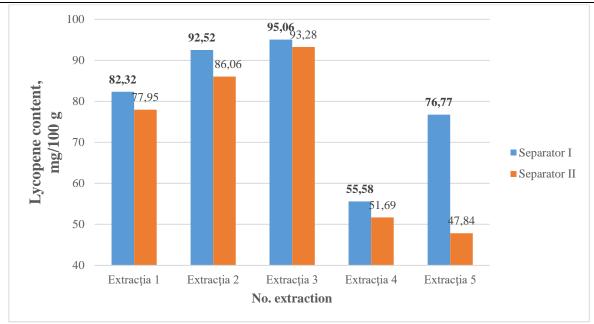


Pic. 2. Weight of fat-soluble CO2-extracts from tomato waste

The highest amount of fat-soluble CO₂- extract from industrial tomato waste (26,4 g) was obtained at the extraction regime at temperature 60,0 °C in separator I, although the extraction duration 75 min. (sample 3).

It has been established that the concentration of lycopene in fat – soluble CO_2 - extracts from tomato waste ranges from 55.58 mg/100 g to 95.06 mg/100 g. For extracts from separator II the lycopene content is within the limits of 47.84-93.28 mg/100 g.

The lycopene content specific to each supercritical extraction are shown in picture 3.



Pic. 3. The lycopene content of fat-soluble CO2-extracts from tomato waste

The highest amount of of lycopene in fat-soluble CO₂-extract from industrial tomato waste (95.06 mg/100 g) was obtained at the extraction regime at temperature 60,0 °C in separator I, although the extraction duration 75 min. (sample 3).

The content of bioactive compounds in fat-soluble CO₂-extracts of tomato waste was taken into account when developing salad dressing recipes and sample 3 was selected.

To ensure the supply of vitamins in significant quantities, it is advisable to provide a minimum of 15%

Name of vitamins

Carotenoids

Lycopene

Vitamin E

of the recommended daily dose, according to HG no. 196 of 25.03.2011 Health Regulation on nutrition and health claims on food products [2].

The recommended daily dose (RDA) for vitamins is established in Government Decision No. 538 of 02.09.2009 Health regulation regarding supplements, point 15 [3]. As for carotenoids, namely lycopene, the RDA is specified in the Methodical Recommendations "Rational Food" MR 2.3.1.19150-04 [4], and Scientific Opinion on the substantiation of health claims related to lycopene [5] and is 5 mg.

Table 4.

Table 5.

1,5

Recommended daily dose (RDA) and quantity in CO2-extracts

Recommended daily dose, mg Maximum daily dose, mg 15% of RDA, mg 2,25 15,0 30,0 5,0 10,0 0,75

30,0

5 basic recipes were developed for the preparation of salad dressings, which were varied by introducing CO2-extract from tomato waste, as an ingredient source of biologically active substances.

10,0

To fortify the product with lycopene we must add 0.8 mg fat-soluble CO₂- extract from tomato waste per 100 g of product.

Recipes of salad dressings with and without added fat-soluble CO2- extract

		Salad dressings with addition of						
No.	The name of product	Apple	Grape	Balsamic	Apple	Grape		
		vinegar	vinegar	vinegar	acidifier	acidifier		
1	Vegetable oil	35,0-34,2	35,0-34,2	35,0-34,2	35,0-34,2	35,0-34,2		
2	CO ₂ -extract	0,0-0,8	0,0-0,8	0,0-0,8	0,0-0,8	0,0-0,8		
3	Apple puree (SU 16 %)	22,0	22,0	22,0	22,0	22,0		
4	Acidifier / Vinegar	5,0	5,0	5,0	12,0	20,0		
5	Sugar	6,0	6,0	6,0	5,0	3,0		
6	Salt	2,0	2,0	2,0	2,0	2,0		
7	Pectin	0,5	0,5	0,5	0,5	0,5		
8	Spices	1,0	1,0	1,0	1,0	1,0		
9	Water	Rest	Rest	Rest	Rest	Rest		
	Total	100	100	100	100	100		

For all assortment of the salad dressings, the base was vegetable oil and apple puree, and as an acidifier was used: apple vinegar, grape vinegar, balsamic vinegar, natural apple acidifier, natural grape acidifier. For the assortment of salad dressings with the addition of fat-soluble CO₂-extract from tomato waste part of the vegetable oil was replaced with extract.



Pic. 4. Samples of salad dressings

Salad dressing is prepared according to the technology in several stages.

In the first stage, sunflower vegetable oil is mixed with the fat-soluble CO₂-extract from tomato waste, obtaining blended vegetable oil.

In the second stage, the pectin is hydrated in water, in a ratio of 1:5, for 30 min, until a homogeneous gelatinous suspension is obtained.

In the third stage, in a small part of the amount of blended vegetable oil (10 g) for dressing add apple puree, gelatinous suspension of pectin, water, sugar, salt and spices.

In the Food Technology Laboratory of IP ISPHTA were prepared laboratory samples of salad dressing, which was diversified by using the addition of fat-soluble CO₂-extract from tomato waste as a source of bioactive substances.



Pic. 5. Samples of salad dressings with addition of fatsoluble CO - extract from tomato waste

The ingredients are mixed for about 5-10 minutes in order to obtain a stable emulsion.

In the fourth stage, vinegar is added and mixed.

In the fifth stage, the major amount of blended vegetable oil (25 g) remaining is added and mixed in a mixer with a shearing action.

The described technology allows the manufacture of a salad dressings with the advantage of obtaining a stable emulsion and in which an insignificant syneresis is possible.

The organoleptic characteristic of salad dressings is specified in table 6.

Table 6.

The organoleptic characteristic of salad dressings

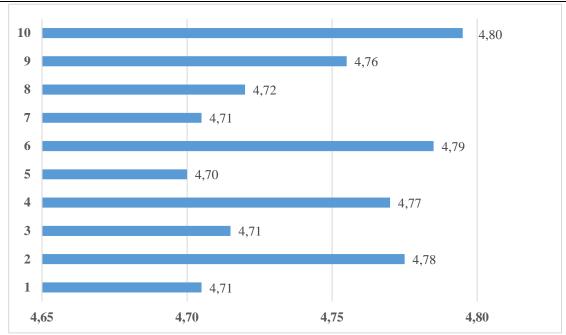
Organoleptic parameter	Salad dressings	Salad dressings with addition of fat-soluble CO ₂ - extract from tomato waste		
External appearance and consistency	Homogeneous mass, without agglome The presence of finely chopped parts	erations of ingredients used, creamy consistency. of the ingredients used is allowed.		
Flavor and taste	Characteristic of the product,	Characteristic of the product, weakly sour, without foreign taste and flavor, with flavor of tomato and spices		
Color	White with a pearly tinge, uniform throughout the mass or with inclusions of spices.	Pale orange to red-orange, due to the CO ₂ -extract of tomato, uniform throughout the mass or with inclusions of spices.		

The salad dressing samples without and with the addition of fat-soluble CO₂- extract from tomato waste were tasted in the Food Technology laboratory.

Samples presented at the tasting:

- 1. Salad dressings with apple vinegar control sample;
- 2. Salad dressings with apple vinegar and fatsoluble CO₂- extract from tomato waste;
- 3. Salad dressings with grape vinegar control sample;
- 4. Salad dressings with grape vinegar and fatsoluble CO₂- extract from tomato waste;

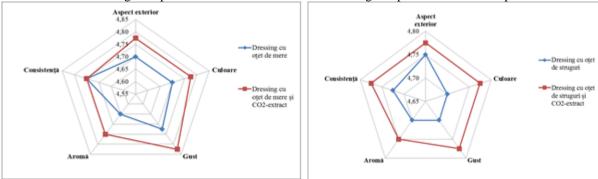
- 5. Salad dressings with balsamic vinegar control sample;
- 6. Salad dressings with balsamic vinegar and fat-soluble CO₂- extract from tomato waste;
- 7. Salad dressings with apple acidifier control sample;
- 8. Salad dressings with apple acidifier and fatsoluble CO_2 - extract from tomato waste;
- 9. Salad dressings with grape acidifier control sample;
- 10. Salad dressings with grape acidifier and fatsoluble CO_2 - extract from tomato waste.



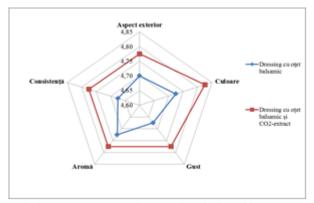
Pic. 6. The overall average score for salad dressing samples without and with the addition of fat-soluble CO2- extract from tomato waste

According to the score obtained, all samples of salad dressings were highly appreciated, with grades from 4.70 to 4.80. Characteristic for the tasted samples is the fact that the salad dressings with the addition of fat-soluble CO_2 -extract from tomato waste were scored higher than the control samples without lipophilic addition.

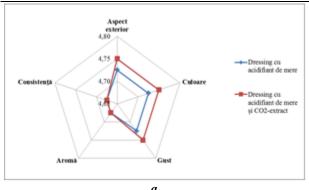
The evaluation of the organoleptic characteristics of the salad dressing samples is illustrated in pictures 7.1-7.3.

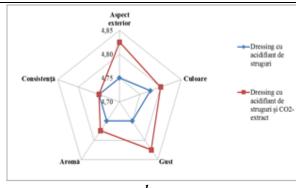


Pic. 7.1 Salad dressings with (a) apple vinegar and (b) grape vinegar, without and with the addition of fatsoluble CO_2 - extract from tomato waste



Pic. 7.2 Salad dressings with balsamic vinegar without and with the addition of fat-soluble CO₂- extract from tomato waste





Pic. 7.3 Salad dressings with (a) apple acidifier and (b) grape acidifier, without and with the addition of fatsoluble CO₂- extract from tomato waste

Compared to the control samples, the introduction of fat-soluble CO_2 - extract from tomato waste, which replaces a part of the sunflower vegetable oil, influences the organoleptic characteristics of the dressings: external appearance, color and taste. The CO_2 -extract from tomato waste improves the external appearance of the products, so the samples with added lipophilic extract are more pleasant and tasty.

The physico-chemical parameters of the salad dressings with and without the addition of CO₂-extract from tomato waste were determined, the data being specified in table 7.

Table 7. The physicochemical parameters of salad dressings with and without added CO₂-extract from tomato waste were determined

Nr.	The name of	Soluble dry substances,		pН	Titrable acids,		Lycopene content, mg/100 g
d/o	product	without CO ₂ - extract	with CO ₂ -extract	without CO ₂ - extract	acetic acid	malic acid	with CO ₂ -extract
1	Salad dressings with apple vinegar	18,0	19,4	3,28	0,35	0,37	0,81
2	Salad dressings with grape vinegar	18,0	19,4	3,30	0,30	-	0,79
3	Salad dressings with balsamic vinegar	20,0	21,8	3,20	0,31	-	0,76
4	Salad dressings with apple acidifier	18,0	19,6	3,10	0,23	0,25	0,75
5	Salad dressings with grape acidifier	17,5	19,0	3,05	0,35	-	0,80

The physicochemical parameters were analyzed in salad dressing samples: content of soluble dry substances, content of titratable acids, pH and lycopene content.

The content of soluble dry substances for the salad dressings without CO_2 -extract varies from 17.5 to 20.0%, and for those with the addition of CO_2 -extract from tomato waste, it is from 19.0 to 21, 8%, the maximum values being identified in salad dressings with the addition of balsamic vinegar.

The pH value is included in the range 3.05 (dressing with the addition of grape acidifier) - 3.30 (dressing with the addition of grape vinegar).

The content of titratable acids, expressed in acetic acid, is within the limits of 0.23% (dressing with added apple acidifier) and 0.35% (dressing with added apple vinegar; dressing with added grape acidifier).

The lycopene content in the dressing samples with the addition of CO_2 -extract from tomato waste is 0.75

 $-\ 0.81\ mg/100$ g, which represents 15% of the recommended daily dose of lycopene.

Thus, as a result of the research, a food product with an increased content of biologically active components was developed - dressing with the addition of $\rm CO_2$ -extract from tomato waste with a lycopene content of 0.8 mg/100 g, which represents 15% of the recommended daily dose of lycopene.

Conclusions

- 1. Samples of fat-soluble CO₂-extracts from tomato waste were obtained in laboratory conditions.
- 2. The recipes of salad dressings with the addition of fat-soluble CO_2 -extract from tomato waste with lycopene content in mg/100 g, which represents 15% of the recommended daily dose of lycopene, were developed.
- 3. Samples of salad dressings with the addition of fat-soluble CO₂-extract from tomato waste, based on apple puree, and as acidifier were used apple vinegar,

grape vinegar, balsamic vinegar, apple acidifier, grape acidifier with increased content of biologically active components, were prepared in laboratory conditions.

- 4. According to the organoleptic estimates, the most successful sample was the salad dressing with grape acidifier and the addition of fat-soluble $\rm CO_2$ -extract from tomato waste.
- 5. The physicochemical parameters in the samples of salad dressings: content of soluble dry substances, content of titratable acids, pH and lycopene content were determined.

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SYNTHESIS OF HYDROGELS BASED ON COPOLYMERS OF CYCLOPROPANE-CONTAINING ALLYL ETHERS WITH MALEIC ANHYDRIDE, CROSS-LINKED WITH POLYETHYLENE GLYCOL

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Abstract

The allyl ethers with ester and geminal chlorine substituents are synthesized in a three-membered cycle. By radical copolymerization of these ethers with maleic anhydride, the linear copolymers of alternating structure are obtained. As a result of chemical cross-linking of copolymers of polyethylene glycol with a molecular weight of 300 Da, the transparent elastic hydrogels differing with high adhesion to a glass substrate are obtained. The influence of the structure of cross-linked copolymers on their ability to swell in an aqueous medium is investigated. The parameters of the hydrogel mesh are studied. The possibility of using them as carriers of physiologically active compounds is investigated.

Keywords: hydrogels, copolymers, maleic anhydride, cyclopropane-containing allyl ethers, polyethylene glycols, degree of swelling, parameters of the hydrogel mesh.

1. Introduction

The hydrogels are one of the most widely studied and used materials in practice. They have many useful properties, such as the ability to retain large quantity of water, to imitate living tissue and react to external stimuli, which makes them very attractive biomaterials. Due to the wide range of properties, the hydrogels began to be used in tissue engineering as drug carriers, in wound dressing materials and other biomedical devices [1-4].

The copolymers of maleic anhydride with various vinyl monomers, which are successfully used in tissue engineering as building frames for the cultivation of living tissue cells or in drug delivery systems and other physiologically active substances are very often serves as the main material for the preparation of the hydrogels [5-7]. It is reported about preparation of cross-linked materials on the basis of a copolymer of methyl vinyl ether and maleic anhydride Gantrez® AN-139, cross-linked with polyethylene glycol (PEG). For example, Singh et al. [8] have investigated the influence of PEG

with various molecular weights on the physical-chemical properties of hydrogels prepared from Gantrez® AN-139 and PEG. It has been revealed that by changing the degree of crosslinking of hydrogels (by varying the molecular weight of PEG), the drug delivery rate can be changed. In the work of Caló et al. [9] has been reported about preparation of the hydrogel on the basis of Gantrez® and poly(vinyl alcohol) with good antibacterial properties. In addition, the obtained hydrogels had good mechanical indices and high adhesion, which made them very suitable materials for wound dressing. MA copolymers are of interest primarily because they are multifunctional: the structure of the macromolecule includes anhydride links and other functional groups, which are reaction centers for post-polymerization conversions [10-12]. Usually, the copolymerization of vinyl ethers with maleic anhydride is accompanied by the appearance of donor-acceptor complexes, the polymerization of which leads to a strict alternation of the links of both comonomers in the macromolecule chain [13]. For the development of biomedical devices and drug delivery systems, such strict alternation of links in the macromolecule plays an important role.

In this work, the polymer hydrogels on the basis of alternating copolymers of cyclopropane-containing allyl ethers with maleic anhydride cross-linked with polyethylene glycol PEG-300 have been obtained and their ability to swelling in an aqueous medium has been investigated.

2. Experimental Methjds and Materials

Materials: Diallyl ether (pure for analysis). poly(ethylene glycol) (PEG, Mn = 300 Da), solvents: benzene (absolute), acetone, maleic anhydride (MA) were purified by recrystallization from chloroform. The initiator azo-bis-isobutyronitrile (AIBN) was used immediately after recrystallization from a solution of a mixture of chloroform and methanol at ratio of 1:5.

IR spectroscopy: The IR spectra of monomers, copolymers and hydrogels were taken on a "Cary 630 FTIR" spectrometer from Agilent Technologies (in the wave number range 600-4000 cm⁻1, ZnSe crystal) with a resolution of 4 cm⁻¹.

Thermogravimetry: The thermal stability of the copolymers was analyzed on derivatograph of mark Paulik-Paulik-Erdei. The samples (about 10 mg) were heated in an aluminum crucible from room temperature to 500°C at a rate of 10°C·min⁻¹, all measurements were carried out in a nitrogen atmosphere (10 ml/min).

Chromatographic investigations: The purity of the initial compounds and synthesized monomers was controlled by GLC method (liquid phase - Apiezon L (15%), KhE-60 (5%) and PEGA (5%); carriers – chromaton and zeolite-547; carrier gas – helium). The molecular weights of the copolymers were determined by gel-penetrating chromatography using styrogel columns as a standard.

Synthesis of monomers: The monomers were synthesized on well-known methods of cyclopropanation of the double bond by carbenes. The monomer 1 was obtained by addition of ethoxycarbonylcarbene formed by catalytic decomposition of ethyldiazoacetate in the presence of copper sulfate, the monomer 2 by addition of dichlorocarbene formed from chloroform under alkaline conditions in the presence of the catalyst of interphase transfer - TEBA-Cl (Makoshi method) on one of two double bonds of diallyl ether [14].

Synthesis of copolymers: The synthesis of copolymers was carried out in an ampoule in a benzene medium at 70°C in the presence of a radical initiator – AIBN, at an equimolar ratio of comonomers [15].

Synthesis of hydrogels: An acetone copolymer solution was made for the synthesis of hydrogels. The calculated quantity (per anhydride links) of polyethylene glycol as a crosslinking agent was added to the copolymer solution in acetone. The mixtures were placed in a round mold and left to react for 48 hours at room temperature and another 48 hours at 80°C.

Swelling Degree: The tests on the swelling ability of the hydrogels were carried out on samples with size 1×1 cm cut from preliminarily dried hydrogel films. The degree of swelling was determined gravimetrically by immersion of the samples in distilled water at room temperature and weighing them at time intervals The tests were completed on achievement of the equilibrium swelling of the samples. The calculations of the kinetic parameters of swelling and the parameters of the hydrogel mesh were carried out similar to the work [8].

The degree of swelling of the gel in % was calculated on Formula 1:

$$S = \frac{M_S - M_d}{M_d} \times 100\% \tag{1}$$

where

S – degree of swelling, %;

 M_d – mass of the dried gel, g;

 M_s – mass of the swollen gel in time τ , g.

The average swelling rate of the gels in water before the equilibrium state ($\bar{\nu}$, min⁻¹) was determined from the tangent of the angle of inclination of the direct dependence of the degree of swelling of the hydrogel on the time of its exposure in water. The coefficient of swelling rate $(k_{\bar{\nu}}, min^{-1})$ was calculated using the **For**mula 2:

$$k_{\overline{\vartheta}} = 1/[\tau \cdot \ln(S_{eq}/(S_{eq} - S_{\tau}))]$$
 (2)

where S_{eq} and S_{τ} – the degree of swelling of the gel at achievement of equilibrium and at time τ, respectively.

For study of the controlled mechanism of the swelling process of the hydrogels cross-linked with PEG, the treatment of the experimental data were carried out using Equation 3 describing kinetic model of the second-order:

$$\frac{\tau}{S} = \frac{\tau}{S_{eq}} + \frac{\tau}{k_S \cdot S_{eq}^2} \tag{3}$$

For elucidation of the mechanism of water diffusion into the hydrogel matrix and for treatment of the kinetic data of the swelling process, the Equation 4 was:

$$\frac{M_{\tau}}{M_{\infty}} = k\tau^n \tag{4}$$

 M_{τ} – mass of water absorbed during the time τ ;

 M_{∞} – water absorption at equilibrium;

k – constant taking into account the structure of the gel and its interaction with the solvent;

n – a swelling index describing the mechanism of solvent penetration into the gel matrix.

The average molecular weight value between the

crosslinking was found by the Flori-Rener **Equation 5**:
$$M_{Ceq} = \frac{-d_p \cdot V_S \cdot \phi^{1/3}}{[\ln(1-\phi)+\phi+\chi \cdot \phi^2]}$$
(5)

The volume fraction of the polymer in the swollen state ϕ was determined using the **Equation 6**:

$$\phi = \left[1 + \frac{d_p}{d_s} \left(\frac{m_b}{m_a}\right) - \frac{d_p}{d_s}\right]^{-1} \tag{6}$$

where

 V_S – molar volume of water ($V_S = 18 \text{ cm}^3/\text{mol}$);

χ − is the Flory-Huggins polymer-solvent interaction parameter;

 m_a and m_b – are the mass of polymer before and after swelling;

 d_p and d_s – are the densities of polymer and solvent, respectively.

γ parameter of the interaction of the polymer with water was found on the basis of the results of experiments and calculated on the Formula 7:

$$\chi = \frac{1}{2} + \frac{\phi}{3} \tag{7}$$

The crosslinking density value V_e was determined on the Formula 8:

$$V_e = d_p \cdot \frac{N_A}{M_C} \tag{8}$$
 Where N_A – Avogadro number (N_A =6.023·10²³

Where N_A – Avogadro number ($N_A = 6.023 \cdot 10^{23}$ mol⁻¹).

3. Results and Discussion

The linear macromolecules sewn into a three-dimensional network structure, at their placing in a solvent, in particular in water or a physiological liquid, are able to swell. This property strongly depends on the structural peculiarities of the macromolecule and the crosslinking agent, their molecular weights, medium temperature, pH and ionic strength of the solution. In addition, the crosslinking density of the hydrogel also influences on the swelling rate. In this paper, we have investigated the influence of the structure of macromolecules of copolymers cross-linked with polyethylene glycol on the ability of the hydrogel to swelling in an aqueous medium.

For the synthesis of the hydrogel, the copolymers of maleic anhydride and cyclopropane-containing allyl ethers with ester and geminal chlorine substituents in the cyclopropane fragment were used. The cyclopropane-containing allyl ethers 1, 2 have been synthesized on the scheme:

$$\begin{array}{c} O \\ \text{DAE} \\ N_2\text{CHCO}_2\text{Et} ; \text{Cu}^{+2} \\ -N_2 \end{array} \qquad \text{:CCI}_2 \begin{array}{c} \text{TEBA-CI} \\ \end{array}$$

The IR spectroscopic investigations of monomers (**Figure 1**) showed the availability of cyclopropane fragments (1031 cm⁻¹), a double bond (1645 cm⁻¹), and also the availability of an ether (925, 1066, 1176 cm⁻¹)

bond. In the IR spectrum of compound **2** there is absorption band at 767 cm⁻¹ characteristics for chlorine atoms.

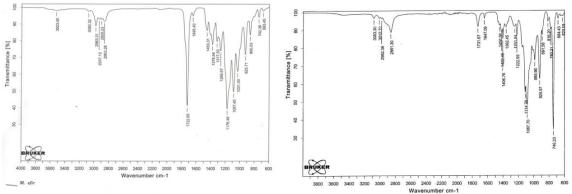


Figure 1. IR spectra of compounds 1 and 2.

The synthesis of copolymers was carried out under the conditions of a free radical initiation reaction in a benzene medium with an equimolar ratio of comonomers.

n O AIBN,
$$70^{\circ}$$
C benzene $x = CO_2Et$; $y = H$ (1) $x = y = Cl$ (2)

The copolymers were weakly colored crystalline products, insoluble in aromatic hydrocarbons, well soluble in polar organic solvents. MW of copolymers found by the viscometric method (in a solution of THF at 20°C) were $5600\text{-}6800~\text{g}\cdot\text{mol-1}$, respectively.

Thermal analysis of the copolymers showed that they are thermally stable up to 157°C. The loss of 5% of the mass of the MA copolymers with compounds 1 and 2 was observed at 155 and 147°C, respectively, and the loss of 50% of the mass of the copolymers was observed at 336 and 331°C, respectively.

The results of IR spectroscopy showed that the copolymerization of ethers with MA proceeded with the participation of a double bond with the formation of copolymers of linear structure and alternating structure. For increase of the hydrophilicity of the copolymers, they were subjected to hydrolysis, as a result of which the anhydride cycles were opened and the obtained copolymer had free carboxyl groups in its structure. For this purpose, the copolymer solutions were prepared in ice distilled water (0°C). For prevention of aggregation and complete wetting of the copolymer particles, the

mixtures were intensively mixed, heated and kept at 95-100°C for proceeding of the hydrolysis reaction, as evidenced by the transparency of the solution.

In **Figure 2** the IR spectra of copolymers: (a) – ethoxycarbonylcyclopropyl-methyl allyl ether and (b) – gem-dichlorocyclopropyl methyl allyl ether with maleic anhydride are presented.

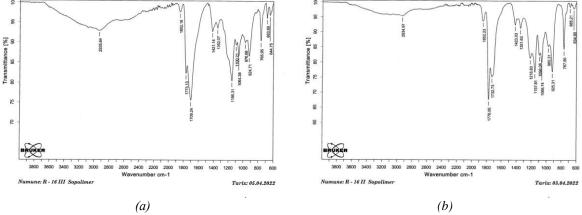


Figure 2. IR spectra of copolymers: (a) - compound 1, (b) - compound 2 with maleic anhydride.

For preparation of the materials of the network structure, the copolymers were esterified with polyethylene glycol with a molecular weight of 300 Da at a ratio of 2:1. The esterification reaction between the carboxyl groups of anhydride cycles and the hydroxyl groups of PEG proceeded according to the scheme shown below.

 $R = H-(O-CH_2-CH_2)_n-OH$

Scheme of hydrogel synthesis by copolymer esterification reaction PEG-300.

It is noteworthy that during this reaction, the cyclopropane fragments located in the chain of the macromolecule of copolymers remain untouched. As is known, the cyclopropane group is a key component of many drugs, and the introduction of new drugs of the cyclopropane group into the structure can give them new specific pharmacological properties [16]. It was also important for us to preserve the cyclopropane fragments in the structure of the cross-linked polymer.

The esterification reaction between the carboxyl groups of anhydride cycles and the hydroxyl groups of

PEG was judged by the IR spectra of the obtained hydrogels. In the IR spectrum of the esterified samples, the disappearance of bands at 1852 cm⁻¹ and 1776 cm⁻¹ characteristic for anhydride fragments and the appearance of a strong band –C=O of the ester and bands characteristic for free COON-groups at 1702, 2680 and 2602 cm⁻¹, was observed respectively (**Figure 3**). In the spectra of samples, it can also be observed the bands at 1040 cm⁻¹ characteristic for the cyclopropane group.

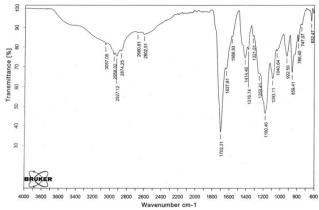


Figure 3. IR spectrum of cross-linked PEG copolymer of compound 1.

The obtained resin-like adhesive products for proceeding of the esterification reaction were subjected to chemical crosslinking at 80°C for 48 h. The esterified copolymers were transparent, elastic, films painted in intensive yellow color (due to the solvatochromic properties of the copolymers [17]) with sufficiently good adhesion to the glass substrate (Figure 4).





Copolymer hydrogel of compound 1



Copolymer hydrogel of compound 2

Figure 4. The appearance of thermally cross-linked PEG-300 copolymers.

The ability of cross-linked materials to swell in water or physiological solutions is an important property if they will be used as carriers of biologically active compounds. The hydrogels formed from comonomers with high hydrophobicity or volume substituents creating steric difficulties have a reduced ability to absorb water. On the other hand, the ability to swell can be adjusted by changing the degree of crosslinking of the hydrogel by selection of the ratio of the copolymer and the crosslinking agent or the type of crosslinking agent and its molecular weight. The hydrogels obtained by us have been tested for the ability to swelling for 300 h in distilled water at room temperature. According to the test results, the swelling curves have been constructed (Figure 5).

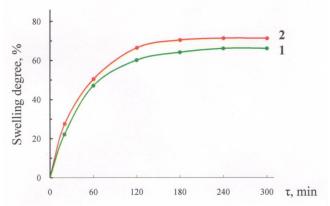


Figure 5. Dependence of the degree of swelling on the time of the hydrogel obtained from: 1 – copolymer of compound 1 with maleic anhydride; 2 – copolymer of compound 1 with maleic acid.

The equilibrium swelling of the hydrogels of the copolymer of compound 1 and its hydrolyzed analog under the studied conditions (at 25°C, pH = 7) was 66 and 71%, respectively. The degrees of swelling have been calculated on the Formula 1.

The average swelling rate of gels in water before the equilibrium state (\bar{v}, \min^{-1}) was determined as the tangent of the angle of inclination depending on the degree of swelling of the hydrogel on the keeping time in water. The hydrogel swelling rate constant was calculated on the Formula 2. It can be seen from the obtained calculations that k_{ν} value practically is not changed in a neutral medium.

For study of the controlled mechanism of hydrogel swelling, the Equation 3 describing kinetic model of the

second-order was used for treatment of the experimental data. From the graphs of linear regression of swelling (**Figure 6**), on the basis of the dependence of t/S on τ , the pseudo-second-order swelling rate constants were found.

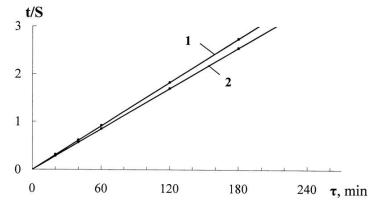


Figure 6. Dependence of t/S on τ time of linear regression of swelling.

For elucidation the mechanism of water diffusion into the hydrogel and treatment of the kinetic data of the swelling process, the Formula 4 was used. After logarithm of Equation 4, a graph of the dependence of ln (M_{τ}/M_{∞}) on ln τ was plotted, and n and k values were graphically determined. n < 0.5 values found in this way indicate the diffusion mechanism of hydrogel swelling. In Table the results of kinetic calculations and the parameters of the hydrogel mesh on the basis of ethoxycarbonyl substituted cyclopropylmethylallyl ether

with maleic anhydride (1) and its hydrolyzed analog (2) are presented.

As is known, the swelling of polymer meshes of hydrogels has been connected with a change of their structure. The possibility of their use as drug carriers depends on parameters such as the density of crosslinks, the average molecular weight between crosslinks or the volume fraction of the polymer in the swollen state. These characteristics of the mesh parameters determine their usefulness and potential area of their application [18,19].

Table. Some kinetic characteristics and parameters of the hydrogels mesh on the basis of copolymer 1 and its hydrolyzed analog (2).

Hydrogel	S, %	$k_{ m \tilde{v}} imes 10^{-5}$ (g gel/ gH ₂ O)/min	r ₀ , (gH ₂ O/ g gel)/min	n	k×10 ⁻²	ф	M _C (eq) g/mol ⁻¹	χ	V _e ×10 ²⁰
1	66	20.06	3.3	0.41	2.12	0.94	664	0.813	12.85
2	71	22.16	3.5	0.43	2.37	0.92	765	0.807	11.09

The volume fraction of the polymer in the swollen state, calculated by formula (6), shows how much liquid can be absorbed into the hydrogel matrix. These values, as can be seen from the data in the Table, indicate the formation of a sufficiently dense polymer mesh. The average calculated molecular weights between the crosslinking, calculated by the Flori-Rener Equation 5, take into account the availability of free movement of the polymer chain between adjacent crosslinking in a hydrogel swollen in a solvent. In the obtained hydrogels, the molecular weights between the crosslinking have low values. On the contrary, the high crosslinking density values (V_e) per unit volume of hydrogel in the swollen state also indicate a tightly crosslinked network structure of the obtained hydrogels. Such mesh materials, as a rule exhibit a low swelling rate. On the other hand, the influence of the structural parameters of the copolymers forming the hydrogel mesh is also obvious. The relatively large volume of substituent with cyclopropane group, showing a hydrophobic character, also prevents the penetration of a large quantity of water into the hydrogel matrix.

Nevertheless, the obtained materials can be used in such systems controlled delivery of medicinal compounds, where a high rate of their release is not required. The preliminary tests showed that in an medium with pH≈9, these materials show greater swelling than in a neutral medium. Therefore, our further investigations will be aimed at studying the swelling process of these hydrogels depending on pH medium and temperature.

4. Conclusion

The polymer hydrogels on the basis of alternating copolymers of cyclopropane-containing allyl ethers cross-linked with polyethylene glycol have been synthesized, the kinetics of their swelling in water has been investigated and the parameters of the hydrogel mesh have been calculated. The behavior of the obtained hydrogels during swelling in water has been shown. The maximum equilibrium swelling of these hydrogels in distilled water did not exceed 71%. The calculated values of the mesh parameters show that the obtained materials are tightly cross-linked meshes with small free volume for solvent diffusion into the cell, which has

been probably caused not only by the ratio of the copolymer and the crosslinking agent, but also by the structural peculiarities of the used copolymers. The practical application of these materials is possible in the systems with delayed release of drugs, and the high adhesion predetermines their possible use as components of membranes and other devices.

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ECONOMIC SCIENCES

RETROSPECTIVE ANALYSIS OF THE PHOTOVOLTAICS MARKET IN THE WORLD AND IN UKRAINE

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Abstract

The article analyzes the photovoltaic market in Ukraine and in the world. It determines the place of photovoltaics among renewable energy sources. Also it reviews the origin of solar energy in the countries of the world and presents the leading countries in the generation of solar energy. In the article is determined Ukraine's place in the European and global solar energy market.

Keywords: renewable energy, photovoltaic, solar energy, solar energy market.

Introduction. Energy is the backbone of the global economy. However, while a few decades ago it was based primarily on fossil resources, in recent years the influence of alternative energy sources has been growing. This is due to both the exhaustibility of fossil resources and their negative impact on the environmental situation on the planet.

Solar energy is the second largest source of renewable energy in the world, second only to hydropower. Thanks to the installation of new photovoltaic installations in previous years, global solar capacity in 2020 exceeded that of wind power.

Analysis of recent research and publications. They presented an analysis from 2015 to 2021 on the share of renewable energy in general and solar energy in particular in global electricity generation, the weighted average cost of solar energy (LCOE) compared to other sources, and proposed scenarios for the medium-term development of solar energy in 2022-2026 [1].

Regarding the prospects for the development of solar energy in Ukraine, it is worth noting the study "Solar energy in Ukraine: analysis and its role in ensuring economic security" [2]. The authors consider that the development of the alternative energy sector is a long-term energy and environmental priority for Ukraine, as provided by domestic legislation and participation in international agreements.

Y. Dziadykevych, M. Buriak and I. Liubezna [3] studied aspects of solar energy development in Ukraine in order to increase the economy of fossil energy sources and energy security of the country.

However, the results of research on the photovoltaic market, covered in these works, do not take into account new trends in the basic indicators of the energy sector due to the constant change in the global economy in the scale and structure of light energy consumption.

Purpose of work. The purpose of our research is to conduct a retrospective analysis of solar energy use in Ukraine and the world. The article focuses on the study of basic indicators characterizing the situation and trends in the development of solar energy.

Analysis and discussion. Solar energy is the second largest source of renewable energy in the world, second only to hydropower. Thanks to the installation of new photovoltaic installations in previous years, global solar capacity in 2020 exceeded that of wind power.

According to the report of the International Renewable Energy Agency (IRENA), at the end of 2021, 3,064 GW of renewable generation capacity was earned worldwide, including 40% from hydroelectric power plants (1,230 GW), 28% from solar power plants and 27% from wind power plants (Figure 1). According to statistics, solar energy and wind have grown many times faster than hydropower over the years [4].

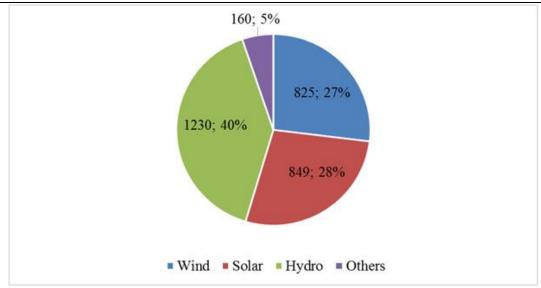


Figure 1. Structure of installed RES capacities in 2021, GW.

Source: estimated by the authors to [4]

Solar and wind have nearly equal market shares with 849 GW (843 GW of photovoltaic and slightly more than 6 GW of solar thermal generation) and 825 GW, respectively. Other renewable energy sources (with a combined share of about 5%) include 143 GW of bioenergy, 16 GW of geothermal and 524 MW of marine energy [4].

In 2022, the global consumption of solar energy reached 12.41 EJ, which is 3448.3 TW-hours (Appendix A). In this period, solar energy volumes grew by 27.63% year on year, adding 2.69 EJ, i.e. about 747.2 TWh of generating capacity. The growth in this type of energy exceeds the growth in all renewable sources (1.49%), such as wind, geothermal, bioenergy and biofuel production. At the same time, the increase in all capacities from renewable sources, fossil fuels, nuclear energy and hydroelectric power is 5.52% [5].

According to British Petroleum [5] (Appendix A), the annual increase in global consumption of solar electricity since 2001 is more than 20%. Moreover, the average growth rate of renewable energy was 15%, and the annual growth in the volume of all total energy resources did not exceed 5% and fluctuated on average within 1-2%. The annual growth rate of solar energy storage capacity makes solar energy the fastest growing renewable energy source.

Since solar energy in the last decade has been not only the largest sector of the world's electric power industry in terms of annually commissioned capacities, but also attracted investments, this gives reason to assert that humanity is confidently moving into the sunny future of clean renewable energy.

Mankind has always tried to use the potential of the Sun, but it was only 69 years ago, in 1954, that they began to turn sunlight into electric current (Table 1).

Table 1

Discoveries that marked the beginning of solar energy

	Discoveries that marked the beginning of solar energy							
Year	Person/company	Content	Importance					
1883	Charles Fritts, American inventor	He first used selenium to turn light into electricity.	The efficiency of this method was very low, but it laid the foundation for solar energy.					
1921		He explained the phenomenon of the photoelectric effect - the release of electrons under the influence of light and received the Nobel Prize for this.	This discovery became the cornerstone for solar energy.					
1946	American engineer Russell Ohl	He patented the silicon solar cell	Silicon is still used in the manufacture of solar panels.					
1954	researchers of the American company Bell Labs	They designed a silicon solar cell capable of achieving 6% energy conversion efficiency under direct sunlight.	Thanks to this discovery, the company released the world's first photomodules.					
1985	scientists from the Austral- ian University of New South Wales	They invented a way to increase the efficiency of solar panels up to 20%	Thanks to this, solar power plants have become cheaper, and the capacity of solar energy generation has increased.					

Source: completed by the authors to [6].

Although the mass production of solar panels began in 1963 [6], however, the mass construction of solar power plants began somewhat later (table 2).

Table 2

The origin of solar energy in the countries of the world

Year	Countries	Year	Countries	Year		
1 Cai	Countries	1 Cai	Countries	1 Cai		
1983	USA	1998	Argentina	2009	Bulgaria, Croatia, Estonia, Ireland, Is-	
					rael	
			Colombia, Trinidad & To-		Venezuela, North Macedonia, Slovakia,	
1984	United Kingdom	2000	bago, Egypt South Africa,	2010	Turkey, Turkmenistan, Algeria, China	
			Western Africa		Hong Kong SAR, Vietnam	
1000	T. 1. D 1. G	2001	Eastern Africa, Middle	2011	III ' I (' I'd ' D.1 1	
1989	Italy, Portugal, Spain	2001	Africa	2011	Ukraine, Latvia, Lithuania, Poland	
	Finland, Germany, Mexico,					
1990	•	2002	Morocco, Bangladesh	2012	Kazakhstan, Malaysia, Brazil, Chile	
	South Korea		, ,			
1001	A	2004	Belgium, Greece, Cyprus,	2012	A selection Delegate IV selections	
1991	Australia	2004	Czech Republic	2013	Azerbaijan, Belarus, Kuwait, Oman	
1002	France, Canada,	2005	DL '11' '	2016	II 1.12.	
1992	Netherlands	2005	Philippines	2016	Uzbekistan	
1993	Austria, Sweden	2006	Iran, Thailand	2017	Colombia	
1995	India	2007	New Zealand, Pakistan			
			Hungary, Slovenia, Saudi			
1996	Denmark	2008				
			pore			

Source: completed by the authors to [5].

The first country in the world (according to British Petroleum) to use solar energy was the United States of America. In 1983, only 3 GWh of electricity was generated. From 1984 to 1991, nine power plants with parabolic trough concentrators were built in California with a total capacity of 354 MW [7, p. 6]. By the end of 1991, US solar power plants had already generated 0.5 TWh of electricity. As of 1991, only 13 countries out of 92 operated solar power plants, namely 7 countries in Europe, 4 countries in Asia and 2 countries in North America (USA and Mexico).

In 1992, the United Nations adopted the first global climate agreement, the Framework Convention on Climate Change [8]. It was then that the call to reduce greenhouse gas emissions and switch to renewable energy sources (RES) was first heard at a high level.

This prompted other countries to install solar power plants. In the 1990s, this process began in European countries, and since the 2000s, Asian and African countries have joined them. Most countries in the Middle East have joined since the 2010s.

In 2015, the Paris Agreement was adopted [9], which provided for concrete steps by the governments

of all countries to curb global warming. Since burning fossil fuels emits more greenhouse gases into the atmosphere, governments and businesses must invest in the development of clean energy technologies to prevent a climate crisis.

The last countries to introduce solar energy in 2016-2017 were Uzbekistan and Colombia.

Note that by the end of 2022, among the countries of the world, only Iceland does not use solar energy to generate electricity and heat. However, despite the low level of insolation in Iceland, electricity in this country is 100% generated from renewable sources. 13 % of Iceland electricity comes from geothermal power, 87 % of the clean energy comes from hydropower. Iceland's glaciers and mountains are perfect for hydroelectric generation [10].

For many years (until 2001), the United States played a leading role in the development of global solar energy (table 3). However, if in 1989 the country accounted for almost 97% of the total volume of this energy, then in 2000 it was only 45%. Such dynamics is associated with an increase in the global production of solar electricity by other countries [5].

Table 3

C1	C 1 1'	. •		1	
Share	of leading	countries	1n :	solar ene	rgv

Year	TOP-5 Countries	Volume, Terawatt-hours	Share, %
	USA	0.300	96.77
1989	Spain	0.006	1.94
1989	Italy	0.002	0.65
	Portugal	0.001	0.32
	Japan	0.700	38.89
	USA	0.600	33.33
2002	Germany	0.200	11.11
	Australia	0.100	5.56
	China	0.048	2.67
	Germany	2.300	39.66
	Japan	2.000	34.48
2006	USA	0.800	13.79
	China	0.100	1.72
	Australia	0.100	1.72
	China	39.500	15.51
	USA	39.400	15.47
2015	Germany	37.200	14.61
	Japan	34.500	13.55
	Italy	22.900	8.99
	China	327.000	31.67
	USA	165.400	16.02
2021	Japan	86.300	8.36
	India	68.300	6.62
	Germany	49.00	4.75
	China	427.700	32.34
	USA	206.200	15.59
2022	Japan	102.400	7.74
	India	95.200	7.20
	Germany	60.800	4.60

Source: estimated by the authors to [5].

Since 2002, Japan has become the world leader in the development of solar energy. Given the island nature of the country and the exhaustive hydropower resources, Japan has focused on solar energy and since 2002 has occupied about 40% of this market. The world leaders in the use of solar energy in 2002 were the USA, Germany, Australia and China. The TOP-5 countries in 2002 generated more than 90% of the world's solar energy.

In 2006, Germany increased the generation volumes. To support renewable energy, Germany has introduced a number of regulations, in particular the Renewable Energy Act [11]. According to this law, it is possible to enter into long-term contracts (even up to 20 years) with green energy suppliers.

In total, Germany, Japan, America, China and Australia in 2005 provided more than 90% of the total capacity of the world's solar energy. Moreover, the first two countries accounted for 75% [5].

Since 2015 and to this day, China has been the world leader in the development of solar energy. It should be noted that the TOP-1 in the photovoltaic market by this country was achieved due to the annual increase in the production of solar electricity at a level of at least 200%. A sharp increase in the generation of solar energy in China began in 2013 due to the reduction in the cost of its production.

According to Solar Power Europe [12] and British Petroleum [5], the world leaders in the use of solar energy in 2021-2022 were the China, USA, Japan, India and Germany. The TOP-5 countries in 2021-2022 generated about 70% of the world volumes, and China and America accounted for almost half of the world market for this energy.

It should be noted that the solar market in India is quite promising. Huge solar power plants have been installed in the country – in the deserts of Rajasthan and Gujarat. Many of these are public-private partnerships run by utility companies – they send electricity to the grid. As for private companies, the government subsidizes the investment of Indian companies in this area and eliminates the payment for the transmission of renewable energy [13]. The world's largest solar power plant (2,245 GW) was built in 2019 at Bhadla Phalodi tehsil, Jodhpur district, Rajasthan, India [14].

As for Ukraine, solar energy is a relatively new industry, but with a rapid pace of development. It should be noted that the entire territory of Ukraine is suitable for the development of electricity and heat supply systems using solar energy. However, the most promising regions of the country are the Crimean Peninsula and steppe Ukraine. It should be added that in Ukraine the annual solar radiation is comparable to countries that actively use solar collectors (e.g. Sweden, Germany, USA).

According to British Petroleum, in Ukraine electricity from solar radiation (0.03 TWh) was for the first time generated in 2011 (table 4).

Ukraine on the global solar energy market

Table 4

Year	Renewables: Generation - Solar Total World, Terawatt-hours	Growth rate compared to the previous period,	Ukraine			
			Renewables: Genera-	Share, %		
			tion-Solar, Terawatt-	value	place	
			hours	varue		
2011	65.60	-	0.03	0.05	34/80	
2012	101.50	154.73	0.30	0.30	27/85	
2013	138.60	136.55	0.60	0.43	20/89	
2014	196.40	141.70	0.40	0.20	30/89	
2015	254.70	129.68	0.50	0.20	31/89	
2016	327.58	128.61	0.49	0.15	37/90	
2017	445.47	135.99	0.72	0.16	38/91	
2018	576.23	129.35	1.11	0.19	35/91	
2019	703.95	122.16	2.93	0.42	29/91	
2020	846.23	120.21	5.37	0.63	21/91	
2021	1032.50	122.01	6.33	0.61	21/91	
2022	1322.6	128.1	5.1	0.38	25/91	

Source: estimated by the authors to [43].

Over the next 10 years, Ukrainian solar power plants increased generation to 6.33 TWh of electricity in 2021, however, the share of Ukrainian solar energy did not exceed 0.61% of global generation volumes in 2021.

In 2022, there was a reduction in solar energy generation, as some of the SPPs were damaged due to hostilities or were located in the occupied territory.

The first step to encourage the production of solar (as well as other renewable) electricity in Ukraine was the introduction of annually renewable "green tariffs". This tariff was adopted at the end of 2008. According to it, electricity obtained from alternative sources is purchased by the state at tariffs that are an order of magnitude higher than the market value. The program of "green tariffs" is designed until 2030 with a gradual reduction in the cost of 1 kW of electricity so that at the end of the program its cost is compared with the standard.

For example, for solar power plants located on the roofs of buildings, in 2010 the "green tariff" was (excluding VAT):

- 484.05 kopecks per 1 kW/h for a station with a capacity of up to 100 kW;
- 463.00 kopecks per 1 kWh for a station with a capacity of more than 100 KW [15].

For photovoltaic facilities located in open areas, the highest tariff was set at 505.09 kopecks per 1 kWh (excluding VAT). Consequently, in 2010, ground-based solar power facilities in Ukraine could receive a "green tariff" at the level of UAH 5.06. for 1 kW (with VAT) or about 60 euro cents for 1 kW/hour. Moreover, the market is considered "interesting" if the tariff is over 28 euro cents [15].

Let us determine the place of Ukraine in the European solar energy market (Table 5).

Table 5

Ukraine on the European solar energy market

Ukraine on the European solar energy market										
Year R	Renewables: Generation - Solar Total World, Terawatt-hours	Growth rate compared to the previous period, %	Ukraine							
			Renewables: Genera-	Shor	o 0/	Growth rate compared to				
			tion-Solar, Terawatt-	Share, %		the previous period, %				
			hours	value	place	value	place			
2011	47.11	_	0.03	0.06	16/47	ı	-			
2012	72.23	153.34	0.30	0.42	13/47	1000.00	3/47			
2013	86.55	119.81	0.60	0.69	12/47	200.00	12/47			
2014	97.34	112.47	0.40	0.41	17/47	66.67	47/47			
2015	108.23	111.19	0.50	0.46	17/47	125.00	21/47			
2016	112.40	103.85	0.49	0.44	19/47	98.00	23/47			
2017	122.76	109.21	0.72	0.59	17/47	146.94	9/47			
2018	136.17	110.92	1.11	0.82	16/47	154.17	10/47			
2019	150.44	110.48	2.93	1.95	10/47	263.96	1/47			
2020	175.65	116.76	5.37	3.06	8/47	183.28	2/47			
2021	195.55	111.33	6.33	3.24	8/47	117.88	12/47			
2022	246.4	126.04	5.1	2,1	11/47	80.35	-			

Source: estimated by the authors to [5].

In terms of solar energy generation in 2022, Ukraine ranked 11th (5,1 TWh) in Europe. The country became the leader in the growth rate of the solar energy industry in 2019 (+163.96%). And in 2020, Ukraine took the 2nd place (with an indicator of 183.28%), second only to Poland (with an indicator of 275.50%) [5].

Thus, the leading positions in the global solar energy are occupied by the countries of Asia (China, Japan and India) and Europe (primarily Germany). At the end of 2022, less than 1% of the world's volumes of this energy were generated in Ukraine.

Conclusion. Therefore, the modern solar energy industry has already gained high development dynamics. The success story of solar energy compared to other technologies has many reasons, but the key factor is the cost reduction that has made solar energy the world leader in terms of cost reduction. In addition, it is virtually inexhaustible and a free resource. The mediumterm forecast for the global economy is difficult to predict. Nevertheless, the world will see high demand for solar energy in the coming years, as this energy is not only economical but also ensures energy security at the national and individual levels. As for Ukraine, it has a significant natural, geographical and investment potential for the renewable energy sources development and therefore it is the main direction in the implementation of state energy saving policy of Ukraine.

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Appendix AVolumes of energy consumption in the world in the period 1965-2022.

	Solar: Consumption		Renewables: Consumption		Primary Energy: Consumption		Share: Solar, %	
Year	Exajoules (input- equivalent)	Growth rate compared to the previous period, %	Exajoules (input- equivalent)	Growth rate compared to the previous period, %	Exajoules (input- equivalent)	Growth rate compared to the previous period, %	In rene- wables	In Primary Energy
1965	0	-	0.23	-	155.88	-	0.00	0
1966	0	-	0.26	109.19	164.20	105.34	0.00	0
1967	0	-	0.26	101.11	170.38	103.76	0.00	0
1968	0	-	0.28	109.55	180.69	106.05	0.00	0
1969	0	-	0.30	104.70	192.82	106.71	0.00	0
1970 1971	0	-	0.33 0.36	111.05 108.33	205.08 213.45	106.36 104.08	0.00	0
1972	0	-	0.38	107.44	224.89	105.36	0.00	0
1973	0	-	0.41	106.10	238.05	105.85	0.00	0
1974	0	-	0.43	105.50	239.50	100.61	0.00	0
1975	0	-	0.43	100.49	240.67	100.49	0.00	0
1976	0	-	0.48	110.71	253.52	105.34	0.00	0
1977	0	-	0.52	108.07	262.84	103.68	0.00	0
1978	0	-	0.56	109.00	273.48	104.05	0.00	0
1979	0	-	0.61	109.31	282.87	103.43	0.00	0
1980	0	-	0.66	107.71	280.56	99.18	0.00	0
1981	0	-	0.69	104.66	279.38	99.58	0.00	0
1982	0	-	0.82	117.83	277.85	99.45	0.00	0
1983	0.00003	210.27	0.92	113.19	282.35	101.62	0.00	0.0001
1984 1985	0.00007 0.00013	210.37 186.14	1.04 1.11	113.18 106.19	295.83 303.47	104.77 102.58	0.01	0.0001
1985	0.00013	129.25	1.11	112.07	310.26	102.38	0.01	0.0001
1987	0.00010	69.83	1.32	105.87	321.08	103.49	0.01	0.0001
1988	0.00011	96.16	1.36	103.62	333.22	103.78	0.01	0.0001
1989	0.00279	2571.83	1.52	111.34	339.68	101.94	0.18	0.0008
1990	0.00413	148.08	1.71	112.35	343.90	101.24	0.24	0.0012
1991	0.00538	130.11	1.79	104.86	346.37	100.72	0.30	0.0016
1992	0.00497	92.36	1.89	105.59	348.55	100.63	0.26	0.0014
1993	0.00593	119.31	1.97	104.05	351.29	100.79	0.30	0.0017
1994	0.00636	107.24	2.07	105.37	355.77	101.28	0.31	0.0018
1995	0.00680	107.00	2.18	105.09	363.78	102.25	0.31	0.0019
1996	0.00744	109.45	2.21	101.68	374.19	102.86	0.34	0.0020
1997	0.00798	107.20	2.38	107.64	377.99	101.01	0.33	0.0021
1998 1999	0.00864	108.30	2.51	105.25	380.42	100.64	0.34	0.0023
2000	0.00964 0.01127	111.51 116.99	2.66 2.85	106.23 107.15	387.05 396.88	101.74 102.54	0.36	0.0025
2000	0.01127	133.53	2.83	104.93	400.76	102.34	0.50	0.0028
2002	0.01890	125.58	3.41	113.97	409.53	102.19	0.55	0.0036
2003	0.02354	124.55	3.73	109.19	424.09	103.55	0.63	0.0056
2004	0.03083	130.93	4.27	114.55	444.97	104.92	0.72	0.0069
2005	0.04316	140.02	4.83	113.08	459.23	103.21	0.89	0.0094
2006	0.05902	136.74	5.53	114.46	472.29	102.84	1.07	0.0125
2007	0.07958	134.84	6.52	117.95	486.91	103.10	1.22	0.0163
2008	0.12845	161.41	7.78	119.36	492.53	101.15	1.65	0.0261
2009	0.21187	164.95	8.93	114.79	485.02	98.48	2.37	0.0437
2010	0.33884	159.93	10.54	118.02	508.68	104.88	3.22	0.0666
2011	0.65131	192.21	12.14	115.18	520.90	102.40	5.37	0.1250
2012 2013	1.00231 1.35989	153.89 135.68	13.82 15.81	113.88 114.39	528.18 537.56	101.40 101.78	7.25 8.60	0.1898 0.2530
2013	1.91502	133.08	17.63	114.39	543.52	101.78	10.86	0.2530
2014	2.46963	128.96	17.03	111.31	548.14	101.11	12.38	0.3323
2015	3.15704	127.83	22.09	110.75	555.91	101.42	14.29	0.4303
2017	4.26785	135.19	25.36	114.78	566.66	101.93	16.83	0.7532
2018	5.48838	128.60	28.53	112.53	582.38	102.77	19.23	0.9424
2019	6.68013	121.71	31.74	111.22	587.43	100.87	21.05	1.1372
2020	8.00080	119.77	34.80	109.65	564.01	96.01	22.99	1.4186
2021	9.72620	121.57	39.91	114.69	595.15	105.52	24.37	1.6342
2022	12.4137	127.63	45.18	113.20	604.04	101.49	27.48	2.0551
Source	a: completed o	and estimated b	the outhors to	o [5]		_		

Source: completed and estimated by the authors to [5].

OPTION FOR IMPLEMENTING STEM METHODOLOGY INTO EDUCATION

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ВАРИАНТ ВНЕДРЕНИЯ МЕТОДОЛОГИИ STEM В ОБРАЗОВАНИИ

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Abstract

A possible option for introducing STEM methodology into preschool and school education is described.

Описан возможный вариант внедрения методологии STEM в дошкольное и школьное образование.

Keywords: STEM methodology, game-based learning, creative thinking, complex problem solving **Ключевые слова:** STEM методология, игровая форма обучения, креативность мышления, комплексное решение проблем.

STEM методология в образовании завоевала популярность и стала одной из самых перспективных. Это связано с высоким уровнем результатов обучения и легкостью использования. Характерные отличия STEM методологии в обучении:

- 1. Постановка комплексных проблем, охватывающих несколько дисциплин (математика, наука, техника, инженерия...)
 - 2. Игровая форма работы с обучаемыми.
- 3. Параллельное развитие других компетенций (стиль изложения, риторика, литература, культура, психология...)
- 4. Возможность проявления нестандартного мышления, свободного от стереотипов. [1.2.3]

В Республике Казахстан начинается активное внедрение STEM методологии в образование. В ВУЗах ввели методологию как дополнительны курс по выбору. В городах появляются коммерческие компании, которые ведут доподготовку педагогов

по STEM методологии. Однако, практика показывает о слабом внедрении в школах и о практически провальных опытах в дошкольном образовании.

Проведенные исследования проблемы привели к следующим результатам.

1. Опрос специалистов по дошкольному образованию о возможности изменений в стандартах образования и системах контроля.

Генеральная совокупность: ≈ 2150 специалистов в области дошкольного образования

Выборка: 47- действующих педагогов; 12- специалистов Министерства просвещения РК (9 из отдела дошкольного образования и 3 из отдела по контролю); 53- специалиста кафедр дошкольного образования различных ВУЗов РК. Всего- 112 чел.

Метод: телефонный опрос методом интервью. Система оценки состояния – шкала 100 баллов (100-отлично; 0-плохо)

Результаты представлены на рисунке 1



Рисунок 1- Результаты интервью о системе дошкольного образования ДО

2. Исследования действующих учреждений дошкольного образования

Генеральная совокупность: в Алматы 824 из них государственных -189, частных -399, мини центров-236; в Астане около 500 из них: государственных-115, частных-240, мини центров- 145. Средняя статистика: всего- 1324 учреждения, из них: государственные 23%; частные 48%; мини центры 29%.

Выборка: 247 учреждений дошкольного образования. Из них 57 государственных; 119 частных; 71 мини центры.

Метод исследований: тайный покупатель. Система оценки: шкала 100 баллов (лучшее состояние-100; худшее соответственно)

Результаты представлены на рисунке 2



Рисунок 2- Результаты исследований по методу «тайный покупатель»

3. Проведение исследования начальных школ

Генеральная совокупность: 11 школ из них три гимназии. Общая численность начальных классов \approx 4 750 чел.

Выборка: 6 школ и две гимназии.

Метод исследований: интервью коллектива учителей начальных классов.

Система оценки: шкала 100 баллов (лучшее состояние-100; худшее соответственно)

Результаты представлены на рисунке 3



Рисунок 3- Опрос педагогов начальных школ о технологии STEM

4. Опрос возможности создания факультатива и интернет платформы по STEM технологиям для школьников

Генеральная совокупность района: 6897 учащихся.

Выборка: Три школы района, по 450 чел из каждой школы по 90 человек со сдвоенного потока(сдвоенный поток- 3,4 класс; 5,6 класс;...) Всего 1350 чел.

Метод исследований

Система оценки: шкала 100 баллов (лучшее состояние-100; худшее соответственно)

Результаты представлены на рисунке 4

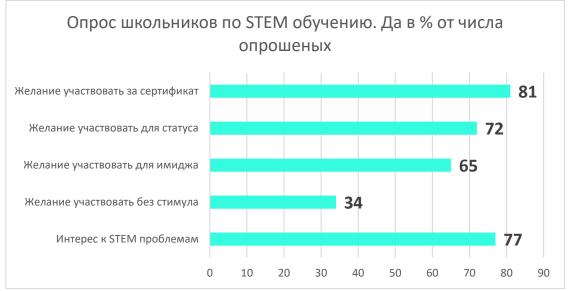


Рисунок 4- результаты опроса школьников о желании участвовать в STEM программах

В целом, опрос показал, что при применении различного рода стимулов возможно привлечение в проект от 500 до 2 000 учащихся. Особенно если учесть проведение командных соревнований в школах по STEM моделям.

Выводы из исследования:

- 1. Действующая система образования соответствует передовым мировым тенденциям на 30-40%, что оставляет нишу для внедрения STEM методологии.
- 2. Дошкольные и школьные учреждения не используют STEМметодологию и аналоги в обучении и воспитании.
- 3. Интерес педагогов к STEM моделям достаточно высок, не хватает знаний, умений и навыков. Но процесс обучения педагогов начался под давлением рейтинга и тестов PISA.
- 4. Родители испытывают повышенный интерес к новым технологиям обучения и в основной массе готовы к его использованию в обучении и воспитании детей.

Для эффективного внедрения STEM методологии в образование необходимо развернуть агрессивную компанию по продвижению и PR.

Эти мероприятия должны проводиться на коммерческой основе и сопровождаться системой вознаграждения, сертификации и широкому освещению в СМИ.

Внедрение STEM методологии в образование протестировано и дало положительный результат в следующем тактическом исполнении:

1. Открыто учреждение по дошкольному обучению детей в возрасте 3-7 лет по методологии STEM. Пятидневный цикл продолжительностью 1-3 часа в день. Стоимость \approx \$ 1 в час. Наполняемость

составила 32-137 детей в месяц. Из них полный курс прошли 75,4%; использовали больше половины учебного времени курса 84,3%; покинули курс после 3-5 занятий 7,4%. Основная причинасложность привести ребенка на занятия в течении дня (не кому).

- 2. Проведение факультативных занятий в школах в рамках подготовки к STEM соревнованиям. Отработано 12 факультативных групп по 5-8 чел. Из них сформированы 5 команд. Проведены отборочные соревнования. В финал школы вышли 2 команды. Результат превзошел все ожидания:
 - высокая активность участников;
 - престижность статуса участника команды;
 - 100% наполняемость зала школы на финале;
 - окупаемость мероприятия 327%.

Все подготовительные мероприятия проводились бесплатно. Билеты продавались только на финал. Стоимость входного билета составила $\approx 1 .

3. Организация командных STEM соревнований на уровне района и города с привлечением СМИ, спонсоров способных сформулировать проблему для команд. Проведены мастер классы на уровне команд с участием команд 3-х школ. Результаты положительные, наполняемость зала 100%, много неудовлетворенных, не попавших в зал.

Общий замысел проекта: дошкольное образование по методологии STEM не обладает высокой привлекательностью и результативностью. Поэтому основным двигателем бизнеса будет являться построение системы соревнований по STEM методологии. На них будет сосредоточены основные мероприятия по продвижению и PR. Проведение внутришкольных, межшкольных, районных и городских соревнований STEM команд с вручением

сертификатов. Привлечение спонсоров через постановку проблем, в решении которых они заинтересованы. В качестве проблем могут выставляться проблемы района, города, отдельного объекта бизнеса...

Программа соревнований:

- 1. Три проблемы, которые сформулированы как домашнее задание для команд. Команды презентуют варианты решения жюри конкурса
- 2. Решение блиц проблем (3-5). На решение блиц проблем командам дается 20 минут. Для публики объявляется перерыв.
- В жюри присутствуют представители спонсора и люди с IQ выше 125.

Таким образом, раскрутка проекта будет охватывать школу и естественным образом, на имидже брэнда вытянет дошкольное образование, которое можно будет реализовывать по франчайзингу.

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JURISPRUDENCE

SOME FEATURES OF THE FIGHT WITH CORRUPTION IN THE REPUBLIC OF KAZAKHSTAN

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Abstract

The article is devoted to the current problem of combating not only in the Republic of Kazakhstan, but also all over the world. The authors reveal the goals, objectives and main conditions for effective and systemic counteraction to corruption. Special attention is given the main factors of contributing for its manifestations in modern conditions.

Keywords: Corruption, anti-corruption, state, politics, public function.

In his message to the people of Kazakhstan "Economic course of fair Kazakhstan," President of the Republic of Kazakhstan Kassym-Zhomarta Tokayev emphasized that the country aims to create a fair state with equal opportunities and progress. He noted that Kazakhstan strives to become an effective country where law and order reign, as well as developing a culture of dialogue, responsibility and solidarity.

The problem of corruption exists all over the world and impedes socio-economic development. It manifests itself in different ways in different countries, but the main essence remains: the abuse of official position and authority for personal gain. Most often this is expressed in bribery and the use of official position for selfish purposes.

The problem of anti-corruption has existed for a long time and was discussed by ancient philosophers. Aristotle considered the fight against corruption one of the ways to increase state stability: "The main thing in the government of the state is to arrange everything in such a way that it is impossible for officials to enrich themselves". Plato also noted that greed is one of the most important social vices, which is unacceptable not only for rulers but also for warriors.

Even in Roman law, the word "corrumipire" had several meanings, including bribery and destruction.ach state faces unique characteristics and challenges in combating corruption, which makes it difficult to develop effective countermeasures.

The main goal of combating corruption is its elimination in society. The Republic of Kazakhstan is designed to achieve this goal by solving the following tasks: creating an atmosphere of intolerance to corruption in society, identifying the conditions and reasons contributing to corruption offenses and eliminating them, strengthening cooperation among anti-corruption subjects, developing international cooperation to combat corruption, as well as identifying, preventing and investigating corruption offenses.

When studying the causes, conditions and consequences of corruption, it is necessary to take into account the local mentality, national and religious peculiarities, as well as the level of legal culture.

An effective fight against corruption requires accountability and control of state bodies to the public, independence and fairness of the judiciary, clear and simple laws worthy of application, meritocracy in the state's personnel policy, transparency of state procedures and zero tolerance for corruption in society.

Lack of transparency in decision-making affecting important public issues, lack of civil control and lack of regard for public opinion in the activities of the state machine lead to excessive bureaucracy, administrative barriers and abuse of power, which contributes to an increase in corruption manifestations.

Despite the qualitative update of basic legislative documents, the issues of proper application of the law remain unresolved in the organizational and legal aspect. It is necessary to use all means to prevent corrupt practices, as well as to strengthen preventive work. Attention should be paid to the activities of local authorities, as they ensure the satisfaction of the daily needs of citizens. In the activities of the special anti-corruption body, it is necessary to maintain a balance between its law enforcement and regulatory functions.

Conflicts of interest in the performance of government functions are one of the serious causes of corruption in the public sector. Conducting a detailed analysis of the mechanisms for the implementation of government functions, including public services, will help identify and eliminate corruption factors [5].

According to some opinions, the fight against corruption comes down only to countering bribery. However, this position is most likely incorrect. Bribery is the most gross and socially dangerous type of corruption crime. Therefore, it is right to pay great attention to the fight against bribery as part of the overall fight against corruption. Recently, there has been an increase in bribery. Every year, the number of bribery facts is growing. However, not all cases reach the court. The number of bribery cases heard by the courts is always

slightly lower than the number of criminal bribery cases initiated. Nevertheless, it is possible to get an upward or downward trend in the number of bribery cases from court statistics.

In his message to the people of Kazakhstan, President Kassym-Jomart Tokayev notes that it is necessary to ensure the rule of law and the quality of justice. This requires urgent renewal and improvement of the judiciary. Judges must be highly qualified, honest and incorruptible. First of all, it is necessary to ensure the equal status of all judges and reduce their dependence on their superior colleagues [6].

One of the problems of combating corruption in government is the close connection between the political (or state) and economic elites. The interaction of the public and private sectors of the economy is still noticeable, especially during the reform period. The rapid development of the private sector was to be accompanied by tough legislation and practices capable of protecting the private sector from government interference and allowing public authority to monitor compliance with the rule of law.

In Kazakhstan, active work continues to eradicate corruption, which is becoming more systematic. The basis of such activities is the demand of the head of state for the steady responsibility of all citizens, regardless of their posts, past merits or public status.

The Kazakh authorities themselves are worried about the loss of public support. The need to maintain their legitimacy through the conduct of elections makes the authorities take care of strengthening their position. The fight against corruption has become one of the effective tools for solving this problem. Representatives of all political parties actively use anti-corruption rhetoric. However, until now, all measures to limit corruption were either symbolic or partial in nature. Unfortunately, our politicians do not realize that everything hidden eventually becomes clear, and if they have chosen a political career, they must be honest and decent.

To develop an effective anti-corruption system, it is necessary first to identify the main factors contributing to the manifestation of corruption in modern conditions. Nowadays, the most relevant of them are the imperfection of industry legislation, whose norms applied in practice often create conditions for corruption crimes, especially for those who do not understand legal intricacies. The lack of transparency of government and corporate governance is also an important factor. The process of making managerial decisions remains closed, even in cases where these decisions affect the rights and legitimate interests of citizens. In addition, there are corruption risks in the provision of public services associated with the direct interaction of officials with the population. Another significant factor is the low level of legal culture, both among the general population and among public sector workers, which allows dishonest employees to use it for selfish purposes. The lack of comprehensive and targeted information work on the formation of an anti-corruption model of behavior and an atmosphere of rejection of corruption is another factor. It is also worth noting the insufficient level of remuneration for some categories of civil servants and the lack of social guarantees in public service. It is important to note that without active public support, anti-corruption measures taken from above have a limited effect. It is necessary that every citizen of Kazakhstan treats corruption with zero tolerance, and honesty and integrity become the norm of behavior. To achieve the desired results, it is necessary to introduce an anticorruption culture among the population and create a persistent immunity to corruption. Every Kazakhstani and every family should understand that the fight against corruption is the task of the whole society. Working with the younger generation plays a fundamentally important role in the formation of an anti-corruption culture not only in the Republic of Kazakhstan, but also in other countries. The implementation of anticorruption standards of behavior from the very early childhood will eliminate this social evil. In addition, it is important to educate a person in the spirit of Kazakhstani patriotism and rejection of corruption. All educational institutions, state bodies and public organizations should include anti-corruption courses in their training programs. Qualified specialists of various industries on a professional basis should carry out the implementation of this process. The media play an important role in shaping public rejection of corruption, motivating Kazakhstanis to take an active civic position and actively counteract corruption. Current legislation and legal institutions have untapped anti-corruption potential, and this potential should be used to the maximum in the implementation of foreign models and experience. Frequent changes in regulatory acts, the presence of lowquality laws with many reference norms that allow bureaucratic arbitrariness - all this is a source of corruption. One of the directions of the preventive fight against corruption is the creation of legislation that prevents corrupt transactions of civil servants. This requires a mandatory analysis of the corruption of legislation to identify the most typical manifestations of corruption in the text of the law. An excellent example is the order on the rules for encouraging persons who have reported the fact of a corruption offense or otherwise help against corruption. [7].

Corruption is not only a violation of the law. It is also a undermining of confidence in the effectiveness of the state and a direct threat to national security. We must dramatically strengthen the fight against corruption, including improving anti-corruption legislation, in order to achieve our ultimate goal of eliminating corruption as a phenomenon [8].

Ensuring transparency and strengthening all forms of control over the activities of state bodies and authorities, as well as the possibility of obtaining timely information about the work of the state apparatus are one of the conditions for anti-corruption activities. The responsibility of print publishers and the media for the accuracy of their publications and speeches is also important. Today, journalism is required based on facts, arguments, serious and professional analysis, as well as a positive approach. It is necessary to more clearly define the scope, scope and competence of state bodies, eliminate duplication and determine the official functions of civil servants as accurately as possible. In this direction, quite constructive work has been carried out

recently (such as contests for filling posts of public administrative officials, which are an effective means of preventing corruption offenses).

The gradual implementation of the anti-corruption program will make it possible at the first stage to strengthen social and political stability in the country, increase public confidence in the state authorities, protect citizens from corruption, develop anti-corruption consciousness in society, and at the second stage - to activate non-governmental organizations, political parties and public associations in the implementation of anti-corruption policy, strengthen international cooperation in the fight against corruption and raise the prestige of the state in the international arena.

Many researchers, both foreign and Kazakh, indicate that the majority of the population treats corruption with some kind of loyalty, not understanding its danger. This hinders the successful fight against this phenomenon. In this regard, it should be noted that corruption causes huge, sometimes irreparable harm to the public interests, the interests of the state and individual citizens. This manifests itself in the following possible consequences:

- Corruption prevents the state from achieving its goals (for example, appointment for a bribe leads to a decrease in the efficiency of government bodies and institutions and causes huge losses);
- Corruption leads to a rise in the cost of the state apparatus (since ultimately, bribery is reflected in the taxpayer, and he is forced to pay more for services);
- Corrupt management personnel are not prepared to compromise their personal interests for the prosperity of society and the state;
- Corruption destroys justice, since the truth belongs to someone who has more money and fewer moral prohibitions;
- Corruption is a threat to democracy because it deprives the people of moral incentives to participate in elections.

Research shows that corruption in the public service in both developed and developing countries takes roughly the same forms and covers the same areas of activity. The areas most susceptible to corruption are:

- public procurement;
- operations with land plots;
- collection of taxes;
- appointment to responsible posts in state bodies.

As in other areas of activity, the most susceptible to corruption are:

- licensing and registration of business activities (including banking);
- issuing permits for placement of securities and conducting banking operations with public funds;
 - obtaining loans (including state targeted loans);
 - customs clearance of imported goods;
 - obtaining export quotas;
 - construction and repair at the expense of state unds;
- recruitment to high-paying or positions that allow you to receive significant illegal income in state

and local bodies (customs authorities, tax inspectorates, police traffic safety units).

The anti-corruption strategy of Kazakhstan is continuously improving taking into account the requests of society, national practice and advanced foreign experience. Within the framework of this process, the national preventive mechanism and public monitoring commissions are actively functioning In addition; a national committee of public trust was established under the President of the Republic of Kazakhstan [9].

It is important to note that the need to take effective measures in the fight against corruption is critical. Otherwise, the problem, which began with criminal, economic and social aspects, can turn into a political problem and acquire the scale of national disaster, threatening the constitutional structure of the country. That is why in his message to the people of Kazakhstan, President of the Republic of Kazakhstan Kassym-Jomart Tokayev focused on the need to change the public consciousness and values of citizens, since "political and economic reforms alone are not enough to build a fair Kazakhstan. First of all, a change in the public consciousness and aspirations of citizens is required, without this all the rest of the work will be in vain.[1]

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MEDICAL SCIENCES

USING MEDICATED PASTE TO TEMPORARILY FILL ROOT CANALS

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Abstract

To study the effectiveness of using a medicinal composition for the treatment of chronic periodontitis. The results were assessed based on clinical examination and radiographic examination. Results. The data obtained as a result of a clinical study indicate the high effectiveness of the therapeutic composition as an antimicrobial agent and a means for stimulating bone tissue regeneration.

Keywords: Endodontic treatment, medicinal paste for filling root canals

There is a very great need among the population for endodontic treatment of complications of caries, pulpitis and periodontitis [1, 2]. This is caused by the significant prevalence of caries complications [3, 4]. Today, dentists have at their disposal almost all the various instruments and medications for endodontic treatment. However, analysis of literature data shows that the effectiveness of endodontic treatment is extremely low and does not exceed 20% [5, 6]. This is explained by the insufficiently correct use of instruments and the stages of treatment, in particular, insufficient treatment of root canals and their poor-quality filling [7, 8, 9, 10, 11]. Therefore, one of the most important tasks of endodontic dental treatment is to prevent the occurrence of errors and complications, which, according to various authors, range from 30 to 70% [12, 13]. Typically, the root canal is filled within the apical narrowing, and the restoration of periapical tissues occurs due to the body's own defenses [14, 15, 16]. It is relevant to use medications for the treatment of chronic periodontitis to stimulate reparative processes in periapical tissues. For this purpose, it is proposed to use agents that have a pronounced osteoinductive effect: autologous materials, osteoplastic materials, etc. [17, 18]. Therefore, it is important to create complex medications that would have an antibacterial, anti-inflammatory effect and stimulate the regeneration of tissue in the periapical area. Many authors point out the inappropriateness of using antibiotics, amides, hormones, and phenolic drugs for this purpose, since the microflora quickly gets used to them and these drugs inhibit local tissue immunity and proliferation processes in tissues [19, 20, 21, 22]. The use of other, more effective drugs will increase the effectiveness of treatment of chronic periodontitis such as thiotriazolin and clipdent-gl. This mixture of drugs was mixed in a selected composition extempore to the consistency of a paste. The purpose of the work was to clinically study the effectiveness of using the proposed therapeutic composition for temporary filling of root canals in the treatment of chronic periodontitis.

Materials and research methods

This study was conducted in a group of 26 patients with chronic periodontitis (10 with chronic granulating and 16 with chronic granulomatous periodontitis). The root canals of teeth with chronic periodontitis were treated instrumentally, always opening the apical foramen within no more than 0.2 mm. The canals were treated with medication and subsequently dried using paper points. On a glass plate or disposable sheets of paper notepad, the components of the proposed medicinal paste (metronidazole, thiotriazoline, clipdent-gl) were mixed to the consistency of a liquid paste. Using a root needle or canal filler, this medicinal composition was injected into the root canal. Through the open apical foramen, the components of the paste penetrated into the periodontal and periapical tissues and had a therapeutic effect on them. The tooth cavity was closed with a sealed bandage made of artificial dentin. If radiographs revealed a larger defect in the bone tissue of the periapical area, or if the anamnesis revealed that the root canal had been open for a long period of time, then the treatment tactics were slightly changed. After thorough instrumental and medicinal treatment of the root canal during the first visit, this medicinal composition was not used in the form of a paste, but was introduced into the root canal on a turunda. To do this, equal amounts of metronidazole and thiotriazoline were mixed on a glass plate or on a paper sheet. Then, Clipdent-GL granules were gradually added to the mixed solution until a rich white solution was formed. They impregnated a cotton swab, which was inserted into the root canal of the tooth. A few days later, if there were no complaints from the patient, the hermetic bandage was removed, the paste was removed from the root canal, and the root canal was washed and dried. The root canal was permanently filled with AN+ material. At the same time, no attempt was made to move the filling material beyond the apical foramen into the periapical tissues. The quality of filling was controlled using x-rays. The carious cavity was closed with a temporary filling made of artificial dentin. If there were no patient complaints, a few days later the carious cavity of the tooth was permanently filled with a composite material. The effectiveness of treatment was assessed based on clinical and radiological data. The results were considered positive if they were characterized by the absence of patient complaints, changes in the condition of the gums, and restoration of bone tissue as specified in the X-ray examination for granulomatous and granulomatous periodontitis. Results and discussion Using this method, 26 teeth with chronic periodontitis were treated (10 and 16 with chronic granulomatous periodontitis). To control the treatment, intraoral contact radiography was used, which was used to determine the degree of filling of the root canals after filling them. There were no cases of exacerbation of the pathological process when there was a need to remove the hermetic dressing. In all cases of treatment, the root canals were filled completely; the filling mass after filling was not carried beyond the apex of the tooth (Fig.). In 2 teeth of the patients, minor pain was noted after filling the root canal, which quickly disappeared after 3-4 sessions of UHF therapy. In general, the treated teeth were painless upon percussion, functioned effectively when chewing. the mucous membrane around the teeth was without pathological changes. The tooth cavity was closed with a sealed bandage made of artificial dentin. Radiographs six months after treatment showed a decrease in the size of the pathological lesion in the periapical tissues. Complete filling of the root canals allows them to be effectively obturated and contributes to the absence of significant irritation of the periapical tissues. The medications used for treatment do not irritate the periodontium. The results obtained indicate the high effectiveness of the clinical use of the proposed composition of drugs in the treatment of chronic periodontitis.

Conclusions.

This gives grounds to recommend this therapeutic composition for the treatment of chronic periodontitis.

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PEDAGOGICAL SCIENCES

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SELF-CONTROL WITH A COMPETENCE-BASED APPROACH TO TEACHING ECONOMIC STUDENTS

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Abstract

In higher education, the control of educational activity is a check of the level of mastering of the curriculum by the student, and self-control is the ability of the student to check his acquired knowledge and make adjustments.

Practice shows that specialists who have a high ability to self-improvement and search for new effective forms of organizing their work are more in demand in the labor market. To do this, it is necessary to form self-control skills among students of economic universities in the process of studying at the university. It is necessary to actively involve, in the management of their educational process. This will allow you to believe in yourself, in your abilities, take a critical approach to learning outcomes and develop creatively. The article raises the current problem of developing students' self-control skills. The author analyzed the functions of self-control in the student's independent work. The conditions under which the skills of self-control of educational activities of students of economic specialties are formed in the process of their professional training are considered.

Keywords: control, self-control; educational activities; pedagogical conditions; training future economists.

Today, the education system does not stand still and is constantly being improved. The reason for this is the general technological revolution and the involvement of society in global processes, which in turn entail an increase in demand for competitive specialists in various fields of activity [1].

In this regard, the meaning and goals of pedagogical control are changing as a mechanism responsible for the continuous process of improving the quality of education and providing feedback between the subjects of the learning process. In the new conditions, pedagogical control, summing up the achievements of students, should become the starting point for the next stage of development and a new level of quality of education. Consequently, not only test and assessment materials must change, but also the goals of testing students' knowledge, skills and abilities and the philosophy of control itself.

Pedagogical control, as a component of the entire educational process, affects not only the result, but also the entire process of training and education, since based on the analysis of control results, one can judge the effectiveness of the educational process and develop ways to further improve the entire educational process. Thus, issues of monitoring and assessing the development of competencies remain significant problems for pedagogical science and practice.

Today, the training of specialists in the higher education system has made a transition to multi-level training, focusing on a competency-based approach to training, providing for professional growth, social mobility and self-improvement of personnel.

In this regard, the meaning and goals of pedagogical control are changing as a mechanism responsible for the continuous process of improving the quality of education and providing feedback between the subjects of the learning process. In the new conditions, pedagogical control, summing up the achievements of students, should become the starting point for the next stage of development and a new level of quality of education.

Consequently, control and assessment materials for testing students' knowledge, skills and abilities in the vocational education system must change.

The main difficulty of assessment and control in a competency-based education system is that competencies are manifested only in the activities of students: completing projects; solving problem situations; solving problems that require a combination of knowledge and experience in combination with the personal characteristics of the student. This means that teachers need to introduce new control methods into the learning process and be aware of the peculiarities of its organization.

Control and measurement activities in the educational process establish not only the achievement of learning goals, but also the goals of education, that is, the development of personal qualities, which is difficult to define. In this regard, carrying out control and measurement activities or pedagogical control comes down to assessing the level of knowledge.

So, V.P. Arkhangelsky distinguishes input and output control, which perform certain tasks and have their own characteristics. In this case, the role of control is clearly specified, but the procedure for conducting control as a means of obtaining feedback is not specified [4].

Yu.K. Babansky argues that control is just one of the elements of learning built into the model of the educational process [5].

I.N. Kovalevsky believes that control tasks can change, i.e. Monitoring the results of education can be carried out both for preventive purposes and for the purpose of learning how to manage the learning process. Monitoring of current educational activities is carried out, first of all, to obtain feedback and check the intermediate educational achievements of students [6].

Hence, it can be argued that the essence of control is to receive feedback during the educational process, to establish compliance of the level of its results with the educational standard of the corresponding direction.

In higher education institutions, the teacher monitors and analyzes the student's activities. At the same time, the student receives an unreasoned mark on his activities. An incomplete assessment of the teacher and the student's inability to self-control, introspection and self-assessment of his activities disorients the student in assessing his own capabilities and forms an inadequate self-assessment of learning results.

Independent work, becoming increasingly important in the educational process, forms readiness for self-education and creates the basis for continuous improvement of one's qualifications. This is due to the fact that despite the fact that there is an increase in the disciplines studied by students, the time budget for classroom training is decreasing, and students have to study most of the course materials on their own in a short time. That is, there is a lack of time to master the volume of educational and scientific material required, according to the program.

To develop students' self-organization skills for studying at a university means learning to plan their educational and professional activities, effectively using free time, being able to process large amounts of information, analyzing them, learning to clearly formulate their thoughts, and being able to work with people. Therefore, the focus of universities on developing students' ability to work independently is completely justified

Curricula in universities today are formed taking into account a significant part of the workload of teachers allocated to independent work of students. Self-study, self-education, self-realization, self-control, self-esteem are necessary conditions for successfully completing the educational process. In addition, the direction of professional training at a university becomes practice-oriented and, consequently, the role of independent activity of students increases. The level of self-control becomes the main criterion of a specialist's professional literacy.

The main aspect of a student's educational work is the control and evaluation of his activities, when the learning results are determined and assessed by him. In addition, in contrast to the control carried out by the teacher to test knowledge, skills and abilities, self-control must be carried out by the student during the entire process of his learning.

The task of vocational education is not only the student's ability to develop, to be able to make decisions, to understand the essence of educational activities, but also to master the methods and means of its implementation for subsequent transfer to others [2].

The wording "self-control" means checking, using one's own methods, the results of one's activities, formed competencies, and also being able to adjust the trajectory of educational activities in the direction of improving learning outcomes. In turn, self-control includes the choice of goals and means to obtain the desired result, identifying the causes of shortcomings and their elimination in the process of educational activities, as well as self-analysis of evaluating the results of one's own activities.

The profession of economist is considered one of the most prestigious professions, and for a successful career in this specialty, a graduate of an economics university must be ready for professional self-development and self-education, as well as be able to objectively evaluate the results of their activities. Practice shows that specialists with a high ability for self-improvement and effective organization of their work are more in demand in the labor market. To do this, it is necessary to develop self-control skills in students of economic universities during the process of studying at a university.

Professional training of economists at a university consists not only of acquiring knowledge, but instills the skills to analyze the current economic situation, the ability to defend one's own opinion and foresee the future of decisions made, which, in turn, pushes students to active self-directed cognitive activity.

In other words, the student's ability to independently manage the learning process and correctly evaluate its results is one of the important tasks of higher education.

In order for a student to develop the ability to selfcontrol as a type of independent work, it is necessary to demonstrate and show certain techniques for analysis using examples, teach how to correctly formulate questions, draw appropriate conclusions, and also be demanding of oneself and be critical of the results of one's work [7].

The main thing here is to instill in the future economist faith in his abilities. It is a well-known fact that, when starting professional activities, graduates often do not dare to take responsibility for solving problems that have arisen, while showing an inability to independently overcome certain difficulties. The solution to this issue, in our opinion, is to develop students' self-control skills, that is, the student must be actively involved in managing their educational process. This will allow you to believe in yourself, in your abilities, critically approach learning results and develop creatively.

An analysis of scientific literature shows that selfcontrol of educational activities, as a problem, arose in parallel with the need to master knowledge and acquire skills.

Indeed, the teacher cannot control the process of assimilation of knowledge without the educational activities of students. A connection is formed between the teacher and the student between the students' self-control and the teacher's control. These two processes, fulfilling their specific functions in the educational process, can complement each other.

This means that the process of control by the teacher is inseparable from the process of self-control by the student. These two components of a single process of personality formation depend on the activity of the student, on the degree of motivation for learning, on the ability to self-control their learning results.

In higher education, control of educational activities is a check of the student's level of mastery of the materials of the academic discipline, and self-control is the student's ability to check his acquired knowledge and make adjustments. At the same time, the teacher can evaluate the effectiveness of the work process and the appropriateness of the introduced adjustments.

A higher school teacher today exercises control over the student's activities. At the same time, the student receives a mark for his work without explanation of the criteria by which the assessment was carried out. Such an assessment system and the student's inability to self-control and self-assessment of learning outcomes does not help the student to really assess their capabilities, which in turn affects the overall learning results and the level of competence development.

Universities began to pay more and more attention to the independent work of students, teaching them to self-educate and constantly improve their level of qualifications. This is primarily due to the fact that less and less time is allocated for classroom training, which naturally leads to a reduction in course material. This means that the student needs to study part of the course independently. This explains the emphasis of universities on students' independent work.

Being able to control one's activities means that a student will manage the process of monitoring one's own educational activities, while acquiring more independence and organization in one's actions. The curricula of higher educational institutions allocate a significant number of hours for students' independent work, because Assessing the results of one's educational activities is a requirement of the modern educational process. Taking into account the fact that students' professional training is becoming more practice-oriented, this means that the role of students' independent work will also increase. The ability to control one's activities becomes the main indicator of a specialist's professionalism.

One of the important tasks of a student's educational activity is the ability to control and evaluate his educational activities. In addition, in contrast to the control carried out by the teacher to test knowledge, skills and abilities, self-control must be carried out by the student during the entire process of his learning.

The task that universities face today is not only to create the basis for the further development of the student, to teach them to make decisions, to develop the ability to independently evaluate themselves, to understand the content of their activities, but also to find ways, methods and means of its implementation for subsequent transfer them to others.

Thus, modern higher education should develop in students the ability to evaluate the results of educational activities.

It is known that the profession of economist is included in the list of prestigious specialties today. In order to be competitive in the labor market, a graduate of an economics university must have the ability to take a realistic approach to assessing the results of their activities, as well as be ready for professional self-development and self-education.

Practice shows that specialists who know how to improve themselves and master new effective forms of organizing their work are more competitive in the labor market. To do this, it is necessary, in the process of educational activities at a university, to develop in economic students the ability to self-control and self-esteem.

Training specialists at an economics university is not only about gaining knowledge of the relevant profile, but also instilling the skills to analyze the economic situation, defend their point of view and make effective decisions. All this will push the student to manage his cognitive activity [3].

To develop the student's ability to self-control as a type of independent work, one should show with practical examples the techniques used in the course of self-analysis of activities, teach how to accurately pose questions, draw the right conclusions, and also critically evaluate the results of one's educational work.

The main thing is to instill in the future specialist faith in his abilities. As a rule, university graduates who have just started their professional activities do not dare, when unforeseen problems arise at work, to take responsibility for eliminating this problem, while showing their unwillingness to get out of non-standard situations in their professional activities [6].

This problem, from our point of view, can be achieved by developing the student's ability to self-control, involving him in the self-management of his own learning activities, and at the same time instilling

faith in his abilities to develop creatively and be selfcritical in the approach to assessing his activities.

An analysis of the scientific literature shows that the need to control the learning process arose in parallel with the need to master knowledge and acquire skills.

Yu.K. Babansky argues that self-control is the ability to independently detect one's mistakes and inaccuracies, as well as find ways to eliminate detected problems [5].

Indeed, in fact, the teacher is not able to control the level of knowledge acquisition without taking into account the results of the student's learning activity, i.e. A connection appears between the teacher and the student in the form of self-control of students and the control of the teacher.

In other words, the process of pedagogical control by the teacher is closely related to the process of selfcontrol by the student. These two processes constitute a unified approach to the formation of an active personality, including the formation of student motivation for education and instilling the ability to self-control their educational activities.

The process of monitoring the educational process is, first of all, establishing the level of mastery of the educational material of the program, and self-control is the student's ability to control and evaluate his acquired knowledge and adjust his own educational process towards improving performance results. In this situation, the teacher can check the level of completion of assignments and work, as well as evaluate the effectiveness of the adjustments introduced into the learning process.

The functions of a teacher at a university include monitoring and analyzing the student's learning process.

In order to develop self-control skills during the educational process, the teacher at each stage of training develops specific tasks for students on the topics of the discipline, selects teaching methods and techniques for better mastery of knowledge, taking into account the student's self-monitoring of their educational results. These tasks are aimed at the ability to realize, understand and analyze the results of one's educational activities, which in turn will contribute to better mastery of educational material [10].

In addition to the functions of organizing and monitoring their own educational activities, future graduates of an economics university and, as a result, also receive the function of managing the educational activities of the teacher. This means that the student will have a need for constant monitoring of the results of his activities, and according to researchers, such graduates have an increased chance of achieving good results in educational activities than students who were under the control of knowledge by the teacher, excluding self-monitoring of their learning results .

If a student is able to monitor his educational results, it means that he will be able to assess the completeness and strength of assimilation of the discipline materials, while identifying gaps in knowledge and finding ways to eliminate them. From a psychological point of view, the student has an incentive to acquire knowledge, because With the help of feedback, he will

be able to check the completed work in the discipline and give a correct assessment of these tasks.

At the same time, self-control also helps the student regulate his behavior in society in accordance with the requirements that exist in society when carrying out certain types of activities, and, therefore, self-control is actions aimed not only at reducing erroneous actions in the learning process and eliminating them, but and on the development of the mental and moral abilities of the individual.

In conditions of an economic crisis, when production is falling and unemployment is high, there is inevitably a need in society for specialists who are able to manage their activities and find non-standard solutions in critical situations [8, 9]. In this regard, the issue of developing self-control skills is of particular importance, since by developing in specialists the skills to control their activities and prevent errors in their work, some economic costs can be avoided.

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ACTION RESEARCH IN ENGLISH TEACHER TRAINING: FLIPPED TEACHING, COOPERATIVE LEARNING, AND PEER ASSESSMENT

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Abstract

The present article shares the experience from applying Flipped Teaching, Cooperative Learning, and Peer Assessment at Kostanay A.Baitursynuly Regional University during 2023-2024 academic year, when all three cycles of Action Research were carried out. Tertiary students who are in their third year of four and are being trained to become English teachers, total number 137 students from 12 groups, were the participants of the research during their English Teaching Methodology Course. The Action Research data was collected through observation, interviews, questionnaires, and testing. As a result, high learning outcomes were achieved that was objectively confirmed in the final assessment through Moodle test.

Keywords: Action Research; English Teacher Training; Flipped Classroom; Cooperative Learning; Peer Assessment

Introduction

The present article describes the authentic educational experience integrated into the professional preparation of prospective English educators at the Foreign Languages Department of the Pedagogical Institute under Umyrzak Sultangazin at Akhmet Baitursynuly Regional University, throughout the first semester of the 2023-2024 academic year. The training of teachers stands as a pivotal aspect of educational advancement globally, necessitating ongoing evolution and enhancement, particularly within student-centric environments. Often it requires Cross-Disciplinarity, as in other jobs training since teachers tend to be universally educated people, who do not only learn effectively themselves, but also can facilitate their students; educational efforts in the future. [1-3] Every effort is taken to ensure best practices in teaching are not talked about, but demonstrated in the real-life teaching process and students' internship training that follows the theoretical study. [4-5] Reflective thinking skills [6-7] have recently become a universally recognized crucial part of university teaching, so we chose to employ Action Research to see whether the methods that are chosen for one of the central courses in future teachers' training are effective and productive. The strategies delineated henceforth were deliberately selected and subsequently implemented within one of the primary subjects of the educational program 6B01705 "Foreign Language: Two Foreign Languages," specifically focusing on English Teaching Methodology.

Methods

The Action Research [8,9] was carried out to observe whether application of Flipped Teaching, Cooperative Learning, and Peer Assessment would be beneficial for achieving high levels of students' learning outcomes. *Observation checklists* were used by the

teacher to keep the record of the educational process and a few times visiting colleagues completed their own observation sheets to register students' involvement into the lectures and seminars. Critical thinking lied in the base of the Action Research procedure.[9] Brief interviews with students from each of 12 groups were conducted three times: in the first week, in week 8 after the first attestation period, and in week 15 prior to examination. It helped us move on from expectations to generative uncertainties in teaching and learning activities. [10] Students' feedback was taken into account and minor changes were introduced into the training: students preferred to stay in the same micro groups rather than change partners for every seminar, and short video recordings for personal publications in students' social networks were approved. Questionnaires were suggested to students twice in Google forms and were not obligatory. However, a lot of students chose to express their opinions concerning microteaching sessions and evaluate their course upon its completion. Testing was used in the form of short weekly tests for particular topics covered during each week and the summative assessment: twice in the semester, in weeks 7 and 15 for intermediate attestation and for the final examination. Test questions were teacher created and formed the test bank of 500 questions.

The teaching methods specified complemented each other in the course: lectures built on the *Flipped Classroom* led to interactive discussions; Group work at the seminars increased student talking time manifolds as students shared their findings in the course. As XXX rightly points out, "Teaching and learning are best accomplished through the novel and blended approaches in today's smart manufacturing, services, and labor processes." [11] *Cooperative learning* proved both popular with students and engaging, as there were

hot discussions on many teaching issues throughout the course. Working in groups of five, alternating for each class, students discussed seminar questions and did micro-teaching sessions with subsequent peer assessment. The same as Qing Xie (2023) stated, in our setting "the participants considered teamwork and group cooperation to be their most improved skills, along with other soft skills and practice abilities."[12] Demonstrating rather than explaining methods useful for student-centered learning is what we find working for a tertiary Methodology course. Lectures turned into interactive discussions instead of teacher talking time and group work at the seminars required change in the assessment procedures as well. Naturally we referred to the peer assessment. Peer assessment was based on the rubrics with assessment criteria created by the teacher in cooperation with the students and thus ensured thorough preparation, active participation, and discussion at the seminars and lectures.

Discussion

This approach was debated in the Foreign Languages Chair meetings and not universally approved of. Such organization involved too much responsibility on students who had to make decisions assessing each other, some of the faculty said. However, since students are trained to be English and German teachers, assessment is likely to be easier in future. As students divided the seminar questions between them, they had to teach each other the content they were responsible for. This also contributed to their teacher training agenda – explaining their peers both theory and demonstrating the methods in 15-minute micro-teaching sessions was highly efficient.

Let's delve into each of these teaching methods and how they proved beneficial for teacher training. Flipped Teaching ensured active learning, critical thinking, and personalized learning. Flipped teaching encourages active engagement with course materials outside of class time. The course teacher modeled some effective instructional techniques, such as creating engaging pre-recorded lectures shared through the Moodle page, assigned relevant readings, which aspiring teachers then analyzed and emulated. Critical Thinking was apparent in a variety of educational situations: by shifting traditional lecture content to pre-class activities, flipped teaching freed up valuable class time for deeper discussions, problem-solving activities, and critical thinking exercises. This approach helped aspiring teachers develop their own critical thinking skills, which are essential for effective teaching and lesson planning. Personalized Learning was a natural part of Flipped teaching, as it allowed aspiring teachers to progress through course materials at their own pace and revisit challenging concepts as needed. This personalized approach accommodates diverse learning styles and fosters a sense of autonomy and responsibility in teacher trainees.

Cooperative Learning involved collaboration skills development; it also provided social interaction increase in the otherwise dull learning environment and opened diverse perspectives on the material studied. Collaboration Skills: Cooperative learning promotes collaboration, teamwork, and communication skills among teacher trainees. Through group activities, aspiring teachers learn to work effectively with their peers, share ideas, and resolve conflicts constructively—skills that are essential for fostering positive classroom environments.

Social Interaction: Teacher training involves more than just acquiring knowledge; it also requires developing interpersonal skills. Cooperative learning activities provide opportunities for aspiring teachers to interact socially, build relationships, and empathize with their peers and future students.

Diverse Perspectives: Working in groups exposes teacher trainees to diverse perspectives, teaching styles, and problem-solving approaches. By engaging with peers from different backgrounds, aspiring teachers gain insights into alternative teaching methods and develop a deeper understanding of educational diversity and inclusivity.

Peer Assessment served to develop feedback skills, professional growth and served the basis for community building. Feedback Skills: Peer assessment encourages aspiring teachers to provide constructive feedback to their peers and reflect on their own teaching practices. By evaluating each other's work, teacher trainees develop valuable assessment and feedback skills, which are essential for fostering continuous improvement and self-reflection.

Professional Growth: Receiving feedback from peers can be a powerful catalyst for professional growth. Aspiring teachers can gain valuable insights into their strengths and areas for improvement, identify teaching strategies that resonate with their peers, and refine their instructional techniques accordingly.

Community Building: Peer assessment fosters a sense of community and mutual support among teacher trainees. By actively participating in the assessment process, aspiring teachers demonstrate respect for their peers' expertise and contribute to a collaborative learning environment conducive to growth and development.

Results

Microteaching session evaluation was conducted in the form of Google Form questionnaire and received 27 answers. The question "Assess how hard you worked during the micro-teaching session in groups" most of the students answered either "Hard" or "Very hard", two people assessed themselves as either "Hardly" or "A little" The diagram below shows the percentage (see diagram 1):

Diagram 1. Students' self-assessment of effort put into group work

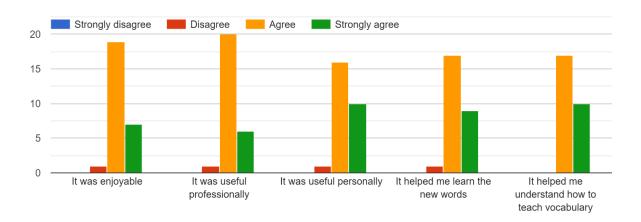
Your self-assessment



Assessment of class organization for the micro-teaching session also received mostly positive feedback, see diagram 2:

Diagram 2. Students' assessment of the class organization

Your assessment of the class organization

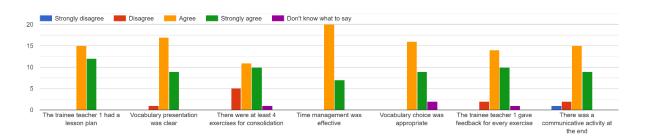


Students assessed each other's teaching in the micro-teaching sessions against a number of criteria:

- The trainee teacher 1 had a lesson plan
- Vocabulary presentation was clear
- There were at least 4 exercises for consolidation
 - Time management was effective
 - Vocabulary choice was appropriate
- The trainee teacher 1 gave feedback for every exercise
- There was a communicative activity at the end The results of assessment of another student's teaching can be seen in Diagram 3:

Diagram 3. Students' peer assessment of microteaching vocabulary session

Your assessment of the trainee teacher 1



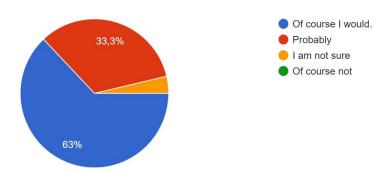
To the question "What was that you liked about the class?" students answered (some of the answers are quoted): "I liked the fact that we all took part in the tasks."; "I liked that everyone was engaged in teaching activities, exercises and we were helping each other with understanding the material"; "Training itself"; "I really liked the atmosphere in the class, it was friendly, everyone supported each other. trainee teachers who performed, very well and responsibly prepared. and did a great job"; "It included some new words for me and may be even it was a new (unusual) type of presentation of some material that I will be able to practice later"; "The opportunity to give a lesson to my group mates".

To the question "What you would change to make it more productive?" there were some constructive criticism responses, like "To do more exercises; trying to be more clear in speaking and communication with students"; "Add more speaking and it would be better if we had more time"; "I would give more time to students so that everyone could reveal their abilities"; "Conduct games on the relevant topic of the lesson"; "I would like microteaching to last more than 15 minutes."; "show instruction for the first lesson plan so that it will be clearer for students how to do it"; "We need online ZOOM meting lessons"; "We should strictly follow the time frames for each student, so that everyone had the possibility to train how to teach"; "show instruction for the first lesson plan so that it will be clearer for students how to do it". The other responses noted that students were satisfied with the micro-teaching session organization.

The answers to the question "Would you like to have more lessons like this?" encouraged the teacher to continue with this lesson mode (see Diagram 4):

Diagram 4. Students' overall assessment of the micro-teaching organization

Would you like to have more classes like this? 27 ответов



The other questionnaire was suggested to students on their completion of the course and received 52 answers. The first question "Level of effort" asked for students' self-evaluation of how much effort they had put into studying the course, the results are presented in Diagram 5 below:

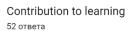
Diagram 5. Students' self-evaluation of the effort they had put into the course.

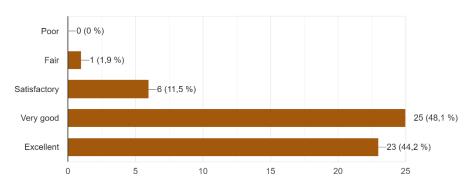
Level of effort



The second question "Contribution to learning" asked how much the course had contributed to their learning. Results are presented in Diagram 6 below:

Diagram 6. Students' assessment of the course's contribution to their learning.

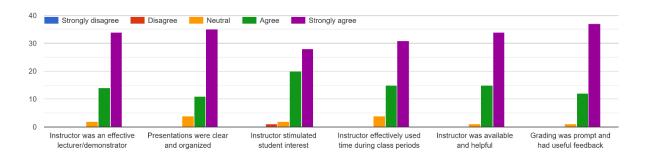




The question "Skill and responsiveness of the instructor" was aimed at receiving students' feedback to the effectiveness of teaching and results are shown in Diagram 7 below:

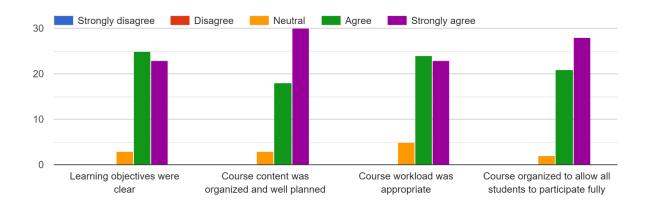
Diagram 7. Skill and responsiveness of the instructor.

Skill and responsiveness of the instructor



The next question was to have students assess the Course content; the results are presented below in Diagram 8. Students assessment of the course content.

Course content



The question "What aspects of this course were most useful or valuable?" received 45 answers, sample answers are presented here: "For me, it was to write a lesson plan and conduct a lesson for group-mates. Thanks to this, I have gained experience and can figure out how to teach a lesson in practice and at school." "Applying teaching in practice, improving presentation skills, having an opportunity for creativity"; "I liked our seminars where my classmates and I shared our knowledge. it was an interesting approach to learning, more interesting and useful in my opinion than traditional seminars"; "Practical part when we write lesson plans"; "the opportunity to repeat everything in the muddle, tests, a combination of practical classes and online platforms"; "How to learn and teach in different ways, how to be a good teacher"; "Teaching Methods, Tips about particular situations in the class room"; "teaching methods, knowledge about the types of students (kinesthetics, visuals, etc.) Your lessons and lectures were really interesting to attend, thank you!"; "it was useful that we exchanged views, the presentations of group mates were very interesting".

The question seeking criticism was formulated "How would you improve this course?" received 39 answers some of them are quoted here: "I've worked on my pronunciation." "To Use more forms of working in classroom, to vary tasks"; "I think, we can make a list of best students every month (maybe, it wi increase students' motivation) like a competition." "Add more explanation according to the references (how to organize them in the course paper)" "I think we need more control over the quality of students' completing assignments"; "I would add some more creative tasks. such as association, poster protection, etc." "Maybe group projects".

Moodle test was conducted as the final assessment procedure. Students were tested in the university test room and were supervised by the surveillance video cameras and human observers, as it is the general requirement. The test consisted of 40 questions, randomly chosen by the testing system from the bank of 500 questions. The maximum test score was 100, the time assigned for testing was an hour. Quality of the

result constituted 85.4%: out of 137 students in the course, 117 got marks in the range of 70-100, 14 got satisfactory (50-69) and 6 students failed. We believe these results prove efficiency of the methods applied to the course.

Conclusion

Action research is a powerful methodology employed by educators to enhance teaching practices and improve student learning outcomes. We believe, it contributes to the improvement of teaching in a number of ways, ensures reflective practice, allows targeted problem solving, leads the teacher to evidence-based decision making, guarantees continuous improvement, professional growth and establishes collaborative learning communities. Action research encouraged us to reflect on the teaching methods we were using, on classroom dynamics, and student engagement. By systematically examining their own practices, teachers gain insights into what works well and what needs improvement. It allows teachers to identify specific challenges or areas of improvement within their teaching practice. Whether it's addressing student motivation, refining instructional strategies, or adapting to diverse learning needs, action research helps teachers pinpoint where interventions are needed. Through action research, we were able to collect and analyze data related to teaching and learning. This data serves as evidence to inform decision-making processes. By basing decisions on empirical evidence rather than intuition alone, teachers can make more informed choices about instructional approaches. Action research is iterative in nature, involving cycles of planning, acting, observing, and reflecting. This continuous improvement cycle allows teachers to gradually refine their teaching practices over time. By making small, incremental changes and assessing their impact, educators can steadily enhance the effectiveness of their teaching. Engaging in action research fosters professional growth and development among educators. By actively investigating and addressing challenges within their practice, teachers expand their knowledge, skills, and expertise. This ongoing process of inquiry promotes a culture of lifelong learning within the teaching profession. Collaborative

Learning Community was strengthened through this action research, as it involved collaboration among teachers within our department. By working together on common goals and sharing findings, teachers can leverage collective expertise and support one another in improving teaching practices. This collaborative approach fosters a sense of community and shared responsibility for student success. Overall, action research empowers educators to take ownership of their professional development and drive meaningful improvements in teaching and learning. By adopting a systematic and reflective approach to inquiry, teachers can enhance their effectiveness in the classroom and ultimately contribute to positive educational outcomes for students.

In summary, flipped teaching, cooperative learning, and peer assessment offered unique benefits for teacher training, including promoting active learning, critical thinking, collaboration, communication, feedback skills, and professional growth. By integrating these methods into teacher training programs, educators can better prepare aspiring teachers for the challenges and opportunities they will encounter in the classroom.

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ANIMATION AND COMPUTER GRAPHICS IN GAMES

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ОЙЫНДАРДАҒЫ АНИМАЦИЯ ЖӘНЕ КОМПЬЮТЕРЛІК ГРАФИКА

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Abstract

This article will describe what computer graphics and animation are, what it is, where it is used, and how important animation is in the field of game creation. Animation and computer graphics are written about their use in many areas of human life. The article discusses all types of animation for the game from the point of view of an ordinary person and talks about the pros and cons of each type, invites the reader to decide which type of animation is closest to him. Computer graphics in games raise the visual quality, turning the game world into real works of art. Examples of games used by 2D, 3D, VFX animation are given.

Түйіндеме

Бұл мақалада компьютерлік графика және анимация дегеніміз не, ол қандай, қайда қолданылатыны және ойын жасау саласында анимацияның қаншалықты маңызды екендігі сипатталады. Анимация және компьютерлік графика адам өмірінің көптеген салаларында қолданылуы туралы жазылған. Мақалада ойынға арналған анимацияның барлық түрлері қарапайым адам тұрғысынан қарастырылады және әр түрдің оң және теріс жақтары туралы айтылады, оқырманды анимацияның қай түрі өзіне жақын екенін шешуге шақырады. Ойындардағы компьютерлік графика ойын әлемін шынайы өнер туындыларына айналдыра отырып, визуалды сапасын көтереді. 2D, 3D, VFX анимация пайдаланған ойындарға мысалдар келтірілген.

Keywords: animation, computer graphics, computer animation, computer games, 2D, 3D, VFX animation **Кілт сөздер:** анимация, компьютерлік графика, компьютерлік анимация, компьютерлік ойындар, 2D, 3D, VFX анимация

Kipicne. Ойындардағы анимация мен компьютерлік графиканы зерттеу академиялық зерттеулерде, салалық бастамаларда, конференциялар және кәсіби ұйымдар сияқты әртүрлі бағыттарда жаһандық деңгейде белсенді түрде жүзеге асырылатын динамикалық және көп қырлы сала болып табылады.

Анимация сөзі латын тілінен шыққан, мұнда «анима» жан дегенді білдіреді. Анимация - кез келген кескінге немесе нысанға жүруге, сөйлесуге немесе кез келген әрекетті орындауға мүмкіндік беретін технология. Анимация-бір көріністі жасау үшін жасалған әртүрлі типтегі кескіндерді жылдам көрсету арқылы қозғалыс елесін жасау және пішінді өзгерту процесі. Анимация жасау үшін бірбірінен сэл өзгеше көптеген суреттер пайдаланылады. Бұл суреттер жоғары жылдамдықпен өзгереді, сондықтан қозғалыс әсері туып, объектілер шынайы болып көрінеді [1].

Компьютерлік анимация - бұл экрандағы қозғалмалы кескіндерді өңдейтін визуалды

цифрлық дисплей технологиясы. Компьютерлер арқылы кез келген жансыз затқа өмір, қуат, эмоция беру өнері немесе қабілеті.

Компьютерлік анимация өз кезегінде компьютерлік графика мен анимация жасауға арналған арнайы құралдарды пайдалана отырып, қозғалатын объектілерді жасау өнері болып табылады. Анимация және компьютерлік графика адам өмірінің көптеген салаларында қолданылады, мысалы:

- материалды неғұрлым анық және түсінікті көрсету үшін анимациялық бейне арқылы білім беру;
- әртүрлі өнімдер немесе қызметтерді анимациялық кейіпкерлер арқылы ұсынылуы мүмкін жарнама;
- ойын-сауық, фильмдер, мультфильмдер және әр түрлі телехикаяларды қамтитын сала;
- медицинада, яғни кәсіби дәрігерлер мен студенттер анимация құралдарының көмегімен адам анатомиясын бейнелей алады;

- анимацияның көмегімен тыңдаушының назарын аударатын презентациялар;
- тұтынушыға өнімді көрсету үшін қолданылатын анимациялар.

Барлық заманауи компьютерлік ойындар ойыншыны қызықтыру және қанағаттандыру үшін ыңғайлы құрал ретінде анимацияны пайдаланады.

Бұл мақалада, қазіргі заманғы ойындарда компьютерлік графиканың, атап айтқанда, анимацияның қалай қолданылатынын және ойын жобасының графикалық бөлігінің қаншалықты маңызды екені нақты сипатталынады.

Негізгі бөлім. Анимация үш негізгі топқа бөлінеді: 2D, 3D және VFX анимация. 2D анимация - бұл екі өлшемді кеңістікте қозғалатын кескіндерді жасау процесі. 2D анимация қозғалыс әсерін жасау үшін сызбалар, спрайттар немесе векторлық нысандар сияқты екі өлшемді пішіндерді пайдаланады. 2D анимация редакторда екі өлшемді кескіндерді жасауды қамтиды, бұдан бастапқы кескінді өзгерту және алынған кадрларды жылдам шығару арқылы 2D анимация алынады. Бұл әдісте эрбір қозғалатын нысан үшін жеке суреттер жасалады, бірақ олар біртұтас анимацияны құра жиынтықта бар тек нысандарды біріктіреді. Бұл көбінесе орынның фонымен немесе декорациясымен жасалады [3].

2D анимациясын жасау үшін компьютерлік графиканың екі түрін қолдануға болады: растрлық (пиксель) және векторлық (математикалық есептеулер графикасы). Компьютерлік графиканың әр түрінің өзіндік артықшылықтары мен кемшіліктері бар.

Векторлық графика кескін сапасын жоғалтпай кез келген экран ажыратымдылығында жақсы көріну мүмкіндігіне байланысты 2D ойындарында жиі қолданылады. Мұндай ойындар әртүрлі математикалық формулаларды бейнелейтін бейнелер негізінде жасалады. Бұл формулалар нысандардың орындарын және олардың түстерін көрсете отырып, бірге көрерменге көрсетілетін кескінді жасайды.

Сонымен қатар растрлық графиканың мүмкіндіктері ойын индустриясының кейбір салаларында өз қолданылуын табады, мысалы, пиксельдік ойындар, онда объектілерді пикселдер жиынтығы ретінде бейнелеу үшін растрлық кескіндердің сипаттамасы негізгі элемент ретінде пайдаланылады. Пиксельді ойындарда графика модельдер мен олардың анимациялары пикселдердің санынан (әдетте 16х16, 32х32, 64х64, 128х128) тұратынына негізделген, мұнда әрбір пиксел анық ажыратылады және суретке белгілі бір береді. Бұл стиль қазір қауымдастығында жақсы дамыған.

2D векторлық ойындарының мысалдарын қарастырсақ. 2D векторлық ойындар екі өлшемді кескіндер мен анимацияларды жасау үшін векторлық графиканы пайдаланады. Бұл оларға таза, стильдендірілген көрініске ие болуға мүмкіндік береді және ерекше көркемдік стильдегі ойындарда жиі қолданылады. 2D векторлық ойындардың кейбір мысалдары:

- 1. Hollow Knight (2017) бұл ойында ойыншы ертегі жәндіктер әлемінде сыртқы тасбақаны басқарады. Ойында кейіпкерлер мен қоршаған әлемді құру үшін әдемі векторлық графиканы қолданады.
- 2. Stardew Valley (2016) RPG элементтері бар фермерлік тренажер. Ойын пикселдік өнер стилінде жасалған, оны 2D векторлық графиканың бір түрі ретінде қарастыруға болады.

Бұл ойындар векторлық стильдердің әртүрлілігін көрсетеді және бірегей және тартымды визуалды эффектілерді жасау үшін 2D векторлық графиканы пайдалану мүмкіндіктерін көрсетеді. 2D анимациясының негізгі артықшылықтары анимацияны басқару туралы болып табылады.

3D анимация-бұл компьютерлік графиканы қолдана отырып, үш өлшемді кеңістікте қозғалмалы кескіндерді құру процесі. 2D анимациядан айырмашылығы, 3D анимация үшінші өлшемді - тереңдікті қамтиды. Бұл неғұрлым шынайы және күрделі көріністерді жасауға мүмкіндік береді, өйткені объект бақылаушыға қатысты алға және артқа жылжи алады.

3D анимациясын құру процесі әдетте үш өлшемді объект үлгілерін жасауды, жарықтандыруды орнатуды, текстураларды қолдануды және қозғалыс қосуды қамтиды. 3D анимациясында қолданылатын технологиялар визуалды қабылдаудың шынайылығы мен динамизміне қол жеткізу үшін компьютерлік бағдарламалар мен арнайы эффектілерді қамтиды.

3D анимациясын қолдану мысалдары анимациялық фильмдер, жарнамалық роликтер, бейне ойындар, виртуалды шындық және үш өлшемді объектермен көріністердің көрнекі тартымды бейнесін қажет ететін басқа салаларды жасауды қамтиды.

Үш өлшемді кеңістікте ойындарға анимация жасау негізінен 3 кезеңнен тұрады: [2]

модельдеу; макет және анимация; көрсету.

Модельдеу кезінде модельдің қаңқасы және объектінің жеке бөліктері жасалады. Модельдің қаңқасы әдетте болашақ объектінің іргетасының рөлін атқаратын тірек сызықтарынан тұрады, бұл іргетастың айналасында анимацияны жасауға қатысатын әртүрлі құрылымдар салынған.

Кейіпкердің жалпы бейнесін құрастырғаннан кейін әрбір тірек сызығына объектінің бір немесе бірнеше бөлігі тағайындалған байланыстыру кезеңі басталады. Бұл бөліктер нысанның соңғы көрінісіне дейін сипатталған. Соңғы нәтиже - тез және оңай анимацияланатын объект.

Модель толығымен дайын болған соң, анимация кезеңіне өтуіңізге болады, мұнда әртүрлі анықтамалық сызықтарды жылжыту немесе олардың элементтерінің пішінін өзгерту арқылы аниматор нысанның әртүрлі күйлерін жасайды.

Рендеринг кезеңінде соңғы кадрлар 2D анимациясындағыдай жасалады, осы жағдайда әр түрлі қосымша әсерлер қолданылады, мысалы: жарықтандыру және көлеңкелер, оларды суретшілер 2D анимациясында дербес қосады.

Заманауи ойындарды қарапайым бір-біріне салынған көптеген шағын қозғалыстары бар және

объектінің ерекшелігін көрсететін 3D анимациясы жасайлы.

Бұл анимация 2D анимациясына қарағанда шынайырақ көрінеді, себебі объектілерді жанжақты қарауға, сонымен қатар кейіпкерлер мен сәндік элементтердің толық көлемін сезінуге мүмкіндік береді.

Ойыншыларға қызықты және көрнекі түрде әсерлі үш өлшемді әлемдерді ұсынатын көптеген 3D ойындары бар. 3D ойындарының мысалдарына Red Dead Redemption, Fortnite және Minecraft және басқалары жатады. 3D анимациясының негізгі артықшылықтары: неғұрлым шынайы модельдер, анықтамалық сызықтардың арқасында қозғалысты басқару, модельдерді көптеген анимацияларда қолдануға болатындығы. 3D ойындары:

- 1. Red Dead Redemption 2 (2018) Rockstar Games-тің ойыны, RDR2 жабайы батыс стиліндегі ашық әлемді ұсынады, мұнда ойыншылар табиғатты зерттей алады, атуға қатысады және әртүрлі тапсырмаларды орындай алады.
- 2. Minecraft (2011) көрнекі түрде қарапайым болғанымен, Mojang ұсынған бұл құмсалғыш ойыншыларға әртүрлі блоктар мен ресурстарды пайдалана отырып, өздерінің 3D әлемдерін құруға мүмкіндік береді.

Бұл ойындар бейне ойындар әлемінде үш өлшемді графиканы қолданудың әртүрлі аспектілерін көрсете отырып, әртүрлі жанрлар мен геймплей стильдерін ұсынады. Сонымен бірге бұл мүмкіндіктер қиялдың ауқымын азайтады. Объектілерді құруда 3D нысандарын әзірлеу 2D нысандарын жасаудан әлдеқайда көп уақыт алады.

Ойындардағы анимацияның тағы бір түрі - VFX немесе визуалды эффектілерді пайдаланатын анимация. Анимацияның бұл түрі көп таралған емес және әдетте 2D және 3D-мен бірге қолданылады.

Ойындардағы визуалды эффектілер (VFX) ойын әлемінің визуалды тәжірибесін жақсарту және шынайы немесе фантастикалық тәжірибе жасау үшін әртүрлі әдістер мен арнайы эффектілерді пайдалануды білдіреді.[4] Көбінесе бұл технология фильмдерде немесе фотосуреттерде қолданылады, индустриясында оны ойын қолданады. Анимацияның әртүрлі түрлері, жарықтандырудың өзгеруі, бөлшектердің əcepi, динамикалық текстуралар және басқа технологиялар кіруі мүмкін.

Ойындардағы VFX мысалдары:

- 1. Жарылыс және өрт әсерлері: Ойындар жарылыстардың, оттың және түтіннің шынайы және қызықты әсерлерін жасау үшін VFX пайдаланады.
- 2. Атмосфера мен ауа-райының әсерлері: VFX пайдалану жаңбыр, қар, тұман және найзағай

сияқты динамикалық ауа-райының өзгеруіне мүмкіндік береді, бұл ойынға атмосфера береді.

Ойындарда VFX пайдалану керемет визуалды атмосфераны құруға, ойынның визуалды стилін жақсартуға және ойыншылардың виртуалды әлемге қатысуын тереңдетуге көмектеседі.

Анимацияның бұл түрі ойын индустриясының

маңызды бөлігі болып табылады, ол 2D және 3D анимациясын толықтырады және жақсартады. Сонымен қатар, мұндай анимация өте тез жасалады, бірақ суретті түсіру және экспорттау үшін үлкен шығындарды, жоғары сапалы анимацияны жүзеге асыру үшін көп уақыт пен күш жұмсауды талап етеді.

Қазіргі уақытта «Қай анимация жақсы?» деген сұраққа нақты жауап жоқ. Бұл сұраққа әр адам әртүрлі жауап береді, бірақ анимациясыз ойындарды белсенді қолданбайтындығы анық.

Қай анимация жақсы деген сұрақ нақты контекстке, мақсаттарға және қалауымызға байланысты. Анимацияның әр түрі - 2D, 3D немесе визуалды эффектілерді қолдану (VFX) - өзінің күшті және әлсіз жақтары бар және таңдау жобаның нақты талаптарына байланысты.

1. 2D Анимация:

- Артықшылықтары: мультфильмдерде, ретро стильдерде, стильдендірілген жобаларда жиі қолданылады. Бюджеттік жобалар үшін қолайлы болуы мүмкін.
- Кемшіліктері: шынайы үш өлшемді әлем құруды шектей алады. Кейбір бейне ойындар сияқты реализмді қажет ететін жобаларда 2D анимация онша қолайлы болмауы мүмкін.
 - 2. 3D анимациясы:
- Артықшылықтары: әсіресе бейне ойындар мен фильмдерде шынайы үш өлшемді әлем құруға өте ыңғайлы. Перспективаны, жарықтандыруды және объектілердің қозғалысын икемді басқаруға мүмкіндік береді.
- Кемшіліктері: жетілдірілген дағдылар мен бағдарламалық жасақтаманы қажет етеді, уақыт пен ресурстарға көбірек жұмсалады.

3. VFX:

- Артықшылықтары: әсерлі арнайы эффектілерді, сиқырды, атмосфералық өзгерістерді жасау үшін қолданылады. Ойындардағы, фильмдердегі және жарнамадағы визуалды тәжірибені күшейте алады.
- Кемшіліктері: стильдендірілген жобалар үшін әрқашан қолайлы емес. Күрделі бағдарламалық жасақтаманы қолдану тәжірибесін қажет етеді.

Қорытынды. Ойындардағы анимация мен компьютерлік графиканы зерттеу бүкіл әлем бойынша академиялық, салалық және кәсіби қауымдастықтар арасындағы ынтымақтастықтың пайдасын көретін қарқынды дамып келе жатқан сала болып табылалы.

Әрбір маңызды саланың ерекшеліктерін сипаттай отырып, ойын индустриясы үшін анимация жасау әдістеріне талдау жүргізілді. Анимацияның барлық түрлері өзіндік ерекше рөл атқаратыны анықталды және қай анимация жақсырақ екенін анықтау мүмкін емес. Нарықтағы ойын жобасын ілгерілетуде және көрермендердің назарын жобаға аударуда анимация үлкен рөл атқаратыны анықталды. Айта кету керек, соңғы жылдары адамдар ойын жасау кезінде 3D анимациясына көбірек жүгінеді, бірақ бұл 2D ойындарының дамуына кедергі жасамайды.

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COMIC POETIC TEXT AS EDUCATIONAL MATERIAL IN TEACHING THE RUSSIAN LANGUAGE

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КОМИЧЕСКИЙ СТИХОТВОРНЫЙ ТЕКСТ КАК УЧЕБНЫЙ МАТЕРИАЛ В ОБУЧЕНИИ РУССКОМУ ЯЗЫКУ

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Abstract

The article analyzes some technologies and techniques for teaching the Russian language using the example of working with a comic poetic text. The study used an integrated approach to the analysis of the poetic work. The results obtained showed that language teaching technologies using the analysis of a comic poem, firstly, play an important role in mastering the rhythm of spoken speech, listening, and word coordination. Secondly, the verse has certain characteristics and often helps to simplify the process of formulating a statement.

Аннотация

В статье проанализированы некоторые технологии и приемы обучения русскому языку на примере работы с комическим стихотворным текстом. В исследовании использован комплексный подход к анализу стихотворного произведения. Полученные результаты показали, что технологии обучения языку при помощи анализа комического стихотворения, во-первых, играют важную роль в освоении ритмики звучащей речи, аудировании, согласовании слов. Во-вторых, стих обладает определенными особенностями и часто помогает упростить процесс формулирования высказывания.

Keywords: comedy, verse, teaching, method. **Ключевые слова**: комизм, стих, обучение, метод.

Современный комический стихотворный текст представляет особую сложность для студентов, изучающих русский язык для которых он неродной. Однако, комические стихотворения - это весьма ценный материал для обучения русскому языку. Они позволяют студентам не только развивать грамматические навыки, но и богатить свой словарный запас, понимание русской культуры и менталитета. Строфическая организация стихотворного текста предоставляет возможность изучать ритм и интонацию, которые важны для развития навыков произношения и аудирования. Стихи также обладают определенной музыкальностью и эмоциональностью, что помогает студентам лучше запомнить изучаемый материал и использовать его в своей речи.

Для успешного освоения комического стихотворных текстов важно создать подходящую методическую систему. Комическое неоднократно становилось предметом исследователей литературы и культуры на протяжении нескольких столетий. Ос-

новой для нашего исследования служат теоретические работы М. Бахтина, В. Проппа, Ю. Борева, Д. Лихачева, Л. Карасева и М. Рюминой [1]. Из казахстанских авторов мы опирались на работы А.Т. Бактыбаевой, поскольку она занимается анализом произведений комического на примере современных писателей и поэтов [2].

Начиная с простых стихотворений с небольшим количеством сложных лексических и грамматических конструкций, студенты могут постепенно переходить к более сложным произведениям, развивая свои навыки чтения, анализа и интерпретации стихов.

Преподаватели могут использовать разнообразные методики работы со стихами, такие как анализ структуры и формы стихотворения, выделение ключевых слов и фраз, обсуждение образов и переносного значения, создание собственных стихотворений и многое другое. Это поможет студентам углублять свое понимание языка и расширять свои выразительные возможности. Например. стихотворение Э. Успенского «Разгром».

Мама приходит с работы, Мама снимает боты, Мама приходит в дом, Мама глядит кругом.

- Был на квартиру налёт?
- Нет.
- К нам заходил бегемот?
- Нет.
- Может быть, дом не наш?
- Наш.
- Может, не наш этаж?
- Напі.

Просто приходил Серёжка, Поиграли мы немножко.

- Значит это не обвал?
- Нет.
- Значит, слон не танцевал?
- Нет.
- Очень рада. Оказалось, Я напрасно волновалась [3].

Чтение и работа с данным стихотворением может быть поделена на несколько этапов. Первый этап связан с проблемой правильной постановки ударения в русском языке. Она действительно может быть сложной для студентов, особенно для тех, у которых родной язык имеет фиксированное ударение, например, в казахском языке. Это вызывает трудности в понимании и произношении слов, так как ударение в русском языке играет важную смысловую роль.

Для преодоления этой проблемы можно использовать различные технологии обучения и упражнения. Вот несколько подходов, которые могут помочь студентам. Методика слушания и повторения: студенты могут слушать записи русской речи с ударениями и повторять за ними. Это поможет им привыкнуть к звучанию ударных слогов и правильному интонационному строю.

Упражнения на определение ударения: студентам следует использовать словари, где указывается ударение в словах, и практиковаться в определении ударных слогов самостоятельно. Это поможет им развить навык распознавания ударений в словах и улучшит их произношение.

Работа с моделями ударения: студенты могут изучать ударные модели в словах разных частей речи. Это позволит им понять закономерности расстановки ударений и правильно использовать слова в своей речи.

Контекстуальное обучение: использование контекста в предложениях может помочь студентам понять, какое ударение ставить в слове. При этом можно обратить внимание на словосочетания и фразы, где ударение может меняться в зависимости от грамматической формы слова.

Большую помощь могут оказать индивидуальные занятия с преподавателем: преподаватель может работать с каждым студентом индивидуально, обращая внимание на его ошибки и объяснять правила постановки ударения. Это позволит студентам

получить персонализированную помощь и исправить свои ошибки.

Второй этап работы над комическим стихотворением связан с согласованием слов в русском языке. Существует множество правил и исключений, которые определяют, как слова должны согласовываться по лицу, роду, числу, падежу и другим грамматическим категориям.

Чтобы помочь студентам справиться с этой проблемой, важно предоставить им определенное количество упражнений и объяснений. Вот несколько подходов, которые могут быть полезны: обучение основным правилам. В этом случае студентам следует предоставить основные правила согласования слов в русском языке, включая соотношение между существительными и прилагательными, между глаголами и их дополнениями и т. д. При этом необходимо объяснить их примерами и провести достаточно практики.

Задания на согласование: студентам можно предложить различные упражнения на согласование слов по лицу, числу, роду и падежу. Это может быть выполнение заданий, состоящих в поиске и исправлении ошибок в предложениях или в сознательном согласовании слов в контексте.

Работа с текстами: чтение и анализ текстов на русском языке может помочь студентам улучшить навыки согласования слов. Они смогут увидеть, как слова согласуются друг с другом в предложениях и как это влияет на общее значение текста.

Изучение синонимических рядов: обучающиеся должны освоить синонимические ряды, чтобы понимать, какие слова согласуются с разными грамматическими категориями. Это поможет им выбирать правильные слова в разных контекстах и улучшит их языковую гибкость.

Наряду с этим можно рассмотреть несколько дополнительных методов, которые могут помочь студентам в преодолении проблем с согласованием слов. Например, использование мнемонических устройств: студентам можно предложить создать мнемонические устройства или ассоциации, которые помогут им запомнить правила согласования слов. Например, для согласования прилагательных с существительными мужского рода, можно использовать фразу "добрый смех" или "улыбчивый мальчик" вместо "смех по-доброму" или "мальчик с улыбкой на губах".

Обучение контекстуального согласования: студентам следует обучиться использовать контекст для определения правильного согласования слов. Они должны обращать внимание на грамматическую информацию, содержащуюся в предложении, такую как падеж и число существительных, чтобы правильно согласовать остальные слова в предложении.

Использование дополнительных материалов: вместо традиционных искусственных примеров можно использовать разнообразные материалы, такие как аутентичные тексты, аудио- и видеоматериалы с носителями языка при чтении данного стихотворения. Это поможет студентам понять, как слова

согласуются в реальных ситуациях и повысит их понимание и практику.

Важно учитывать индивидуальные особенности каждого студента и предоставлять им достаточное количество практических заданий и обратную связь. Только с постоянной практикой и активным использованием языка студенты смогут развивать свои навыки согласования слов на русском языке и достичь лучших результатов.

На следующем этапе обучения для студентов часто используют учебно-методические материалы, содержащие простые фрагменты из современной литературы или русской классической прозы. Однако такие тексты обычно не являются основой для языковой практики.

Не стоит считать, что фрагменты комических стихотворных текстов не используются в преподавании русского языка. В большинстве случаев выбор таких текстов обусловлен методологической целью - ознакомить обучающихся с общеупотребительной лексикой или наиболее известными юмористическими стихами русских поэтов, а также помочь им улучшить понимание русской поэтической традиции. Однако метрико-ритмическая, рифменная и интонационная структуры таких текстов, как правило, не уделяются большого внимания.

Действительно, часто хрестоматии, созданные для обучающихся, основаны на адаптированных вариантах хрестоматий для российских студентов. Из-за этого стихотворные тексты, которые содержатся в них, могут быть не только непонятными, но и звучать как бессмысленные последовательности слов для изучающих язык. В лучшем случае обучающийся видит поэтический текст как первичную знаковую систему, опираясь на знание узуальных значений слов, которые используются в повседневной жизни. Однако мы считаем, что именно комические стихотворные тексты могут стать плодотворным учебно-методическим материалом, который позволяет на различных этапах обучения русскому языку естественным образом осваивать отличительные особенности менталитета и логики языка.

При этом подбор материала может быть сложным заданием, но результаты от его использования стоят затраченных усилий. Ритм является одной из самых мощных мнемонических функций, и это широко известно. Восприятие ритмической инерции, даже при отсутствии лексического содержания фразы, обычно происходит легко для обучающихся и, главное, легко запоминается. Русский силлаботонический стих, где сильные позиции обозначаются силовыми ударениями, позволяет использовать тексты (на первых порах без пропусков ударений), в которых обучающийся, читая, автоматически ставит ударение на соответствующих слогах. Это помогает студентам осваивать ритм и ударение русского языка естественным образом.

Учебная литература по русскому стихосложению содержит множество примеров подобного рода. В ней можно найти объяснения ритмической структуры двусложных размеров с регулярными

чередованиями ударных и безударных слогов, таких как "та-та-та-та-та". Это позволяет любому обучающемуся легко читать предложенный текст и правильно расставлять ударения в русских словах. Этот метод обучения стихосложению на основе ритмического инерции позволяет студентам быстро освоить основы русского стихотворного языка.

Изучение русского языка как неродного может быть сложным из-за трудностей, с которыми сталкиваются студенты при формулировании мыслей, вспоминании подходящей лексики, грамматических правил согласования и определения порядка слов. Однако стих, как особая форма речи, обладает определенными особенностями и часто использует ритмико-синтаксические клише, которые помогают упростить процесс формулирования высказывания.

В стихотворении ритм играет важную роль и помогает студентам запомнить и выразить свои мысли более легко. Ритмическая структура стихотворения создает определенный шаблон, который помогает учащимся легче ориентироваться в языковой системе и выбирать подходящие слова и фразы. Кроме того, стихи часто используют повторяющиеся фразы, аллитерацию, рифму и другие стилистические приемы, которые делают высказывания более запоминающимися и эмоционально выразительными.

Ознакомление учащихся с ритмической структурой русского стиха, а также с основными ритмико-синтаксическими клише, помогает им развить свои коммуникативные навыки и улучшить способность формулировать и выражать свои мысли на русском языке. Такой подход к обучению русскому языку помогает преодолеть трудности связанные с поиском слов и грамматическими правилами, и позволяет учащимся более свободно и выразительно общаться на данном языке.

Игровые стихотворные тексты имеют значительное значение в изучении русского языка как неродного. Они могут стать важным инструментом для носителей восточных языков, где омофоны широко используются в поэзии, чтобы создавать тексты с двумя возможными чтениями или играть на звучании языка. Такие языки, как китайский, японский, вьетнамский и другие, богаты звуковыми сочетаниями, и для обучающихся из этих стран русские стихи с каламбурной рифмой, омонимическими рифмами или омографами и омофонами могут стать увлекательным материалом, вызывающим их искренний интерес и помогающим им лучше осознавать тексты на слух.

Игровые стихотворные тексты создают необычную звуковую атмосферу, где рифмы и звучание слов играют значительную роль. Они требуют от учащихся более внимательного слушания и анализа звуковой структуры, что способствует развитию навыков аудирования и способности адекватно воспринимать загадочные и многозначительные тексты. Кроме того, такие стихи рассчитаны на формирование когнитивных навыков и ассоциаций,

что помогает обучающимся связывать звуки и значения слов, улучшают их словарный запас и грамматическую компетенцию.

Жил старик на развесистой ветке, У него были волосы редки. Но галчата напали И совсем общипали Старика на развесистой ветке [3].

Игровые стихи открывают для студентов новые грани русской поэзии, помогают им улучшить понимание ритма и интонации речи, а также развивают творческое мышление и воображение. Благодаря такому подходу к изучению языка, обучающиеся становятся более мотивированными и заинтересованными в освоении русского языка и легче достигают прогресса в его изучении.

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PHARMACEUTICALS

ACUTE TOXICITY STUDY OF THE THICK EXTRACT OF LYCHNIS CORONARIA HERB

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ВИВЧЕННЯ ГОСТРОЇ ТОКСИЧНОСТІ ГУСТОГО ЕКСТРАКТУ З ТРАВИ ЛІХНІСУ КОРОНЧАТОГО

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Abstract

The aim of research was acute toxicity study of the thick extract of Lichnis coronaria herb at a single intragastric input to rats of both sexes at a dose of 5000 mg/kg. Analysis of the body weight dynamics and mass coefficients of internal organs shows the absence of pathological changes in the organism of studied animals in comparison with the control group. It has been established that LD_{50} of the thick extract of Lichnis coronaria herb is beyond 5000 mg/kg. Studying results of the experiment made it possible to assign the researched extract to the V class of toxicity (practically harmless substances).

Анотація

Метою дослідження було вивчення гострої токсичності густого екстракт з трави ліхнісу корончатого при одноразовому внтрішньошлунковому введенні щурам обох статей у дозі 5000 мг/кг. Аналіз динаміки маси тіла та масових коефіцієнтів внутрішніх органів свідчить про відсутність патологічних змін в організмі досліджуваних тварин у порівнянні з контрольною групою. Встановлено, що ЛД₅₀ густого екстракту з трави ліхнісу корончатого знаходиться за межами 5000 мг/кг. Вивчення результатів експерименту дозволило віднести досліджуваний екстракт до V класу токсичності (практично нешкідливі речовини).

Keywords: Lychnis coronaria, thick extract, acute toxicity. **Ключові слова:** ліхніс корончатий, густий екстракт, гостра токсичність.

Вступ. За останнє десятиліття відбулося зростання наукового інтересу до рослинних лікарських засобів. Це пов'язано з особливостями клінічної ефективності фітотерапевтичних препаратів: незначна токсичність і біологічна безпека для людського організму; широкий терапевтичний спектр дії; комплексний вплив на різні патогенетичні ланки захворювань; нечасті прояви побічних ефектів, навіть при тривалому застосуванні [1, 13].

Встановлено, що серед загальної кількості лікарських призначень засоби рослинного походження в різних країнах становлять від 20 % до 60 % [2, 14]. В Україні понад 50 % лікарських препаратів виробляється із рослинної сировини. Потенційні можливості фітотерапії величезні, оскільки майже кожній рослині із 1,5 тис. відомих видів притаманний широкий спектр лікувальних властивостей [1, 3].

Із точки зору перспективності пошуку нових високоефективних і малотоксичних препаратів рослинного походження нашу увагу привернув ліхніс корончатий (Lychnis coronaria L.). Основні цілющі властивості ліхнісу корончатого визначаються вмістом біологічно активних речовин: флаваноїдів, стероїдів, тритерпеноїдів, летких сполук [6, 9].

За даними літературних джерел [9, 12], ліхніс корончатий проявляє протимікробну, антиоксидантну, протизапальну, гепатопротекторну, протидіа-бетичну, антигемораргічну, нейропротекторну, анаболічну активність. Водні та етанольні витяжки із надземної частини ліхнісу корончатого застосовуються при лікуванні авітамінозу, діареї, прокази, геморою, захворювань легень і печінки [7].

Ліхніс корончатий широко використовується для лікування різного роду захворювань у країнах світу. Зокрема, в Італії цією рослиною лікують мігрені та спазми кишечника [6]. У Великобританії та Ірландії мазь з трави ліхнісу корончатого використовують як антидот при укусах змій. У традиційній румунській медицині екстракти з надземної частини ліхнісу корончатого використовуються для обробки ран [6, 9].

Відомо, що для впровадження та безпечного застосування нових лікарських засобів необхідним є дослідження їхньої токсичності [5]. Визначення основного токсикологічного параметру (ЛД $_{50}$) дозволяє отримати необхідні показники для встановлення рівня токсичності нового препарату, широту його терапевтичної дії і співвідношення між дозою та негативними ефектами в умовах застосування препарату в дозах, що у декілька десятків та сотень разів перевищують терапевтичну [4, 8].

Метою дослідження було вивчення гострої токсичності густого екстракту з трави ліхнісу корончатого.

Матеріали та методи. Матеріалом дослідження слугував густий екстракт з трави ліхнісу корончатого (ГЕТЛ). Експериментальне дослідження з визначення гострої токсичності ГЕТЛ вивчали на білих щурах обох статей за умов одноразового внутрішньошлункового введення [5]. Згідно з методичними рекомендаціями ДЕЦ МОЗ України при виборі доз для внутрішньошлункового введення лімітуючим показником при визначенні гострої токсичності є максимальна доза четвертого класу токсичності (малотоксичні речовини) — 5000 мг/кг, якщо при цьому не спостерігається загибелі тварин. Введення більшої дози є недоцільним.

Виходячи із вищенаведеного для проведення дослідження нами була обрана доза ГЕТЛ 5000 мг/кг. Розчин готували шляхом розведення 1 г екстракту в 5 мл води, який отримувала одна тварина. ГЕТЛ вводили одноразово внутрішньошлунково щурам самцям та самицям з масою тіла 180-200±20 г, яких утримували на стандартному раціоні віварію Тернопільського національного медичного університету імені І. Я. Горбачевського МОЗ України. З тваринами поводились згідно з правилами «Європейської конвенції щодо захисту хребетних тварин, яких використовують для експериментальних та інших наукових цілей» [11].

Дослідні тварини були розподілені на 4-ти групи (по 2-ві групи кожної статі), кожна з яких включала 6-ть тварин (табл. 1): 1-ша група — контрольні тварини, які отримували питну воду в дозі 20 мл/кг; 2-га група — тварини, які отримували водний розчин ГЕТЛ у дозі 5000 мг/кг, в об'ємі 20 мл/100 г маси тіла тварин через металевий зонд.

Таблиця 1 Рандомізація щурів в експерименті з вивчення гострої токсичності густого екстракту з трави ліхнісу корончатого (n=24)

Групо трории	Доза	Кількість щурів		
1 рупа тварин	доза	самці	самиці	
Контрольні тварини	20 мл/кг	6	6	
ГЕТЛ	5000 мг/кг	6	6	

Після внутрішньошлункового введення ГЕТЛ за тваринами проводили спостереження за проявами інтоксикації. Оцінювали їх поведінку, загальний стан, летальність, динаміку маси тіла та внутрішніх органів протягом 14-ти днів. Спостереження за масою тіла проводили перед початком досліду та у динаміці— на 3-ту, 7-му та 14-ту доби. Після двох тижнів спостереження, тварин виводили з експерименту шляхом евтаназії під тіопенталовим наркозом, проводили макроскопічний огляд і розрахунок масових коефіцієнтів (МК) внутрішніх органів (печінки, серця, легень, нирок і селезінки):

$$MK = m_{\text{органу}} / M_{\text{тварини}} \cdot 100 \%$$

3 метою виявлення можливого токсичного впливу ГЕТЛ на організм щурів їхній стан порівнювали зі станом контрольних тварин (самців і самок).

Результати досліджень піддавали статистичному аналізу за допомогою статистичної програми Statistica 12.0 з використанням параметричного критерію Ст'юдента та непараметричного критерію

Вілкоксона для зв'язаних вибірок. Зміни вважали вірогідними при р ≤ 0.05 [10].

Результати й обговорення. Згідно результатів дослідження, після внутрішньошлункового введення ГЕТЛ у дозі 5000 мг/кг щурам обох статей ознак інтоксикації не спостерігалося. Загальний стан та поведінка дослідних тварин відповідали фізіологічній нормі та не відрізнялись від щурів контрольної групи. У перший день введення ГЕТЛ і протягом всього періоду спостереження тварини мали охайний зовнішній вигляд, вільно рухалися у клітці, добре реагували на звукові та світлові подразники, порушення дихання або судом не спостерігали, процеси сечовипускання та дефекації були в нормі. За показниками спожитого корму та води в дослідних групах до закінчення дослідження не було виявлено відмінностей з групами інтактних тварин. Загибелі щурів обох статей протягом всього періоду спостереження не зареєстровано (табл. 2).

Таблиця 2

Показники летальності щурів обох статей при дослідженні гострої токсичності густого екстракту з трави ліхнісу корончатого після одноразового внутрішньошлункового введення (n=24)

_	Доза	Самці	Самиці	
Група тварин		Кількість загиблих тварин/за-	Кількість загиблих тварин/загальна	
		гальна кількість тварин у групі	кількість тварин у групі	
Контрольні тварини	20 мл/кг	0/6	0/6	
ГЕТЛ	5000 мг/кг	0/6	0/6	

Згідно з методикою вивчення гострої токсичності для оцінки токсичного впливу ГЕТЛ на орга-

нізм щурів проводили дослідження маси тіла тварин перед початком досліду та у динаміці — на 3-ту, 7-му та 14-ту доби (табл. 3).

Таблиця 3

Динаміка маси тіла щурів обох статей після одноразового внутрішньошлункового введення густого екстракту з трави ліхнісу корончатого (M±m; n=24)

Газуга правич	Термін спостереження					
Група тварин	Вихідні дані	3-тя доба	7-ма доба	14-та доба		
	Самці					
Контрольні тварини	191,50±2,12	201,83±2,07*	207,67±1,17*	225,50±1,82*		
ГЕТЛ	192,33±2,12	197,17±0,94	206,00±1,69*	223,10±1,69*		
Самиці						
Контрольні тварини	179,50±1,23	185,50±2,09	190,00±1,34*	218,83±2,63*		
ГЕТЛ	180,83±1,64	185,66±1,74	192,33±1,38*	208,12±1,71*		

Примітка. * - відхилення показника вірогідне щодо вихідних даних, р≤0,05.

Встановлено збільшення живої маси у щурів самців контрольної групи на 3-ту, 7-му та 14-ту доби порівняно з вихідними значеннями на 5 %, 8 % та 18 % відповідно. Достовірні зміни (р≤0,05) у динаміці маси тіла інтактних самиць спостерігаються на 7-му та 14-ту доби експерименту. Дані показники становили (190,00±1,34) г та (218,83±2,63) г, що на 6 % і 22 % відповідно більше вихідного значення.

Тваринам, яким вводили водний розчин ГЕТЛ, маса тіла збільшувалася на 7 % у самців та 6 % у самиць відносно вихідних даних наприкінці першого тижня експерименту. Приріст живої маси дослідних тварин (ГЕТЛ) відбувався протягом усього терміну дослідження і наприкінці експерименту (14-та доба) збільшився на 16 % у самців та на 15 % у самиць порівняно з вихідними значеннями.

Упродовж усього терміну спостереження відбувалося фізіологічне збільшення маси тіла тварин

обох статей, яким вводили водний розчин ГЕТЛ і дані показники були вірогідними (р≤0,05) відносно вихідних даних на 7-му та 14-ту доби експерименту. Приріст маси тіла у тварин відбувався рівномірно, відхилень між дослідними групами відсутні. Отримані результати дослідження динаміки маси тіла щурів обох статей після одноразового внутрішньошлункового введення ГЕТЛ не виявили значних відхилень від групи контрольних тварин. Отже, одноразове внутрішньошлункове введення ГЕТЛ не призводить до загибелі тварин і не впливає на приріст маси тіла. Це свідчить про відсутність токсичного впливу досліджуваного екстракту на організм.

Після закінчення експерименту (через два тижні) провели розтин тварин, під час якого зробили макроскопічний огляд і розрахунок масових коефіцієнтів внутрішніх органів. Дані результатів дослідження наведені у таблиці 4.

Таблиця 4 Масові коефіцієнти внутрішніх органів щурів обох статей після одноразового внутрішньошлункового введення густого екстракту з трави ліхнісу корончатого (М±m; n=24)

Група тварин	Орган						
	Печінка	Серце	Легені	Нирки	Селезінка		
	Самці						
Контрольні тварини	$3,34\pm0,07$	$0,32\pm0,02$	$0,61\pm0,04$	0,65±0,04	$0,42\pm0,03$		
ГЕТЛ	3,41±0,06	$0,33\pm0,02$	$0,63\pm0,03$	$0,64\pm0,05$	$0,39\pm0,02$		
Самиці							
Контрольні тварини	3,25±0,08	$0,29\pm0,01$	$0,59\pm0,04$	$0,62\pm0,04$	$0,44\pm0,02$		
ГЕТЛ	3,29±0,11	$0,31\pm0,02$	$0,62\pm0,03$	$0,61\pm0,03$	$0,41\pm0,01$		

Під час розтину дослідні тварини мали охайний зовнішній вигляд та незмінені слизові оболонки природних отворів. Встановлено, що досліджувані органи мали правильне анатомічне розташування та звичайний колір. Серозні оболонки

черевної, плевральних та навколо-серцевої порожнини гладенькі, блискучі, без ознак запалення чи патологічних змін.

М'яз серця на розрізі темно-червоний, міокард пружний при пальпації. Легені дослідних тварин конусоподібної форми, губчасті. Права легеня щурів більших розмірів, ніж ліва та увігнута з медіальної сторони. Структура печінки щурів на розрізі збережена, передній край гострий. Орган забарвлений у вишневий колір, виражена пластинчата будова, поверхня без виразок. Поверхня нирок дослідних тварин гладка, форма та колір не відрізняють від анатомічної норми. Макроскопічний огляд селезінки щурів показав виражену трабекулярна будова. Аналіз масових коефіцієнтів внутрішніх органів дослідних тварин свідчить про відсутність патологічних змін в організмі досліджуваних тварин у порівнянні з контрольною групою.

Результати проведених досліджень з вивчення гострої токсичності дозволили встановити, що при одноразовому внутрішньошлунковому введенні щурам обох статей ГЕТЛ у дозі 5000 мг/кг маси тіла відсутня токсична дія. Про це свідчить незмінена поведінка тварин, відсутність загибелі у дослідних групах тварин та змін у масових коефіцієнтах внутрішніх органів порівняно з контрольною групою. Це дозволяє віднести досліджуваний екстракт до V класу токсичності — практично нетоксичні речовини.

Висновки. Встановлено, що одноразове внутрішньошлункове введення ГЕТЛ у дозі 5000 мг/кг не спричиняє загибелі щурів обох статей, не впливає на приріст маси тіла, не викликає ознак інтоксикації чи патологічних змін з боку функціонального стану організму тварин протягом двох тижнів дослідження. Це свідчить, що ЛД₅₀ досліджуваного екстракту знаходиться за межами 5000 мг/кг. Отже, ГЕТЛ при внутрішньошлунковому введенні належать до V класу токсичності (практично нешкідливі речовини). Отримані результати свідчать про доцільність подальшого вивчення фармакологічних властивостей ГЕТЛ як перспективної рослинної субстанції для створення нових лікарських препаратів.

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PHILOLOGICAL SCIENCES

THE ARTISTIC WORLD OF F.DOSTOEVSKY IN THE ASPECT OF INTERCULTURAL DIALOGUE

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ХУДОЖЕСТВЕН МИР Ф.ДОСТОЕВСКОГО В АСПЕКТЕ МЕЖКУЛЬТУРНОГО ДИАЛОГА

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Abstract

Later, at the turn of the XIX-XX centuries, female images in the works of F.Dostoevsky began to be studied not in the context of a particular work, but as one of the conceptual foundations of his entire literary heritage. The peculiarity of F.'s poetics Dostoevsky called the ability to create artistic characters that are valuable not so much in themselves as capable of deepening the degree of unhappiness experienced by other actors. When analyzing the characters of F.Dostoevsky also took as a basis an ethical and ideological approach, which includes the dominant ideological and ethical principles on the basis of which certain actions and actions are performed. There were three main concepts: environment, land and soil. Adherents of the environment deny the need for both freedom and responsibility for base principles and motives of behavior. The soil embodied the element of the developing national spirit, and the earth was a symbol of inner spiritual freedom.

A separate aspect for literary studies was the problem of the correlation of atheism and religious faith in F.'s work. Dostoevsky. It was suggested that religious humility was analyzed by the writer as a possible way for humanity to achieve harmony and positive transformation of life, but in the end it was eventually rejected by him as fruitless. Russian literary studies applied various methodological principles and philosophical and aesthetic concepts, trying to comprehend the mysteries of the artistic skill of the great Russian classic and approach the concept of a systematic study of his literary heritage. Western Slavists tried to make up a general picture of the reception of the Russian writer's work by the English-speaking readership and criticism in their works.

Western critics emphasized that the popularity of the Russian writer's work was a rather complex intellectual phenomenon consisting of a craving for mysticism, pathopsychology and artistic experimentation. Many provisions in philological studies devoted to women's topics speak about the typological similarity of literary and critical consciousness in Russia, Europe and the United States of America.

Аннотация

Позднее на рубеже XIX-XX веков женские образы в творчестве Ф.Достоевского стали исследоваться не в контексте определенного произведения, а как одна из концептуальных основ всего его литературного наследия. Особенностью поэтики Ф.Достоевского называлась способность создавать художественные персонажи, самоценные не столько сами по себе, сколько способные углубить степень переживаемых событий несчастий, уготованных другим действующим лицам.

При анализе персонажей Ф.Достоевского принимался за основу также этико-идеологический подход, включающий в себя доминанту идейно-этических принципов, на базе которых совершаются те или иные поступки и действия.Выделялись три основных концепта: среда, земля и почва. Приверженцы среды отрицают необходимость как свободы, так и ответственности за низменные принципы и мотивы поведения.

Почва воплощала собой стихию развивающего народного духа, а земля - то символ внутренней духовной свободы.

Отдельным аспектом для литературоведческих исследований стала проблема соотношения атеизма и религиозной веры в творчестве Ф.Достоевского. Высказывалось мнение, что религиозное смирение анализировалось писателем как возможный для человечества путь достижения гармонии и позитивного преобразования жизни, но в итоге было им в итоге отвергнуто как безрезультатное.

Российское литературоведение применяло различные методологические принципы и философско-эстетические концепции, пытаясь постичь загадки художественного мастерства великого русского классика и подойти к концепту системного исследования его литературного наследия.

Западные слависты пытались в своих работах составить общую картину рецепции творчества русского писателя англоязычной читательской аудиторией и критикой. Западные критики подчеркивали, что популярность творчества русского писателя представляла собой довольно многосложный интеллектуальный феномен, состоящий из тяги к мистицизму, патопсихологии и художническому экспериментаторству.

Многие положения в филологических исследованиях, посвященных женской тематике, говорят о типологическом сходстве литературно-критического сознания в России, Европе и Соединённых Штатах Америки.

Keywords: artistic, character, ideological approach, ethical principle, national spirit, methodological principle, philosophical and aesthetic concept

Ключевые слова: художественность, характер, идеологический подход, этический принцип, национальный дух, методологический принцип, философско-эстетическая концепция

Литературный материал писателя стал источником для исследований в психоаналитическом ключе. Ф.Достоевский именовался «психопатологом», который проявлял интерес к половым отклонениям у мужчин и женщин. Подобным работам характерно свободное обращение с художественным текстом и бездоказательность большинства выдвигаемых заключений, что делало их объектом различной критики со стороны филологической науки.

Позднее женские образы в творчестве Ф.Достоевского стали исследоваться не в контексте определенного произведения, а как одна из концептуальных основ всего его литературного наследия. Особенностью поэтики Ф.Достоевского называлась способность создавать художественные персонажи, самоценные не столько сами по себе, сколько способные углубить степень переживаемых событий несчастий, уготованных другим действующим лицам. Такие образы играют второстепенную роль, но при этом являются эффективным средством обозначения в художественном мире автора вечную и ожесточенную борьбу добра и зла.

Существовали и более крайние точки зрения. Например, Н.А.Бердяев утверждал, что женщина как таковая в принципе лишена в прозе Ф.Достоевского самостоятельного места, а интересует писателя лишь в той мере, в какой она влияет на судьбу связанного с ней мужчины» [1,79].

В более поздних работах сохранился креп в стороны психоаналитики в силу чего отправным импульсом творчества Ф.Достоевского называлось «половое чувство» и сладострастие, включающие муки душевных переживаний и не приводящее к ощущению гармонии и наконец достигнутого счастья [2,239].

Однако слышались и более трезвые высказывания. Так, А.П.Скафтымов категорически отвергал «беспутство» и «половое начало» в героине Ф.Достоевского из романа «Идиот». В образе

Настасьи Филипповны ученый прежде всего увидел трагический излом и душевную раздвоенность, составляющие драму ее жизненной судьбы. А.П.Скафтывому удалось связать авторское решение женских образов с общим контекстом идейнотематической направленности романа и с мировоззренческими принципами Ф.Достоевского.Он увидел в Настасье Филлиповне «гордость» и «стихию живых, непосредственных источников сердца» [1,57].

Довольно интересна в этом смысле монография В.Ф.Переверзева. Он указывал на психологическую неустойчивость и ярко выраженную нервозность женских персонажей Ф.Достоевского. Ученый акцентировал элемент двойничества в творчестве писателя и подчеркивал эволюционное развитие этих образов, начиная от Екатерины из «Хозяйки» и заканчивая Настасьей Филипповной и Грушенькой из последующих романов русского писателя.

При анализе персонажей Ф.Достоевского принимался за основу также этико-идеологический подход, включающий в себя доминанту идейноэтических принципов, на базе которых совершаются те или иные поступки и действия. Выделялись три основных концепта: среда, земля и почва. Приверженцы среды отрицают необходимость как свободы, так и ответственности за низменные принципы и мотивы поведения. Почва воплощала собой стихию развивающего народного духа, а земля - то символ внутренней духовной свободы.

Монография М.Бахтина доказывала, что Ф.Достоевский являлся мастером художественного слова, который открывал читателю неизведанные грани человеческой природы. В образе Настасьи Филипповны ученый увидел напряженный внутренний поиск себя как самоценной личности и своего достойного места в мире людей.

В последующий период уделялось внимание идеологической направленности литературного наследия Ф.Достоевского. В статье Л.П.Гроссмана

женские образы писателя проецируются на их социальное положение, и они рассматриваются как невинные жертвы общественных отношений в современном им человеческом сообществе.

В 40-е годы XX столетия литературоведы подчеркивали гуманистический характер творчества Ф.Достоевского. Они вновь обратились к проблеме типологии женских образов писателя, выделяя типы «поруганных девушек», «чистых сердцем» и «гордых и кротких» [3,33]. В работе Г.М. Фридлендера, посвященной роману «Идиот», женские характеры Ф.Достоевского освещаются в аспекте общегуманистической направленности, а основу их натуры составляет яростная борьба противоположных сил, что очевидно в характере Настасьи Филипповны, соединяющем бунтующую гордость и смирение перед нелегкой жизненной судьбой.

Отдельным аспектом для литературоведческих исследований стала проблема соотношения атеизма и религиозной веры в творчестве Ф.Достоевского. Высказывалось мнение, что религиозное смирение анализировалось писателем как возможный для человечества путь достижения гармонии и позитивного преобразования жизни, но в итоге было им в итоге отвергнуто как безрезультатное.

В книге Н.Чиркова подчеркивалось тяготение Ф.Достоевского к типизации своих женских образов, а не к стремлению ярко выделить их человеческую индивидуальность. В его исследовании уделялось внимание художественным средствам изобразительности, которые «формировали языковой и психологический портрет женских персонажей в произведениях Ф.Достоевского» [2,68].

Дальнейшим шагом в исследовании авторской манеры и художественного мира писателя стало появление филологических работ сопоставительного плана. Творчество Ф.Достоевского, в частности, сопоставлялось с драматургией Шиллера, и были найдены довольно интересные параллели в подаче и обрисовке женских характеров, а также в постановке некоторых сюжетных сцен.

Таким образом, российское литературоведение применяло различные методологические принципы и философско-эстетические концепции, пытаясь постичь загадки художественного мастерства великого русского классика и подойти к концепту системного исследования его литературного наслелия.

Первым писателем, который вошел в круг чтения и оживленного обсуждения англоязычного читателя, был вовсе не Ф.Достоевский, а И.Тургенев. XIX век не отличен вниманием англоязычной критики к творчеству этого русского писателя. Потребность в обращении к произведениям Ф.Достоевского открыл американский критик и талантливый переводчик Юджин Скайлер. После публикации романа «Идиот» и появления в печати романа «Подросток» он сделал основательный обзор русской литературы, ставшей достоянием читающей публики в 1875 году и высказался о последнем романе «Подросток».

Ю. Скайлер обнаружил мастерство психологического анализа и «удивительную выразительность» [4,73] художественных характеров, которые составляли художественный мир Ф.Достоевского.

Позднее в Англии и в Америке вышел англоязычный перевод «Записок из Мёртвого дома», выполненный Марией фон Тило. Так былоположено начало систематическим переводампроизведений Ф.Достоевского и публикаций их на Западе. Причем первенство, несомненно, принадлежало англичанам, которые раньше американцев приобщали произведения русского писателя к читающей аудитории. Но вслед за Англией романы Ф.Достоевского стали с известной регулярностью публиковаться и в Соединенных Штатах.

Это имело свои причины, так как именно в Великобритании девятнадцатого столетия художественная литература во многом формировала эстетику и общественно-моральные установки просвещенной и образованной части британского общества. В Англии выходит в свет литературоведческая работа, полностью посвященная творчеству Ф.Достоевского. Она была иллюстрирована и написана пропагандистом русской культуры Х.С. Вильтоном и рассказывала английским читателям и специалистам в области филологии об известности произведений Ф.Достоевского в Европе.

Позднее англичане познакомились с книгой французского литератора и дипломата Е.Вогюэ, который анализировал русский роман как особый литературный жанр. Но французский литературовед не понял сущности художественного метода Ф.Достоевского и его трактовки человеческой и, в частности, женской натуры. В своей работе он упрекает русского писателя в том, что Ф.Достоевский не представляет любовное чувство как светлое, радостное и естественное. Любовь в текстах Ф.Достоевского, по мнению Вогюэ, состоит либо из грубой страсти, либо из нервных потрясений и слез отчаяния, и в итоге описание всех переживаний героев содержат неестественные, преувеличенные формы.

Британский филолог Гиссинг сопоставлял романы Ф.Достоевского с художественной прозой Г.Диккенса. И в творчестве этих различных писателей он увидел сближающее их искреннее и даже «болезненное» [4,101] сочувствие к обездоленным и бедным людям, ставшим жертвами социального неравенства и антигуманного общественного устройства. Но при этом Ф. Достоевский, по мнению Гиссинга, превосходит английского классика по верности и точности социальных деталей и глубине психологического анализа своих персонажей.

Английские литературоведы в лице Г.Брандеса и Э.Гарнетта не оставляли попыток сопоставить философско-этическое мировоззрение Ф.Достоевского с доктриной Ницше о сверхчеловеке и «его трактовкой человеческой природы и человеческой сообщности» [5,77]. Говоря о причинах недопонимания и порой даже непринятия прозы Ф.Достоевского британской аудиторией, Морис Беринг подчеркивал, что у англичан с их традицией романтической литературы и усадебного романа со свет-

лым, жизнеутверждающим финалом не было желания или достаточных мотивов, погрузится в «преисподню страдания или в расстроенное сознание» [6,255] персонажей русского писателя.

Художественный мир Ф.Достоевского воспринимался как «глубинные и темные пределы духовной правды», как некий антимир, лишенный логической стройности и композиционкойпропорциональности. Новый всплеск интереса к литературному наследию Ф.Достоевского возник после публикации в Лондоне и Нью-Йорке романа «Преступление и наказание». Критика в лице В.Хоуэллса отмечала, что картины человеческих страданий не умоляют силу авторского призыва к гуманизму, терпимости и взаимоответственности всех членов человеческого сообщества друг за друга.

В XX столетии американцы и англичане прочитали в английском переводе роман «Братья Карамазовы». Эта эпоха превратила личность Ф.Достоевского в культовую фигуру, чему способствовало издание в Англии его 12-томного собрания сочинений в переводе К.Гарнетт и солидный монографии Дж.Лойда «Великий русский реалист: Фёдор Достоевский» [5].

Западные слависты пытались в своих работах составить общую картину рецепции творчества русского писателя англоязычной читательской аудиторией и критикой. М. Дейвенпорт, Х. Мачник и Д.Брюстер собрали рецензии, критические статьи и читательские отклики, которые отражали не только отдельные грани английской репутации Ф.Достоевского, но и значительно проясняли траекторию восточно-западных литературных контактов в целом. Западные критики подчеркивали, что популярность творчества русского писателя представляла собой довольно многосложный интеллектуальный феномен, состоящий из тяги к мистицизму, патопсихологии и художническому экспериментаторству. В глазах англоязычной читающей аудитории Ф.Достоевский являлся автором, который углублялся в психологию бессознательности и «был новатором в области художественной формы» [3,5].

Западный прагматичный подход к человеческой природе столкнулся с постижением культа так называемой русской души, связанной в их понимании с религией человеческого страдания и поиска жизненной правды. Этот поиск был неизбежно сопряжён с острым духовным кризисом, который во всей полноте переживали женские персонажи романов Ф.Достоевского.

Женские образы в произведениях Ф.Достоевского исследовались также в свете трактовки православного вероучения. Однако в том вопросе оценки критиков довольно резко разошлись. Так, английская писательница В.Вульф считала концепт святости «основополагающим для всей русской культуры и художественного словотворчества» [7,86].

С такой позицией были категорически не согласны Э.Синклер и Д.Лоуренс, которые относили Ф.Достоевского к ортодоксам византийского хри-

стианства, ложно уверовавшим «в исключительность и чудесность русской души» [18,106] и называли его автором, который смешивает божественное начало и откровенный, неприкрытый садизм» [4, 93].

Патопсихология, которая в тот период стала предметом филологического интереса, позволила сделать вывод о том, что Ф.Достоевский отражал в своих литературных текстах двойственность человеческой природы, и его художественные характеры претерпевали «внутренний конфликт между страстью и рассудком, желаемым и возможным» [8,107]. Но западные филологи упрекали русского писателя в чрезмерной сосредоточенности на физических недостатках и нравственных пороках, объясняя их попыткой реализации Ф.Достоевским личных переживаний и душевных травм в духе фрейдизма. Но, с другой стороны, «зловещий выверт человеческого мышления»[8,93] героев русского писателя объявлялся ярким признаком его художнического мастерства.

В середине XX столетия в американском литературоведении активно использовались концепции и методы «закрытого прочтения» (closereading) и экзистенциализма. В этот период англоязычная художественная литература испытывает сильное влияние мировоззренческих концепций и технических приёмов Ф.Достоевского.

Внимание филологов начинает сосредоточиваться на художественных особенностях литературного наследия русского классика. В самых престижных университетах США, расположенных в Нью-Йорке, Чикаго, Калифорнии и Йельсе, появляются центры по изучению русской литературы и творчества Ф.Достоевского. В частности, сторонники «новой критики» с ее методикой «закрытого чтения» старались рассматривать произведения Ф.Достоевского вне исторической эпохи и культурологической специфики. Другое направление составляли исследования, которые встраивали художественный мир русского писателя в общий контекст европейского культурного наследия. В работах американских филологов продолжала развиваться тема двойничестваженских персонажей Ф.Достоевского и их тяготения к кротости или своеволию.

Символический подход к литературным текстам классика предложил Р.Блэкмур, который представил хронотоп произведений Ф.Достоевского как «систему символических поворотов и ситуаций» [8,97]. Самое ценное в этой работе - это попытка объективной интерпретации литературных текстов писателя без опоры на его философские или общественно-политические пристрастия.

Рассматривая творчество Ф.Достоевского в рамках литературного процесса девятнадцатого столетия, Стайнер нашел в его текстах возрождение лучших традиций античной драматургии, так как «художественные характеры кажутся свободными от авторской воли» [9,73].

В монографии Р.Бэлнапа развивается методы «новой критики», принципы формализма при анализе литературного текста и тенденция углубления

в психологию творчества отдельного автора. С этих позиций роман «Братья Карамазовы» исследуется на уровне сюжета, фабулы, внутренней связи всех художественных образов и их точек зрения на происходящие события. В работе выделяются оппозиции намеренного шутовства и душевного надрыва, Божьей благодати и дьявольской воли. Р.Белнеп пишет о том, что доминантной эмоционального построения романа «Братья Карамазовы» является шестиугольник, включающий в себя трёх братьев и трёх женщин, от которого тянутся нити к другим персонажам произведения.

В монографии Вагнера отмечается стилевое разнообразие художественной прозы Ф.Достоевского. Языковой портрет очень ярко выделяет отличительные черты женских образов в романах и повестях русского писателя. Останавливаясь на образе Нелли ИЗ романа «Униженные оскорбленные», западный филолог находит истоки этого персонажа в романе Ч.Диккенса «Лавка древностей». Однако полноценную аналогию провести довольно трудно. В романе Ф.Достоевского разрабатываются две сюжетные линии, связанные с образами Наташи и Нелли. Импульсивная и склонная к мазохизму любовь Наташи к князю Волконскому заканчивается трагической смертью ее незаконнорожденного ребенка. Такая же участь постигла в свое время и мать Нелли, и в этом женские судьбы героинь Ф.Достоевского соприкасаются.

Обращались к женским персонажам Ф.Достоевского, Вагнер раскрывает социальную проблему проституции, связывая ее «с преступным началом» [10,29]. Эта тема оказывается сквозной в романе «Преступление и наказание» и прослеживается в образе девочки, которую спас от великовозрастного растлителя Раскольников, и через женщину, которая желала обрести свой конец в водах Невы, и через образ Сони Мармеладовой. Эта проблема приобретает, по мнению западного филолога, остро социальное звучание, так как женщины, подобные Соне Мармеладовой вынуждены продавать себя и на эти деньги содержать свои обездоленные семьи, не имеющие иного дохода или способа выжить.

Для феминистской критики женские образы Ф.Достоевского стали фактическим материалом, раскрывающим социально-общественного положения женщин в России в определенную историческую эпоху, которыйзаменял объективные истори-

ческие свидетельства. Считалось, что Ф.Достоевский обрисовал женскую судьбу в патриархальном обществе и чем самым способствовал началу борьбы за полноправное место женщины в мире мужчин.

Таким образом, женские образы в художественных произведениях Ф.Достоевского изучались в религиозно-философском, социальном, формальном и психоаналитическом аспекта, что говорит о признании личности и литературного наследия русского писателя как в России, так и за рубежом. Многие положения в филологических исследованиях, посвященных женской тематике, говорят о типологическом сходстве литературно-критического сознания в России, Европе и Соединённых Штатах Америки.

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THE PROBLEM OF THE TRANSFORMATION OF MENTAL CONCEPTS IN THE ENGLISH-LANGUAGE RECEPTION OF A POETIC TEXT

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ПРОБЛЕМА ТРАНСФОРМАЦИИ МЕНТАЛЬНЫХ КОНЦЕПТОВ ПРИ АНГЛОЯЗЫЧНОЙ РЕЦЕПЦИИ ПОЭТИЧЕСКОГО ТЕКСТА

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Abstract

The English and Russian conceptual spheres are very different from each other, but this difference nevertheless conceals a deep inner unity. It consists in attention to objects and ordinary objects of the outside world, which have found expression both in the desire for simplicity and in the laconism of the linguistic form. The commonality of Russian and English-speaking approaches was revealed in attempts to indirectly convey the emotional experiences of the lyrical hero, artfully hiding them behind a play of words, vivid images and subtly noticed details. The process of adapting a literary text in another language environment may entail the substitution of the national conceptual sphere and distortion of the original meaning and national identity of the original. Translations of A.Akhmatova's poetry have received well-deserved recognition from both English-speaking readers and discerning critics. But, of course, this work was not without losses. The desire to bring Akhmatova's poetry closer to an English-speaking audience led to sacrifices in the field of verse, and the introduction of changes and additions to punctuation led to a change in the intonation and meaning of the author's voice.

Аннотапия

Английская и русская концептосферы очень различны между собой, но это различие таит в себе, тем не менее, и глубокое внутреннее единство. Оно заключается во внимании к предметам и обычным объектам внешнего мира, которые нашли выражение и в стремлении к простоте, и в лаконизме языковой формы. Общность русских и англоязычных подходов обнаруживалась в попытках опосредованно передать душевные переживания лирического героя, искусно скрывая их за игрой слов, ярких образов и тонко подмеченной детали.

Процесс адаптации литературного текста в другой языковой среде может повлечь за собой подмену национальной концептосферы и искажение первоначального смысла и национальной самобытности оригинала.

Переводы поэзии А.Ахматовой получили заслуженное признание и со стороны англоязычных читателей, и со стороны взыскательной критики. Но, конечно, эта работа прошла не без потерь. Желание приблизить ахматовскую поэзию к англоязычной аудитории приводило к жертвам в области стихотворной строки, а внесение изменений и дополнений в пунктуацию приводило к изменению интонации и смысла авторского голоса.

Keywords: the English and Russian conceptual spheres, lyrical hero, literary text, national identity, meaning of the author's voice

Ключевые слова: английская и русская концептуальные сферы, лирический герой, художественный текст, национальная идентичность, значение авторского голоса

В каждой культуре существуют национально значимые ментальные концепты, имеющие у каждого народа особое вербальное выражение. Эта вербальность настолько специфична, что трудно передается средствами другого языка. При переводе они теряют свой первоначальный смысл, поскольку иноязычные вербальные средства соответствуют по значению совершено иным концептам. Те ассоциации, которые связаны с определенным концептом в оригинальном тексте, не вызывают тех же ассоциаций в языке другой национальности и метальной культуры. В результате художественного перевода порождаются такие метаморфозы, которые существенно изменяют смысл оригинала [1,29].

Английская и русская концептосферы очень различны между собой, но это различие таит в себе, тем не менее, и глубокое внутреннее единство. Оно заключается во внимании к предметам и обычным объектам внешнего мира, которые нашли выражение и в стремлении к простоте, и в лаконизме языковой формы. Общность русских и англоязычных подходов обнаруживалась в попытках опосредованно передать душевные переживания лирического героя, искусно скрывая их за игрой слов, ярких образов и тонко подмеченной детали.

Оригинальный текст соответствует национальной концептосфере в области грамматики, синтаксиса, пунктуации, рифмы и ритмической организации.

Опасность несовпадения и культурного сбоя может таиться на любом из этих уровней при работе над переводным текстом. На уровне звуковой организации текста символизм, связанный с фонетическим звучанием отдельных звуков, оказывается не схожим с исходной концептосферой и принимающей ее национальной и литературной традицией.

Казалось бы, незначительные изменения пунктуационной организации оригинального текста также влекут за собой существенные сдвиги в его интонации, что «приводит к искажению его смысловой заряженности» [2,81]. Изменения, связанные с метром, ритмом и рифмой, порождают серьёзные изменения целостной художественной системы текста, который принадлежит к определённой поэтической традиции.

На Западе очень в скором времени развился академический интерес к литературному наследию А.Ахматовой. В Колумбийском и Пенсильванском университетах Америки были защищены диссертации, посвящённые исследованию ее творчества. В англоязычном мире личность А.Ахматовой и разгадка феномена ее поэтического таланта включали попытки ответа на вопрос, почему она пренебрегла личным спасением и не оставила Россию в самой опасный для себя период. Исследователи пытались

проникнуть в сущность ее творческого метода и выявить своеобразие природной индивидуальности ее лирического голоса. Таким образом, западный мир проявил стойкое внимание к литературному наследию А.Ахматовой и сделал достаточно много, чтобы ее творчество стало одним из лучших достояний мировой культуры.

Концептосфера художественного мира A.Aхматовой реализуется через образное воплощение его мотивно-тематической основы.

Перевод стихотворений А.Ахматовой на английский язык позволяет проследить подобную динамику трансформации концептов исходного и переводного текстов.

Процесс адаптации литературного текста в другой языковой среде может повлечь за собой подмену национальной концептосферы и искажение первоначального смысла и национальной самобытности оригинала. В поэзии А.Ахматовой фонетическая основа стихотворной строки не представлена звукоподражанием или акустическими эффектами, которые порождали бы новые эмоциональные нюансы или ассоциации.

Некоторые произведения А.Ахматовой трудно поддавались адаптации в сфере английского языка, что привело к «культурному сбою», так как художественный мир автора неизбежно трансформируется в процессе перевода на другой язык.

Художественный мир А.Ахматовой включает систему всех образов и мотивов, которые присутствуют в литературном контексте. Строительный материал для этого мира берется из действительности, в которой живет реальный художник. Художественный мир обладает изначальной неповторимостью, так как отражает собственно авторское представление о том, каким этот мир был, должен быть, является в настоящем и каким автор видит его в будущем.

Концепт предполагает выбор в качестве художественной перекодировки действительности в сознании автора определенный символ или образ, «способный выйти на исторические, ментальные, этнопсихологические плоскости, которые лежат за пределами конкретного литературного текста» [3,147]. Если этот образ или доминантный мотив способ способен органично войти в ассоциированную систему культуры, он приобретает функции и значимость концепта.

Концептосфера предполагает отдельный, основной доминирующий концепт, из которого развиваются другие концепты образной системы, отражающие различные векторы авторского осознания и отображения действительности.

В период революционного террора, наступившей диктатуры сталинизма и в годы беспощадной борьбы с фашизмом А.Ахматова обращается ко всей стране, осознавая каждую пядь русской земли

как нечто свое, кровное и единое целое. Русская поэтесса никогда не сожалела о том, что не выбрала иммиграцию. Для нее творчество было возможно только на родной земле, где она дышали одним воздухом со своим народом.

Этот гражданский выбор был абсолютно осознан для А.Ахматовой, и она никогда не перейдет на сторону тех, кто предпочел думать о своей родине и о ее судьбе, находясь за сотни километров вдали от нее. Русская поэтесса готова была принять все, даже самые ужасные удары судьбы в обмен на светлые и мирные, а не кровавые рассветы над своей страной.

К такому решению А.Ахматова приходит, пережив страшные годы братоубийственной гражданской войны и личную трагедию, связанную с расстрелом в 1912 году ее первого мужа и отца ее сына Николая Гумилева:

«Дай мне горькие годы недуга,//Задыханья, бессонницу, жар//Отыми и ребенка, и друга,//И та-инственный, песенный дар-//Так молюсь за твоей литургией//После стольких томительных дней//Чтобы туча над темной Россией//Стала облаком в славе лучей»(«Молитва»,1915).

Образ Родины в стихах А.Ахматовой наполнен ощущением беспредельной любви к ней и щемящей тоски при виде нищеты и неухоженности ее повседневного быта. «Неяркие просторы» скудной земли встречают пришельца «ветхими колодцами» и скрипучими воротами» сельских убогих построек с запахом «хлеба» и «тоски»: «... Но все мне памятна до боли//Тверская скудная земля//Журавль у ветхого колодца.// Над ним, как кипень, облака//И запах хлеба, и тоска//И те неяркие просторы//Где даже голос ветра слаб» («Ты знаешь, я томлюсь в неволе..»,1913).

Русский пейзаж созвучен с картинами народного страдания и нищеты, но здесь А.Ахматова выходит за пределы своего личного «Я» и поднимается до трагического осмысления судьбы своего поколения и народной судьбы в целом: «И, согнувшись бесслезно //Молилась о слепеньком мальчике мать,//И кликуша без голоса билась,//Воздух силясь губами поймать».

А.Ахматова постоянно возвращалась к теме иммиграции. В стихотворении, посвященном Борису Анрепу, она называет его решение покинуть свою родину «отступничеством». В строках этого произведения слышится и ревность, и ирония, и горький упрек человеку, предавшему не только родную землю, но и любимую женщину: «Ты- отступник: за остров зеленый//Отдал, отдал родную страну//Наши песни, и наши иконы//И над озером тихим сосну» («Ты- отступник: за остров зеленый», 1917).

Про себя поэтесса уверено скажет, что она готова разделить со своей страной все ее испытания и беды: «Не с теми я, кто бросил землю// На растерзание врагам...» («Не с теми я, кто бросил землю...», 1922).

Но А.Ахматова прекрасно понимала, что для всех, кто оставил Россию в эту драматическую эпоху, это был совсем нелегкий выбор. Уезжая, они

оставляли за собой все, с чем и на чем они выросли, формировались как личности, что любили и чем дорожили: «Но вечно жалок мне изгнанник//Как заключенный, как больной//Темна твоя дорога, странник//Полынью пахнет хлеб чужой» («Не с теми я, кто бросил землю», 1922).

У А.Ахматовой печальная судьба покинувших родину сопоставляется с совсем нелегкой долей и тех, кто предпочел остаться: «А здесь, в глухом чаду пожара//Остаток юности губя//Мы ни единого удара//Не отклонили от себя».

Мотив верности своей стране, любовь к ней даны у А.Ахматовой в самом широком понимании. Эта любовь проходит испытания изменой, предательством и переживанием безответного любовного чувства:

«Мне голос был. Он звал утешно.// Он говорил: «Иди сюда,// Оставь свой край глухой и грешный//Оставь Россию навсегда... //Но равнодушно и спокойно// Руками я замкнула слух//Чтоб речью этой недостойной//Не осквернился скорбный дух..»(«Когда в тоске самоубийства»,1917).

В поэме «Реквием» А.Ахматова с уверенностью говорила о правильности своего выбора, состоящего в том, чтобы предпочесть чужбине единство личной судьбы и судьбы своего народа: «Нет! И не под чуждым небосводом //И не под защитой чуждых крыл-// Я была тогда с моим народом//Там, где мой народ, к несчастью, был» («Реквием», 1940).

Весь этот сложный комплекс переплетений мотивов и переживаний, созвучный «русскому» сознанию, оказывается порой трудным для восприятия английского читателя. Поэзия Ахматовой - это глубокая погруженность в мир человеческой души и точная психологическая передача и описаний пейзажа, и человеческого состояния или характера.

Стиль А.Ахматовой отличается короткими фразами и строгими и точными рифмами. В этом смысле грамматический строй ее поэзии близок к грамматическим особенностям английского языка.

Западные переводчики интересовались прежде всего раскрытием любовной темы в творчестве русской поэтессы. Гражданственность и патриотизм ее лирики привлекали переводчиков гораздо меньше, что приводило к искажению трактовки миросозерцания А.Ахматовой в целом.

Образ Ахматовой, сосредоточенный только на любовных томлениях и переживаниях, получался обыденным и неполным. Однако англоязычные переводчики пытались проникнуть в художественный мир русской поэтессы и познакомить с ним своего читателя.

Английский переводчик Ричард Мак Кейн в своей книге "Anna Akhmatova. Selected poems" (1969) дал достаточно полную картину творчества русской поэтессы. Он пытался донести до англоязычного читателя наибольший охват тем и мотивов ахматовской лирики, хотя любовная тема составляет в его отборе поэтических произведений абсолютную доминантность:

"I am not one of who left land" («Не с теми я, кто бросил землю...»); "Wind of war" («Ветер войны»);

"The Moon in Zenith" («Луна в зените»); "The Muse" («Муза»); "To the Artist" («Художнику»).

В переводах Лина Коффина отражены отдельные произведения А.Ахматовой. При большинстве стихотворений о любви только три из них посвящены теме творчества и только два содержат тему Родины. "In August 1940" (« Август 1940»); "To the Muse" («Музе»); "The Muse" («Муза»); "This craft of ours, sacred and bright " («Наше священное ремесло...»).

Американский переводчик Стэнли Куница также предлагает англоязычному читателю лишь наиболее известные произведения А.Ахматовой: ("I Wrung My Hands..") («Сжала руки под темной вуалью»); "To the Muse" («Музе»); "When in the Throes of Suicide..." («Когда в тоске самоубийства...»); "I Am Not One of Those Who Left Land.." («Не с теми я, кто бросил земли») и т.п.

В литературоведческой науке уже объяснялось подобное отношение к теме «родина» у англоязычного читателя и переводчика.

У русских образ Родины связан с определениями «матушка», «мать-земля», то есть это отношения интимно- близкие и очень родственные. У англичан принято другое, дистантное отношение к понятию «родина». Им не приходит в голову называть родину «матерью-землей», как это принято в русской традиции. Для английского сознания более приемлемо нейтральное определение "this country".

В русской художественной традиции образ поэта трактуется как образ провидца, глашатая истины и божественного избранника. Такая трактовка романтическо-возвышенного представления о поэте также расходится с английским взглядом на этот образ.

Но описание самого процесса творчества неизбежно захватывает воображение переводчиков, что находит отражение в книге Лина Коффина "Anne Akhmatova 'Poems".

Переводы стихотворений А.Ахматовой на английский язык часто вызывали смысловые нестыковки межкультурного характера. Например, стихотворение «Мне с тобою пьяным весело» (1911): «Мне с тобою пьяным весело//- Смысла нет в твоих рассказах.//Осень ранняя развесила// Флаги желтые на вязах.//Оба мы в страну обманную// Забрели и горько каемся,//Но зачем улыбкой странною//И застывшей улыбаемся?//Мы хотели муки жалящей//Вместо счастья безмятежного...//Не покину я товарища//И беспутного и нежного». Английский перевод выглядит следующим образом:

"When you're drunk it's so much fun-//An early fall has strung//The elms with yellow flags.//We've strayed into the land of deceit//And we're repenting bitterly,//Why then are we smiling these//Strange and frozen smiles? We wanted piercing anguish//Instead of placid happiness...//I won't abandon my comrade,//So dissolute and mild".

У А.Ахматовой «листья желтые на вязах», которые «развесила ранняя осень» означают сиюминутность любовного влечения, которое не будет длиться долго. Лирическая героиня испытывает

острое ощущение счастья, которым нужно насладиться «весело» и не думать о завтрашнем расставании.

Это счастье на грани безумия, своеобразный «загул» без продолжения и без будущего.

В русской традиции именно желтый цвет ассоциируется с безумием, и существует употребление «желтый дом» в отношении дома для умалишенных. В английской трактовке слово "yellow" никакого оттенка безумия не содержит. Этот цвет связан, как и в русской традиции, с темой измены и предательства.

В русской традиции «тихое счастье» ассоциируется с повседневностью и упорядоченностью бытия. Счастье спокойное, лишенное острых перепадов чувств, сближается с тоской.

Понятие «русской тоски» настолько лингвоспецифично, что не соответствует ни одному определению в английском эквиваленте в полной мере. "Melancholy", "yearning", "longing", "boredom" не раскрывают состояние «русской тоски», которая означает желание вырваться за грани обыденного, пережить «удаль», безудержное веселье, не знающее границ.

В ахматовском стихотворении переплетаются мотивы беспутного веселья, опьянения, «жажды муки» любовных переживаний и даже горького раскаянья. В стихотворении слышится удаль и упоение нахлынувшим счастьем, с четким осознанием его неизбежной краткотечности.

Недаром Ф.Искандер писал, что русская удальэто « паника, бегущая вперед. Она утоляет тоску по бессмыслию» [4,75].

Существуют расхождения в трактовке других вербальных единиц стихотворения. Русское слово «горе» этимологически связано с концептом горящего пламени, а в английском языке слово "bitterly" означает едкий, острый и сильный вкус, и в переносном смысле понимается как нечто тяжелое и плохо переносимое. Жажда «горения» соотносится в ахматовском стихотворении с «мукой любви», которая насыщает переживания героини глубоким душевным содержанием. В английском варианте слово "anguish" означает физические или ментальные страдания, а также некое состояние душевного смятения, неврозности, мотивированное непониманием возникшей конкретной ситуации. Можно заключить, что английское слово содержит в себе менее узкий концепт, передающий душевные переживания и так называемую ментальную сторону сердечной «муки».

Расхождения в процессе инокультурной рецепции творчества А.Ахматовой связаны с теми особенностями ее художественного мира, которые продиктованы индивидуальным авторским видением окружающей реальности. Это влечет за собой особенности национальной концептосферы, которые представляют особую сложность при переводе на другой язык. Неверная передача оборачивается тем, что «переводчик искажает или субъективно переосмысливает особенности и всей художественной системы исходного литературного теста» [5,47].

В работах американских исследователей образ А.Ахматовой принимает широкомасштабный характер, и читатель убеждается в том, что русская поэтесса пережила все значимые события XX века, разделив все бедствия и свершения со своей страной и своим народом.

Англоязычные переводчики восхищались изысканной простотой и «величием человеческого духа, всеми силами противостоящего низости, бесчеловечности и мракобесию, нашедшего воплощение в ахматовском творчестве» [6,7].

Переводы поэзии А.Ахматовой получили заслуженное признание и со стороны англоязычных читателей, и со стороны взыскательной критики. Но, конечно, эта работа прошла не без потерь. Желание приблизить ахматовскую поэзию к англоязычной аудитории приводило к жертвам в области стихотворной строки, а внесение изменений и дополнений в пунктуацию приводило к изменению интонации и смысла авторского голоса [7].

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PHYSICAL SCIENCES

PRODUCTION OF RADIACTIVE GEMSTONES

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Abstract

The possibility of making precious stones from radioactive waste is being considered. Vitrified and cemented radioactive waste (RW) is considered as an artificial rock belonging to aluminosilicates and calcites. Two methods are proposed for the manufacture of radioactive gemstones from RW and their subsequent storage with the possibility of sale, resale, inheritance, and so on. That is, RW is considered as real estate in which capital can be invested. After decontamination in hundreds and thousands of years, it will be of scientific, historical, jewelry interest.

Keywords: radioactive waste, radioactive waste processing, radioactive waste disposal, trinitite, radioactive gemstones, radioactive corundum, radioactive sapphire, radioactive ruby.

Introduction

The problem of disposal of radioactive waste (RW) is still largely unresolved. To date, a huge amount of liquid radioactive waste has been accumulated, requiring conditioning and disposal [1]. Solid radioactive waste (SRW), already buried for hundreds and thousands of years, requires constant monitoring and protection. At the same time, the question of the possibility of storing radioactive waste for hundreds and thousands of years is questionable due to social and political reasons. No country has ever existed for so many years without the complete destruction of its state structure, industrial and technological potential due to wars, revolutions, crises. The current international situation convinces us that the irreconcilable enmity between the various poles of the world order is not only inevitable, but it will certainly continue to intensify, due to transcendental causes which lie in the depths of the collective unconscious of various nations. These transcendental causes have not yet been disclosed by philosophers, psychologists, historians and sociologists [2].

Wars will not only be the cause of environmental disasters caused by the violation of the conditions for the storage of RW, but also the intentional depreservation of radioactive waste for military needs. The question arises about the possibility of such storage of RW, which will not allow it to be used for military purposes in the future. A method was proposed for the utilization of RW, when they are processed in order to extract chemical elements and compounds used in the space industry for the construction of space probes and planetary rovers. Thus, RW is utilized of by sending it into space in the form of a radioactive payload for the purposes of space researches [3], [4].

This article proposes to process radioactive waste, making precious stones from them using the same technology that produces artificial gems. Two approaches are suggested: 1) to manufacture precious stones entirely from vitrified and cemented RW; 2) to make gemstones from the same materials used for production the non-radioactive gemstones, but with the addition of ra-

dioactive material. In the latter case, it is possible to reduce the specific activity of the material from high to medium or low activity. Radioactive gems can be viewed as real estate that can be invested in. Being deactivated after hundreds and thousands of years, this property will be of great scientific interest due to its antiquity.

Methods for the production of radioactive gems

The first and last artificial radioactive minerals used in jewelry came from the testing of the first atomic bomb, Trinity, in 1945. Quartz sand on the surface of the polygon had been drawn into a plasma ball, where it has evaporated and, after condensation and solidification, fell back to the surface in the form of vitrified minerals of various shapes and sizes [5], [6]. This glassy material was named trinitite. Its main components (wt. %) are silica SiO2 51.3-96.8%, alumina Al₂O₃ 0.35–18.82%, calcium oxide CaO 0.52–27.33%, TiO₂ 0.08-1.89%, Na₂O 0.1-3.14%, FeO 0-4.29%, MgO 0.1-2.28% and other components from atomic bomb evaporation and supporting structures, radioactive fission products [5], [6]. The cost of samples of trinitite prepared as jewelry or for mineral collections is up to \$50 per gram [7].

In terms of chemical composition, trinitite is similar to a combination of components of glass-forming and cement matrices for radioactive waste storage. Thus, for glass-forming matrices we have the main chemical composition (wt. %) – silica SiO₂ 15–20%, Na₂O 9–12%, datolite CaBSiO₄(OH) 24–32%, bentonite $Al_2[Si_4O_{10}](OH)_2 \cdot nH_2O$ 9-12%, Fe_2O_3 3-4%, and up to 20% high-level radioactive waste (HLW) [8]. The composition of Portland cement - calcium oxide CaO 64-67%, silica 21-25%, alumina Al₂O₃ 4-8%, Fe₂O₃ 2-4%, Na₂O and K₂O 0.5-1%, MgO 0.5-5%, TiO₂ 0.1-0.3%, P_2O_5 0.3-0.5% [9]. The cement matrix based on Portland cement contains up to 30% by weight of medium or low active radioactive waste [10]. Suppose we decide to create an analogue of trinitite from vitrified and cemented radioactive waste in order to sell, resell them and carry out the same monetary transactions with them as with any real estate during the storage of the obtained radioactive gemstones. After the expiration of the storage period for radioactive gems, i.e. in hundreds and thousands of years, they will already be of interest as an antique rarity. In addition, the storage of radioactive gems with their simultaneous sale and resale at auctions will offset the costs of storage and monitoring. How can all this be done?

Quartz sand at the nuclear test site is presented in the form of micro and millimeter particles. Solid radioactive waste (SRW) needs to be crushed to these sizes. Figure 1a) shows an opened container with SRW and a robot similar to Brokk 900 [11] destroying a cement or glass-like matrix with a chipper.

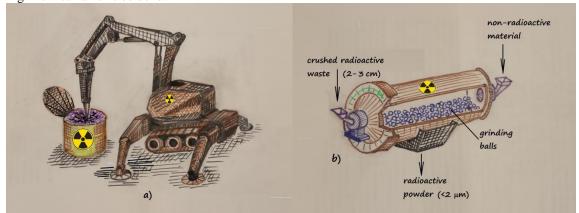


Figure 1. a) Crushing of reopened SRW by a remote-controlled robot of the Brokk 900 type [11]. b) Grinding crushed SRW in a ball mill to micro sizes.

The crushed radioactive material is then sent to ball mills (Fig. 1b), where it is grinded to millimeter [12] and micrometer sizes [13]. After the mills, we obtain a product similar to what lies at the test site before the explosion of the atomic bomb. The only difference is that our sand is already radioactive. To reduce the activity of highly radioactive waste, non-radioactive material can be added to the ball mill. For example, for the production of radioactive sapphire, non-radioactive oxides of aluminum, iron and titanium can be added to a ball mill along with pieces of radioactive waste.

Now we have to reproduce the temperature of a nuclear whirlwind of several thousand degrees Celsius to melt the radioactive powder material. To date, the industry has mastered the production of artificial corundum, a variety of which is sapphire and ruby, and the production of many other precious stones. The melting temperature of alumina micro powder, from which corundum is obtained, is 2200°C. To obtain corundum (as well as sapphire and ruby), the Verneuil method is used [14], although there are other methods, but we will limit ourselves to this. The procedure for melting the radioactive powder and its crystallization by the Verneuil method is shown in Figure 2.

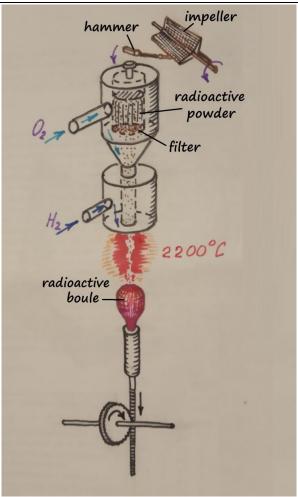


Figure 2. Verneuil method for obtaining a radioactive preform from SRW.

The impeller forces the mechanical impactor to act on the container with RW powder or with a mixture of RW powders and non-radioactive material, which is poured through the filter into the combustion area. In the combustion chamber, hydrogen and oxygen interact with the release of heat, which provides the required temperature of about 2200°C. Micro particles of radioactive powder melt, radioactive drops fall onto a seed (in the form of boule) from some glassy or crystalline substance, which gradually moves down from the high temperature region. On the boule, radioactive droplets

solidify, forming a crystalline or amorphous phase. So we get a cylindrical boule of solidified radioactive material. The growth rate of the boule in modern devices is several millimeters per hour. The composition of the RW powder and the rate of cooling of the liquid phase on the boule will determine the ratio between the amorphous and crystalline phases in the resulting sample.

Next, it is necessary to cut the radioactive boule into pieces, which is done by a remote-controlled robot similar to Robo SawJet 2.0 [15] (Fig. 3a).

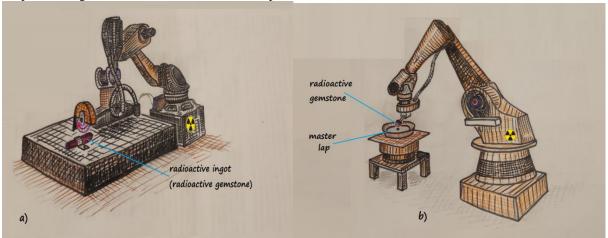


Figure 3. a) Cutting of the radioactive boule into samples by remote-controlled robots of the Robo SawJet 2.0 type [15]. b) Faceting and polishing of samples of radioactive stones by a robot similar to KUKA KR QUANTEC series with program control [16].

Further polishing of each sample of radioactive material to give it the necessary form, which has artistic value, can be carried out by robots such as KUKA KR QUANTEC series [16] (Fig. 3b). In order to sell the received radioactive products during the period of their

storage, in addition to monitoring the gemmological characteristics of the samples using the necessary detectors, a video camera must record the state of the radioactive gems (Fig. 4).

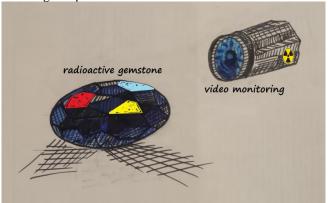


Figure 4. Video monitoring of radioactive gemstones for sale at auctions during their storage for hundreds and thousands of years.

Stones obtained from RW or from a mixture of RW and non-radioactive material will contain additional inclusions, impurities and defects that will make them unique in comparison with conventional artificial gemstones, because the uniqueness of precious stones is determined precisely by the variety of defects and impurities [17].

Conclusion

A method has been proposed for the manufacture of precious stones from reopened RW by crushing, grinding, mixing, melting, solidifying according to the method used in the manufacture of artificial precious stones, and subsequent faceting and polishing to give radioactive gemstones an artistic form. The modern industry already possesses the installations and robots with remote control and software necessary for these processes. Storage of radioactive gemstones until their deactivation with video monitoring of their condition and sale at auctions will provide compensation for the costs of processing, monitoring and storage of RW. Because during the storage of radioactive stones for hundreds and thousands of years, many world events will take place, which they will witness, then after deactivation these stones will be of not only jewelry and scientific interest, but also historical. In the manufacture of radioactive stones from a mixture of highly active RW and non-radioactive material, the resulting product can be obtained with medium and low activity, which will reduce the environmental and terrorist threat from their possible use for military purposes.

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