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BIOLOGICAL SCIENCES

REGARDING THE MECHANISMS OF ACTION OF ALIPHATIC HYDROCARBONS ON THE ANIMAL REPRODUCTIVE SYSTEM

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Abstract

Medical and biological studies are currently of particular relevance to the impact of various man-made pollutants, such as aliphatic hydrocarbons on the human body. Aliphatic hydrocarbons are the most frequently encountered hydrocarbons known to humans. Therefore, poisoning by these products is often caused by solvents. Inhalation addiction to adhesives is also related to an addictive state formed by the action of organic solvents on the CNS. Literature review on the nature of hexane's effects on the body indicates that although there is a large range of data on the effects of hexane on the body, it has not been sufficiently investigated. There is much data on the effects of hexane on the nervous system. Hexane is also known to affect lung tissue. Toxicants can cause adverse effects at any stage of the function. The adverse effects of toxicants (and their metabolites) on male and female reproductive organs may be due to either disruption of the mechanisms of physiological regulation of their functions or to direct cytotoxic effects. Both laboratory and epidemiological studies have found that many xenobiotics have a fairly high potential for reproductive toxicity. Sensitivity to a particular teratogen varies considerably among representatives of different species, subspecies and even individuals of the same species. It follows that the significance is not so much the mechanism of action of the toxicant as the fact that the cellular elements are damaged at a certain stage of development of the organism, initiating a largely identical sequence of events leading to deformities.

Keywords: hydrocarbon, animal, hexane, reproductive function, mechanism

Aliphatic hydrocarbons are the most frequently encountered hydrocarbons known to humans. It is due to the fact that the main component of oil are alkanes [1]. Aromatic hydrocarbons have a better solvent capacity compared to gasoline, but they are highly toxic and therefore rarely used in domestic industry [2]. All organic solvents are characterized by similar toxicological properties: they inhibit central nervous system functions (narcotic effect). As a rule, solvents are a mixture of compounds and include nitrogen and sulphur compounds, as well as petrol and some oils. They are used in the manufacture of dyes, varnishes, adhesives etc. Therefore, poisoning by these products is often caused by solvents [3]. Inhalation addiction to adhesives is also related to an addictive state formed by the action of organic solvents on the CNS [4-5].

Hexane is widely used as a solvent in the production of synthetic materials (polyethylene, polypropylene, etc.), commonly mixed with other solvents and toluene. Hexane is widely used as a solvent in the tyre industry, in adhesives for the shoe industry, for the extraction of vegetable oils, in the textile, leather and furniture industries. Various grades of gasoline also have significant hexane content.

Literature review on the nature of hexane's effects on the body indicates that although there is a large range of data on the effects of hexane on the body, it has not been sufficiently investigated [6-8]. There is much data on the effects of hexane on the nervous system. There are cases of polyneuritis, loss of color vision, etc. In experiments on animals the effects on various enzyme systems in lungs were observed in the form of atelectasis and edema of lungs, changes in monooxygenase system of liver, atrophic changes in thymus and spleen, disorders of lymph nodes [9-12] were noted. Particularly, the impact on the nervous system inevitably leads to disorders of the digestive system: reduced intestinal peristalsis, changes in the integrity of enterocytes of the small and large intestine, impaired synthesis of digestive enzymes. Disorders of the pancreas and liver are to be expected naturally. Hexane is also known to affect lung tissue [13]. However, there is no data on the effect of hexane on the reproductive system of animals. Meanwhile, the indicators of these systems may be important features characterizing the threshold of hexane action.

Reproductive function is carried out as a complex sequence of physiological processes in mammals. Toxicants can cause adverse effects at any stage of the function. The complexity of the reproduction phenomenon makes it highly vulnerable to both xenobiotics and aliphatic hydrocarbons. What makes the phenomenon difficult to understand is that reproductive disorders can be the consequence of even acute toxic effects on various organs and systems of one of the "participants" in the process, at different periods, and manifest only after many months and sometimes years, defects in conception, nurturance, fetal development and the failure of the growing organism [14-16]. It is sometimes almost impossible to identify the exact mechanism underlying reproductive disorders, as the eco-toxicants can affect either both parents, only one of them, or the mother and fetus. The adverse effects of toxicants (and their metabolites) on male and female reproductive organs may be due to either disruption of the mechanisms of physiological regulation of their functions or to direct cytotoxic effects [17]. The disturbance of hormonal regulation of ovarian function may result from the competition of xenobiotics with sex hormones (androgens, contraceptives), action on estrogen receptors (organochlorine and organophosphorus compounds), changes in production rate. Postnatal reproductive performance can be affected by xenobiotics ingested by the breastfeeding mother and excreted with breast milk. Substances such as metals (mercury, lead), tetrachloroethane, halogenated aromatic hydrocarbons (dibenzofurans, biphenyls, dioxides), pesticides (DDT, dieldrin, heptachlor, etc.) can enter the neonate this way in large amounts [18]. In reproductive disorders, polygenic (action on various organs and systems), multifactorial (action of several toxicants), and synergistic (unidirectional spontaneous and toxicant-induced developmental disorders) effects are the most common. The main manifestations of the toxic effects of chemicals on the organs and tissues responsible for reproductive functions of the body and directly on the fetus are: infertility and teratogenesis. Teratogenic is the action of a chemical substance on the body of the mother, father or fetus, accompanied by a significant increase in the likelihood of structural and functional disorders in offspring. Substances with teratogenic activity are called teratogens. It is believed that almost any chemical substance introduced into the body of the father or mother, at some time in pregnancy in a large enough dose can cause teratogenesis. For this reason, only toxicants in the narrow sense should be referred to as teratogens, causing effects in concentrations that have no discernible effect on the parental organism. Both laboratory and epidemiological studies have found that many xenobiotics have a fairly high potential for reproductive toxicity. About 40% of the approximately three thousand xenobiotics surveyed have teratogenic properties. Sensitivity to a particular teratogen varies considerably among representatives of different species, subspecies and even individuals of the same species. Rabbits and mice, for example, are very sensitive to cortisone, which causes cleft palate in offspring. Rats do not show this defect when exposed to the substance. Humans, higher pri-

mates and some albino rabbit lines are extremely sensitive to the teratogenic action of thalidomide; individual rat and mouse lines only respond to very high doses of the substance. Most mammals are resistant to the toxicant. Different substances with different mechanisms of toxicity, when acting on the fetus during the same critical period, often cause the same types of disorders. It follows that the significance is not so much the mechanism of action of the toxicant as the fact that the cellular elements are damaged at a certain stage of development of the organism, initiating a largely identical sequence of events leading to deformities.

Theoretically, the risk of reproductive dysfunction can only be assessed in terms of xenobiotic doses since, as mentioned above, there are virtually no substances that are safe under any exposure conditions and in any doses. However, in practice, it is currently not possible to do this for humans. An extremely complex methodology for obtaining data to develop dose-response relationships, as applied to the problem in question, does not allow us to accumulate the necessary information.

Therefore, there is undoubted interest in studying the reproductive performance of experimental animals exposed to aliphatic hydrocarbons, particularly hexane, the work carried out will make it possible to study the dynamics of development of changes in intoxication in more detail.

REFERENCES:

1. Adeeva V., Liu H.Y., Xu B.Q., Sachtler W.M. Alkane isomerization over sulfated zirconia and other solid acids // *Topics in Catalysis*, 1998. - № 6(1). - pp. 61-76.
2. Matsushashi H., Shibata H., Nakamura H., Arata K. Skeletal isomerization mechanism of alkanes over solid superacid of sulfated zirconia // *Applied Catalysis A: General*, 1999. - № 187(1). - pp. 99-106.
3. Yamaguchi T. Alkane isomerization and acidity assessment on sulfated ZrO₂ // *Applied Catalysis A: General*, 2001. - № 222(1-2). pp. 237-246.
4. Jiménez C., Romero F.J., Roldán R., Marinas J.M., Gómez J.P. (2003) Hydroisomerization of a hydrocarbon feed containing n-hexane, n-heptane and cyclohexane on zeolite-supported platinum catalysts // *Applied Catalysis A: General*, 2003. - № 249(1). - pp. 175-185.
5. Liu H., Lei G.D., Sachtler W.M. Alkane isomerization over solid acid catalysts Effects of one-dimensional micropores // *Applied Catalysis A: General*, 1996. - № 137(1). - pp. 167-177.
6. Jao R.M., Leu L.J., Chang J.R. Effects of catalyst preparation and pretreatment on light naphtha isomerization over mordenite-supported Pt catalysts: optimal reduction temperature for pure feed and for sulfur-containing feed // *Applied Catalysis A: General*, 1996. - № 135(2). - pp. 301-316.
7. Chao K.J., Wu H.C., Leu L.J. Hydroisomerization of light normal paraffins over series of platinum-loaded mordenite and beta catalysts // *Applied Catalysis A: General*, 1996. - № 143(2). - pp. 223-243.
8. Holló A., Hancsok J., Kalló D. Kinetics of hydroisomerization of C₅-C₇ alkanes and their

mixtures over platinum containing mordenite // *Applied Catalysis A: General*, 2002. - № 229(1-2). - pp. 93-102.

9. Chao K.J., Lin C.C., Lin C.H., Wu H.C., Tseng C.W., Chen S.H. n-Heptane hydroconversion on platinum-loaded mordenite and beta zeolites: the effect of reaction pressure // *Applied Catalysis A: General*, 2000. - № 203(2). - pp. 211-220.

10. De Lucas A., Ramos M.J., Dorado F., Sánchez P., Valverde J.L. Influence of the Si/Al ratio in the hydroisomerization of n-octane over platinum and palladium beta zeolite-based catalysts with or without binder // *Applied Catalysis A: General*, 2005. - № 289(2). - pp. 205-213.

11. Blomsma E., Martens J.A., Jacobs P.A. Mechanisms of heptane isomerization on bifunctional Pd/H-Beta zeolites // *Journal of catalysis*, 1996. - № 159(2). - pp. 323-331.

12. Blomsma E., Martens J.A., Jacobs P.A. Isomerization and hydrocracking of heptane over bimetallic bifunctional PtPd/H-beta and PtPd/USY zeolite catalysts // *Journal of Catalysis*, 1997. - № 165(2). - pp. 241-248.

13. Remy M.J., Stanica D., Poncelet G., Feijen J.P., Grobet P.J., Martens J.A., Jacobs P.A. Dealuminated H- Y zeolites: relation between

physicochemical properties and catalytic activity in heptane and decane isomerization // *The Journal of Physical Chemistry*, 1996. - № 100(30). - pp. 12440-12447.

14. Pope T.D., Kriz J.F., Stanculescu M., Monnier J. A study of catalyst formulations for isomerization of C7 hydrocarbons // *Applied Catalysis A: General*, 2002. - № 233(1-2). - pp. 45-62.

15. Stöcker M. Gas phase catalysis by zeolites // *Microporous and Mesoporous Materials*, 2005. - № 82(3). - pp. 257-292.

16. Abramova A.V., Slivinskii E.V., Skryleva E.A. Study of the structure and composition of decationated dealuminated Y zeolites // *Kinetics and catalysis*, 1998. - № 39(3). - pp. 421-429.

17. Yushchenko V.V. (1997) Calculation of the acidity spectra of catalysts from temperature-programmed ammonia desorption data // *Russian Journal of Physical Chemistry A*, 1997. - № 71(4). - pp. 547-550.

18. Kitaev L.E., Bukina Z.M., Yushchenko V.V., Abramova A.V., Slivinskii E.V. Modification of acid properties and catalytic activity of ultrastable zeolite Y treated with aqueous solutions of boric and phosphoric acids // *Petroleum Chemistry*, 2003. - № 43(3). - pp. 159-166.

SOLUTIONS FOR THE CONSERVATION OF THE CASPIAN SEAL POPULATION

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ПУТИ РЕШЕНИЯ ПО СОХРАНЕНИИ ПОПУЛЯЦИИ КАСПИЙСКОГО ТЮЛЕНЯ

Дуйсенбай Б.

Магистрант Евразийского Национального университета имени Л.Н. Гумилева<https://doi.org/10.5281/zenodo.6592860>**Abstract**

This article is devoted to the problem of preserving the population of the Caspian seal. This work presents the main arguments for the organization of a specially protected natural area (SPNA) in the Kazakhstani part of the Caspian Sea in the form of a state nature reserve, connected in one network with the existing SPNA. There should be organized rehabilitation centers for sick, weakened and injured seals. In this network, on the basis of intergovernmental agreements, other Caspian countries' SPNAs can also be included in the future, which will serve as the basis for the creation of a transboundary reserve to preserve the population of the caspian seal. The creation of a network of protected areas will contribute to the constant and targeted monitoring of the status of the caspian seal in all the Caspian countries – a transboundary species that is an indicator of the state of the ecosystem of the Caspian Sea.

Аннотация

Данная статья посвящается проблеме сохранения популяции Каспийского тюленя. Приведены основные доводы для организации особо охраняемой природной территории (ООПТ), в казахстанской части Каспийского моря, в виде государственного природного резервата, связанного в одну сеть с существующими ООПТ. В составе резервата должны функционировать реабилитационные центры для больных, ослабленных и травмированных тюленей. В данную сеть, на основе межгосударственных соглашений, могут быть включены в последующем и ООПТ других Прикаспийских стран, что послужит основанием для создания трансграничного резервата для сохранения популяции каспийского тюленя. Создание сети ООПТ будет способствовать постоянному и целенаправленному мониторингу всех Прикаспийских стран за состоянием каспийского тюленя – трансграничного вида, являющего индикатором состояния экосистемы Каспийского моря.

Keywords: caspian seal, specially protected area, state nature reserve, conservation, deposits, rookeries.

Ключевые слова: каспийский тюлень, особо охраняемая территория, государственный природный резерват, сохранение, залежки, лежбища.

Введение. Каспийский тюлень (*Pusa caspica*) – единственное млекопитающее, эндемик Каспийского моря. Включен в Красный список МСОП как вид, находящийся под угрозой исчезновения [1]. Занесен в Перечень редких и находящихся под угрозой исчезновения видов животных Казахстана (Постановление Правительства Республики Казахстан от 9 ноября 2020 г. № 746). Аналогичный статус вид имеет и в других Прикаспийских странах. Прежде всего, негативно на состояние популяции тюленя повлиял неумеренный промысел, а также: загрязнение моря, накопление токсикантов в организме животных, приводящее к снижению иммунитета и, как следствие, к эпидемиям и увеличению бесплодия самок, развитие судоходства в местах островных и ледовых лежбищ, прилов в рыболовные сети [2]. До

сих пор о современной численности популяции каспийского тюленя среди специалистов нет единого мнения – по разным оценкам, численность тюленей с начала XX века сократилась от 3-4 до 10 раз и составляет от 100 до 270 тыс. особей [3].

Цель исследования. Целью исследований является предоставление путей для решения проблемы сокращения популяции каспийского тюленя.

Материал и методы исследования. Каспийский тюлень – животное пагофильное, размножение и спаривание происходит на льдах. По результатам авиаучетов за 2005-2012 гг. районы размножения каспийского тюленя относительно ледовых условий представлены на рисунке 1 [4].



Рисунок 1 – Районы размножения каспийского тюленя в различные по состоянию ледового покрова зимы (желтый цвет – район размножения, голубой цвет – ледовый покров)

В мягкую зиму тюлени концентрируются на самом востоке Северного Каспия. В умеренную — места размножения тюленей располагаются в районе Уральской Бороздины, к северо-востоку от границы между Северным и Средним Каспием. В более суровые зимы — расширяются в южном и западном направлении, но ограничиваясь в целом Северным Каспием. Таким образом, расположение зимних лежищ тюленей имеет зависимость от площади ледового покрова, характерного для разных типов зим. Стоит также учесть, что в течение зимы под воздействием ветра происходит многократный взлом припая, подвижка льда, дрейф и образование полыней — обширных пространств чистой воды. Протяженность полыни может достигать 200 км, а ширина от сотен метров до 20 км.

Все указанные факторы, несомненно, затрудняют выбор особо охраняемой территории для сохранения мест воспроизводства тюленей на ледовых полях казахстанской части моря. По всей видимости, только район Уральской Бороздины может рассматриваться как наиболее постоянное место, где происходит размножение тюленей в умеренные и суровые зимы. Расширение добычи углеводородного сырья в Северном Каспии предполагает строительство искусственных островов и развитие зимнего судоходства для обслуживания инфраструктуры морских нефтегазовых разработок. Исследования показывают, что прохождение ледоколов вблизи зимних скоплений тюленей приводит к разрушению льда в местах размножения, разлучению матерей и щенков, случается гибель тюленей при их столкновении с судами [5]. В целом, это негативно влияет на воспроизводство тюленей и, следовательно, увеличивает угрозу существования вида. Северный Каспий в пределах Казахстана относится к одному из видов особо охраняемых природных территорий республиканского значения — государственной заповедной зоне (Закон РК «Об особо охраняемых природных территориях»). Среди экологических требований при осуществлении хозяйственной и иной деятельности в заповедной зоне определено, что нефтяные операции должны осуществляться не ближе 1 морской мили от концентраций тюленей в период размножения — с октября по май месяцы (Экологический Кодекс РК). В экологическом законодательстве Казахстана заложена основа гибкого режима охраны зимних

скоплений тюленей. Но для его реализации рекомендуется дополнить это требование необходимостью разработки и утверждения уполномоченным органом специального порядка осуществления указанной деятельности. В этом порядке должны быть учтены предварительная и периодическая авиаразведка, корректировка маршрутов движения судов, рассмотрение альтернативных сроков доставки грузов и других хозяйственных работ для снижения или исключения воздействия на воспроизводство каспийских тюленей.

Результат исследования и их обсуждение.

Сохранение мест воспроизводства — одно из определяющих критериев создания особо охраняемых природных территорий. Наиболее действенной мерой для сохранения каспийских тюленей в казахстанской части Каспия рекомендуется создание государственного природного резервата (ГПР). Именно этот вид ООПТ, согласно законодательству Казахстана, предназначается не только для сохранения, но и для восстановления утраченных местобитаний и численности вида. При этом территория резервата подразделяется на две зоны — с заповедным режимом, где запрещается любая хозяйственная деятельность, и буферную, где могут быть сохранены и осуществляться различные формы хозяйственной деятельности с определенными ограничениями. К зоне с заповедным режимом могут быть отнесены те районы моря и острова, которые наиболее значимы для тюленей в периоды размножения и залегания, и в то же время могут не терять эту значимость в течение длительного времени при продолжающейся регрессии моря. К примеру, акватория Каспия на Уральской Бороздине, остров Кулалы и острова в заливе Кендырли.

В буферной зоне возможно проведение работ по восстановлению утративших свое былое значение лежищ каспийских тюленей, где должны быть исключены рыболовство и судоходство во время залегания тюленей, в то же время должны проводиться работы по сбору рыболовных сетей, брошенных или утерянных рыбаками в море, а также выносимых на мелководные пространства у лежищ. Особую важность приобретает строительство реабилитационных центров в составе ГПР для больных, ослабленных и травмированных тюленей, которых в популяции в настоящее время много. Хотя основной задачей реабилитации является забота о диких животных, реабилитологи также

должны хорошо разбираться в законодательных нормах, которые влияют на их способность действовать на законных основаниях [6].

В экологическом и природоохранном законодательстве Казахстана до сих пор не заложены правовые основы, которые регулируют деятельность

реабилитационных центров. Такое положение дел необходимо исправлять и совершенствовать законодательство в области охраны редких и находящихся под угрозой исчезновения видов животных.

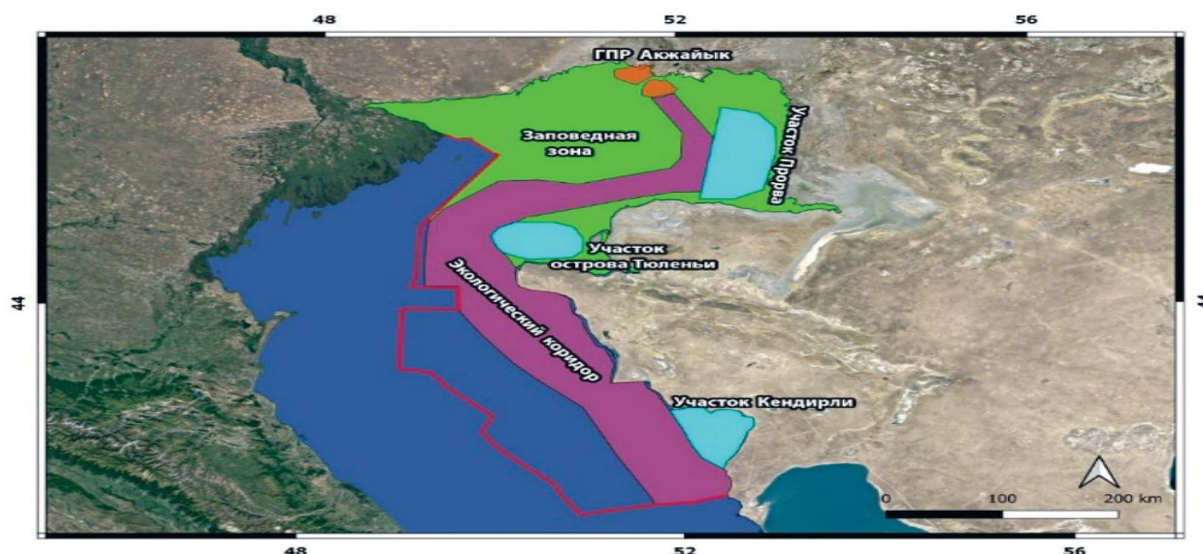


Рисунок 5 – Карта-схема рекомендуемой особо охраняемой природной территории для сохранения популяции каспийского тюленя в казахстанской части Каспийского моря

Таким образом, учитывая, что лежбища тюленей распределены от Северного Каспия до Среднего, резерват рекомендуется организовать мозаичного типа, состоящего из различных пространственно-разделенных участков: в Северном Каспии – участок Прорва (объединяющий острова Дурнева, Прорва и Ремонтные шалыги) и острова Тюленьи, в Среднем Каспии – участок залива Кендирли с островами у косы Ада. Учитывая миграционные пути тюленей, необходимо также утвердить между этими участками экологический коридор, ограничивающийся в Среднем Каспии 200 м изобатой, с особым режимом хозяйственной деятельности, и связать с существующими ООПТ (с заповедной зоной Северного Каспия, с государственным природным резерватом «Акжайык», в одну сеть (рисунок 5). Принятие специальных Правил хозяйственной деятельности в заповедной зоне Северного Каспия позволит обеспечивать охрану мест зимнего залегания тюленей в гибком режиме. К сожалению, несмотря на то, что острова Зюйд-вестовые шалыги, располагающиеся в предустьевом пространстве р. Урал, входят в буферную зону ГПР «Акжайык», тюлени на них не залегают, что также связано с развитым на этом участке моря нелегальным ловом рыб и судоходством. На указанных островах ранее располагались многочисленные залежки и следует усилить охрану потенциального лежбища тюленей.

В данную сеть на основе межгосударственных соглашений могут быть включены в последующем и ООПТ других прикаспийских стран, что послужит основанием создания трансграничного резервата для сохранения популяции каспийского тюленя.

Выводы. Несомненно, что рекомендуемый государственный природный резерват в

казахстанской части Каспия и сеть ООПТ, включая и экокоридоры, будут важны не только для сохранения одного вида – каспийского тюленя, но и сыграет роль для сохранения осетровых рыб, будет охватывать и водно-болотные угодья для охраны редких видов птиц и защищать в целом биоразнообразие Каспийского моря. Именно на основе этого резервата станет возможным организовывать экотуризм, центральным объектом которого станет уникальный вид Центрально-Азиатского региона – каспийский тюлень. И сохранение вида при восстановлении местообитаний и увеличения численности станет экономически оправдано. Стоит особо подчеркнуть, что создание сети ООПТ будет способствовать постоянному и целенаправленному мониторингу всех прикаспийских стран за состоянием каспийского тюленя – трансграничного вида, являющего индикатором состояния экосистемы Каспийского моря.

СПИСОК ЛИТЕРАТУРЫ:

1. Goodman, S. & Dmitrieva, L. Pusa caspica. The IUCN Red List of Threatened Species 2016: e.T41669A45230700. <http://dx.doi.org/10.2305/IUCN.UK.20161.RLTS.T41669A45230700.en>. Downloaded on 11 August 2017.
2. Баймуханов М.Т. Как сохранить каспийского тюленя (Pusa caspica)? // Известия НАН РК Института биологии и биотехнологии растений. Серия Биологическая и медицинская 6(324). Алматы, 2017. - С.100-111., [Bajmukanov M.T. Kak sokhranit' kaspijskogo tyuleny (Pusa caspica)? // Izvestiya NAN RK Instituta biologii i biotekhnologii rastenij. Seriya Biologicheskaya i meditsinskaya 6(324). Almaty, 2017. - S.100-111]

3. Сволкина Л., Ермолин И.В., Суворков П. Э., Холмс Д., Гудман С. Ко-личественная оценка смертности тюленей в ННН-промысле Каспийского водного бассейна и объём нелегального рынка продуктов из дериватов каспийского тюленя, реализуемых через потребительские сети//Сборник тезисов XI-ой Международной конференции «Морские млекопитающие Голарктики». - 2021. - С.83., [Svolkinas L., Ermolin I.V., Suvorkov P. E.H., KHolms D., Gudman S. Kolichestvennaya otsenka smertnosti tyulenej v NNN-promysle Kaspijskogo vodnogo bassejna i ob»yom nelegal'nogo rynka produktov iz derivatov kaspijsk-ogo tyuleny, realizuemykh cherez potrebitel'skie seti//Sbornik tezisov XI-oj Me-zhdunarodnoj konferentsii «Morskie mlekoпитayushhie Golarktiki». - 2021. - S.83]

4. Дмитриева Л.Н., Баймуканов М.Т., Касымбеков Е.Б., Вилсон С., Гудман С.

Распространение каспийского тюленя//Атлас Атырауской области. Алматы, 2014. - С. 94-95., [Dmitrieva L.N., Bajmukanov M.T., Kasymbekov E.B., Vilson S., Gudman S. Rasprostranenie kaspijskogo tyuleny//Atlas Atyrauskoj oblasti. Almaty, 2014. - S. 94-95]

5. Wilson, S., Trukhanova I., Dmitrieva L., Dolgova E., Crawford I., and Baimukanov M., Baimukanov T., Ismagambetov B., Pazylbekov M., Jussi M., and Goodman S. Assessment of impacts and potential mitigation for icebreaking vessels transiting pupping areas of an ice-breeding seal. Biological Conservation.– 2017. - Vol. 214. P. 213-222

6. Johnson A.N. Detailed Discussion of Wildlife Rehabilitation Laws// Animal Legal & Historical Center, 2012 - / <https://www.animallaw.info/article/detailed-discussion-wildlife-rehabilitation-laws>

CHEMICAL SCIENCES

SYNTETHIS AND ANALYSIS OF ZINC OXIDES NANOPARTICLES

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Abstract

This article is devoted to the synthesis of zinc oxide nanoparticles using the sol-gel method. optimal conditions for the synthesis of zinc oxide nanoparticles were developed using various environmentally friendly reducing agents and reaction media. The structure of the obtained materials containing a finely dispersed metal phase has been studied, and the size of metal particles in the volume and on the surface of the obtained material has been determined. Based on the results of the study, these synthesized compounds were recommended as bioinhibitors against microorganisms.

Keywords: nanoparticles, zinc oxide, scanning electron microscopy, spectrometry.

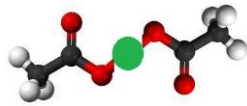
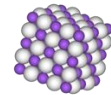
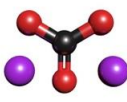
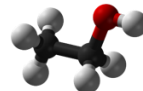
ZnO nanoparticles are considered one of the three most produced nanomaterials, along with titanium dioxide nanoparticles and silicon dioxide nanoparticles. Most often, ZnO nanoparticles are used in sunscreens. They are used because they effectively absorb ultraviolet light, but have a band gap large enough to be completely transparent to visible light. They are also being tested for the destruction of harmful microorganisms in packaging and in UV protection materials such as textiles. Based on the highly efficient and promising properties of zinc oxide nanoparticles, it was concluded that it is necessary to synthesize and study these compounds [1].

The chemical system in the sol-gel method consists of three main components - a precursor, a solvent, and a stabilizer. In the sol-gel process, the molecular precursor in a homogeneous solution undergoes a sequence of transformations: hydrolysis, polymerization

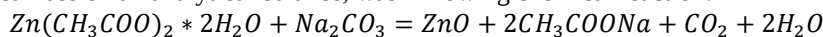
by sequential bimolecular addition of ions with the formation of oxo-, hydroxyl or aqua-bridges. condensation by dehydration, nucleation and growth [2]. The solvent must have a relatively high dielectric constant to dissolve the inorganic salts. Most alcohols fulfill this condition. Alcohols with low carbon numbers up to 4 are the most used solvents: methanol, ethanol, 1-propanol, 2-propanol, 1-butanol and 2-methoxyethanol. Additives are chemical compounds that have at least one functional group, which allows these compounds to play multiple roles. They act as a basic or acidic and/or chelating agent. For this, alkali metal hydroxides, carboxylic acids, alkanolamines, alkylamines, acetylacetone and polyalcohols are used. They can contribute to the dissolution of the zinc salt in some alcohol environments. Based on the collected data, the initial substances for the synthesis of nanoparticles were selected [3,4].

Table 1

Characteristics of the chemicals used in the work

Substance name	Chemical formula	Molecule model
1	2	3
Zinc acetate dihydrate	$\left[\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^- \right]_2 \text{Zn}^{2+} \cdot 2\text{H}_2\text{O}$	
Sodium hydroxide	$\text{Na}-\text{O}-\text{H}$	
Liquid glass	$\text{Na}^+ \text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}^- \text{Na}^+$	
Ethanol	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{OH} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	

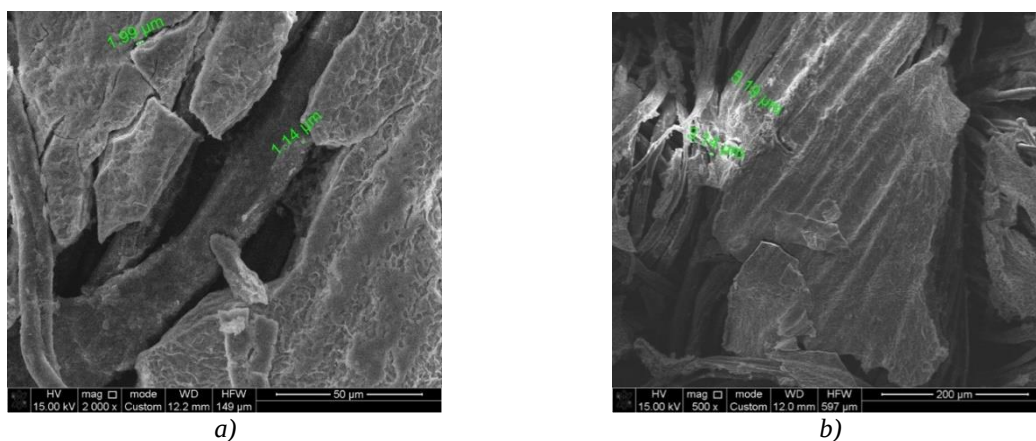
The purpose of this study is to establish the patterns of formation of zinc oxide nanoparticles in ethyl solutions, and to obtain zinc oxide nanoparticles. A series of experiments was carried out in alcoholic solutions. To achieve the goal, the following tasks were solved: - determination of the nature of the influence of various factors (concentrations of reagents, temperature, stabilizing additives) on the formation of zinc oxide nanoparticles; - search for optimal conditions for the synthesis of stable zinc oxide hydrosols, including concentrated ones; The ratio of their concentrations was established by varying the volumes of reagent solutions. A fiber sample 100 × 100 mm in size, after determining the exact mass on an analytical balance, was



A dispersion of zinc oxide nanoparticles was obtained by alkaline hydrolysis of zinc acetate in ethanol. First dissolve the zinc acetate (in this method the concentration of zinc acetate varies) in ethanol by heating in a laboratory shaker. At the same time, 50 ml (total ml of ethanol is 100 ml) of ethanol was placed in the flask. When the zinc acetate was completely dissolved, 50 ml of chilled ethanol was added to the solution. Sodium hydroxide was also dissolved in ethanol alcohol

impregnated with an aqueous solution of zinc oxide nanoparticles on a laboratory two-shaft padding with 90% extraction, and drying and heat treatment were carried out on needle frames in a drying cabinet with a thermostat. After drying and heat treatment, the sample was washed in distilled water and then dried at room temperature. Before carrying out the experimental work, the unseamed flax fiber was preliminarily washed in distilled water to remove residues of various impurities, dried, and kept in a desiccator with a calcium chloride desiccant to determine the exact weight. The method for obtaining zinc oxide nanoparticles was based on the method of precipitation from solution during the following chemical reaction:

(0.05 M) and cooled in an ice bath, and then an aqueous solution of zinc acetate was added dropwise to the solution with constant stirring. In this way, ZnO was obtained. The dressed and undressed fiber was sent for analysis to the nanotechnological laboratory at Al-Farabi Kazakh State University for subsequent identification of the resulting nanoparticles using a Quanta 3D 200i Dual system Field Emission Scanning Scanning Electron Microscope.

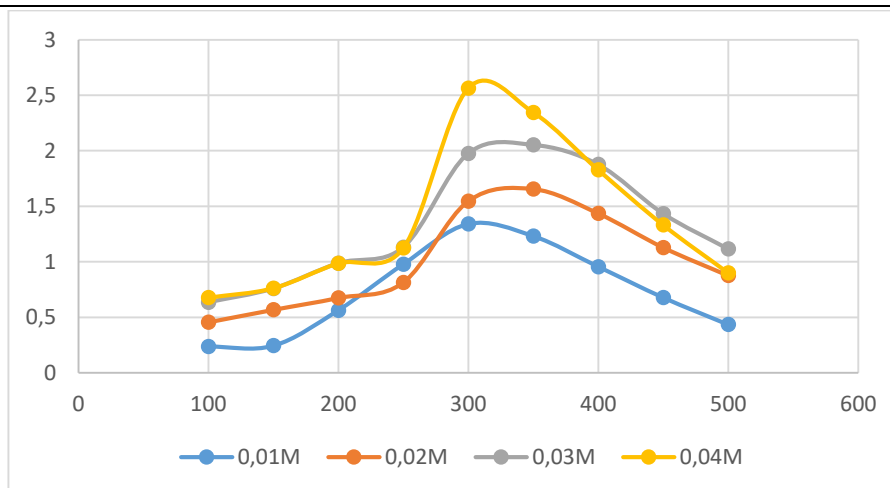


Pic.1. Photographs of the finished sample with a resolution of a) 200 μm b) 50 μm

The optical densities of the reaction solutions were also determined using an ultraviolet spectrophotometer with Agilent Cary 60, G6860A software.

Table 2

Optical density of solutions at wavelengths of 100-500nm				
Wavelength, nm	Optical density at 0.01M	Optical density at 0.02M	Optical density at 0.03M	Optical density at 0.04M
100	0,238	0,456	0,635	0,678
150	0,245	0,568	0,759	0,763
200	0,564	0,675	0,987	0,987
250	0,978	0,814	1,131	1,124
300	1,34	1,545	1,976	2,563
350	1,231	1,654	2,053	2,345
400	0,956	1,435	1,876	1,828
450	0,678	1,128	1,433	1,332
500	0,435	0,876	1,115	0,901



Pic.2. Wavelength to absorbance diagram

A method has been developed for modifying cellulose fabrics using sol-gel synthesis, using sodium hydroxide, sodium silicate with the addition of zinc acetate, which provides effective antimicrobial activity of the textile material. The method of modifying materials is universal, accessible and simple in execution.

REFERENCES:

1. Shahidi, S. Antibacterial Agents in Textile Industry/ S. Shahidi, J. Wiener //Antibacterial Agents / V. Bobbarala. - InTech, 2012. - P. 387-406.
2. B. Pinto, R. J., C., M., Pascoal, C., Trindade, T. (2012). Composites of Cellulose and Metal Nanoparticles. Nanocomposites - New Trends and Developments, P. 74-95
3. Cady, N. C., Behnke, J. L., & Strickland, A. D. (2011). Copper-Based Nanostructured Coatings on Natural Cellulose: Nanocomposites Exhibiting Rapid and Efficient Inhibition of a Multi-Drug Resistant Wound Pathogen, *A. baumannii*, and Mammalian Cell Biocompatibility In Vitro. *Adv. Funct. Mater.*, 21(13), 2506-2514.
4. Lizundia, E., Goikuria, U., Vilas, J. L., Cristofaro, F., Bruni, G., Fortunati, E., Torre, L. (2018). Metal Nanoparticles Embedded in Cellulose Nanocrystal Based Films: Material Properties and Post-use Analysis. *Biomacromolecules*, 19(7), 2618–2628.

SYNTHESIS OF HYDROXYL-CONTAINING FURAN REZINS AND POLYURETHANE FOAMS
BASED ON THEM

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100011, Republic of Uzbekistan, 32, Navoi Str. Tashkent*СИНТЕЗ ГИДРОКСИЛСОДЕРЖАЩИХ ФУРАНОВЫХ ОЛИГОМЕРОВ И ЖЕСТКИХ
ПЕНОПОЛИУРЕТАНОВ НА ИХ ОСНОВЕ

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The reaction of furfuryl and polyatomic alcohols synthesized hydroxyl-containing furan oligomers and their physical-chemical properties have been studied. Using these oligomers, industrial foams are modified and rigid polyurethane foams are developed. The influence of the nature of the synthesized furan oligomers on the performance properties of rigid polyurethane foams is presented.

Аннотация

Реакцией фурфурилового и многоатомных спиртов синтезированы гидроксилсодержащие фурановые олигомеры и изучены их физико-химические свойства. Использование этих олигомеров модифицированы промышленные пенопласты и разработаны жесткие пенополиуретаны. Показано влияние природы синтезированных фурановых олигомеров на эксплуатационные свойства жестких пенополиуретанов.

Keywords: oligomer, furfuryl alcohol, polyhydric alcohols, polycondensation, physical-chemical properties, polyurethane foam, modification, technological indicators, strength properties.

Ключевые слова: олигомер, фурфуриловый спирт, многоатомные спирты, поликонденсация, физико-химические свойства, пенополиуретан, модификация, технологические показатели, прочностные свойства.

Введение

Наряду с высокой тепло-, термо-, огне- и химостойкостью полимерам на основе фурфурилового спирта (ФС) присущи такие недостатки как низкая адгезия к различным поверхностям, значительная усадка после отверждения, хрупкость.

Вышеуказанные недостатки гомополимеров фурфурилового спирта (ФС) связаны чрезмерной жесткостью полимер-основы, строение основной цепи которых состоят из фурановых гетероатомов, соединенных между собой метиленовыми звеньями. Для их устранения синтезированы фурано-эпоксидные олигомеры, олигоуретаны, олигоамидоуретаны, полиимиды, сложные и простые олиго-, полиэфиры [1-4]. Гетерогенная упорядоченная структура фурфуриловых олигомеров и полимеров придает им ряд специфических свойств, по сравнению со свойствами гомополимеров или их механических смесей.

Гидроксилсодержащие олигомеры на основе фурфурилового спирта и этиленгликоля, левоглюкозана и ксилита описаны в [5]. Полученные олигомеры имели близкие свойства, что позволило автором высказать предположение о едином механизме их образования. При этом в структуре олигомера между фурановыми циклами расположены метиленовые и диэтиленовые группы (в случае продуктов реакции фурфурилового спирта и этиленгликоля). Выяснено, что синтезированные олигомеры при-

годны для использования в качестве лака для антикоррозионной защиты технологического оборудования.

В данной статье приведены результаты исследований по синтезу и изучению олигоэфирполиолов совместной поликонденсацией ФС с многоатомными алифатическими спиртами. В качестве многоатомных спиртов выбраны этиленгликоль (ЭГ), диэтиленгликоль (ДЭГ) и глицерин (Гл), что позволяет более наглядно изучить влияние типа, природы многоатомных спиртов на строение и физико-химические свойства олигомеров и полимерных композиционных материалов на их основе в последующем.

Производство пенополиуретанов (ППУ) предъявляет определенные требования к полиэфирполиолам, используемым для их получения [6,7]. Исходя из поставленной цели и учитывая сказанное, нами проведены исследования по изучению условий образования фурфурил-алкиленовых олигомеров «пенополиуретанового назначения».

Экспериментальная часть

Методика синтеза олигомеров разработана по аналогии с методикой, описанной в работе [5]. В трехгорлую колбу, снабженную механической мешалкой с масляным затвором, термометром и обратным холодильником загружали 6 моль ФС и 1 моль многоатомного спирта. При энергичном перемешивании температуру доводили до 110°C и добавляли необходимое количество катализатора –

малеинового ангидрида (ГОСТ 11153-75). Затем реакционную смесь вновь нагревали до 120°C в течение определенного времени. По истечении этого времени реакционную смесь охлаждали, отгоняли надсмольные воды, непрореагировавшие мономеры, нагревая реакционную смесь до температуры 112-114°C при пониженном давлении. За ходом конденсации следили по изменению содержания гидроксильных групп, свободных мономеров, молекулярной массы и вязкости [8].

ППУ получали перемешиванием заранее взвешенной композиции дисковой мешалкой с частотой вращения 3000 об/мин. Параметры вспенивания снимали при свободном вспенивании композиции. Для определения физико-механических свойств композицию заливали в металлическую форму размером 160x180x70мм, предварительно нагретую до 40-60°C. Физико-механические свойства ППУ определяли согласно соответствующим методикам [9] и стандартам.

Результаты и их обсуждение

На ход поликонденсации оказывает влияние температура, продолжительность реакции, концентрация катализатора. Температуру проведения реакции выбрали по данным [5]. В качестве катализатора использовали малеиновый ангидрид (МА). В отсутствие катализатора концентрация фурфуролового спирта с алифатическими многоатомными спиртами протекает слишком медленно.

При этом реакционная способность алифатических спиртов по отношению к ФС снижается в ряду этиленгликоль (ЭГ), диэтиленгликоль (ДЭГ), глицерин (Гл). Так, на снижение концентрации гидроксильных групп реакционной смеси до (17-20%), свободного ФС до (85-95%) и выделение (5-12) мл конденсационной воды затрачивается 60, 90 и 120 минут соответственно при реакции ФС с ЭГ, ДЭГ и Гл. Введение в реакционную смесь МА и увеличение его содержания ускоряет конденсацию. Ход изменения кривых показывает, что до содержания МА 0,17 вес. % от количества ФС происходит резкое уменьшение значения содержания свободного ФС, гидроксильных групп, увеличение количества выделившейся воды, молекулярной массы и вязкости. Дальнейшее возрастание концентрации МА не

вызывает резкого изменения указанных показателей.

Введение и увеличение концентрации МА в реакционную смесь не изменяет порядок реакционной активности исследованных спиртов в реакции с ФС. Например, на образование олигомеров приблизительно с одинаковыми физико-химическими свойствами в присутствии 0,17 вес.% МА соответственно необходимо 1,0ч, 1,5ч, 2,0ч при взаимодействии ФС с ЭГ, ДЭГ и Гл. Это, по-видимому, связано с присутствием в молекуле ДЭГ и Гл дополнительно электроноакцепторных атома кислорода и гидроксильной группы.

Проведенная серия экспериментов позволила определить оптимальную концентрацию МА в реакционной смеси - 0,17% от веса ФС.

Другим параметром, оказывающим влияние на физико-химические свойства олигомеров является продолжительность реакции. Конденсация ФС с исследованными многоатомными спиртами характеризуется резким уменьшением конденсации свободного фурфуролового спирта и гидроксильных групп, повышением значения молекулярной массы олигомеров. Кроме того, в начальный период реакции выделяется больше воды. Причем время достижения излома на кривых изменения соответствующих показателей составляет 1,0ч, 1,5ч, и 2,0ч соответственно для фурфурил-этиленгликолевых (ФЭО), фурфурил-диэтиленгликолевых (ФДО) и фурфурил-глицериновых олигомеров (ФГО).

Резкое снижение концентрации свободного фурфуролового спирта, гидроксильных групп на начальной стадии и затем замедление снижения этих показателей позволяет предложить о том, что гетерополиконденсации предшествует гомополиконденсация ФС. Образовавшиеся олигомеры ФС затем реагируют с гликолями.

Проведенные систематические исследования позволили выявить оптимальные условия проведения конденсации ФС с многоатомными спиртами – мольное соотношение ФС: многоатомный спирт=6:1, температура реакции-140°C, концентрация малеинового ангидрида -0,17 вес. %, продолжительность реакции-1,0ч (ФЭО), 1,5ч (ФДО) и 2,0ч (ФГО). Физико-химические свойства олигомеров, синтезированных при этих условиях, приведены в табл.1.

Таблица 1

Физико-химические свойства фурфурил-алкиленовых олигомеров

Показатели	ФЭО	ФДО	ФГО
Внешний вид	Вязкие жидкости темно-коричневого цвета		
Среднечисленная молекулярная масса	500-600	550-650	600-700
Вязкость динамическая при 25°C, Па*с	2,0-3,0	3,0-4,0	4,0-5,0
Содержание гидроксильных групп, %	5-7	5-7	10-15
Содержание свободного фурфуролового спирта, %	5-10	15-20	8-16
Средняя функциональность	1,9-2,1	1,9-2,1	3,0-4,0

Данные таблицы показывают, что синтезированные олигомеры имеют широкий спектр физико-химических свойств.

Таким образом, в результате проведенных исследований изучены условия конденсации фурфуролового спирта с этилен-, диэтиленгликолями и

глицерином в присутствии каталитических количеств малеинового ангидрида. Показано, что в начале процесса происходит гомополиконденсации фурфуролового спирта. Предложен механизм образования олигомеров фурфуролового спирта, кото-

рый подтвержден изучением кинетики гомополиконденсации фурфурилового спирта [10] в водной среде. Установленные закономерности позволили в свою очередь выявить закономерности образования фурфурил-алкиленовых олигомеров [11].

В дальнейшем на основе синтезированных олигомеров разрабатывали жесткие ППУ. При этом с целью изучения влияния природы синтезированных олигомеров на структурные характеристики, параметры формования и физико-механические свойства ППУ в композиции для вспенивания вводили минимальное необходимое количество веществ, без которых пенопласты не образуются (катализатор, поверхностно-активное вещество, вспенивающий агент). При разработке пенопластов соответствии с требованиями производства и эксплуатационных свойств.

Увеличение количества малеинового ангидрида, взятого для синтеза фурфурил-алкиленовых олигомеров приводит к ускорению пено- и уретанообразования. При этом к изменению физико-химических свойств олигомеров наиболее чувствительно время подъема. Необходимо отметить, что композиция на основе ФЭО и ФДО характеризуются меньшей текучестью. Это вызывает ряд технологических трудностей при получении ППУ с качественной макроструктурой. Требуется своего объяснения экстремальное изменение количества МА, взятого для их синтеза. При этом функциональность компонента α возрастает от 3,0 (в случае олигомеров, полученных в присутствии 0,085% масс. МА) до 6,5 при использовании олигомеров, полученных в присутствии 0,5% масс. МА. По-видимому, увеличение функциональности до определенного уровня приводит к ускорению накопления частиц коллоидных размеров и сокращению времени достижения их критической концентрации, после которой образуется сплошная сетка полимера (момент, когда из композиции вытягиваются нити при определении геля образования) [12]. По мере повышения функциональности композиции образуется сильно разветвленные макромолекулы. При этом в силу превалирования диффузионного фактора скорость реакции замедляется, что приводит к симбатному удлинению времени достижения

критической концентрации частиц коллоидных размеров. Это, в свою очередь, приводит к возрастанию значений времени гелеобразования.

Необходимо отметить, что в ряду ФЭО, ФДО, ФГО реакционная способность по отношению к изоцианатным группам понижается.

В отличие от ФЭО и ФДО у ФГО с увеличением количества катализатора конденсации возрастает функциональность. Это, в свою очередь, приводит к повышению функциональности компонента α и средней функциональности соответственно от 3,0 до 6,5 и 2,66 до 3,14 при изменении количества МА от 0,025 до 0,5% масс. Повышение функциональности системы приводит к симбатному возрастанию напряжения сжатия при 10%-ной деформации, снижению разрушающего напряжения при изгибе и ударной вязкости. Снижение значения водопоглощения, по-видимому, указывает на образование преимущественно закрытоячейчатой макроструктуры ППУ в отличие от олигомеров на основе ФС и диолов. Большие возможности варьирования физико-химических свойств фурфурил-алкиленовых олигомеров предоставляет изменение продолжительности реакции ФС с многоатомными спиртами.

Увеличение продолжительности реакции приводит в основном к почти линейному росту молекулярной массы олигомеров. С повышением молекулярной массы олигомеров скорости пено- и уретанообразования возрастают, что в общем-то характерно и для фурановых олигомеров [13]. Причем к изменению молекулярной массы фурфурил-алкиленовых олигомеров наиболее чувствительно время подъема композиции. Это, по-видимому, связано с повышением функциональности компонента α от 2,14 до 2,86, от 2,14 до 2,67 и от 2,22 до 3,88, соответственно, для композиций на основе ФЭО, ФДО и ФГО.

Проведенные исследования показали принципиальную возможность получения ППУ на основе синтезированных олигомеров. Кинетические параметры формования и физико-механические показатели ППУ на основе синтезированных олигомеров приведены табл. 2.

Таблица 2

Физико-механические свойства пенопластов на основе фурфурил-алкиленовых олигомеров

Наименование показателей	П П У на основе			
	ФЭО	ФДО	ФГО	ППУ-307
Время старта, с	16	20	25	18
Время гелеобразования, с	38	48	50	33
Время подъема, с	72	110	150	75
Кажущаяся плотность, кг/м ³	100	100	100	100
Напряжение сжатия при 10%-ной деформации, МПа	0,58	0,62	0,68	0,78
Ударная вязкость, кДж/м ²	0,30	0,38	0,32	0,31
Водопоглощение за 24 часа, кг/м ²	0,24	0,27	0,17	0,15
Горючесть (огневая труба) потеря массы, %	61	64	50	100

Разработанные ППУ на основе фурфурил-диэтиленгликолевого, фурфурил-глицеринового олигомеров превосходят промышленный пенополиуретан марки ППУ-307, в котором полиэфирная часть полностью заменена на синтезированные

олигомеры, по прочности при изгибе, ударной вязкости, огнестойкости и незначительно уступают ему по прочности при сжатии.

Заключение

Гетерополиконденсацией фурфурилового

спирта и многоатомных спиртов синтезированы гидроксилсодержащие полифункциональные фурановые олигомеры «пенополиуретанового назначения», выявлены оптимальные условия их образования. На основе полученных олигомеров разработаны жесткие ППУ, свойства которых в основном зависят от природы и функциональности олигомеров.

СПИСОК ЛИТЕРАТУРЫ:

1. Шукурджиев М.С. Получение фурано-эпоксидных совмещенных смол с использованием кубовых остатков фурфурилового спирта и разработка полимерных композиций на их основе // Автореферат дисс. ... к.т.н., Ташкент, ТашПИ, 1990, с.20.
2. Магруппов Ф.А. Закономерности образования и свойства полимеров гидроксилсодержащих фурановых соединений. Автореферат. дисс. ... д.х.н., Киев, ИХВС АН УССР, 1982, с.42.
3. Gökmen V., Açar Ö.Ç., Arda S., Francisco J.M., Effect of leavening agents and sugars on the formation of hydroxymethylfurfural in cookies during baking. / *Eur. Food Res. Technol.*, 2008, 226, p.1031-1037.
4. Ma Jiping, Pang Yi, Wang Min, Xu Jie, Ma Hong, Nie Xin j Mater. Chem. The copolymerization reactive of diols with 2,5-furandicarboxylic acid for furan-based copolyester. *J terials*. 2012, 22, №8, p.3457-3461.
5. Маматов Ю.М. Фурановые смолы. -М.: ОНТИТЭИмикробиопром, 1974. -100 с.
6. Randall D. The polyurethanes book. John Wiley and Sons LTD/D. Randall, S. Lee. 2002, -477p.
7. Марк Ф. и др. Полиуретаны. Состав, свойства, производство, применение. Пер. с англ. СПб, ЦОП «Профессия». 2018. 576с.
8. Торопцева А.М., Белгородская К.В., Бондаренко В.М. Лабораторный практикум по химии и технологии высокомолекулярных соединений. – Л.: «Химия», 1972. - 416с.
9. Сборник физико-механических испытаний пеноматериалов, Под ред. Ю.Н.Полякова, Владимир, изд. ВНИИСС, 1967, -с.63.
10. Alimuhamedov M.G., Magrupov F.A., Kinetic of homopolycondensation of furfuryl alcohol, *Polym. Sci.* 2007, SER B., vol.49, № 78, p.167-171.
11. Низамов Т.А. Синтез и исследование фурфурил-алкиленовых олигомеров// «Пласт. массы», 2011, №3. –с.41-44.
12. Иржак В.И. Топологическая структура полимеров. Казань, Изд-во КНИТУ, 2013, -520с.
13. Rentz W.J., Dunlop W.L., Leitheiser. A new furan polyol for low-fire-hazard rigid urethane foams // *Consum. Prod. Flamm. Abic.* 1982, 9. №12. p.149-160.

EARTH SCIENCES

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COMPLICATIONS IN THE OPERATION OF WELLS WITH A HIGH CONTENT OF ASPHALTENE-RESIN-PARAFFIN SUBSTANCES IN THE PRODUCTION AND THEIR CONTROL

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ОСЛОЖНЕНИЯ ПРИ ЭКСПЛУАТАЦИИ СКВАЖИН С ПОВЫШЕННЫМ СОДЕРЖАНИЕМ В ПРОДУКЦИИ АСФАЛЬТЕНОСМОЛОПАРАФИНОВЫХ ВЕЩЕСТВ И БОРЬБА С НИМИ

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Abstract

There are several well-known and widely used technologies for the prevention of deposits, as well as methods for their removal. But the conditions for the development of deposits and the characteristics of the produced products are diverse and often require an individual approach, or the development of new technologies. However, many modern methods of combating the formation of ARPD only increase the turnaround time of wells for some time, and it is not always possible to completely avoid the formation of deposits. It is necessary to know the composition of deposits, their physical and chemical properties and the causes of formation.

Аннотация

Существует несколько известных и широко применяемых технологий по предупреждению образования отложений, а также методов по их удалению. Но условия разработки месторождений и характеристики добываемой продукции разнообразны и часто требуют индивидуального подхода, либо разработки новых технологий. Однако многие современные методы борьбы с образованием АСПО лишь увеличивают межремонтный период скважин на некоторое время, и полностью избежать образования отложений не всегда удастся. Необходимо знать состав отложений, их физико-химические свойства и причины образования.

Keywords: high-viscosity emulsions, bottom-hole formation zone, asphaltene-resin-paraffin deposits, surfactants, well, flow rate, object, pressure, viscosity.

Ключевые слова: высоковязкие эмульсии, призабойная зона пласта, асфальтеносмолопарафиновые отложения, поверхностно-активные вещества, скважина, дебит, объект, давление, вязкость.

Одной из актуальных проблем нефтяной отрасли является повышение эффективности эксплуатации скважин. Особую актуальность она приобретает при разработке залежей аномальных (неньютоновских) нефтей, где эксплуатация скважин осложняется проявлением аномалий вязкости и подвижности нефти, образованием асфальтеносмолопарафиновых отложений (АСПО) и высоковязких эмульсий в призабойной зоне пласта (ПЗП). Кроме того, аномальные нефти, как правило, содержат в своем составе сероводород, что вносит дополнительные осложнения при эксплуатации скважин [1].

Стадия разработки, на которой находится в настоящее время месторождение Каламкас, в силу ряда известных причин способствует росту доли осложнений, связанных с асфальтеносмолопарафиновым образованием (АСПО).

Образование отложений АСПО на поверхностях скважинного оборудования – наиболее распространенный вид осложнений при эксплуатации скважин. Факторами, определяющими этот процесс, являются высокое содержание в пластовой нефти коллоидных частиц асфальтенов, растворенных смол и твердых углеводородов – парафинов, температура и давление.

Нефти месторождения Каламкас характеризуются как смолистые, содержание асфальтено-смолистых веществ колеблется по скважинам в довольно широком диапазоне (13,7-22,2 % масс.), оказывая влияние на вязкость нефти и способность к осадкообразованию. Содержание асфальтенов от 3,3-5 % масс, содержание парафина невысокое от 2,4-3,3 % масс. При повышенном содержании смолаасфальтеновых веществ, нефти приобретают осо-

бый специфический характер. Смолы легко адсорбируются различными адсорбентами, которыми в нефти являются асфальтены и парафины. Адсорбируясь на частицах асфальтенов и парафинов, смолистые вещества образуют непрочные отложения, которые легко удаляются при промывке скважин горячей водой [2].

На месторождении с целью профилактики и борьбы с асфальтено-смолопарафиновыми отложениями (АСПО) в скважинах проводят тепловые обработки горячей водой (ОГВ) с добавлением поверхностно-активного вещества (ПАВ) «Рауан-100» и горячей нефтью (ОГН).

Для примера, на рисунках представлены технологические параметры работы скважин 2240, 6304 до и после ОГВ и ОГН [3].

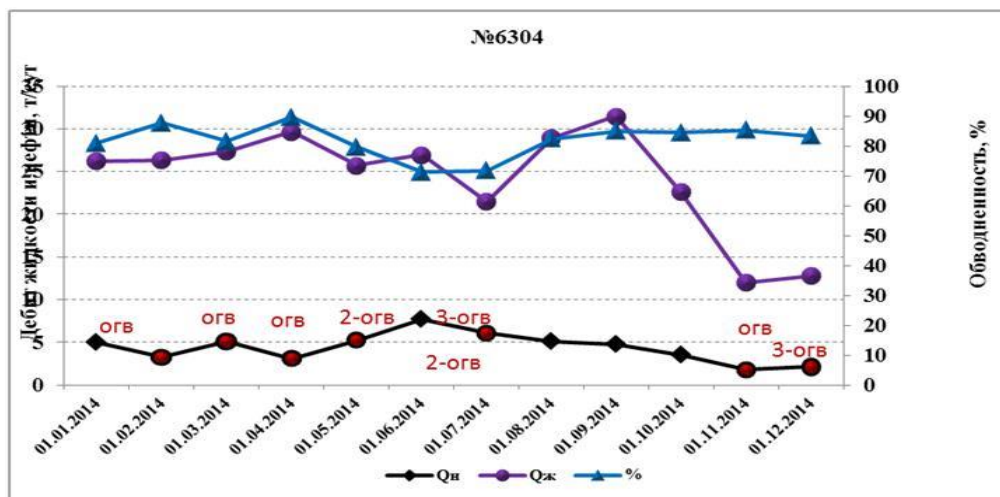


Рисунок 1. Динамика работы скважины 6304 до и после проведения ОГВ

В скважине 6304 в 2014 г. проведено 14 скважино-операций ОГВ.

По состоянию на 01.01.2014 г. дебит по нефти в среднем составил 4,98 т/сут. За 2014 год средний дебит по нефти составил 4,4 т/сут.

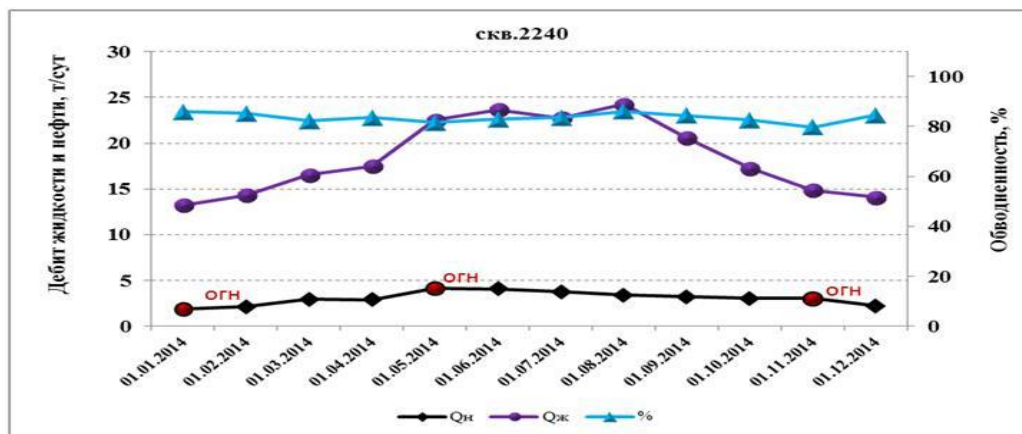


Рисунок 2. Динамика работы скважины 2240 до и после проведения ОГН

В скважине 2240 проведено 3 скважино-операции ОГН. Дебит скважины по нефти составлял 2,6 т/сут. Средний дебит по нефти составил 3,1 т/сут
Обработка горячей водой (ОГВ)

На месторождении основным мерами борьбы с осложнениями от АСПО и загустевания нефти являются периодические обработки скважин горячей водой (ОГВ). С целью лучшей очистки подземного оборудования в теплоноситель добавляется «Рандим-6031».

Технология промывки скважин заключается в следующем: производится обвязка затрубного пространства НКТ обрабатываемой скважины с ЦА-

320. Опрессовывается нагнетательная линия на полтора-двакратное давление от максимально ожидаемого, но не выше 3,2 МПа в течение 5 минут. Открывается задвижка затрубного пространства скважины и начинается обработка промывочной жидкостью температурой 70-90 °С в двукратном объеме скважины, но не менее 30-40 м³ в целях очистки выкидной линии.

Проведен статистический анализ проведения ОГВ с добавлением РАУАН-100 по группе скважин. Оценка успешности проводимых восстановительных работ производилась по коэффициенту восстановления $K_{вст}$ равному:

$$K_{вст} = \frac{q_2}{q_1},$$

q_2 – дебит жидкости (нефти) после ГТМ.

Дебит до ГТМ q_1 принимается как средний за последние 3 месяца работы скважины до проведения ГТМ, исключая месяцы простоя и исключая месяц обработки. Дебит после ГТМ q_2 определяется

после вывода скважины на режим – принимается равным значению дебита за тот месяц после ГТМ, когда скважина проработала не менее 25 дней.

При значении коэффициента восстановления:

$K_{вст} > 0.9$ – восстановление полное;

$0.9 > K_{вст} > 0.5$ – восстановление частичное;

$K_{вст} < 0.5$ – восстановление отсутствует.

Таблица 1.

Показатели коэффициента восстановления по скважинам

№ п/п	№ скв	НГДУ	Вид тепловой обработки	Дебит нефти, т/сут		$K_{вст}$	Примечание
				до	после		
1	2	3	4	6	7	8	9
1	26	1	ОГВ	3	2,5	0,8	восстановление полное
2	138	1	ОГВ	3	3	1,0	восстановление полное
3	198	1	ОГВ	4	4	1,0	восстановление полное
4	1293	1	ОГВ	5	6	1,1	восстановление полное
5	1318	1	ОГВ	4	4	1,0	восстановление полное
6	1322	1	ОГВ	9	10	1,1	восстановление полное
7	1326	1	ОГВ	1	3	3,0	восстановление полное
8	1337	1	ОГВ	9	13	1,4	восстановление полное
9	1459	1	ОГВ	3	4	1,1	восстановление полное
10	1465	1	ОГВ	5	5	1,0	восстановление полное
11	1641	1	ОГВ	3	4	1,1	восстановление полное
12	1906	2	ОГВ	5,5	5,5	1,0	восстановление полное
13	3376	2	ОГВ	1,5	1,7	1,1	восстановление полное
14	3598	2	ОГВ	5,7	5,9	1,0	восстановление полное
15	4264	2	ОГВ	17,6	19,1	1,1	восстановление полное
16	4693	2	ОГВ	6,7	10,5	1,6	восстановление полное
17	6542	2	ОГВ	0,9	2,5	2,7	восстановление полное
18	6818	2	ОГВ	12,1	13,1	1,1	восстановление полное
19	7324	2	ОГВ	4,0	4,0	1,0	восстановление полное
20	238	3	ОГВ	16	18	1,1	восстановление полное
21	327	3	ОГВ	23	26	1,1	восстановление полное
22	1579	3	ОГВ	8	8	1,0	восстановление полное
23	2081	3	ОГВ	5	5	1,0	восстановление полное
24	3158	3	ОГВ	8	8	1,0	восстановление полное
25	6955	3	ОГВ	6	8	1,3	восстановление полное

Как следует из данных, представленных в таблице, анализ проведен по 25 скважинам, где проводились тепловые обработки. Полное восстановление производительности произошло во всех скважинах.

Эффективная борьба с отложениями парафина и асфальтеносмолистых веществ остается той проблемой, которую приходится решать повседневно, так как процесс отложения их ухудшает технико-экономические показатели НГДУ: снижается межремонтный период работы скважин, увеличиваются потери нефти и энергопотребление, повышается аварийность на объектах, создаются условия для распространения замазученности территории промысла и др.

Таким образом, проводимые тепловые промывки позволяют стабилизировать дебит скважины

на непродолжительный период (в среднем от 20 до 40 суток) и носят профилактический характер.

СПИСОК ЛИТЕРАТУРЫ:

1. Ибрагимов Н.Г., Хафизов А.Р., Шайдаков В.В. и др. Осложнения в нефтедобыче, Уфа, «Монография», 2003г.
2. Изучение проблем парафиносолеотложений, сульфатредукции, коррозии и механических примесей, осложняющих добычу нефти, и разработка технических решений по их эффективному преодолению, г. Актау. Отчет АО «КазНИПИМунайгаз», 2012г.
3. «Авторский надзор за Уточненным проектом разработки месторождения Каламкас», АО "КазНИПИМунайгаз", 2014 г.

ECONOMIC SCIENCES

DETERMINANTS FOR THE FORMATION OF SOCIO-ECONOMIC COMPONENT OF NATIONAL SECURITY

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Abstract

The article the determinants of the formation of socio-economic security as an integral part of the national security of the state analyzed. The field of analytical support of economic security management acquires new features with the strengthening of the digitalization of the economy and the strengthening of the negative consequences of global economic crises, risks of business environment. The definite sources of socio-economic security as an integral part of the national security of the state are analyzed. A systematic approach to assessing socio-economic security is considered and it is determined that socio-economic security is a state characterized by the protection of the socio-economic system from macro-environment threats, which provides opportunities for self-development, conservation, an appropriate social state and level of life support in conditions of an appropriate level. profitability and consistency and the realization of economic interests. It was determined that along with the development of measures to strengthen economic security as a component of national security at the macro level, economic security management at the level of economic entities plays a significant role.

Keywords: socio-economic security, economic structure, social development, analysis, business entities, control.

At present, the interpretation of national security is considered primarily in the context of ensuring economic independence, social stability, stability of the political system and military-defense ability to protect the territorial integrity of the country. The main determinants of the formation of economic security are its relationship with the external and internal environment of the functioning of the state at the macroeconomic level and economic entities at the microeconomic level, as well as with the level of its protection from market dangers and economic threats. However, consideration of economic security solely from the point of view of protection from threats does not reflect the totality of cause-and-effect relationships and components that are embodied in it as a component of national security.

A preliminary analysis of the theoretical aspects showed that at present there are different approaches to the interpretation of such a definition as "economic security". It is considered as a process of meeting public needs, protecting the national interests of the state, economic stability and stability of the economic system, a state of the national economy in which the state does not lose its sovereignty and protects its economic environment from external threats. That is why we propose to consider economic security in its dialectical relationship with the development of the social system of the state and its balance in the temporary space of economic activity.

The high level of integration of the country's economy into raw materials markets based on price competition, rather than competition between technologies and innovations, poses a significant risk to the stable

operation of the economy [1-3]. The dynamics of the Ukrainian economic structure does not correspond to the general laws of structural changes, which presently occur in the world's developed economies and consist in increasing the share of high-tech processing industry, telecommunications, financial and business services, as well as socially oriented economic activities, and in the advanced development of knowledge-intensive high-tech industries.

Instead, Ukraine has an inefficient economic structure with highly resource-intensive and energy-intensive production, economically backward agribusiness, low level of innovative production, lagging infrastructure development, financial sector non-correlated with the real economy, inefficient operation of the sectors involved in social development [4].

In general, the trends specified are consistent with the global economic structural transformations, are characteristic primarily of emerging economies and step-by-step bring the structure of domestic economy closer to the ratios typical of highly developed countries.

However, the decrease in the role of the real sector economy is to be followed by a significant growth in labor productivity through the introduction of innovative technologies, which is not observed in Ukraine [5]. The growth of domestic economy in the pre-crisis period, determined by the combined action of both internal and external favorable factors, had a restorative nature and was not accompanied by critically needed progressive structural changes and technical progress. The national economy remained poorly diversified and,

therefore, vulnerable to the world market volatility, it was characterized by a low level of innovations and resource efficiency. Thus, the implementation of an export-oriented strategy in the domestic and foreign wholesale markets requires radical changes and the development of an action plan that provides for the expansion of the existing market, innovation or diversification of production [6].

The economic dynamics was determined by the combined effect of both internal and external favorable factors, however, no stable uptrends were formed, but the economic growth was characterized by high volatility of macroeconomic dynamics, not accompanied by systemic reforms, thus exacerbating the existing imbalance. The growing role of the financial sector is not accompanied by an adequate improvement of lending conditions in the real economy and by intensification of investment processes. Each sector of the social sphere has accumulated a number of significant structural problems.

In recent years, Ukraine has been facing increasing social tensions, lowering demographic indices, deterioration of living standards and quality of life, especially in rural areas, together with stagnation in the innovation area, especially in small and medium-sized businesses. It requires closer attention, well-balanced management decisions and management focused on these factors as sources of future comfort of living, new job openings and a quality boost for the economic growth of business entities.

It is this structural transformation of the economy that ensures the adaptation of domestic business to the global operating environment in order to meet social needs and socio-economic growth. Diagnostics of structural transformations of the economy by its main types indicates the presence of significant imbalances, which poses a threat to achieving the goals. Changes in the political, economic and social life of Ukraine in recent years are not only limited to the search for new ways of doing business, but have set a number of tasks to ensure the viability of the country in the new economic conditions [7].

In order to optimize and improve the efficiency of the national economic structure, it is necessary to pursue an active structural policy involving the potential of all state institutions. We can supplement the theoretical understanding of the content of economic security, which is still considered mainly from the standpoint of countering risks and threats and achieving competitive advantages in an unstable environment. The structural policy should be based on a detailed analysis of the impact of basic market and social institutions on the structure of the domestic economy.

The research of risks caused by both excessive and insufficient administrative influence on the activities of transnational companies makes it possible to identify the negative consequences of the processes under consideration both for the country as a whole and for its individual regions and systematize threats to the country in the field of economic security formation in terms of the nature relationships between economic entities and public authorities in the context of globalization processes [8].

In general, economic security can be characterized as a set of conditions necessary to ensure the normal economic development of the country and restore the gap in development compared to European countries during Ukraine's integration into the world economy [9]. Economic security can be viewed as the ability of an economy to achieve sustainable economic growth. Among other things, the economic security of a country depends on the international economic and political situation, relations with neighbors and membership in powerful international economic, political and military structures [10]. The generalized foreign experience in determining the determinants that determine the formation of economic security and analysis of the regulation of the processes of economic security of enterprises at the macro and micro levels, shows ways to improve the efficiency of the economic security of Ukraine as a whole [11, 12]. The results of research on economic development of countries in the context of the global economy and, in particular, the developed economies of the world and the EU and developing countries contribute to generalizing the effects of globalization on the world economy [13].

The only source of the formation of socio-economic security is its relationship with the external and internal environment of the functioning of the state at the national level and the enterprise at the local level, as well as with the degree of protection from dangers and threats of an economic nature. We believe that the definition of "economic security" solely from the point of view of forming a response to external threats is somewhat utilitarian and does not reflect the entire set of cause-and-effect relationships and components embodied in economic security from the point of view of its social aspects. That is why we propose to consider economic security in its dialectical relationship with the development of the enterprise and its balance in the temporary space of economic life.

With the development of the country, the issues of strengthening the economic security of the state and society are becoming increasingly relevant, as a result of which there is a need to study the determinants of the formation of national security, taking into account its most important component - the social one. Consequently, the determinants of socio-economic security are a set of processes of subjects and objects involved in ensuring security, interacting and connected in time and space by certain ways of socio-economic interaction, determined by the socio-economic status, goals and functions of security subjects [14].

The economic basis as a set of production relations of society, due to a certain level of development of material productive forces, determines its social structure. Indeed, in matters of ensuring the quality of life of society at different stages of its development, the main attention was paid to the social component of security. Anti-crisis management in the context of structural changes in the economy and globalization processes is the main tool for ensuring socio-economic security and focuses on minimizing or eliminating risks and threats through the use of modern methods and techniques, as well as modern management capabilities that allow de-

veloping the priority activities of a socially and economically promising business. In general, the socio-economic security component of national security is determined by effective operation of life support systems on their territories, production of necessary material goods, positive demographic changes, provision and restoration of all conditions necessary, first of all, for the activities of rural population, careful attitude to resources, and progress in the field of production, innovation and information. This set of security elements is also systemic, requiring the same systemic impact. Along with the development of measures to strengthen economic security as a component of national security at the macro level, economic security management at the level of economic entities plays a significant role.

The study allowed to supplement the theoretical ideas about the content of the category "socio-economic security", which until now was considered solely as a state of counteracting risks and threats and achieving competitive advantages in an unstable environment and identify features of socio-economic security. The structural transformation of the national economy ensures its adaptation to the global economic environment in order to meet social needs and ensure socio-economic growth. Diagnosis of the determinants of structural transformations of the economy by its main types indicates the presence of significant imbalances. This poses a threat to its sustainable development. In order to optimize and increase the degree of reliability of national economic security, it is necessary to pursue an active structural policy involving the potential of all state institutions. Structural policy should be based on a detailed analysis of the impact of basic market and social institutions on the structure of the domestic economy.

REFERENCES:

1. Borzenko, O. (2019). Imperatives of development of post-socialist countries financial markets. *University Economic Bulletin*, (43), 80-88. DOI: 10.31470/2306-546X-2019-43-80-88 [in Ukrainian].
2. Grundke, R. and J. Arnold (2019). *Fostering Argentina's integration into the world economy*. OECD Economics Department Working Papers, No. 1572, OECD Publishing, Paris. DOI: 10.1787/7ed95b2b-en
3. Feenstra, Robert C. (1998). Integration of Trade and Disintegration of Production in the Global Economy. *Journal of Economic Perspectives*, Vol. 12 (4), 31-50. DOI: 10.1257/jep.12.4.31
4. Oliynyk, T.I. & Sievidova, I.O. (2012). *Ovochivnytstvo zakhyschenoho gruntu v konteksti zabezpechennia prodovolchoi bezpeky Ukrainy: monohrafiia* [Protected ground vegetable growing in the context of ensuring food security of Ukraine: monograph]. Kharkiv: Maidan [in Ukrainian].
5. Sievidova, I.O. (2013). *Rozvytok zovnishnotorhivelnikh perspektyv optovoho rynku silskohospodarskoi produktsii v konteksti yevrointehratsii* [Development of foreign trade prospects of the wholesale market of agricultural products in the context of European integration]. *Visnyk Kharkivskoho natsionalnoho ahrarnoho universytetu im. V.V. Dokuchaieva. Ser.: Ekonomichni nauky*, 8, 143-148 [in Ukrainian].
6. Tkachenko, S.O. (2012). *Formuvannia systemy bezpeky finansovo-hospodarskoi diialnosti pidpriemstv: kontseptualni zasady ta osnovni napriamy* [Formation of a security system for the financial and economic activities of enterprises: conceptual foundations and main directions]. *Visnyk Chernihivskoho derzhavnogo tekhnolohichnoho universytetu. Ekonomichna seriia*, №3(60), 72-77.
7. Sievidova, I.O., & Plyhun, S.V. (2019). *Osoblyvosti orhanizatsiino-ekonomichnoho mekhanizmu zabezpechennia konkurentospromozhnosti marketingovoi diialnosti pidpriemstv* [Features of the organizational and economic mechanism for ensuring the competitiveness of the marketing activities of enterprises]. *Visnyk KhNTUSH im. P. Vasylenka : «Ekonomichni nauky»*, № 202, 149-158 [in Ukrainian].
8. Nenko, S., Tyukhtenko, N., & Krasnopolska, T. (2021). Administrative and legal support for the management of integrated economic structures in a globalized business processes. *Baltic Journal of Economic Studies*, 7(4), 145-152. DOI: 10.30525/2256-0742/2021-7-4-145-152
9. Duliba, Y., & Ilkiv, O. (2017). Relevant problems of Ukraine's integration into global economy. *Baltic Journal of Economic Studies*, 3(5), 146-150. DOI: 10.30525/2256-0742/2017-3-5-146-150
10. Braddon, D. (2012). The Role of Economic Interdependence in the Origins and Resolution of Conflict. *Revue d'économie politique*, 122, 299-319. DOI: 10.3917/redp.218.0299
11. Pakhucha, E., & Sievidova, I. (2020). Business social responsibility as a component of economic security. *Norwegian Journal of Development of the International Science*, (51-4), 62-67.
12. Cherniavskiy, S., Dzhuzha O., Babanina, V., Harust, Yu. (2021). System of ensuring the economic security of the state: world experience and ways of its reform in Ukraine. *Journal of Gender and Interdisciplinarity*, Vol. 02, N.01, pp.168-206.
13. Shopina, I., Oliynyk, O., and Finaheiev, V. Globalization and its negative impact on the global economy. *Baltic Journal of Economic Studies*, № 3(5), (2017): 457-461.
14. Mohilevskiy, L., Fursa, V., Sievidova, I., Komziuk, M., Khloponina-Gnatenko O. and Pidkopai, D. (2021). Ensuring the Economic Security of Ukraine in the Aspect of the Association Agreement Between the EU. *European Journal of Sustainable Development*. № 10. Vol.2, 171-186. DOI: 10.14207/ejsd.2021.v10n2p171

HISTORICAL SCIENCES

RELIGIOUS ARGUMENTS USED TO CREATE NEGATIVE PERCEPTIONS OF WOMEN

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РЕЛИГИОЗНЫЕ АРГУМЕНТЫ, ИСПОЛЬЗУЕМЫЕ ДЛЯ СОЗДАНИЯ НЕГАТИВНОГО ВОСПРИЯТИЯ ЖЕНЩИН

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Abstract

The phenomenon of woman has always been a subject of discussion in all religions. Women throughout history have often been positioned relative to men. All aspects of her life, such as her creation and function in the world, to which she corresponds in terms of physiology, are constantly compared with men. And religions occupy the most important place in the formation of her personality. Because religions believe that God created everything and He knows its characteristics best of all. But in most cases, it is about changing the principles of religion by people in their favor. This article examines the role and importance of women in the Abrahamic religions, as well as the reasons for the change in this role in more recent times.

Аннотация

Феномен женщины всегда был предметом обсуждения во всех религиях. Женщина на протяжении всей истории часто позиционировалась относительно мужчин. Все аспекты ее жизни, такие как ее создание и функции в мире, то чему она соответствует с точки зрения физиологии постоянно сравнивается с мужчинами. И религии занимают важнейшее место в формировании ее личности. Потому что религии верят, что Бог создал все и Он лучше всех знает ее характеристики. Но в большинстве случаев речь идет об изменении принципов религии людьми в их пользу. В данной статье рассматривается роль и значение женщин в Авраамических религиях, а также причины изменения этой роли в более поздние времена.

Keywords: religion, sin, woman, rights, Christianity, Judaism, Islam.

Ключевые слова: религия, грех, женщина, права, Христианство, Иудаизм, Ислам.

Как и все религий, в Авраамических религиях есть некоторые положения о создании женщин и ее обязанностей. По крайней мере на практике, роль женщины всегда оставалась второстепенным и в итоге это привело к сомнению у верующих. На самом деле, в Иудаизме и Христианстве роль женщины, особенно той которая обманула Адама, описывается как вводящее в заблуждение и вызывающее грех который в богословии называется «первородным». Именно поэтому взгляд на женщин в христианских источниках и церкви также был негативными. Женщина приносит грех на землю, губит мужчину, соблазняет.

В Иудаизме в рамках текстов из Торы женщина рассматривается не однозначно. С одной стороны женщины выступают в роли пророков и религиозных лидеров (Дебора, Хульда, Мириам) и спасительниц (Эстер, Рахав, Абигейл), а также имеющих вес в обществе женщин (Сара, Ривка, Хана, Рут, Рахель, Лея, Иудит, Брурия и т.д.) Иудейского народа, в том числе мать почитается на равне с отцом [15, Исход, 20:12; Левит, 19:3, 20:9; Второзаконие 5:16, 27:16], а также равное отношение полов в правилах и запретах [15, Исход 20:8, 22:18; Второзаконие 5:12-14; 22:20-22, 31:12; Левит 24:13-23], с другой же стороны как сущность с отрицательными

качествами (Ева), которой не обязательно получать образование [15, Второзаконие, 11:19], выполнять религиозные обряды и молиться [15, Исход 23:17, 34:23; Второзаконие 16:16]. В Иудаизме последнее восприятие достигло такой степени, что в глазах раввинов каждое утро в молитве они благодарили Бога за то, что они не были созданы женщинами [3, с. 15-17]. Соблюдение ограниченного числа религиозных заповедей (3 из 613 мицвот) и правил чистоты после определенных дней (роды, цикл) [15, Левит 15:19-31, 12:2, 5], роды, приготовления к шаббату некоторыми приравнивается к наказанию за «первородный грех» [15, Бытие 3:16]. В своих недостатках в раввинистической литературе порицаются больше женщины, нежели мужчины [15, Бытие 45:5; Еккл. 7:49; Мэг. 14б, 15а; Кид. 80б; Таан. 23а; Зохар I, 85б и т.д.]. С другой стороны, в Торе есть два разных рассказа о творении. В первом из них утверждается, что человек был создан по образу и подобию Божию как мужчина и женщина [15, Бытие 1:26-27]. Во втором повествовании говорится, что сначала человек был создан из земли, затем из его ребра создана женщина для него [15, Бытие 2:21-25]. Хотя можно интерпретировать это как «в помощь ему» [15, Бытие 2:21-22], но никак не в «подчинение».

Главная роль, отведенная женщине в Священном писании это роль матери [15, Бытие 3:16; Нид. 456; Сот. 116; Кид. 31 6] и хранительницы очага [15, Притчи 31:28]. Но несмотря на это начиная уже с периода Второго Храма роль женщины значительно возрастает. Она совместно с мужчинами читает молитву и в завете считается равноправной [15, Неемия 10:28-29], принимают участие в построении Стены [15, Неемия, 3:12], служат на должности [15, Эздра 2:55; Неемия 7:57] и имеют права подать на развод что ранее не существовало [4, с. 177-187; 13, с. 125-126; 7, с. 423]. В последствии, Талмудическое мировоззрение на роль женщины начатое в III веке заканчивается воздействием современных идей на западных иудеев в XIX веке [5, с. 152]. Впервые в 1846 году на конференции организованной реформистским иудаизмом в Бреслау, было поднята тема о существовании тенденции в равенстве женщин во всех областях. Однако, в 1921 году этот вопрос вновь встал на первый план и наконец-то в 1972 году первая женщина была избрана в сан раввина, в реформаторских синагогах была предусмотрена смешанная рассадка и в 1973 году женщины были включены в «Миньян», в результате чего женщины смогли участвовать в общественных ритуалах и принимать участие в обучении [1, с. 72-73]. А в 1951 и 1964 гг. в Израиле были приняты законы о равноправии женщин как в частном, так и в государственном секторе.

Выражение, что первая женщина, Ева, была создана из ребра Адама, упоминается и в Торе, и в Библии. Все знают историю, где Бог берет одно из его ребер пока Адам спит, и заменяет его плотью. Создав женщину, Бог приводит ее к Адаму [15, Бытие 2/21-23] [14, с. 26-27]. По данным Ветхого Завета Адам винит Еву, а она змея, что ее обманула. В Христианстве Ева представлена так же как и в Торе [15, 1 Коринфянам 11:8-9; Тимофей 2:13-4]. Впервые Юстиан сравнивает Еву с Марией (Римлянам 5:18-20). Первая символизирует смерть и неверность, вторая же жизнь и верность [9, с. 63; 10, с. 82-86; 11, с. 545]. Не смотря на то что Иисус совершил свое первое чудо по просьбе матери, что был за обучение женщин (вспомним сестру Марты; Лука 8:1-3, 10:38-42), среди апостолов имелись женщины [15, Матфей 8:14-15, 14:21, 15:28; Иоанна 4:7-42; Лука 7:48-50, 13:13], первая кто увидела воскресшего Христа была женщиной (Магдалена), жены мироносцев [15, Лука 24:1-10; Марк 16:1-10; Иоанна 20:1-10] и посланницы Иисуса [15, Матвей 27:55; Лука 23:49, 55-56; Марк 15:40-41], он ценил и оберегал женщин [15, Лука 7:47; Марк 10:9], но так же в посланиях Павла в Новом Завете мы замечаем что роль женщины по прошествии времени преуменьшается [15, 1 Коринфянам 7:1-8; 1:3], например она не имеет права голоса в церкви [15, 1 Коринфянам 14:34], может спрашивать интересующие ее вопросы только у мужа дома [15, 1 Коринфянам 14:34-35] и муж считается главным над женщиной [15, Ефессянам 5:22-24] и она обязана ему подчиняться [15, 1 Коринфянам 7:2-4, 10-11; Ефессянам 5:22] т.д. Это начало происходить после II века, видимо тогда начало сказываться давление

Римской империи и рост поклонение Ашеру считающейся женой Яхве [8, с. 74-88].

Начиная с XVI века Протестантские теологи (Кальвинисты, Лютеране, Квакеры) приступили за изучение прав женщин. А в XIX веке создалось движение либеральной феминистской теологии. Они пытались привнести новые альтернативные взгляды на традиции, раскрывая негативные предубеждения, созданные по отношению к женщинам в религиозных текстах. Начиная с 1833 года женщинам дали право на образование. А в 1853 году женщина официально была избрана священником.

В соответствии с этими данными, которые мы очень кратко обобщили, подход в выражениях и оценках женщин в сакральных источниках первых Авраамических религий до ислама отмечается положительным. По некоторым утверждениям похожая ситуация и подобные причины негативного отношения к женщинам можно встретить и в исламской традиции [15, Ниса 4:11, 34].

О роли Евы в первородном грехе в аятах Корана нет четкого обвинения [12, Бакара 2:36; Таха 20:115-121; Худжурат 49:13]. По интерпретации аята можно понять, что змеем обмануты оба человека [12, Араф 7:20-2] [2, с. 531]. В Исламе не существует антиженский дискурс, основанный на первородном грехе. Каждый рожденный человек, будь то мужчина или женщина, рожден без греха [6, с. 497]. Тот факт, что люди созданы в разной природе подчеркивается в Коране [12, Анам 6:165] как причина испытаний и для приобретения покоя [12, Араф 7:189]. Мужчины и женщины с разными физиологическими и психологическими характеристиками описываются как дополняющие друг друга. В Исламе, настоящим феноменом является не женщина или мужчина, а сам человек [12, Нахл 16:97].

Еще несколько примеров, показывающих порождение жесткой критике это проблемы, связанные с покрыванием (хиджаб), правами женщин (брак, развод, наследство и т.д.) и полигамией. Для начала стоит отметить, что предписание покрывания существовало во всех Авраамических религиях [12, 1 Коринфянам 11:3-10; 14:34-35], просто со временем некоторые религиозные течения это правило упразднили, а Ислам продолжил традицию [12, Ахзаб 33:59 и опять таки это делается не для того чтобы угнетать женщин, а ради их защиты [16]. Что касается полигамии, то и в Иудаизме оно тоже действовало [12, Бытие 38:8-10; 2 Царств 5:13; 3 Царств 11:1-3] в плоть до XVI века. А в Исламе это скорее не правило, а исключение, которое выполняется под сложным сводом правил [12, Ниса 4:3] и не всем под силу, как материально, так и морально. А на счет прав мусульманских женщин можно лаконично подвести черту сказав, что по сравнению с другими религиями Ислам дал ей больше прав нежели какие-либо другие. Это права голоса, право выбора суженого, право на образование, право на проведение религиозных практик, право на долю в наследстве, право на собственность и право на его управление, право не делиться заработком с семьей, право на развод, право на подачу иска и выступление в качестве свидетеля и т.д.

В заключение нужно упомянуть что некоторые тексты в священных книгах вырываются из контекста и трактуются своеобразно (на примере Адама и Евы: женщина вводит мужчину в заблуждение, из-за женщины мужчина изгнан из рая, женщина безвольна, женщину наказывают рождением ребенка и т.д.) и эти подсознательные заблуждения негативно сказываются на роли женщины в обществе.

Можно так же сказать, что женщины имели более высокий метафизический, религиозный и социальный статус в начале. Но в какой-то исторический момент произошло изменение, повлекшее за собой утрату этого статуса, своих сакральных функций из рук женщины, что, в свою очередь, привело к метафизической деградации обоих полов. Таким образом, образ женщины не зависит от ее функций в религии, а роль и место женщины регламентируются событиями и личностями, происходящими в определенное время. Возрождение тенденции женщин вновь занять свое место в религии в наше время может привести к нормализации отношений между полами и установлению гармонии.

СПИСОК ЛИТЕРАТУРЫ:

1. Andrienne Baker, *The Jewish Women in Contemporary Society*. London: Susie Orbach, 1993, p. 72-73
2. Allame Zemaḥṣeri, *el-Keṣṣâf*, çev. Harun Ünal. İstanbul: Ekin, 2021, (V c.) c. III, 531
3. Birnbaum, Philip, çev., *Ha-Siddur Ha-Sahalem: Daily Prayer Book*. New York: Hebrew Publishing Company, 1949, 15-17 pp.
4. B. Porten, *The Elephantine Papyri in English: Three Millennia of Cross-Cultural Continuity and Change*. Lieden: Brill, 1996, 177-187 pp.
5. Denise Lardner Carmody, *Women and World Religions*. New Jersey: Prentice Hall, 1989. p. 152
6. Günay Tümer, “Asli günah”, *Türkiye Diyanet Vakfı İslam Ansiklopedisi*. İstanbul: TDV Yayınları, 1991, 3: 497
7. J. Baskin, *Marriage. Medieval Jewish Civilization: An Encyclopedia*, N. Roth (ed.). New York: Routledge, 2002, p. 423
8. О. Перфильева. Женщины в легендах и мифах. Москва: "Крон-Пресс", 1998. с. 74-88.
9. Ömer Faruk Harman, *İbrahimi dinlerde kadın: Hristiyanlık'ta Kadın Algısı*. İstanbul: Kadem, 2021, 63 s. (72 s.)
10. Ö.F. Harman, “Kadın”, *Türkiye Diyanet Vakfı İslam Ansiklopedisi*. İstanbul: TDV Yayınları, 2001, 2: 82-86
11. Ö.F. Harman, “Havvâ”, *Türkiye Diyanet Vakfı İslam Ansiklopedisi*. İstanbul: TDV Yayınları, 1997, 16:545
12. Коран, перевод: Кулиев Э.Р., Россия: Эксмо, 2022, 816 с.
13. Saime Leyla Gürkan, *Yahudi ve İslam kutsal metinlerinde insanın yaratılışı ve Cennet'ten düşüşü*. İstanbul: İslam Araştırmaları Dergisi, N 9, 2003, s. 26-27,
14. T.C. Eshkenazi, *Ezra-Nehemiah. Women's Bible Commentary*, 125-126 pp.
15. Библия, Книги Священного Писания Ветхого и Нового Завета. Россия: АСТ, 2014, 968 с.
16. <https://amu.org.ua/ru/islam/stanovishche-jinki-u-svitovih-relihiyah>

MATHEMATICAL SCIENCES

SOLUTION OF BIMATRIX GAMES IN PREFERRED MIXED STRATEGIES

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Abstract

In the article the task of finding the most preferred mixed strategies in finite scalar $m \times n$ bimatrix $\Gamma(A, B)$ game is studied. The equilibrium situation in the mixed strategies always exists in $\Gamma(A, B)$ game according to the Nash theorem. The problem of finding an equilibrium in the $\Gamma(A, B)$ game has a long history, but due to the complexity of the known algorithms and methods, that cause various problems, its study is being continued today. Our approach is different from these methods. In $\Gamma(A, B)$ game each player primarily has his own interest in order to do so he can act different principles in addition to the principle of Nash equilibrium. Therefore we consider such a principle in mixed strategies. To apply such a principle, the player uses Adam Smith's principle of optimality, which does not take into account the interests of the partner and acts to achieve the best result so that it is the best for him. To achieve such a result, the player in the game $\Gamma(A, B)$ ranks his pure strategies according to the advantages, for which he finds the weights of the strategies. The weight of the strategy corresponds to the probability of its choice. For such a ranking of the multiplicity of player strategies, we use Thomas Saaty's simple method of analytical hierarchy. We obtain the weight vector of the pure strategies as the preferred mixed strategy. Relevant examples are given.

Keywords: Bimatrix game, Nash Equilibrium, Preferred, Mixed strategy, Weight vector.

1. INTRODUCTION

Game theory is divided into two parts: one is a noncoaltive (as the same as noncooperative, strategic) game theory, and the second is a cooperative game theory [1;2]. Such division is based on the premise that the main unit of a noncooperative game's analysis is a rational individual participant, who tries clearly, with defined rules and possibilities to get maximal utility (payoff) from the game independently. If individuals use such actions, that can be named as "cooperation" in the ordinary sense of the word, then this is because, that such cooperative behavior is in the interest of all individuals: each avoids cooperative breach.

Strategic theory is strategically oriented. Therefore, according to this approach, the players' result depend on their abilities in the game. But the cooperative approach is concerned with the multitude of possible outcomes, not how they can be achieved. Noncooperative theory is a peculiar microtheory that provides a detailed description of what is happening in the process of the game. Thus, cooperative theory is a macrotheory compared to noncooperative, the basis of which is the theory of noncooperative games. At the same time, game theory deals with the modelling of socioeconomic processes, and is oriented toward socioeconomic applications. Consequently, the methodological and metaphysical aspect is even more essential for game theory than for other branches of mathematics, and demands move careful consideration [3].

A strategic game has two forms of presence. One is a positional form, another one is normal form. We will discuss the game in its normal form. There is no dynamics in them; each player makes only one decision (makes one move), and all players make decisions

simultaneously and independently from each other, however none of them knows what decisions have made or will make their partners. Therefore, such game is static game, where the player's strategy and move are the same. The difference can only arise in dinamic (including positional) games. In general, a player's strategy in game theory is to plan his action throughout the game, taking into account all the information recieved.

Definition 1.1. A normal (or strategic) form of a noncooperative game is called triple (model)

$$\Gamma = \langle N, \{S_i\}_{i \in N}, \{H_i\}_{i \in N} \rangle, \quad (1)$$

where $N = \{1, \dots, n\}$ is a set of players; S_i is $i \in N$ player's set of pure strategies (moves) and $H_i : S = \prod_{i \in N} S_i \rightarrow R^1$ is $i \in N$ player's function

of payoff (utility function). This function to every $S = (S_1, \dots, S_n)$ set of the players strategies that is called the **game's result**, i.e. **situation**, i.e. **profile**, matches this player's payoff (utility) - $H_i(s), i \in N$.

If there are two players participate in the (1) game, i.e. the set of players' $N = \{1, 2\}$, and their sets of strategies are finite and they respectively are $S_1 = \{1, \dots, m\}$ and $S_2 = \{1, \dots, n\}$, there exists at least one situation $(i, j) \in S_1 \times S_2$, where the payoffs sum of players' is not zero $H_1(i, j) + H_2(i, j) \neq 0$, we get two players strategy game, called $m \times n$ **bimatrix game**. Therefore, in bimatrix game the players' interest may be diametrically opposed, as well their interest may

partially coincide. Designate the players' functions of payoff $H_1 \equiv A = (a_{ij})$, $H_2 \equiv B = (b_{ij})$ and from (1) thus received bimatrix game let be $\Gamma(A, B)$ (or (A, B) bimatrix game), that will be written payoff's separately A and B matrices, or by one matrix that is composed by the pairs of players' payoffs:

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \cdot & \cdot & \dots & \cdot \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}, B = \begin{pmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \\ \cdot & \cdot & \dots & \cdot \\ b_{m1} & b_{m2} & \dots & b_{mn} \end{pmatrix}; \quad (2)$$

In (2) payoff's A and B matrices may be numeral or other elements of nature (for example vectorial). In the first case we have **scalar bimatrix game**. Both types of games are very topical with their theoretical and practical values. There are many scientific papers dedicated to solving their studies nowadays, but there are a lot of problems in such games and it is imposible to complete them. In this article we will only discuss the problems of solving the first types of games with some point of view.

Consider $m \times n$ bimatrix game $\Gamma(A, B)$ with A and B matrices of scalar payoff. It will have following form

$$(A, B) = \begin{array}{c|cccc} & 1 & 2 & \cdot & n \\ \hline 1 & (a_{11}, b_{11}) & (a_{12}, b_{12}) & \cdot & (a_{1n}, b_{1n}) \\ 2 & (a_{21}, b_{21}) & (a_{22}, b_{22}) & \cdot & (a_{2n}, b_{2n}) \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ m & (a_{m1}, b_{m1}) & (a_{m2}, b_{m2}) & \cdot & (a_{mn}, b_{mn}) \end{array} \quad (3).$$

In the strategic (1) game and therefore in (3) bimatrix game in the role of solution **Nash equilibrium** (or shortly **equilibrium**) situation is considered. Define it in (3) game in pure and in mixed strategies.

Definition 1.2. The situation (i^*, j^*) in (3) game is called an **equilibrium (or solution in the pure strategies)**, if the following inequalities are fulfilled

$$a_{i^*j^*} \geq a_{ij^*} \quad \forall i = 1, \dots, m; \quad b_{i^*j^*} \geq b_{ij^*}, \quad \forall j = 1, \dots, n. \quad (4)$$

The equilibrium situation in the (3) game may not exist in pure strategies and the equilibrium situation in the mixed strategies always exists according to the Nash theorem. Define an equilibrium situation in mixed strategies.

Like matrix games, in the given (3) $\Gamma(A, B)$ game let's note the first and the second player's mixed strategies note respectively $P = (p_1, \dots, p_m)^T$ and $Q = (q_1, \dots, q_n)^T$.

In (P, Q) situation the player's mixed payoffs (average payoffs, expected payoffs, expected utilities) respectively are equal

$$v(A) = A(P, Q) = \sum_{i=1}^m \sum_{j=1}^n a_{ij} x_i y_j = P^T A Q,$$

$$v(B) = B(P, Q) = \sum_{i=1}^m \sum_{j=1}^n b_{ij} x_i y_j = P^T B Q. \quad (5)$$

Definition 1.3. In $\Gamma(A, B)$ game, the situation (P^*, Q^*) is called an **equilibrium in mixed strategies (or solution in the mixed strategies)**, if for $\forall P, \forall Q$ strategies the following inequalities are fulfilled:

$$P^{*T} A Q^* \geq P^T A Q^*, \quad P^{*T} B Q^* \geq P^T B Q. \quad (6)$$

Also, Nash theorem asserts that in any bimatrix game there exists at least one equilibrium situation in mixed strategies, does not give the ways of finding the equilibrium situation in mixed strategies. This is a separate problem for bimatrix games, that is solved by different algorithms - Vorob'ev [4], Kuhne [5] and Mangasarian [6]. For n player's case there are algorithms for Lemke - Howson [7] and Rosenmuller [8] for noncoalition (1) games. All of these algorithms are quite complex and can not be used by students. It is relatively easy to solve a bimatrix 2×2 game, for it a graphical method is used. This requires elementary actions. 2×2 bimatrix games simulate many simple social - political situations. In particular, their usage have been studied in a teaching organization [9,10]. A lot of needs however, require the resolution of more dimensional games, for which algorithm K. Lemke [11] is formed. In addition to the listed algorithms, different methods and algorithms are used to find Nash equilibrium in bimatrix games [12;13].

All of the listed algorithm need to solve bimatrix games contain a very complex mathematical apparatus and is very difficult to use. So we tried to discuss different approaches to solve this problem.

Firstly, note that in the strategic game each player's task is to make a prediction other players' behavior. The player discusses which strategy not to use. So we have to find some way of comparing of two strategies. Obviously, none of the players will choose a strategy, if another strategy brings him more payoff. The simplest and the most natural principle to compare strategies with, is **the principle of dominance**. It is explored in the article [14]. In the same article we also studied other methods of preferred pure strategies.

Note, that in $\Gamma(A, B)$ game each player primarily has his own interest in order to do so he can act different principles in addition to Nash equilibrium principle. Therefore let's discuss some of this kind of principles in preferred mixed strategies.

2. FINDING the PREFERRED MIXED STRATEGY by HIERARCHICAL ANALYSIS METHOD

Consider $m \times n$ bimatrix game $\Gamma(A, B)$ with a A and B matrices of payoffs

$$A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \cdot & \cdot & \dots & \cdot \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{pmatrix}, B = \begin{pmatrix} b_{11} & b_{12} & \dots & b_{1n} \\ b_{21} & b_{22} & \dots & b_{2n} \\ \cdot & \cdot & \dots & \cdot \\ b_{m1} & b_{m2} & \dots & b_{mn} \end{pmatrix}. \quad (7)$$

Assume that the goal of the 1st player in a given game is to win as many as possible regardless of the interests of the 2nd player. This means that he does not use the principle of Nash equilibrium and therefore uses the principle of Adam Smith's optimality, which does not take into account the interests of the partner and according to which "to act for the best result so that it is best for him". To do this, of course, he will not use his dominated pure strategies and will free the profit matrix from such [14]. The player will then try to rank the number of his strategies according to the advantages. The order of such advantages can be determined through certain weights of strategies. Match the weight of the strategy to the probability of its choice. This is how we get the weight vector of clear strategies, which we consider to be the player's preferred mixed strategy. At the same time it will be a fully mixed strategy.

To rank the multiplicity of player strategies in this way, use the Thomas Saaty's analytical hierarchy method [15].

Let's start the game $\Gamma(A, B)$ by solving a set of strategies in the game for a set of 1 player strategies $S_1 = \{1, \dots, m\}$. Use the method of analytical hierarchy to pairwise compare $(i, j), i = 1, \dots, m; j = 1, \dots, n$ situations on the set of A matrix elements. Here are the qualitative advantages: 1) equally superior, 2) weakly superior, 3) strongly superior, 4) very strongly superior, and 5) absolutely superior. In the role of the corresponding quantitative scale, consider a transit scale with an advantage $a = 2$ coefficient. Then the mentioned quality scale corresponds to the corresponding quantitative scale: 1) 1, 2) 2, 3) 4, 4) 8, 5) 16.

As it is known, using the method of analytical hierarchy is quite time consuming. We therefore use a simple method of calculating the weight vector [16], according to which: the player determines the elements of the first line of the pairwise comparison (or estimation) S_A matrix, for which he compares the situation

(1,1) with the situations $(1,1), (1,2), \dots, (1,n); (2,1), \dots, (2,n); \dots, (m,1), \dots, (m,n)$, whose number is $m \cdot n$. In comparison with other situations $(i, j), i = 1, \dots, m; j = 1, \dots, n$ of the situation (1,1) we mean how much profit is superior a_{11} to other $a_{ij}, i = 1, \dots, m; j = 1, \dots, n$ gains on the mentioned scale. One of the difficulties in using this method is how much the point a_{ij} considered as the starting point of the calculation of profits (benefits) compared to the numbers taken on the number axis is superior to each other separately.

Axiom. The weight of the player strategy (probability of selection) is equal to the sum of the weights of the situations corresponding to this strategy:

$$p_i = \sum_{j=1}^n p(i, j), \quad i = 1, \dots, m,$$

p_i is the weight of the 1st player's pure strategy, $p(i, j)$ is the weight of the situation (i, j) .

Let's start by evaluating the situation (1,1) with advantage over other situations $(1, j), j = 1, \dots, n; (2, j), j = 1, \dots, n; \dots; (m, j), j = 1, \dots, n$.

Let's denote these rating accordingly as follows:

$$\alpha_{11} = 1, \alpha_{12}, \dots, \alpha_{1n}; \alpha_{21}, \dots, \alpha_{2n}; \dots; \alpha_{m1}, \dots, \alpha_{mn}. \quad (8)$$

Evaluations $\alpha_{ij}, j = 1, \dots, n$ are called situation assessments of the 1st player's i ($i = 1, \dots, m$) strategy. Place these estimates in the first row of the rating matrix S_A .

(8) calculate the following divisions in the order given for each $i = 1, \dots, m$:

$$\alpha_{ij}^0 = a_{mn} / a_{ij} > 0, \quad j = 1, \dots, n, \quad (9)$$

where $\alpha_{11}^0 = \alpha_{mn}, \alpha_{mn}^0 = 1$. We place these values even in the last column of the matrix S_A . Fractions (9) are the division of the last α_{mn} evaluation of the first line of the evaluation S_A matrix with the evaluations of the same line $\alpha_{11} = 1, \alpha_{12}, \dots, \alpha_{1n}; \dots; \alpha_{m1}, \dots, \alpha_{mn}$:

	(1,1)	(1,2)...	(1, n);	(2,1) ...	(2, n);	...;	(m,1)...	(m, n)
(1,1)	$1 = \alpha_{11}$	$\alpha_{12}...$	$\alpha_{1n};$	α_{21}	$...$	$\alpha_{2n};$	$...$	$\alpha_{m1}...\alpha_{mn}$
(1,2)	.	1	.	.	.	.	.	α_{12}^0
.								.
(1, n);	.	.	.	.	.	.	.	$\alpha_{1n}^0;$
$S_A = (2,1)$								α_{21}^0
.								.
(2, n);	.	.	.	.	.	.	.	$\alpha_{2n}^0;$
.								.
(m,1)								α_{m1}^0
.								.
(m, n)								$1 = \alpha_{mn}^0$

(10)

All numbers in the last column of the rating matrix S_A are positive. Draw a vector from them P :

$$P = (\alpha_{11}^0, ..., \alpha_{1n}^0; \alpha_{21}^0, ..., \alpha_{2n}^0; ...; \alpha_{m1}^0, ..., \alpha_{mn}^0).$$

Let us normalize this vector and let's denote it $P^N = (p_{11}^1, ..., p_{1n}^1; p_{21}^2, ..., p_{2n}^2; ...; p_{m1}^m, ..., p_{mn}^m).$

The components of the weighted vector $(p_{i1}^i, ..., p_{in}^i), i=1, ..., m$ create the weights of the situations corresponding to the first player's i strategy. According to the axiom, for each i find the sums

$$p_i^* = \sum_{j=1}^n p_{ij}^i, i=1, ..., m, \text{ that represent the weight of}$$

the pure i strategy or the probability of choosing it.

Conclusion 1. $p_1^*, p_2^*, ..., p_m^*$ weight will rank for the advantages of pure strategies $i=1, ..., m$ -more weight corresponds to the preferred pure strategy.

Thus the vector $P^* = (p_1^*, p_2^*, ..., p_m^*)^T$ obtained from the vector P^N represents the preferred mixed strategy of the 1st player in the bimatrix game (7) (or the preferred strategy according to A. Smith). The preferred mixed strategy of the preferred mixed strategy of the 2nd player in the given game is denote by $Q^* = (q_1^*, q_2^*, ..., q_n^*).$

We will discuss examples below and compare preferred mixed strategies with equilibrium mixed strategies in terms of profitability and sustainability: We will look at examples below and compare it to equilibrium mixed strategies in terms of gain and

sustainability: Will a player win more by using a preferred mixed strategy if his partner can not predict and use a balanced mixed strategy? In addition to the above, a variety of content questions can also be asked here. We will try to answer some of them. We note, however, that the introduction of a predominant mixed strategy into a strategy game is a problematic issue, and it requires a deep analysis.

3. EXAMPLES

Example 1. Find the preferred mixed strategies in $\Gamma(A, B)$ bimatrix game

$$A = \begin{pmatrix} 2 & 3 \\ 1 & 4 \end{pmatrix}, B = \begin{pmatrix} 4 & 6 \\ 6 & 0 \end{pmatrix}.$$

Solution. In the present game there is no equilibrium situation in pure strategies. Here is the only equilibrium situation in mixed strategies $(X^*, Y^*) = ((0,75;0,25)^T, (0,5;0,5)^T)$, and there are player wins $v(A) = 2,5; v(B) = 4,5$.

To find the preferred mixed strategy $P^* = (p_1^*, p_2^*)$ of the 1st player, compare the number $a_{11} = 2$ with the other elements of the matrix A on the above-mentioned quantitative scale of advantages. To do this, express such advantages in the following table of advantages (table 1). According to this table, the advantage $2 \succ 1$ is weak and it is rated by 2. Because $3 \succ 2$ it is weakly valued at 2, so $2 \succ 3$ it is valued at $\frac{1}{2}$. Also, $4 \succ 2$ strongly or by 4, , so $2 \succ 4$ it is evaluated by $\frac{1}{4}$.

Table 1

Advantages.			
$2 \succ$	1	3	4
situation (i, j)	(2,1)	(1,2)	(2,2)
rating	2	$\frac{1}{2}$	$\frac{1}{4}$

Find the rating S_A matrix:

$$S_A = \begin{matrix} & \begin{matrix} (1,1) & (1,2) & (2,1) & (2,2) \end{matrix} \\ \begin{matrix} (1,1) \\ (1,2) \\ (2,1) \\ (2,2) \end{matrix} & \begin{pmatrix} 1 & \frac{1}{2} & 2 & \frac{1}{4} \\ & 1 & & \frac{1}{2} \\ & & 1 & \frac{1}{8} \\ & & & 1 \end{pmatrix} \end{matrix} \quad (11)$$

From here $P = \left(\frac{1}{4}, \frac{1}{2}, \frac{1}{8}, 1\right)$ is the sum of its components $\frac{15}{8}$ and will be the normalized weight vector $P^N = \left(\frac{2}{15}, \frac{4}{15}, \frac{1}{15}, \frac{8}{15}\right)$. From here we get 1st player preferred mixed strategy $P^* = \left(\frac{2}{5}, \frac{3}{5}\right)^T$.

Now find the preferred mixed strategy Q^* of the 2nd player, for which we consider the winning matrix

$$B^T = \begin{pmatrix} 4 & 6 \\ 6 & 0 \end{pmatrix}.$$

Consider the following table of benefits here and compile a rating matrix:

4 >	0	6
situation (i, j)	(2,2)	(1,2),(2,1)
rating	4	0,5

$$S_B = \begin{matrix} & \begin{matrix} (1,1) & (1,2); & (2,1) & (2,2) \end{matrix} \\ \begin{matrix} (1,1) \\ (1,2); \\ (2,1) \\ (2,2) \end{matrix} & \begin{pmatrix} 1 & 0,5 & 0,5 & 4 \\ & 1 & & 8 \\ & & 1 & 8 \\ & & & 1 \end{pmatrix} \end{matrix}.$$

From here $Q = (4,8;8,1)$, By which normalization we will get the vector $Q^N = \left(\frac{4}{21}, \frac{8}{21}, \frac{8}{21}, \frac{1}{21}\right)$ from which the 2nd player will be the preferred mixed strategy $Q^* = \left(\frac{4}{7}, \frac{3}{7}\right)^T$.

Suppose the 1st player uses a superior mixed strategy $P^* = \left(\frac{2}{5}, \frac{3}{5}\right)^T$, while the 2nd uses a balanced mixed $Y^* = \left(\frac{1}{2}, \frac{1}{2}\right)^T$ strategy. Then the payoffs of the players in the situation (P^*, Y^*) will be $v_1(P^*, Y^*) = 3,1$; $v_2(P^*, Y^*) = 3,8$. Hence, the winnings of the 1st increased (were 2,5) compared to the equilibrium situation of Nash, and the winnings of the 2nd decreased (were 4,5).

What is the maximum strategy of the 1st player? There is a saddle point (1,1) in the matrix payoff A

and the corresponding payoff 2. In a bimatrix game, payoff 1 by Nash equilibrium is greater than, that, as we have seen, the payoff obtained by the preferred mixed strategy are greater than all the others.

The advantage of players in a situation of mixed strategies (P^*, Q^*) is the payoffs of the players

$$v_1(P^*, Q^*) = P^{*T} A Q^* = 2,34,$$

$$v_2(P^*, Q^*) = P^{*T} B Q^* = 4.$$

Thus, if both players use the preferred mixed strategy, then both winnings are less than they were in the equilibrium situation, ie. it is better for both of them to use balancing strategies

Note 1. It is easy to check that the situation (P^*, Q^*) does not satisfy the Nash equilibrium conditions.

Now assume that the 2nd player uses the preferred mixed strategy and the 1st the balanced one. Then $v_1(X^*, Q^*) = 2,32$, $v_2(X^*, Q^*) = 4,57$, e.g. compared to the equilibrium situation, the gain of 1 decreased slightly and the gain of 2 increased slightly.

Based on the answers received, it is the best for the player to use a preferred mixed strategy if his partner is unable to guess this decision.

As we have seen so far, there is some difficulty in compiling a table of such priorities, the rest being easily calculated by the other established method.

Example 2. A bimatrix game of "Prisoners' Dilemma" is given

$$A = \begin{pmatrix} -1 & -10 \\ 0 & -8 \end{pmatrix}, B = \begin{pmatrix} -1 & 0 \\ -10 & -8 \end{pmatrix}.$$

Here Nash equilibrium is a situation (2,2), in which the players payoffs is equal to (-8), while in mixed strategies there is no equilibrium situation. Find the players' preferred mixed strategies.

Consider the table of advantages of the 1st player as follows:

-1 >	-10	-8	0
situation (i, j)	(1,2)	(2,2)	(2,1)
rating	16	8	0,5

$$\text{We get it } P^* = \left(\frac{17}{51}, \frac{34}{51}\right)^T.$$

If

$$B^T = \begin{pmatrix} -1 & 0 \\ -10 & -8 \end{pmatrix}$$

we discuss the table of advantages for the matrix with the same scale we used for the A matrix elements:

-1 >	-10	-8	0
situation (i, j)	(2,1)	(2,2)	(1,2)
rating	16	8	0,5

Then the 2nd player's preferred mixed strategy will be the same as the 1st one $Q^* = \left(\frac{17}{51}, \frac{14}{51}\right)^T$.

The expected average winnings of the players in the received situation (P^*, Q^*) is equal $v_1(P^*, Q^*) = v_2(P^*, Q^*) = -5,9$, to which is greater than the winnings obtained in the equilibrium situation. The situation (P^*, Q^*) is therefore preferable to the Nash equilibrium situation for both players, indicating the advantage of using them.

Conclusion 2. The player's preferred mixed strategy is approaching to the Nash equilibrium mixed strategy.

Example 3. Find the preferred mixed strategies in a bimatrix game

$$A = \begin{pmatrix} 6 & 0 & 2 \\ 0 & 4 & 3 \\ 7 & 0 & 0 \end{pmatrix}, B = \begin{pmatrix} 5 & 0 & 6 \\ 0 & 3 & 0 \\ 1 & 2 & 3 \end{pmatrix}.$$

Solution. Here we have one equilibrium situation in pure strategies (2,2) with payoffs (4,3) and one equilibrium situation in mixed strategies

$$(X^*, Y^*) = \left(\left(\frac{3}{10}, \frac{4}{10}, \frac{3}{10} \right)^T, \left(\frac{8}{23}, \frac{11}{23}, \frac{4}{23} \right)^T \right)$$

payoffs $v(A) \approx 2,4$, $v(B) = 1,8$.

Consider the table of 1st player benefits as follows

6 >	0	2	3	4	7
situation (i, j)	(1,2),(2,1), (3,2),(3,3)	(1,3)	(2,3)	(2,2),	(3,1)
rating	16	8	4	2	0,5

We will find out through it $P = (16, 1, 2, 1, 8, 4, 3, 2, 1, 1)$ and the 1st player will be the preferred mixed strategy

$$P^* = \left(\frac{19}{66}, \frac{13}{66}, \frac{34}{66} \right)$$

For the 2nd player's payoff matrix

$$B^T = \begin{pmatrix} 5 & 0 & 1 \\ 0 & 3 & 2 \\ 6 & 0 & 3 \end{pmatrix}$$

Suppose it is a table of advantages

5 >	0	1	2	3	6
Sit. (i, j)	(1,2),(2,1), (3,2)	(1,3)	(2,3)	(2,2), (3,3)	(3,1)
rating	16	8	4	2	0,5

From here

$$Q = \left(\frac{1}{2}, \frac{1}{32}, \frac{1}{16}, \frac{1}{32}, \frac{1}{4}, \frac{1}{4}, \frac{1}{32}, 1 \right)$$

and $Q^* = \left(\frac{19}{101}, \frac{17}{101}, \frac{65}{101} \right)$ In the situation of the preferred mixed strategies, the players payoffs $v_1(P^*, Q^*) \approx 1,65$, $v_2(P^*, Q^*) \approx 2,7$. Comparing the profit values, it can be seen that compared to the equilibrium situation in mixed strategies, the profit of 1 in this case decreased (was 2,4), and the profit of the 2nd increased (was 1,8). In both situations the player's payoffs are significantly less than in the equilibrium situation in pure strategies. So it is not advisable to use mixed strategies in a given game in order to make a high payoff.

Example 4. Solve a bimetric game in preferred mixed strategies

$$A = \begin{pmatrix} -1 & 0 & 0 \\ 0 & -1 & -1 \end{pmatrix}, B = \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \end{pmatrix}.$$

Solution. Without solving we will write the situation in the given game into the preferred mixed strategies

$$(P^*, Q^*) = \left(\left(\frac{5}{9}, \frac{4}{9} \right)^T, \left(\frac{6}{14}, \frac{5}{14}, \frac{3}{14} \right)^T \right),$$

and there players' payoffs are $v_1(P^*, Q^*) \approx -0,49$, $v_2(P^*, Q^*) \approx 0,1$.

The situation has a face in balanced mixed strategies

$$(X^*, Y^*) = \left(\left(\frac{1}{3}, \frac{2}{3} \right)^T, \left(\frac{1}{2}, \frac{1}{2}, 0 \right)^T \right),$$

the payers' payoffs are $v(A) = -0,5$, $v(B) = \frac{1}{3}$.

Here, too, the winnings of the players in both situations are close to each other.

Conclusion 3. If we consider that the situation of the preferred mixed strategies is a certain approximation to the equilibrium situation, then we can say that finding the preferred mixed strategies is incomparably easier to say compared to the Lemke algorithm.

4. CONCLUSION

The players preferred mixed strategies existence in a bimatrix game are explored. To determine them, the ranking of players' pure strategies with advantages over the winnings using a quantitative scale using a simple method of analytical hierarchy is considered. We find weights of clear strategies that correspond to the probabilities of their choice. The weighted vector of pure strategies thus obtained is the preferred mixed strategy. Examples are discussed that compare preferred mixed strategies with equilibrium mixed strategies in terms of profitability and sustainability. The situation in the preferred mixed strategies generally does not meet the Nash equilibrium conditions and such a situation represents an approximation of the Nash equilibrium situation. Finding the preferred mixed strategies in bimatrix games is very simple easier than any algorithm for solving it. Such an introduction of a predominant mixed strategy into a strategy game is a problematic issue that requires its continuation in the future.

REFERENCES:

1. Owen G. Game Theory. Academic Press, Third Edition, 1995, 459 p.
2. Vorob'ev N.N. Foundations of Game Theory. Noncooperative Games. Birkhauser Verlag, Basel – Boston – Berlin, 1994, 496 p.
3. Beltadze G. Game theory: A mathematical theory of correlations and equilibrium. Georgian Technical University, Tbilisi, 2016, 505 p. (in Georgian).
4. Vorob'ev N.N. Equilibrium situations in bimatrix games. *Teor. Veroznost I Primenen.* 3, no. 3 1958, pp. 318-331 (in Russian).
5. Kuhn H.W. An algorithm for equilibrium points in bimatrix games. *Proc. Nat. Acad. Sci. USA* 47, 1961, pp. 1657- 1662.
6. Mangasarian O.L. Equilibrium points in bimatrix games". *Journal Soc. Industr. Appl. Math.*, Vol 12, 1964, pp. 778- 780.
7. Lemke C. E. and Howson J.T. Equilibrium points of bimatrix games. *Journal of the Society for Industrial and Applied Mathematics*, Vol 12, no. 2, 1964, pp. 413-423.
8. Rosenmuller J. On e generalization of the Lemke-Howson algorithm to noncooperative N -person games. *SIAM Journal on Applied Mathematics*, Vol 21, no. 1 (1971), pp. 73-79.
9. Beltadze G.N. Game Theory - basis of Higher Education and Teaching Organization“. *International Journal of Modern Education and Computer Science (IJMECS)*. Hong Kong, Volume 8, Number 6, 2015, pp. 41-49.
10. Salukvadze M.E., Beltadze G.N. Strategies of Nonsolidary Behavior in Teaching Organization. *International Journal of Modern Education and Computer Science (IJMECS)*. Hong Kong, Volume 9, Number 4, 2017, pp. 12-18.
11. Lemke C.E. Bimatrix equilibrium points and mathematical programming. *Management Science*. Vol 11, no. 7, New York, 1965, pp. 681-689.
12. Savani R. Finding Nash equilibria of bimatrix games. A thesis of PhD. London School of Economics and Political Science, 2009, 116 p.
13. Balthasar Anne Verena. Geometry and equilibria in bimatrix games. A thesis submitted for the degree of Doctor of Philosophy. Department of Mathematics London School of Economics and Political Science, 2009, 107 p.
14. Beltadze G.N. The Solution of Scalar Bimatrix Games in Preferred Pure Strategies. *International Journal of Modern Education and Computer Science (IJMECS)*. Hong Kong, Volume 12, Number 3, June, 2020, pp. 1-7.
15. Saaty Thomas L. Fundamentals of Decision Making and Priority Theory with the Analytic Hierarchy Process. RWS Publications, 1994, 527 p.
16. Beltadze G.N. The problem of multiple election in the case of multicriteria candidates“. *Transaction Technical University of Georgia*, №4 (474), 2009, pp. 66-80 (in Georgian).

MEDICAL SCIENCES

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FEATURES OF PROSTHETICS IN PATIENTS WITH REMOVABLE LAMELLAR DENTURES IN THE PRESENCE OF SINGLE TEETH

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ОСОБЕННОСТИ ПРОТЕЗИРОВАНИЯ ПАЦИЕНТОВ СЪЁМНЫМИ ПЛАСТИНЧАТЫМИ ПРОТЕЗАМИ ПРИ НАЛИЧИИ ОДИНОЧНО СТОЯЩИХ ЗУБОВ

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Abstract

The results of the study showed that when using clasp fixation on single teeth, atrophic changes in the periodontium occurred earlier and were more severe than when using prosthesis structures that overlap the roots of the teeth and are fixed with spherical attachments. Fixation on intracoronary spherical attachments is more prognostically favorable for the preservation of periodontal tissues than clamp fixation, and more preferable in cases of subtotal dentition defects with preservation of single supporting teeth

Аннотация

Результаты исследования показали, что при использовании кламмерной фиксации на одиночных зубах атрофические изменения в пародонте возникали в более ранние сроки и имели более тяжелую степень, чем при использовании конструкций протезов, перекрывающих корни зубов и фиксированные с помощью сферических аттачментов. Покрывные конструкции съёмных протезов с фиксацией на интракоронарных сферических аттачментах являются более прогностически благоприятными для сохранения тканей пародонта, нежели кламмерная фиксация, и более предпочтительными в случаях с сохранением одиночно стоящих опорных зубов.

Keywords: partial removable dentures, overdentures, abutment teeth, periodontal tissues.

Ключевые слова: частичные съёмные протезы, покрывные протезы, опорные зубы, ткани пародонта.

Несмотря на развитие современных стоматологических технологий, потеря зубов остается проблемой, которая обуславливает значительную потребность в съёмном протезировании среди взрослого населения. В результате генерализованных форм патологии пародонта образуются дефекты зубных рядов значительной длины, при этом выраженная атрофия альвеолярных отростков челюстей приводит к возникновению крайне сложных условий для ортопедического лечения [1]. Конструирование протезов при субтотальных дефектах, когда на челюстях сохраняются лишь несколько зубов, является сложной клинической проблемой. Крепление на одиночных опорах не обеспечивает надежной фиксации и стабилизации протезов и приводит

к значительной функциональной перегрузке тканей пародонта [2, 3]. Наиболее рациональным способом замещения подобных дефектов является использование ортопедических конструкций на внутрикостных имплантатах. [3,4]. Однако возможность протезирования с опорой на имплантаты не является доступной для широкой общественности из-за высокой стоимости лечения, а также ограничивается рядом общих противопоказаний, количество которых растёт в соответствии с увеличением возраста пациентов [5]. Поэтому наиболее распространенным видом ортопедических конструкций, используемых для замещения дистально неограниченных и больших включенных дефектов зубных рядов, остаются частичные съёмные протезы (ЧЗП).

Наиболее часто используемой конструкцией является частичный съемный пластинчатый протез с удерживающими кламмерами. Доказано, что точечная кламерная фиксация на одиночных зубах приводит к значительной перегрузке их пародонта [6]. Наиболее сложным планирование конструкции частичных съемных протезов являются пациенты с сохранившимися единичными зубами на челюстях.

В этих случаях в полости рта наблюдаются крайне неудовлетворительные условия анатомической ретенции, так как из-за предыдущих воспалительных и дистрофических процессов в костной ткани атрофия альвеолярных отростков достигает значительной степени, что приводит к уменьшению площади протезного ложа [7]. У зубов, еще сохранных в полости рта, как правило налицо атрофия стенок альвеол, вследствие чего выносливость их пародонта снижена, что приводит к быстрой их потере в случае использования в качестве опоры под кламер. Наиболее критической эта проблема является в случаях протезирования на нижней челюсти, где протезное ложе мало по площади и окружено мощными подвижными тканями, которые приводят к значительным экскурсиям протеза во время функции речи и жевания. В процессе пользования нижнечелюстными протезами с традиционной кламерной фиксацией возникают осложнения, обусловленные перегрузкой зубов вследствие подвижности съемных ортопедических конструкций. Перегрузка опорных зубов приводит к их разрушению, раскачиванию или удалению, что еще больше ухудшает условия для фиксации съемных протезов.

Способ фиксации не только имеет значение для удержания съемного протеза в полости рта во время функции, но и влияет на состояние тканей пародонта, а следовательно на срок службы опорных зубов. Существуют различные виды механического крепления съемных протезов, однако самой распространенной остается кламерная фиксация. Существенным недостатком использования кламмеров при сохранении одиночных зубов является перегрузка пародонта. Альтернативным способом протезирования при наличии одиночных зубов являются покрывные конструкции съемных протезов, опирающиеся на альвеолярные отростки и корни зубов и фиксирующиеся с помощью замковых креплений. К преимуществам покрывных конструкций перед обычными кламерными ЧСП относят надежную фиксацию за счет как механических креплений, так и функциональной присасываемости, равномерное распределение жевательного давления на ткани протезного ложа и более физиологическое вертикальное направление нагрузки опорных зубов, эстетический вид при отсутствии видимых элементов крепления. Развитие высокоточных технологий дает возможность улучшить качество съемного протезирования за счет использования в покрывных протезах современных видов механических креплений, в частности замковых, балковых и телескопических систем фиксации.

Материалы и методы

Проведено обследование и ортопедическое лечение 24 человек в возрасте 65-80 лет с большими

дефектами зубных рядов и сохранением на челюстях одиночных (1-3) зубов. Пациенты были разделены на две клинические группы: 11 человек, которым изготовили покрывные протезы с фиксацией на сферических атачментах составили основную группу; 13 человек, которым изготовили протезы классическими ЧСП с кламерной фиксацией вошли в контрольную группу. Пациенты находились под диспансерным надзором в течение 1,5 лет после изготовления съемных протезов. Изготовление протезов осуществлялось согласно общепринятым технологиям. Пациентам основной клинической группы были изготовлены покрывные протезы с пластмассовым базисом и фиксацией с помощью сферических полулабильных замковых креплений расположенных интракоронарно на штифтовых вкладках. Опорные зубы подлежали эндодонтическому лечению и укорачивались до уровня 2 мм над десневым краем. Корневые каналы препарировались под цельнолитые штифтовые вкладки согласно общепринятым требованиям. Получали анатомические оттиски для изготовления окклюзионных валиков и жестких индивидуальных ложек. После определения центрального соотношения челюстей проводили подгонку индивидуальных ложек с помощью функциональных проб Гербста, как при полной адентии. На рабочей модели осуществлялось моделирование штифтовых вкладок с патрицами сферических атачментов и съемного протеза с матричными частями крепления в базисе. Внутрикорневые вкладыши использовали для установки патричной части замкового крепления, которая размещалась в над десневой части в проекции центра корня. Матричная часть замкового крепления устанавливалась в базе несъемного протеза; жесткость силиконовой матрицы для крепления выбирали в зависимости от податливости слизистой оболочки – при умеренной степени податливости использовали желтые матрицы средней жесткости, при значительной податливости – мягкие красные матрицы. Границы базиса конструировали как при полной адентии с созданием краевого замыкающего клапана. Это препятствует попаданию воздуха под протез, который во время функционирования удерживается на челюсти за счет разницы давления между внешней средой и в пространстве под базисом.

Результаты исследования и их обсуждение

В основной группе 4 (36,36%) лиц имели дефект на верхний, 7 (63,67%) – на нижней челюсти; из них сохранными на челюсти трех зубов – 1 (9,1%), двух зубов – 7 (63,63%), одного зуба – 3 (27,27%) человека. В контрольной группе 5 (38,46 %) лиц имели дефект на верхней, 8 (61,54 %) – на нижней челюсти; из них сохранение на челюсти трех зубов – у 2 (15,39 %), двух – 6 (46,15%), одного – у 5-ти (38,46%) человек. Клиническую оценку результатов ортопедического лечения проводили через 6 месяцев, 1 и 15 года по таким же параметрам, как наличие воспаления тканей маргинального пародонта, динамика атрофии костной ткани в участке опорных зубов и их потеря на протяжении всего срока пользования протезами.

Через 6 месяцев после протезирования у лиц основной и контрольной группы клинических изменений состояния тканей пародонта опорных зубов по сравнению с состоянием до протезирования не выявлено. В контрольной группе в течение года пользование протезами с кламерной фиксацией 2 (15,38%) зуба было потеряно из-за значительной подвижности. Потеря опорных зубов у пациентов основной группы в течение 1.5 года пользования протезами с замковым креплением не отмечена. В контрольной группе, где пациенты пользовались протезами с кламерной фиксацией, в течение полутора лет количество потерянных опорных зубов увеличилось еще на 4 (30,76%). Исходя из результатов клинического наблюдения установлено, что у лиц контрольной группы, которые пользовались ЧЗП с кламерной фиксацией, атрофические изменения тканей пародонта опорных зубов развивались более быстро и имели более тяжелую степень, чем у лиц основной группы, которые пользовались покровными протезами с фиксацией на аттачментах. В течение рекомендованного полугодового срока пользования кламерными протезами у пациентов контрольной группы было потеряно 6 (46,15%) опорных зубов; также в конце этого еще у 4 (30,76%) зубов атрофия ячеистых стенок достигла третьей степени, что исключило их дальнейшее использование для фиксации любых ортопедических конструкций. У лиц основной группы, где для фиксации протезов использованы сферические аттачменты, случаев потери опорных зубов из-за расшатывания не выявлено; в конце контрольного срока пользования протезами также обнаружены зубы с третьей степенью атрофии ячеистых стенок, но количество таких зубов меньше, чем у лиц контрольной группы – 1 (7,69%) случаев (против 4 (30,76%) случаев в контрольной группе. Это можно объяснить тем, что применение покровной конструкции протезов уменьшает действие трансверзального компонента жевательной нагрузки на опорные зубы. Использование для фиксации протезов аттачментов, расположенных интракоронарно в проекции корней, обеспечивает более физиологическое распределение жевательного давления на опорный зуб, чем в случае использования кламера. Таким образом, конструкция покровного протеза обеспечивает использование всех возможных факторов фиксации – механического крепления, анатомической ретенции протезного ложа, адгезии базиса к слизистой оболочке и созданию замыкающего клапана. Благоприятные результаты сохранения приемлемого состояния тканей пародонта опорных зубов

также достигаются при использовании сферических аттачментов в других конструкциях частичных съемных. При наличии одиночно расположенных корней зубов, перекрытия их базисом протеза и установки замкового крепления позволяет создать дополнительный пункт фиксации протеза и замедлить процесс атрофии беззубых участков альвеолярных отростков. Конструирование базиса с границами полного съемного протеза позволяет улучшить фиксацию также за счет функционального присасывания, отсутствие видимых частей механических креплений создает более эстетический вид протезов.

СПИСОК ЛИТЕРАТУРЫ:

1. Князевич В.М. Стоматологічна допомога в Україні / В.М. Князевич, М.В. Голубчиков, О.В. Павленко та ін. – К.: Полімед, 2009. – 43 с.
2. Кулаков А.А. Организация медико-социальной стоматологической помощи лицам пожилого и старческого возраста. Состояние проблемы в целом / А.А. Кулаков, Ю.М. Максимовский // Стоматология. – 2010. – № 5. – С. 43–44.
3. Проценко А.С. Потребность в стоматологической помощи лиц преклонного возраста с учетом состояния их зубочелюстной системы и соматического статуса / А.С. Проценко, Е.Г. Свистунова // Молодой ученый. – 2011. – Т. 2, № 11 (34). – С. 188–190.
4. Стоматологический статус людей пожилого и старческого возраста / А.К. Иорданишвили, С.В. Солдатов, Л.Н. Солдатова и др. // Успехи геронтологии. – 2010. – Т. 23, № 4. – С. 644–651.
5. Каленчук В. В. Рациональні методи лікування вторинної адентії у пацієнтів знесприятливими клінічно-анатомічними змінами / В.В. Каленчук, П.В. Польовий // Актуальні проблеми сучасної медицини // Вісник Української медичної стоматологічної акадeмії. – 2009. – Т. 9, вип. 4. – С. 216–217.
6. Обоснование конструкции комбинированного кламмера для фиксации частичного съемного пластиночного протеза верхней челюсти при одиночно стоящем зубе / С.А. Хорхордин, Е.Л. Альберт, М.И. Обухов, И.Л. Яловой // Актуальні проблеми сучасної медицини // Вісник Української медичної стоматологічної акадeмії. – 2009. – Т. 9, вип. 4. – С. 197–199.
7. Левандовський Р.А. Ортопедична реабілітація хворих на складну щелепно-лицеву патологію із застосуванням дентальних імплантатів: дис. ... д-ра мед наук: спец. 14.01.22 «Стоматологія» / Р.А. Левандовський. – Чернівці, 2015 – 390 с

THE NEED TO USE MODERN METHODS OF ORAL HYGIENE IN PATIENTS WITH FIXED DENTURES

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Abstract

The problem of replacing the partial absence of teeth remains relevant and today due to the high prevalence of defects in the dentition. One of these methods is the use of fixed metal-ceramic bridges, fixed both on abutment teeth as well as on implants. It is known that for the duration of the use of these structures is particularly affected by hygiene oral cavity, which can be carried out both with a toothbrush and with the help of irrigators.

The aim of the study was a clinical study of the effect of the use of irrigators on periodontal condition and oral hygiene in patients with based on natural teeth and implants. 25 patients who underwent orthopedic treatment with the use of aesthetic metal-ceramic fixed prostheses. The first group consisted of 13 patients with prosthetic ceramic-metal bridges, which after fixation fixed structures used an irrigator. Of these, five patients fixation of fixed prostheses on implants was carried out. second group consisted of 12 patients prosthetized with metal-ceramic bridges, which, after fixing fixed structures used a toothbrush. Four of them have dentures fixed was carried out on implants. Study of the state of oral hygiene was performed using the PBI gum bleeding index, hygiene index Sillnes-Loe and Schiller-Pisarev samples, which were determined before fixation of orthopedic structures, after one month and three months after prosthetics. When performing the study, we used JETPIK irrigators, the peculiarity of which is the use of smart floss technology that combines the power of a water jet and penetrating power of pulsating dental floss. Irrigator provides deep cleansing in places inaccessible to a toothbrush, strengthens the gums. With the help of clinical examination methods, in particular indexes of bleeding gums, oral hygiene, samples Schiller-Pisarev, it was proved that in patients who used the JETPIK irrigator, one and three months after the fixation of fixed dentures these indicators were significantly better than in patients who only a toothbrush was used for oral hygiene.

Keywords: fixed dentures, irrigators, oral hygiene, Abutment teeth, fixed constructions, irrigators.

The rapid development of modern society is characterized not only by rapid development of modern technologies, but also high requirements for the physical characteristics of the human body. One of them is an aesthetic component, due, in particular, condition of the oral cavity. A number of factors are known to influence high aesthetic characteristics: balanced nutrition, compliance with oral hygiene, hereditary factors, as well as, environmental influence [1]. However, the problem of substitution of partial lack of teeth remains relevant today due to the high prevalence of defects in the dentition [2, 3]. One of these methods is the use of non-removable metal-ceramic bridge-like prostheses fixed both on natural abutment teeth and on implants. It is known that for the duration of data use structures are particularly affected by oral hygiene, which can be carried out both with the help of a toothbrush and irrigators [4, 5, 6]. than a conventional toothbrush, because it completely washes even smallest food items. This is what prevents reproduction of microorganisms and prevents the development of inflammatory processes in oral cavity. Among the advantages of the irrigator is the simplicity in use; helping to stop bleeding from the gums, bad breath and plaque; improving local exchange

substances, blood flow, and also it provides therapeutic and prophylactic action. According to the literature, only 1.0% of patients know irrigators, which should be recommended by dentists [7]. What cleaning of proximal surfaces of teeth with interdental brushes is the most effective method of removing dental plaque. Flossing has been shown to be generally ineffective in removal of dental plaque [8]. use of 0.06% chlorhexidine at irrigation with an irrigator can be a valuable addition to oral hygiene mouth in patients with implants. Oral irrigator combined with 0.2% chlorhexidine solution is highly effective in reducing the area of biofilms. Daily use of an irrigator in combination with a manual brushing your teeth is much more effective in reducing gingival bleeding than flossing, as defined under 4-week study. It was found that the total amount of plaque removed by the oral irrigator reached approximately 40.7±16.7% compared to 71.6±11.5% with electric toothbrush. But an electric toothbrush causes much more gingival injuries than an irrigator. Currently up to date is the question of the effectiveness of the use of irrigators in patients for prevention of exacerbations of periodontal diseases and after orthopedic treatment. Therefore, the aim of the study was a clinical

study of the effect the use of irrigators on the condition of the periodontium and oral hygiene in patients based on natural teeth and implants.

Materials and Methods. We examined 25 patients who underwent orthopedic treatment using aesthetic ceramic-metal fixed prostheses. Of these, five patients underwent fixation of fixed prostheses on implants. The second group consisted of 12 patients who were prosthodontized with ceramic-metal bridges, who, after fixing fixed structures, used a toothbrush. In four of them, the fixation of prostheses was carried out on implants. months after prosthetics. The ARVI papilla gingival bleeding index was determined using a bellied probe, which was used to probe the gingiva of the papillae of the oral and vestibular surfaces of the teeth of the opposite halves of the jaws, exposed and removed. JETPIK, the peculiarity of which is the use of smart-flos technology, which combines the power of a water jet and the penetrating ability of a pulsating dental floss. The irrigator provides deep cleaning in places inaccessible to a toothbrush, strengthens the gums. Due to the mechanical friction of the floss, food microparticles and bacterial plaque are easily removed from open surfaces and hard-to-reach places (Fig. 1). The results of the study did not differ and amounted to 2.53 ± 0.34 in the first group, and 2.65 ± 0.21 points in the second. Such values of these indicators are due to the state of the gums after the preparation of the abutment teeth and the absence of artificial crowns. However, already a month after fixation of fixed bridge-like prostheses, the RVI index was significantly lower in patients who used an irrigator and amounted to 1.5 ± 0.27 points, while in patients who used a toothbrush, they were 2.03 ± 0.23 points. Further analysis of the clinical situation indicates that already three months after the fixation of ceramic-metal bridges in patients of group I, the RVI index significantly decreased and amounted to 0.41 ± 0.08 points and was accompanied by the absence of bleeding gums, and in patients of group II it was 0.82 ± 0.15 points and was characterized by the appearance of separate pinpoint foci of bleeding (Fig. 2). To determine the hygienic index in the area of the abutment teeth, the Sillness-Loe hygienic index was used, which was used to determine the presence of plaque on the distal, medial, scoring system, points were determined and the resulting amount was divided by 4. Analysis of the results obtained showed that patients who used only a toothbrush for oral hygiene care, the hygiene index one month after fixing the prostheses was higher than in patients who used an irrigator and amounted to 1.27 ± 0.21 points compared with the first group - 0.91 ± 0.19 . Three months later, this indicator improved significantly, but was significantly worse - 0.68 ± 0.04 points than in patients of group I - 0.51 ± 0.05 points. Characteristics of the index of hygiene in patients of group I is characterized by a significant significant improvement in oral hygiene already a month after using the irrigator - 0.91 ± 0.19 points, as well as a significant improvement in these indicators after three months - 0.51 ± 0.05 points (Fig. 3). To determine the intensity of the inflammatory process of the gums, the Schiller-Pisarev test was performed, which consists in the lifetime coloring of gum glycogen, the amount of which increases with

inflammation. This test was used to determine the presence and extent of inflammation. 1.18 and 2.91 ± 0.19 points, which indicates a moderately pronounced inflammatory process. However, one month after the fixation of prostheses and the application of appropriate methods of maintaining oral hygiene, the indicators of the Schiller-Pisarev test significantly improved and amounted to 2.33 ± 0.07 points in patients of group I and 2.53 ± 0.21 points in patients of group II, which are a sign of a mild inflammatory process in group I and its absence in these patients three months after fixing metal-ceramic bridges and using an irrigator (in particular, after three months, the Schiller-Pisarev test was 0.91 ± 0.27 points in group I patients and was significantly better than in the previous period, and better than the indicator in the II group of patients, which was 1.17 ± 0.16 points after three months. It has been proven that the use of irrigators contributes to the achievement of positive long-term clinical results after orthopedic treatment.

Conclusions. A feature of modern JETPIK irrigators is the use of smart-flos technology, which combines a powerful jet and the penetrating power of pulsating dental floss and provides deep cleaning in places inaccessible to a toothbrush, strengthens the mass. Due to the mechanical friction of the floss, micro-particles of food and bacterial plaque are easily removed from open surfaces and hard-to-reach places, and good oral hygiene is achieved. Pisarev, it was proved that in patients using JETPIK irrigators, these indicators are significantly better one and three months after fixation of fixed dentures than in the group of patients who used only a toothbrush for oral hygiene.

REFERENCES:

1. Ortopedicheskaya stomatologiya / N.G. Abolmasov, N.N. Abolmasov, V.A. Bychkov, A. Al'-Khakim. – M.: Medpress-inform, 2002. – 576 s.
2. Beda V.I. Gigena polosti rta pri nes"emnom zubnom protezirovanii / V.I. Beda, M.A. Yarifa // Sovremennaya stomatologiya. – 2009. – № 4. – S. 124–129.
3. Barkan I.Yu., Gorbunova I.L. Prognosticheskiye khronicheskogo generalizovannogo parodontita v otdalennyye sroki posle protezirovaniya nes"emnymi mostovidnymi metallokeramicheskimi konstruktsiyami // Sovremennyye problemy nauki i obrazovaniya, 2016, №5. Setevoye izdanie. URL: <https://science-education.ru/ru/article/view?id=25428>
4. Gulyaeva O.A., Bulyakov R.T., Gerasimova L.P., Chemi-kosova T.S. Sovremennyye metody vkompleksnom lechenii vospalitel'nykh zabolevaniy parodonta. – T. 190. – Ufa: UralPoligrafSnab, 2016. – S. 5-9.
5. Kosenko K.N., Gromov O.V. Otdalennyye rezul'taty kompleksnogo lecheniya patsientov razlichnykh vozrastnykh grupp s patologiei parodonta kombinirovannymi konstruktsiyami zubnykh protezov // Vestnik stomatologii, 2011, №3, str.63-66
6. Ozhogan Z.R. Kliniko-eksperimental'ne obruntuvannya ortopedichnogo metodu liku-vannya znimnimi mostopodibnimi protezami z diskretnim chasom fiksatsii: Avtoref. dis. ...d-ra med. nauk: spets.

14.01.22 «Stomatologiya» / Z.R. Ozhogan. – Ivano-Frankivs'k, 2002. – 36 s.

7. Lebedenko I.Yu., Arutyunova S.D., Ryakhovskogo A.N. Ortopedicheskaya stomatologiya: natsional'noe rukovodstvo. Moskva: GEOTAR-Media, 2016. 824 str.

8. Reissmann D, Hacker T, Farhan D, Heydecke G. The Burdens in Prosthetic Dentistry Questionnaire (BiPD-Q): development and validation of a patient-based measure for process-related quality of care in prosthetic dentistry // Int. J. Prosthodont. 2013; 26(3): 250. DOI: 10.11607/ijp.3266.

PEDAGOGICAL SCIENCES

THE PROBLEM OF IMPLEMENTING OF CLIL POLICY IN THE CONTEXT OF LIFELONG EDUCATION IN KAZAKHSTAN

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Abstract

The given article is devoted to the issues of CLIL policy in the context of lifelong education in Kazakhstan. It is well-known that lifelong education refers to a certain constant, continuous improvement of knowledge, skills and habits of a person, associated with the need to be relevant in the modern professional and at the same time social environment. The review of scientific and pedagogical literature on the study of lifelong learning and CLIL policy is presented in the work. Furthermore, the authors dwell on the lesson plan using CLIL technology of the class conducted in Information Technologies Department for the 1st course students of Information Technologies educational program in Dulaty University.

Keywords: CLIL policy; lifelong education; technology; language integrated learning; personality

It is well-known that CLIL is a way of teaching academic subjects "through a foreign language" (teaching content through foreign language) and teaching a foreign language "through the subject itself" (teaching foreign language through content). CLIL assumes the duality of subject content and language learning. The term "lifelong education" has many meanings. First, lifelong education refers to a certain constant, continuous improvement of knowledge, skills and habits of a person, associated with the need to be relevant in the modern environment (professional, social). Secondly, this term refers to the system of views on the educational process as a whole. This system considers educational activities as an integral and fundamental component of a person's lifestyle at any age; it assumes the need to complete the educational ladder with new steps designed for all periods of a person's life. Third, lifelong education provides for the continuous enrichment of the creative potential of the individual, the development of a person as a creative person.

Nowadays, lifelong education is interpreted as a single system of state and public educational institutions, which ensures the organizational, substantive unity and continuity of all levels of education. The solution of the problems of education and training, professional training of a person should, on the one hand, take into account the current and future social needs, on the other hand, satisfy the desire of a person for self-education, versatile and harmonious development throughout life.

The origins of the idea of lifelong education can be found in the views of Confucius, Socrates, Aristotle, L. A. Seneca, Voltaire, J. V. Goethe, J. J. Rousseau, who associated them with the achievement of full development of a person as a personality. The first attempts to implement the idea of continuous education were made in the XIII-XIV centuries. In the cities of Europe on the basis of the so-called "workshop

schools", which were opened and maintained by craft workshops [1].

Yan Amos Komensky, the Czech humanist teacher, is considered to be the founder of modern ideas about lifelong education, his works contain the main idea that is currently reflected in the concept of lifelong education. The idea of continuity of education received new interpretations in the country after 1917, which was facilitated by the formation of a new education system. New forms and types of educational institutions have appeared, including those for adult education and professional development of the working population. However, by the end of the 60s of the XX century, the concept of lifelong education failed, and did not have time to become a central educational system. Appeals to this problem were based largely on the intuition of individual scientists and practitioners.

The term "lifelong education" was first used in 1968 in the UNESCO materials, and in 1972, a UNESCO decision was adopted that recognized lifelong education as the main principle, the "guiding structure" for innovations or reforms in education in all countries of the world. Currently, much attention is paid to the development of the system of lifelong education. Life puts forward its own requirements: to develop a person's ability to respond quickly to all changes, to take the initiative, to develop communication skills, etc. In a rapidly changing world, even a very good education may not be enough. The goal of education, related to the ability of a person to adapt to constantly changing living conditions, has changed. Gradually, "education for life" is replaced by "education through life" [2].

Indeed, lifelong education is a constant improvement of a person's knowledge and skills, caused by the need to "keep up with the times", the desire to be in demand in the existing professional and social environment. In addition, lifelong education is an important component of the interaction of science, economics and

education. The idea of lifelong education also emerged as a response to the dynamic changes in science and industry. In most countries of the world, it was associated with learning, and later with the need for personal development in the process of lifelong education [3].

The development of the system of lifelong education is one of the most important areas of educational activity, which implies the continuity of processes in the systems of preschool, general secondary, primary, secondary, higher, postgraduate and additional professional education. The effectiveness and possibility of educational activities are determined by the interrelationships between the various stages of the innovation cycle, producers and consumers of services; firms, the market, the state and other social partners. Lifelong education can be considered as part of the structure of "lifelong learning" [4].

The system of lifelong education is widespread all over the world. A modern person should not only have certain skills and abilities, but also be able to learn, constantly strive to enrich their knowledge, develop skills, find various sources of information, i.e. engage in self-education.

Self-education may include:

- obtaining a good secondary professional, higher professional education;
 - mastering foreign languages;
 - improvement of their cultural and technical level;
 - constant striving to obtain new skills and abilities, their rapid updating and replenishment;
 - improvement of such qualities as discipline, responsibility, initiative, creative approach to activity.
- Thus, the goal of lifelong education is not only to teach a person all his life, but also to teach him himself [5].

The components of the system of lifelong education are:

- educational programs;
- educational structures;
- financing and management mechanisms;
- social environment.

The system of lifelong education is aimed at the implementation of the following functions [6]:

- ensuring the adaptation of a person to the constantly changing conditions of not only professional activity, but also the social environment by providing opportunities for the organization of an individual educational trajectory throughout life;
- strengthening, combining the educational resources of the society;
- formation of educational social partnership as a component of civil society.

Lifelong learning refers to the process of gaining knowledge and learning new skills throughout your life. Many people continue their education for personal development and fulfillment, while others see it as a significant step toward career advancement [7].

The change of the paradigm of "lifelong education" to "lifelong learning" has revealed a new concept for the Republic of Kazakhstan – "lifelong learning". The content of this term is perceived by many ambiguously, and there are several reasons for this. On the one hand, it is associated with the three – level training system "bachelor – master - doctoral", the transition

to which was carried out in the national educational system of the republic within the framework of the Bologna process. This system is focused both on the assignment of qualifications (bachelor's degree), and on the award of academic (master's degree) and academic degrees (doctoral degree) in accordance with the established procedure. With its introduction, the process of obtaining education has become multi-level (pre-university, university and postgraduate training), multi-stage (school, college, university, master's degree, doctoral degree) and continuous-in the literal sense of the word [8].

According to the typology proposed by UNESCO, this type of lifelong education is usually called formal, that is, provided by special educational institutions, according to established standards, with the involvement of specially trained personnel.

In our republic, there is an obvious trend of an increasing role of enterprises in financing the professional development of their employees (usually through the organization of corporate training seminars), which is more due to commercial interests than to such a concept as "social responsibility of business". The degree of state participation in the financing of non-formal lifelong education is limited by tax benefits, which are not of significant interest to business.

Today, along with information and communication competence, multiculturalism is recognized by the global education community as one of the main directions in the field of education in the formation of a competent and global educational space. In the 90s, within the framework of the policy of multilingual development in Europe, the CLIL method was developed. The role of information and Communication Technologies is constantly increasing. The formation of key competencies is facilitated by training in English, conducted using the CLIL method (Content Language Integrated Learning). The peculiarity of this method of teaching is that in different teaching situations, classes are conducted in two languages (domestic and foreign) using the appropriate language for a given period of study and learning goals.

The main goal of the CLIL method is to reduce the teacher's speech and, on the contrary, develop students' ability to communicate with each other.

Content (content) – knowledge, business, skills in the subject area that form information competence, i.e. the skills and ability to independently search, analyze, select, process and transmit the necessary information [9];

Communication - teaching a language that offers additional use of foreign language knowledge, rather than learning a foreign language in the classroom, so that students use a foreign language when learning, as well as learn how to use it. This aspect forms communicative competencies, as the ability to listen, ask questions and formulate clear answers to them, listen carefully and actively discuss the issues under consideration, understand the opinion of your partner and give them a critical assessment develops the ability of personal language communication;

Cognition – develops cognitive and thinking skills and contributes to the formation of educational competencies that ensure good training of students in one or more areas of study [10].

Culture - an aspect of the development of general cultural competence by means of knowledge of the world, presenting itself as a part of Culture, Understanding and perception of an alternative culture, ensuring the assimilation of the language of culture.

Thus, conducting in English using the CLIL method provides meta subject connections and allows you to achieve practical results in the development of the principles of a new educational standard, in particular, develops cultural awareness, internationalization, language competence, not only readiness to study, but also the ability to apply new knowledge in life and, accordingly, increase life motivation, achieve the goal of success, and ultimately the main goal – it leads to the formation of professional competencies of future graduates, increasing their mobility and ability to adapt to rapidly changing life situations [11].

The development of professional competence of teachers is a tool for improving the quality of Education. In modern society, where science and technology are developed, the education system requires competitive specialists with developed professional competencies. For this purpose, there is a need for subject – specific integration in the training process in accordance with the requirements of the time. That is, CLIL technology is one of the main ways to solve this problem.

We are going to show a lesson plan using CLIL technology (conducted in Information Technologies Department in Dulat University, 1st course)

Course «Communication network installations»

Lesson topic: Reliability of communication routes. End-to-end cable installations. End installations of coaxial cable

Lesson type – theory, component lesson

The aim of the lesson:

- a) Educational – to check the students' knowledge on the subject, the ability to use student's knowledge effectively and readily in execution

b) Developmental – to improve students' responsibility, knowledge, develop the right attitude to life, thinking development, study carefully the general public

Method of lesson: presentation, interpretation, interviews, lectures elements, question-and-answer, development, approval, repeat.

Visual aids and technical equipment: Interactive whiteboards, books, handouts, samples

Procedure of the lesson

Organization moment:

a) Greeting with students

b) Checking up the attendance

c) Paying attention to the readiness of the classroom

Introducing with the first slide



Plan

1. To divide into groups (to divide the with the method of construction, assembling the pieces of the pictures, assessment worksheet)

2. Home task (group, individual work)

3. Defining the content (new theme, picture, Video)

4. Assessment

5. Meditation (poster)

6. Reflection

7. Home task

Progress:

1. Homework: Safety of fiber optic cables from various obstacles

List of references:

1. Nietaliev Zh. Zh. "Ways of communication", 2017

2. Belorussov N. I. "Electrical cables and wires". M, "Energy", 2019

Familiarization of students with the system of scoring points based on achievement criteria.

According to the homework:

Group work (working in a group, analyzing the progress of work, sharing and performing tasks with solidarity, be responsible)	3 scores
Opening a topic based on this image	1 score
Answer on behalf of the group on a given task (leader)	3 scores
Show activity in a group	
1 token	1 score
2 tokens	2 scores
3 tokens	3 scores
4 tokens	4 scores
5 tokens	5 scores
Individual work	
Answer test questions	
To 5 questions	
To 4 questions	
To 3 questions	
To 2 questions	
To 1 question	

Checklist:

Number of points by Criterion					Score	Grade
	Full name of the student	A	B	C		
1	Omar Serik					
2	Mustafa Aruzhan					
3	Omirezak Moldir					
4	Akbay Amina					
5	Nursultan Diana					
6	Abdenbay Madiyar					
7	Zaripulla Mukhtar					

Converting points to grades:

Number of points scored	Grade
17 – 20	“5”
13 – 16	“4”
10 - 12	“3”

Assessment: Evaluation according to the point system

Recognition of meaning: A new lesson

Topic: Reliability of communication routes. End-to-end cable installations. End installations of coaxial cable.

Plan:

1. Capacity of communication lines	1. Жолдардың өткізу қабілеті
2. subscriber cable devices: Kroos, box, plinth	2. Абоненттік кабель: Кроос, бокс, плинтус
3. coaxial cable	3. Коаксиалды кабель
4. types of coaxial cables	4. Коаксиалды кабельдердің түрлері

Working with the copybook: term words, abbreviated words

List of references: Nietalieva Zh. Zh."Ways of communication", 2017

Video: Ways to use coaxial cables

Thinking: The poster is made according to the method of protection

Progress: Protection of the project by each group on the specified illustrated topics

Project topics for groups:

Kroos	5 scores
Boxing	5 scores
Plinth	5 scores
Cable	5 scores
Project protection by poster method	5 scores

Assessment: Calculating the number of points for tokens

Reflection: Feedback (What did we learn? What did we know? What do I want to know?)

Homework assignment

If so, the most effective way to implement an integrated educational program is to learn English. Learning English is a huge task and responsibility for all of us.

Conclusion

The content of school teacher training using the CLIL methodology should not be limited solely to teaching a foreign language, but should include theoretical and methodological aspects necessary for the effective integration of new language material and subject content within the framework of one lesson.

Coming to the conclusion, we want to say that teaching English with the help of CLIL technology is not only relevant now but also it provides us opportunities to introduce a wide range of cultural contexts to help students develop positive attitudes and become aware of the responsibilities of global as well as local citizenship.

CLIL unites language teachers and subject teachers. CLIL helps students discover and develop multiple skills - so-called pluriliteracy skills.

REFERENCES:

1. Zaitseva, O. V. Lifelong education: basic concepts and definitions / O. V. Zaitseva // Bulletin of TSPU.-2009.- No. 7.-p.106.
2. Современная наука: от теории к практике: монография / Аксигитов А.Р., Афанасьева А.В., Бузин А.Н. [и др.]; под общей редакцией Г.Ю. Гуляева; Международный центр научного сотрудничества "Наука и просвещение". – Пенза: МЦНС "Наука и Просвещение", 2020. - 170 с.
3. Continuing education [Electronic resource].- Access mode: <http://www.womanwiki.ru>
4. Christiane Dalton-Puffer. Outcomes and processes in Content and Language Integrated Learning (CLIL): current research from Europe. Werner Delanoy and Laurenz Volkmann, (eds.) Future Perspectives for English Language. Teaching. Heidelberg: Carl Winter, University of Vienna, 2018. 19 p.
5. <http://edu-resource.net> (subject-language integrated training).
6. Coyle D. Content and Language Integrated Learning Motivating Learners and Teachers : http://bloccs.xtec.cat/clilpractiques1/files/2008/11/slrc_oyle.pdf
7. Kozhamzharova, D. P., Issabekova, G. B., Duisenova, N. T., Akhmetova, A., & Eskermesova, G. (2019). The main results of research on the CLIL project in Taraz State Pedagogical University. Journal of Advanced Pharmacy Education and Research, 9(1), 38–43.
8. Сайт European Centre for Modern Languages of the Council of Europe: European Framework for CLIL Teacher Education [Электронный ресурс]. — Режим доступа: <https://www.ecml.at>.
9. Zhetpisbayeva B.A. Theoretical Model of training the CLIL-teacher in the terms of the higher educational institutions / B.A. Zhetpisbayeva, A.E. Kubeeva, A.K. Kitibaeva // Strategiczne pytania światowej nauki: Materiały XIV Międzynarodowej naukowo-praktycznej konferencji (07-15 lutego 2018 roku). — Warszawa, 2018. — P.70–77.
10. Goris J., EJPJ Denessen, LTW Verhoeven (2019) Effects of content and language integrated learning in Europe A systematic review of longitudinal experimental studies. European Educational Research Journal 18(2):147490411987242
11. Nguyen, The Content and language integrated learning in Vietnam: evolution of students' and teachers' perceptions in an innovative foreign language learning system, 2019.

EFFECTIVENESS OF THE VIRTUAL LEARNING ENVIRONMENT

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The article by Polumeeva I.N. considers the issue of creating by a teacher an effective learning environment that has a positive impact on both the teaching process and the learning process, indicates the need to maintain personal contact established between the teacher and the student, draws attention to the use of visual tools to improve the effectiveness of the learning environment.

Keywords: distance learning, effective learning environment, personal contact, visual tools

Nowadays, there are several forms of higher education, and applicants make their choice, justifying it with a specific reason. Many opt for full-time education in order to immerse themselves in the educational environment and gain fundamental knowledge in the chosen direction with personal contact with teachers. According to the press center of the Administration of St. Petersburg in 2021, more than 709 thousand applications were submitted to the universities of St. Petersburg for full-time education. The average competition for state universities was 17 people per place. In 2020, the average competition was 14 people per place. [1]

Due to the epidemiological situation, higher education institutions have repeatedly made a temporary transition to distance learning. During the transition, personal contact with the teacher is lost, and students are faced with solving problems of self-discipline, self-organization, and at the same time, students need to remain interested in the learning process and make progress. The opportunities that the programs have for organizing online meetings help the teacher to keep in touch with students in various ways. So, Microsoft Teams offers such an opportunity as to call a meeting participant who did not join the session, the list of absent students of the group is indicated at the bottom of the list of all listeners. Of course, here we are talking about maintaining contact in small groups.

With a temporary transition to distance learning, classes are held according to a schedule, as if they were held in classrooms and it is not easy to spend six hours in front of a computer screen from the teacher's point of view. But on the other side of the screen there is a student who spends the same number of hours of study

time in front of the computer screen. The teacher prepares for classes, spends extra time on posting material and checking assignments on the educational portal, and the student spends extra time on completing assignments in all subjects and tries to keep up with the deadlines set by the teachers.

Maintaining the contacts established by the teacher with students and a favorable climate in the group becomes one of the tasks of the teacher in distance learning. There are objective reasons that the teacher cannot influence, for example, technical problems that arise on the educational platform, or the student does not have a favorable learning environment, which undoubtedly entails a decrease in the effectiveness of the educational process. However, creating an effective favorable environment during the webinar is the task of the teacher. The teacher analyzes the possibilities of the educational platform and selects the tools suitable for each specific lesson that will involve students, and they will not remain indifferent to third-party listeners. [2, p.68]

The degree of involvement in the educational process, according to a survey of groups of listeners, is increased by visual tools. It was proposed to evaluate the visual tools used in foreign language webinars: multimedia tools, mental maps, clusters and infographics. The presentation of the lesson, compiled using multimedia technologies, such as audio-video fragments, animation, received the largest number of votes in the survey - 34%. Infographics took second place in the poll with 30% of the votes. 22% of the survey participants gave their preference to mental maps as the most effective means of visualizing educational material. And 14% was given to clusters.

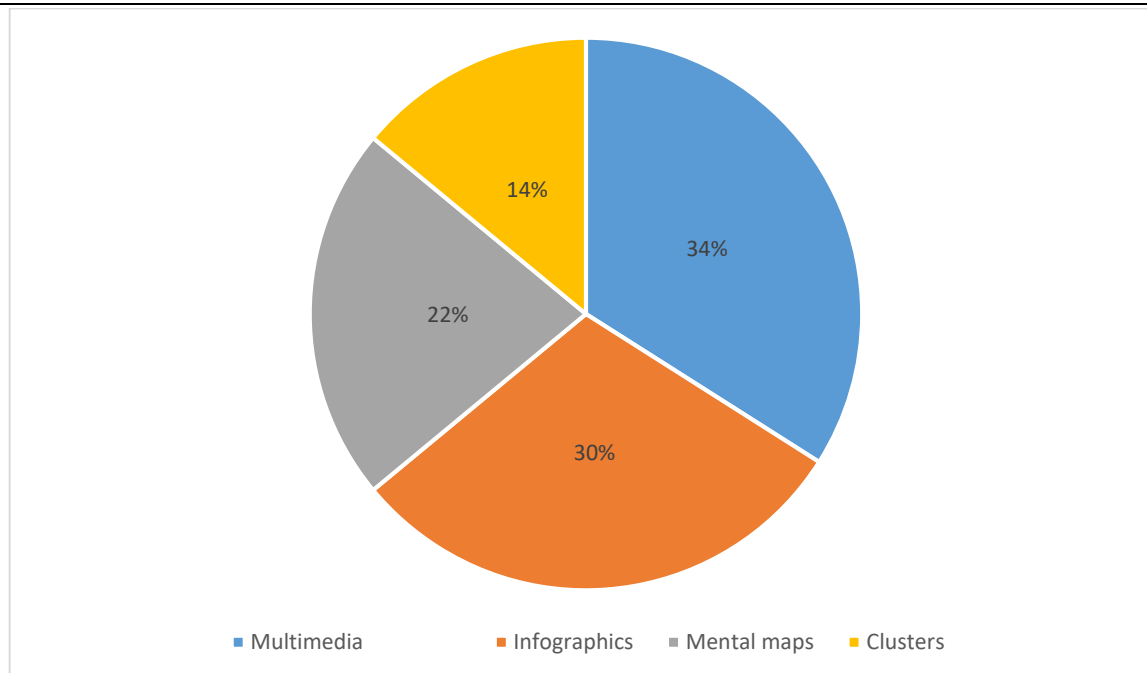


Chart. Students' assessment of the effectiveness of visual tools.

As we can see from the chart by the percentage ratio, all visual tools have found a response among students, in their opinion, the use of such means increases interest and facilitates the perception of the educational material offered by the teacher. As a result, the effectiveness of the educational environment created by the teacher increases. "The creation of visual tools is based on various ways of processing information, allowing it to be presented in a compact and easy-to-understand and use form." [3, p.70]

Conclusion

During the distance learning period, in addition to the functions that the teacher performed by organizing the learning process in the classroom, the teacher assumes the functions of the organizer of the virtual learning environment, increasing its effectiveness by visual

means. The teacher organizes effective communication in a virtual environment, guides students, monitors their progress, helps solve emerging problems, provides emotional support.

REFERENCES:

1. The official website of the administration of St. Petersburg URL <https://www.gov.spb.ru/press/governor/220069/> / (date of request: 04/28/2022)
2. Kaigorodtseva N. V., Luzgina V. B. Formation of teachers' competencies for conducting webinars. // Omsk Scientific Bulletin. Series. Society. History. Modernity. 2017. No.2.
3. Izotova N.V., Buglaeva E.Yu. System of visualization tools in teaching a foreign language.// Bulletin of the Bryansk State University. 2015 (2).

PHILOLOGICAL SCIENCES

LEXICO-SEMANTIC FEATURES OF THE TERM DERIVATION

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ЛЕКСИКО-СЕМАНТИЧЕСКИЕ ОСОБЕННОСТИ ТЕРМИНА ДЕРИВАЦИЯ

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Abstract

Derivatology, as a complex system, creates a chain of simple and complex units as a multilevel hierarchical organization. It is formed by the confrontation of the correlation between the words and the words with the same roots, and is characterized by the identity of the derivation structure with different roots. One of the most important units of the derivation system is the category of derivation. This category includes general types of derivation.

Аннотация

Дериватология, как сложная система, создает цепочку простых и сложных единиц в виде многоуровневой иерархической организации. Он формируется путем противостояния корреляции между словами и словами с одинаковыми корнями и характеризуется идентичностью структуры деривации с разными корнями. Одной из наиболее важных единиц системы деривации является категория деривации. Эта категория включает в себя общие типы деривации.

Keywords: derivation, semantics, new words, structure, notion, word formation.

Ключевые слова: деривация, семантика, новые слова, структурный, термин, словообразование.

Словарный состав языка постоянно меняется. Некоторые слова выходят из обихода, появляются новые слова, тем самым обогащая словарный состав. Отличительные особенности любого языка связаны с реакцией его носителей на мельчайшие изменения в культурной, общественной и повседневной жизни. Чтобы обозначить новое слово и понятие либо используются ресурсы языка, либо создаётся новое слово, либо же это слово заимствуется из других языков. Раздел языкознания, изучающий словообразование называется дериватологией. Это сравнительно юный раздел языкознания, проблемы которого до XX века были недостаточно изучены.

Данный раздел языкознания за последнее время развился как независимый отдел. Слово «дериватология» образовалось от латинского слова *derivatus* и греческого слова *logos* (9, с.5). А.Курбанов отмечает, что в дериватологии надо различать два понятия; одно из них – это понятие «образования новых слов», другое – понятие «придумывания новых слов» (1, с.248).

Как мы уже отмечали, каждое новое слово в языке образуется на базе языкового материала, на примере уже существующих в языке слов. Однако надо отметить, что если новые слова не создаются на базе уже существующих, то усложняется их вос-

приятие. Слова в языке образуются разными способами. Согласно особенностям, наблюдаемым в словообразовании, определяются и пути словообразования языка. И.Мамедов отмечает необходимость созревания условий для реализации данного процесса, так как словообразование зависит от комплексного воздействия различных внутриязыковых факторов, а также в некоторой степени от внеязыковых факторов (2, с.329).

Что такое деривация? Деривация – это комплекс методов и правил создания новых слов путём присоединения слова к уже существующему корню, а также наука, изучающая словообразования в языке (4, с.5; 9, с.4). В «Словаре-справочнике лингвистических терминов» указывается, что деривация – это образование новых слов при помощи аффиксов или безаффиксным способом (10, с.414). Деривация – это процесс создания новых слов (14; 15; 16). Деривация – это формирование новых слов, происходящее в основном путём аффиксации. Дериваты в большинстве случаев в отличие от исходных слов относятся к другому классу слов и поэтому принимают аффиксы соответствующего класса. В дескриптивном языкознании и традиционной грамматике деривация – это формирование слов путём присоединения к слову аффиксов. Это основной источник словообразования в языке. Если

в историческом языкознании деривация – это история слова или его этимология, то в производной грамматике показывает последовательность лингвистических взглядов, что указывает на структурную или лингвистическую единицу предложения, образовавшегося в результате применения определённого грамматического правила (13). Это процесс создания одних языковых единиц (дериватов) на базе других, принимаемых за исходные, в простейшем случае – путем «расширения» корня за счет аффиксации или словосложения, в связи с чем, дериват приравнивается иногда к словопроизводству или даже словообразованию (12, с.129). Согласно более широкой точке зрения деривация – это обобщающий термин при определении словообразования или словоизменения, или же наименование образования вторичных знаков в языке. Исследованием деривационных процессов занимается наука дериватология, основы которой заложены в трудах М. В. Ломоносова, А. А. Барсова, Н. И. Греча, Ф. И. Буслаева, С. О. Карцевского. В языкознание термин «деривация» введён Е. Куриловичем. Учёный выделил лексическую и синтаксическую деривации (6). Что понимается под понятием деривация в языкознании?

- процесс образования в языке любого вторичного знака, который может быть объяснён с помощью единицы, принятой за исходную, или выведен из неё путём применения определённых правил (5, с.64).

- процесс, в результате которого на базе существующих в языке слов создаются новые слова (7, с.129).

Т.Г.Борисова даёт такое определение деривации: «Явления деривации, процессы образования любых вторичных знаков возможны на разных уровнях строения языка, и отношения, складывающиеся между первичными и вторичными знаками, возникают как следствие применения к первым из них вполне определённых формальных операций» (3, с.19). В её понимании механизмы деривации – это специфическая система действующих правил, совокупность приёмов, способов, средств образования новых вторичных единиц.

Деривация – это лексический процесс, в результате которого новые слова фактически формируются путём совокупности основы и деривационных аффиксов. Например, activate, activation, activeness, activity, activism, activist (17). Э.Мамедова отмечает, что деривация, находя себе место в подсистеме языка, характеризуется всеми признаками языковой системы (8, с.7).

В результате надо отметить, что «деривация» как термин используется в языковедении в двух формах. В первом случае указывает на образование слова путём присоединения аффикса к существующему слову. Во втором случае деривация определяется как синхронное образование слова от исходного. Так как деривация лексический процесс, то и её результатом является новое слово.

СПИСОК ЛИТЕРАТУРЫ:

1. Курбанов А. Общее языкознание. I том, Баку, Нурлан, 2004, 748 с.
2. Мамедов И. Семантика азербайджанского языка. Баку, Изд-во Хазар, 2006, 372 с.
3. Борисова Т.Г. Когнитивные механизмы деривации: деривационная категория вещественности в современном русском языке : дис. д-ра филол. наук. Краснодар, 2008, 390 с.
4. Земская Е.А. Современный русский язык. Словообразование. Уч.пос., М., Просвещение, 1973, 304 с.
5. Кубрякова Е.С. Деривация, транспозиция, конверсия // Вопросы языкознания. М., 1974, № 5, с. 64-76,
6. Курилович Е. Деривация лексическая и деривация синтаксическая // Очерки по лингвистике. Биробиджан, 2000, С. 57-70.
7. Лингвистический энциклопедический словарь / под ред. В.Н. Ярцевой. М.: Советская энциклопедия, 1990, 685 с.
8. Мамедова Э.С. Словообразовательные модели в русском и азербайджанском языках. Баку, Мутарджим, 2005, 248 с.
9. Немченко В.Н. Современный русский язык. Словообразование. М., 1984, высш.школа, 250 с.
10. Розенталь Д.Э., Теленкова М.А. Словарь-справочник лингвистических терминов. Просвещение. 1985, 545 с.
11. Словарь иностранных слов. 15-е изд., испр. М.: Русский язык, 1988, 608 с
12. Ярцева В. Н. Большой энциклопедический словарь. Языкознание. М.: Большая Российская энциклопедия, 1998. 685 с.
13. <http://www.britannica.com/topic/derivation-traditional-grammar>).
14. www.english.org/lesson/word-structure/word-structure-derivation
15. <https://www1.essex.ac.uk/linguistics/external/clmt/MTbook/HTML/node46.html>
16. <http://wn.com/mobile/derivation>

SOCIAL SCIENCES

EMPLOYMENT OF DISABLED PERSONS IN KAZAKHSTAN: OPPORTUNITIES OF SOCIAL ENTREPRENEURSHIP

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Abstract

The advantages of employment for disabled people are undoubted: not only it provides financial sustainability and helps disabled people integrate in the community but also has economic benefits for the society as a whole. However, today disabled people around the world face different challenges when it comes to the questions of employment. In Kazakhstan, there are multiple state support measures aimed at the employment of disabled persons. Nevertheless, only 25% of disabled people of working age are employed. This article examines the labor market statistics and existent employment opportunities for disabled people in Kazakhstan. It also outlines the opportunities that social entrepreneurship provides in solving this problem.

Keywords: disability, employment, social entrepreneurship, labor market, state support of employment, employment of disabled people.

According to the International Labour Organization 15% of world's population – almost a billion people – have some forms of disability. About 80% of these people are of working age. As early as in 1944, the International Labour Organization has acknowledged that people with disabilities must have equal rights and access to job opportunities [1, p. 4]. However, today, almost 80 years later, disabled people around the world still face employment challenges.

Ensuring effective employment of the population and the rational use of labor resources is an important factor for the sustainable economic growth of the country, consistent increase in the standard of living and

welfare of the population. Therefore, governments try to involve in the economic activity as much labor resources and human capital as possible.

In 2020, the labor force in Kazakhstan reached 9.2 million people (69.2% of population aged 15 and older; 48.7% of total population). More than 8.7 million people were employed in the economy of the republic. The employment rate reached 95.1% to the labor force, and 65.9% to the population aged 15 years and older. The number of unemployed people in 2020 amounted to 448.8 thousand people with the unemployment rate of 4.9% [2].

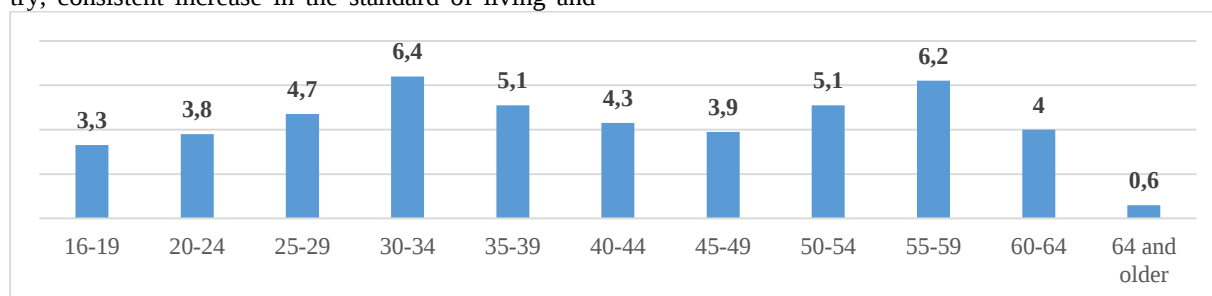


Figure 1. Unemployment rates (share in the labor force) by age groups, %

Source: Bureau of National Statistics of the Republic of Kazakhstan [2, p. 52]

Every third unemployed person was unemployed due to the lack of available jobs, 21.2% were dismissed by their own free will, 14% were dismissed due to family circumstances. More than 30% of unemployed people claimed that they have never worked, while 6% were unemployed for less than a month (Figure 2).

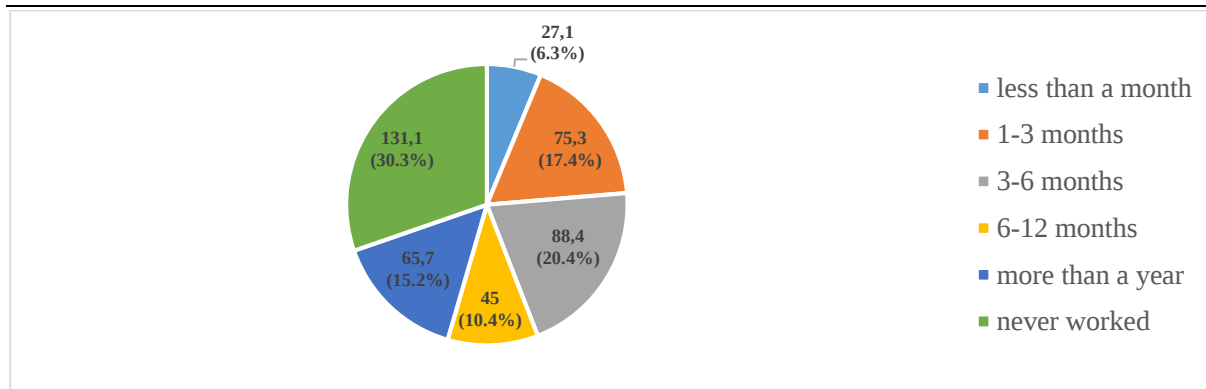


Figure 2. Unemployed people by the length of unemployment period, thousand people (%)
Source: Bureau of National Statistics of the Republic of Kazakhstan [2, p. 59]

In 2020, more than 4 million people were not included in the labor force. Main reasons for the exclusion from the labor force were reaching the retirement age and studying on full-time basis: almost 50% of are elderly aged 60 and older, and 30% are youth aged 15-24.

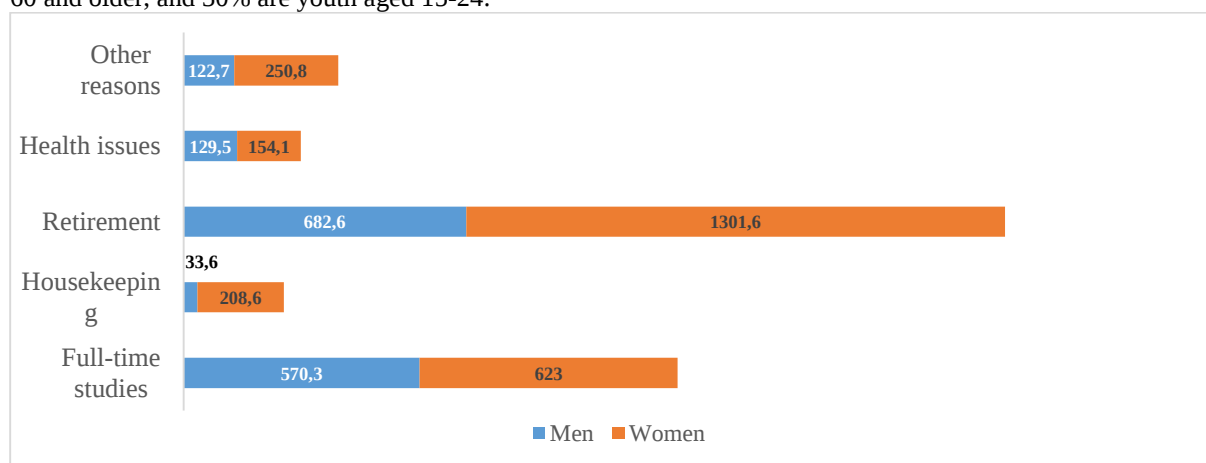


Figure 3. Unemployed people by the reasons of exclusion from the labor force, thousand people

Source: Bureau of National Statistics of the Republic of Kazakhstan [2, pp. 82-83]

It is worth mentioning that 283.6 thousand people were excluded from the labor force due to health issues. Among them, almost 157 thousand (55%) are men and women aged 45-64 years who did not reach the retirement age [2, pp. 82-83].

According to the Ministry of Labor and Social Protection, 7.5% of country's population or 697 thousand people have been certified as being disabled. The share of working-age people in the total number of disabled persons is 60% or 419 thousand people [3]. Nonetheless, only a quarter of these people (104 thousand) are employed. For comparison, the United Nations report that "in developing countries, 80% to 90% of persons with disabilities of working age are unemployed, whereas in industrialized countries the figure is between 50% and 70%" [4]. During the study conducted by UNICEF for the Ministry of National Economy's Statistics Committee, 32% of participating persons with disabilities highlighted barriers to employment as one of the most important problems that worsen the quality of life for disabled people in Kazakhstan [5].

Therefore, the issue of encouraging employment of persons with disabilities and ensuring their social integration is one of the main priorities of the government agenda. As part of these efforts, on December 11, 2008, the Republic of Kazakhstan signed the UN Convention

on the Rights of Persons with Disabilities, which was ratified by the relevant Law of the Republic of Kazakhstan on February 20, 2015. This law is aimed at providing persons with disabilities with equal opportunities to exercise civil, political, social, economic, cultural and other rights and freedoms preserved in the Constitution of the Republic of Kazakhstan, as well as international treaties to which Kazakhstan is a party.

In 2005, the country has adopted the Law on social protection of persons with disabilities (Law) that provides definitions of "disability" and "persons with disabilities", sets out the government policies and principles of social protection, and elaborates the rights and state support measures for disabled people [6].

Namely, Article 14 of the Law states that persons with disabilities have rights and freedoms to get professional training and retraining, vocational rehabilitation and employment. Moreover, Article 31 of the Law places obligation on the local state authorities to ensure the employment of persons with disabilities via:

- 1) setting quotas on employers to hire 2-4% of employees from among the disabled people;
- 2) creating additional jobs for persons with disabilities through the development of sole proprietorship, small and medium entrepreneurship;

3) creating special and social work positions for persons with disabilities;

4) vocational training of disabled people.

Another measure adopted in Kazakhstan in order to encourage the employment of persons with disabilities is the priority of associations of disabled people in the government procurement of certain goods, works and services. In accordance with the Article 51 of the Law “On Public Procurement” public organizations must ensure that at least 50% of goods and 100% of works and services specified in the corresponding government decree are bought from the associations of persons with disabilities [7]. The government decree includes 15 groups of goods (such as furniture, stationery, uniforms, etc.), 7 types of services (cleaning, landscaping, printing services, etc.) and 1 type of work (landscaping) [8]. Additionally, special taxi services for persons with disabilities are procured from the associations of disabled people by signing direct contracts without tender procedures [7].

Despite the availability of legal framework and multiple measures adopted by the government, statistics of employment among the disabled people suggest that these measures are inadequate and do not encourage employers to hire disabled people. A deeper analysis of the legal acts has educed several explanations for this trend.

Firstly, quotas on employers are set annually regardless of the type, legal form and ownership of the organizations. The only exceptions are the associations of persons with disabilities, organizations where more than 20% of employees are disabled, and organizations that have special rules for hiring employees according to the laws of Kazakhstan (mainly state bodies and law enforcement authorities). For organizations with 50 – 100 employees, quota is set at a rate of 2%; 101 – 250 employees – 3%; 251 and more employees – 4% [9].

At the same time the rules do not clarify sanctions or penalties for the employers who do not fulfill this obligation. Moreover, the rules do not impose any responsibilities or penalties on the local authorities who

fail to control the implementation of the quota scheme. As a result, 64% of the employers have failed to meet the required level of quota in 2020 [10] and only 5.8 thousand people with disabilities obtained employment using this instrument [3].

Secondly, most of the adopted measures are authoritative and do not include any financial or social incentives for the employers. Considering that in Kazakhstan people with disabilities are still perceived as unproductive, burdensome and incapable of performing equally with other employees [10], this stems a great degree of reluctance from the employers.

Thirdly, the Law “On Public Procurement” provides privileges only for the associations of persons with disabilities. Initially, this norm was included in the legislation to support the employment of disabled people. However, today the associations employ not more than 3 thousand persons with disabilities which is less than 1% of working-age disabled people. Total number of employees in half of these organizations is less than 5 people [3]. Meanwhile organizations that employ greater numbers of disabled people but are not registered in the form of association do not have any privileges.

One of the effective ways to tackle the problem of unemployment among the persons with disabilities, as well as other underprivileged groups of population, can be the development of social entrepreneurship. As Fonteneau et al. state: “in the context of mainstream labour policies’ inability to ensure a balanced allocation of the available labour force, social enterprises have emerged as innovative institutional solutions for supported employment favouring those workers who are discriminated against by conventional enterprises” [11, p. 90].

The study conducted by the European Commission [12] has demonstrated that in countries with the developed social entrepreneurship sector these organizations can employ hundreds of thousands of people, including persons with disabilities and other vulnerable groups of population. Some country examples are provided in Table 1.

Table 1

Estimated number of social enterprises’ employees in European countries

Country	Estimated number of social enterprises	Number of social enterprises per million inhabitants	Estimated number of employees
France	96,603	1,414	1,187,249
Italy	102,461	1,694	894,800
Belgium	18,004	1,530	572,914
Poland	29,535	768	428,700
United Kingdom	30,753	464	353,357
Portugal	7,938	771	145,734

Source: The European Commission [12, pp. 106-107]

In Kazakhstan, social entrepreneurship is just starting to develop. In 2021, amendments to Kazakhstan’s Entrepreneurial Code were made in order to incorporate the concept and objectives of social entrepreneurship. Thus, social enterprises are defined as sole proprietors and legal entities (excluding large business enterprises) which are included in the Register of Social Entrepreneurship (Register) and correspond to one of the four categories detailed in the Entrepreneurial

Code. The first category of social entrepreneurs consists of organizations that contribute to the employment of vulnerable groups of population, including persons with disabilities. These organizations must satisfy two criteria: 1) at least 50% of employees must be from vulnerable groups of population; 2) at least 25% of labor costs should be used to pay salaries for vulnerable groups of population. As of May, 2022 the Register includes 25 social entrepreneurs, of which more than half (13) belong to the first category [13].

The Entrepreneurial Code also outlines nine measures of state support that the social entrepreneurs are entitled to, such as ensuring the availability of infrastructure to support social entrepreneurship; tax benefits (reduction of taxable income by the amount of expenses spent on training employees from the vulnerable groups of population and reduction of property tax); financial support (including subsidies on the interest rates of bank loans and for paying property rent); leasing state property on preferential terms; information support; consulting and methodological support, development through acceleration programs; assistance in the development of interregional cooperation and in the search for business partners; organization of vocational training and additional education; state grants for the implementation of significant social projects

However, to jump-start the rapid development of social entrepreneurship and encourage the employment of persons with disabilities, additional measures of state support should be included. For instance, instead of providing privileges to the associations of persons with disabilities in public procurement procedures priority should be given to the first category of social entrepreneurs. Namely, additional points can be assigned to social entrepreneurs in the evaluation of their bids or certain share of contracts can be reserved for this category of enterprises. Similar strategies are practiced by many developed countries. For example, Article 20 of the European Directive on public procurement states that "Member States may reserve the right to participate in public procurement procedures to sheltered workshops and economic operators whose main aim is the social and professional integration of disabled or disadvantaged persons or may provide for such contracts to be performed in the context of sheltered employment programmes, provided that at least 30 % of the employees of those workshops, economic operators or programmes are disabled or disadvantaged workers" [14].

Furthermore, special financial incentives should be put in place for social entrepreneurs hiring disabled or disadvantaged groups of population such as wage subsidies for the workers with disabilities, tax exemptions, reduction of social security contributions state grants, issuing guarantee letters for the social entrepreneurs who do not have collateral to get bank loans, etc. [15].

Encouraging and promoting social entrepreneurship and corporate social responsibility, rather than pressuring and forcing employers, can have much better results in solving the problem of unemployment among the disabled and disadvantaged groups of population.

REFERENCES:

1. International Labour Organization (2015). Decent work for persons with disabilities: promoting rights in the global development agenda. ISBN: 978-92-2-129358-3. URL: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_430935.pdf
2. Bureau of National Statistics of the Republic of Kazakhstan (2021). "Employment in Kazakhstan" Statistical Yearbook. URL: <https://stat.gov.kz/official/industry/25/publication>
3. Ministry of Labor and Social Protection of Population of the Republic of Kazakhstan. Statistics on the Persons with Disabilities. URL: <https://www.gov.kz/memleket/entities/enbek/documents/1?lang=ru> [Date accessed: May 20, 2022]
4. United Nations Department of Economic and Social Affairs. Disability and Employment Factsheet. URL: <https://www.un.org/development/desa/disabilities/resources/factsheet-on-persons-with-disabilities/disability-and-employment.html>
5. Ministry of National Economy of the Republic of Kazakhstan Statistics Committee (2015). Final report on the results of the sample survey "Quality of life of persons with disabilities, taking into account gender specifics". URL: <https://www.unicef.org/kazakhstan/media/671/file/%D0%9F%D1%83%D0%B1%D0%BB%D0%B8%D0%BA%D0%B0%D1%86%D0%B8%D1%8F%20.pdf>
6. Law of the Republic of Kazakhstan dated 13 April, 2005 No.39 "On Social Protection of Disabled Persons in the Republic of Kazakhstan". URL: https://adilet.zan.kz/eng/docs/Z050000039_ [Date accessed: May 20, 2022]
7. Law of the Republic of Kazakhstan dated December 4, 2015 No. 434-V "On Public Procurement". URL: <https://adilet.zan.kz/eng/docs/Z1500000434> [Date accessed: May 20, 2022]
8. Decree of the Government of the Republic of Kazakhstan No.1181 "On approval of the list of specified goods, works and services that are procured from the associations of persons with disabilities and the organizations established by the associations of persons with disabilities" adopted on December 31, 2015. URL: <https://adilet.zan.kz/rus/docs/P1500001181> [Date accessed: May 20, 2022]
9. Order of the Minister of Healthcare and Social Development of the Republic of Kazakhstan No. 498 "On approving the Rules of setting quotas on job places for persons for disabilities" adopted on June 13, 2016. URL: <https://adilet.zan.kz/rus/docs/V1600014010> [Date accessed: May 20, 2022]
10. Ministry of Labor and Social Protection of Population of the Republic of Kazakhstan. How to solve the issue of employment of persons with disabilities in Kazakhstan. (In Russ.). URL: <https://www.gov.kz/memleket/entities/ombudsman/press/news/details/102790?lang=ru>
11. Fonteneau, B., et al. (2011). Social and Solidarity Economy: Our common road towards Decent Work. International Labour Organization. URL: www.ilo.org/empent/units/cooperatives/WCMS_166301/lang--en/index.htm
12. European Commission (2020). Social enterprises and their ecosystems in Europe. Comparative synthesis report. Authors: Carlo Borzaga, Giulia Gallera, Barbara Franchini, Stefania Chiomento, Rocío Nogales and Chiara Carini. Luxembourg: Publications Office of the European Union. URL: <https://europa.eu/Qq64ny>

13. The Entrepreneurial Code of Kazakhstan (articles 79-1, 79-2, 79-3, 79-4, 232-1). URL: <https://adilet.zan.kz/rus/docs/K1500000375#z2078> [Date accessed: May 20, 2022]
14. Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC. URL: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0024>
15. International Labour Organization (2019). Promoting Employment Opportunities for People with Disabilities. Quota Schemes. Volume 1. URL: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---ifp_skills/documents/publication/wcms_735531.pdf

TECHNICAL SCIENCES

PREPROCESSING DATA FROM THE MOUSE MANIPULATOR FOR USE IN BEHAVIORAL BIOMETRICS ANALYSIS

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Abstract

The main tools for analyzing behavioral biometrics based on manipulator data are analyzed and described, the data preprocessing scheme is described, and the dataset preparation scheme is developed dataset based on. A model of user behavioral biometrics been developed, and 4 modules have been defined.

Keywords: biometric authentication, behavioral biometrics, RemoteTopology, data preprocessing, mouse manipulator.

Examples of biological characteristics include fingerprints, hand geometry, face image, iris structure, and retinal pattern. Behavioral characteristics - signature, hand gestures, keystrokes, and gait. The modality of a biometric system depends on a combination of the type of biometric characteristic, the type of sensor, and algorithms for extracting and processing biometric features. Currently, biometric systems attract more attention from researchers [1]. Biometric data collected by sensors, processed by algorithms, and classified by types of characteristics or samples are used to improve the accuracy of recognition of the biometric system.

The study identified the following results:

- 1) describes the main tools for developing software for capturing data on mouse actions;
- 2) the method of collecting and preparing a dataset is described, based on data from the mouse manipulator, with the main patterns;
- 3) projects of the DL model for CA and AD that allow user verification are proposed;

As a research platform, the software product RemoteTopology was chosen, designed for organizing and conducting remote championships and training in operating systems and network technologies [2]. The module responsible for data collection was developed from scratch in Python. The model provides a set of parameters for mouse operations, such as each individual user click in a controlled environment. The module is based on the pyHook software package pyHook[3]. The Windows Hooking API is used to provide callbacks in low-level global mouse and keyboard events [4]. Hook Manager records manipulator events.

The connection manager provides for collecting various manipulator events, via callbacks. This paper discusses the issue of getting a dataset, in which all mouse events were recorded, including the message name, message ID, time, window name, X and Y. Our software is able to receive events when they occur and record these events in a log file (CSV format), which is constantly updated. Our data collection software does not record data that can be classified as personal data that is involved in testing. The user. To collect the data, software for recording mouse actions was installed on a reference personal computer.

The basis of the experiment was the Asia-Pacific Best Practice Marathon project Marathon held on the basis of the Khabarovsk Regional Institute of Education Development, as there is a certificate of approbation dated 25.03.2022 No. 10. The competence "Network and system administration" participated in the experiment. The participants determined their jobs independently, i.e. there was no reference to the types of devices and their location, the position of furniture, lighting, etc. In accordance with the infrastructure competence sheet, the minimum requirements for furniture, premises, and technical characteristics of equipment were determined. The described experimental database allowed us to collect a dataset consisting of 20,000 samples of manipulator movement actions, 10,000 images of pointing actions with a click of the manipulator. In total, data collection was performed on 12 participants. Figure 1 shows the RT form when performing a task.

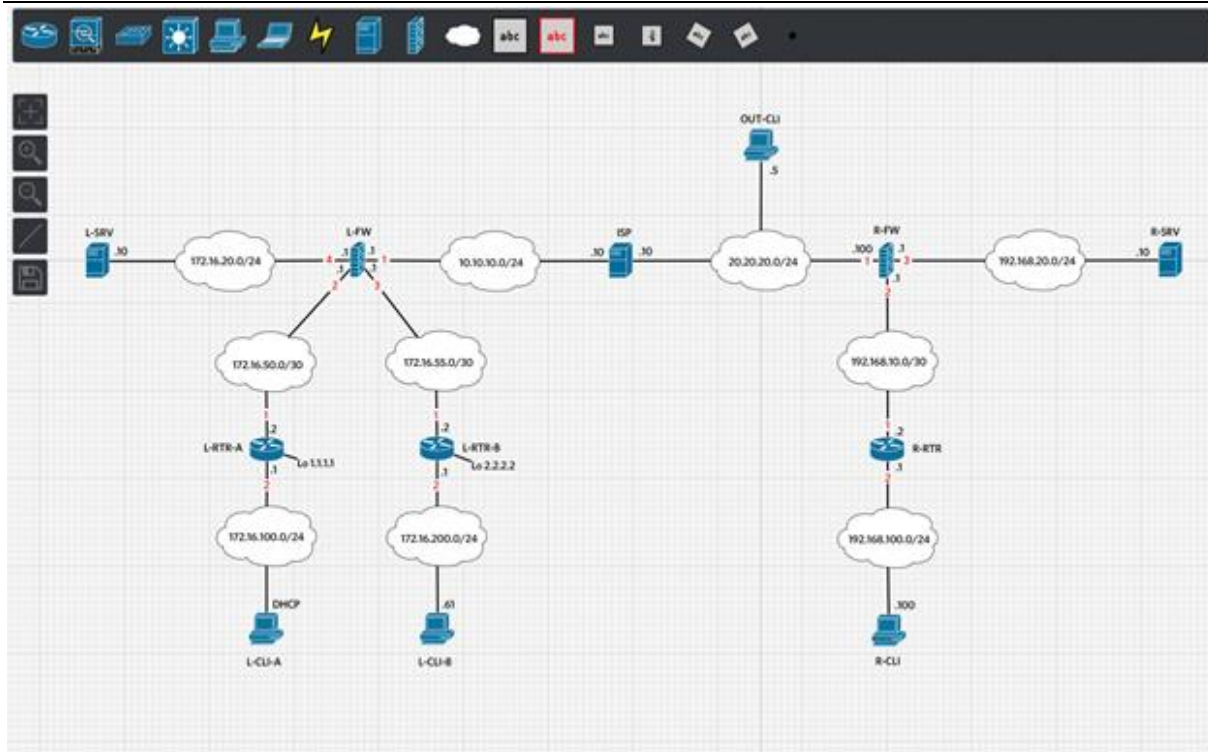


Figure 1-RT when completing a task

Each session resulted in a file with data strings. A click is a recorded mouse action. Mouse hover contains 7 parameters: message name, event ID, message ID, time, window name, X and Y axes. The message name describes the name of the event (for example, move left/right, click down/up). The message ID represents the event ID (for example, the event ID for moving the mouse is 1024, the event ID for the down mouse button is 1023, and the event ID for the up mouse button is 1022). Time is the time that has elapsed in seconds from the beginning to the end of the recorded session, provided that the parameter is removed no more than 5 ms. The window name contains the name of the application being used (for example, in our task, the event occurs

in the Chrome web browser, and therefore, the Window Name parameter shows the Chrome web browser). The X and Y parameters are the coordinates of the cursor on the screen. message ID, time, window name, and the X and Y axes. A limitation of the project at the moment is that it is possible to work in a single resolution, without scaling.

We define the movement of the manipulator as a set of consecutive user actions, which is the movement of the manipulator between two points on screen. Figure 2 shows a mouse action consisting of n events represented as a sequence of n points: $\{P_1, P_2, P_3, \dots, P_n\}$ [5].

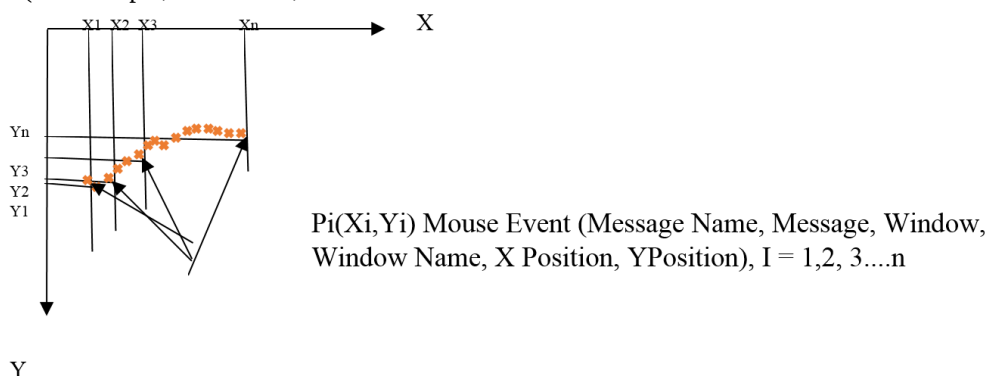


Figure 2. Moving the mouse between a series of screen locations

Based on the literature review, we divided the data set of mouse actions into three types, similar to [5], namely MM, PC, and DD: MM describes moving the mouse between two screen locations; PC describes hovering and clicking, moving the mouse over a point, and then pressing one of the mouse buttons; and DD is a drag-and-drop movement that is initiated by pressing the main mouse button and ends with releasing it. In our

study, data on mouse actions is divided into two categories: "Category 1" - mouse movement and "Category 2" - hover and click action (the action of pressing and releasing). The command treats the action as a hover-and-click (PC) action, when the previous mouse event is a down mouse click and then an up mouse click; otherwise, it is a data set as a mouse move action (MM). Two complete sets of actions are shown in table 1.

Table 1

Data Acquisition parameters and segmentation of mouse data into actions

Message Name	Event ID	Time	Window	Window ID	X axis	Y axis
mouse movements	1024	43351750	3999736	ChromeLegacy Windows	1121	701
mouse movements	1024	43351781	3999736	ChromeLegacy Windows	1124	712
mouse movements	1024	43351796	3999736	ChromeLegacy Windows	1125	720
mouse movements	1024	43351812	3999736	ChromeLegacy Windows	1127	726
mouse movements	1024	43351828	3999736	ChromeLegacy Windows	1127	728
mouse movements	1024	43354000	3999736	ChromeLegacy Windows	1127	730
left left mouse click mouse click	1023	43354078	3999736	ChromeLegacy Windows	1127	731
releasing the pressed mouse button release mouse button	1022	43354078	3999736	ChromeLegacy Windows	1127	731
mouse movements	1024	43354515	3999736	ChromeLegacy Windows	1127	732
mouse movements	1024	43354531	3999736	ChromeLegacy Windows	1162	733
mouse movements	1024	43354546	3999736	ChromeLegacy Windows	1123	736

Figures 3

and 4 show the user's behavior when moving the manipulator and hover and click actions that belong to users.

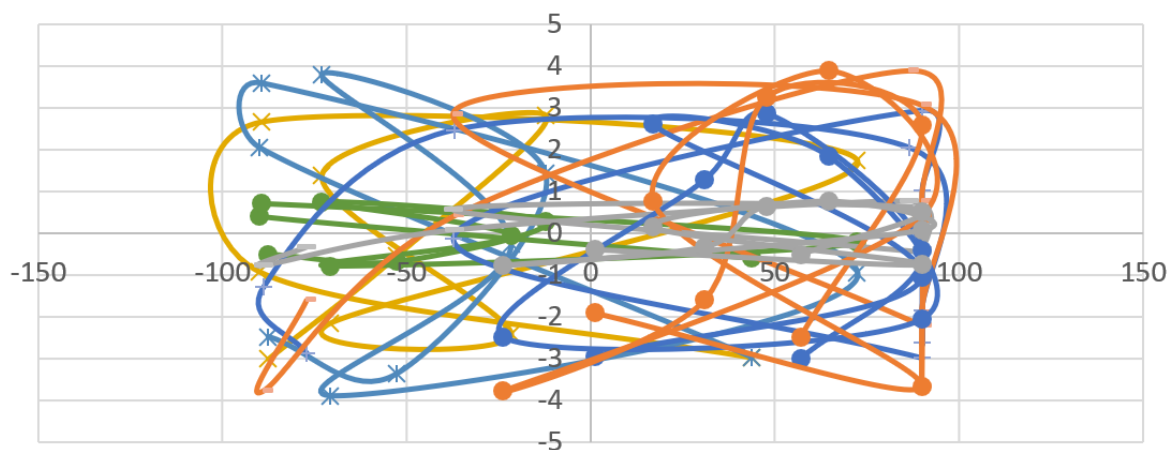


Figure 3. User behavior when moving the manipulator and hovering and clicking actions.

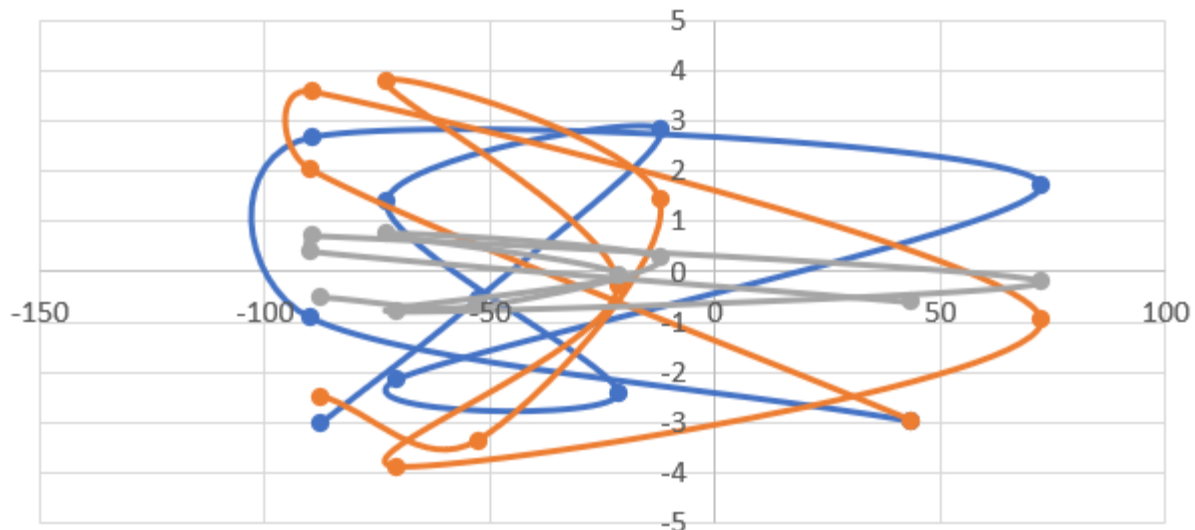


Figure 4. Mouse movement, hover actions, and manipulator clicks for three users

The main difficulty when working with data received from the manipulator is their extraction. You need to get data that is suitable for training the ML model or analyzing it using other methods. We propose the following data preprocessing scheme, shown in Figure 5.

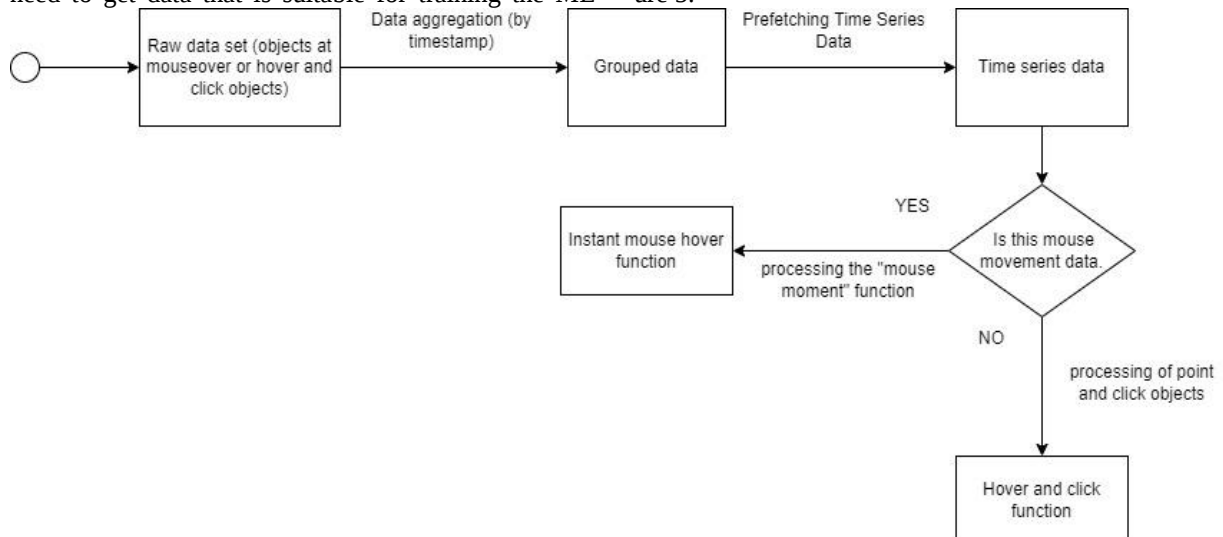


Figure 5. Scheme of actions for data preprocessing.

After preprocessing using this scheme, we will get a dataset with unique timestamps in the UNIX standard. Then, the sampling phase is determined along the time axis, with the condition that all missing records belonging to missing timestamps within the range of data sets are filled with interpolated values. This is achieved by using the "pandas" function in the Python library. Resampling is followed by linear interpolation, which provides continuous time-series data that can be conveniently used for complex time-series analysis. In this case, resampling and interpolation are used to complete the dataset. Data used for time series analysis must have all data points either recorded or interpolated. Most time series methods, such as AROMA / ARIMA [6] and LSTM-based neural network training [7], require LSTM to be complete, without any missing timestamps. Analyzing time series based on incomplete data with missing timestamps can lead to erroneous or inaccurate analytical results.

As a platform for the experimentпредлагается, the CNN neural network architecture is proposed in which the first layer consists of 64 filters, followed by a second layer with 32 filters, and the last layer contains only 16 filters. A core (1×1 pixel) is used for each of the three layers. In addition, the rectified linear unit (ReLU) activation function is used[8]. To reduce the effect of overfitting on the training set, we use the dropout probability $p = 0.05$ between each two layers. All three convolution levels and the maximum pooling level are connected to a fully connected layer to determine the final probabilities for each user. A pooling layer is located between each convolutional layer and a fully connected pair of layers. In Figure 5, the proposed user behavioral biometrics model consists of four modules: a data acquisition module, a feature extraction module, a classifier module, and a continuous authentication and anomaly detection module. The model is responsible for deciding whether a certain amount of mouse data belongs to a given user. In particular, the

following steps describe how the proposed model works:

- Data collection stage: Initial user data is collected.
- * Object extraction phase: Pandas and numpy were used to extract objectsnumpy.
- Data preparation stage: During the training stage, all user data was combined and placed in a random order. The training dataset was then divided into two parts: the first part (80% of the data) was used for training, and the second part (20% of the data) was used for testing the model's performance. For each experiment, the balance of training sets and evaluation sets remained unchanged to avoid biasing the classifier.

- Classifier phase selection: DT, RF, KNN, and CNN were used to show the ability of the proposed model to determine whether a user was authentic or impostor based on the user's mouse click flow data.

- Training data stage: The training process started with reading the characteristics of all users from the training dataset and then loading them into four classifiers to train the model. This step was an important step, since the training data contained the user behavior itself and the class label.

- Data testing phase: After completing the training phase, the model was tested on new data that was never used for training to determine whether the user was a genuine user or an impostor.

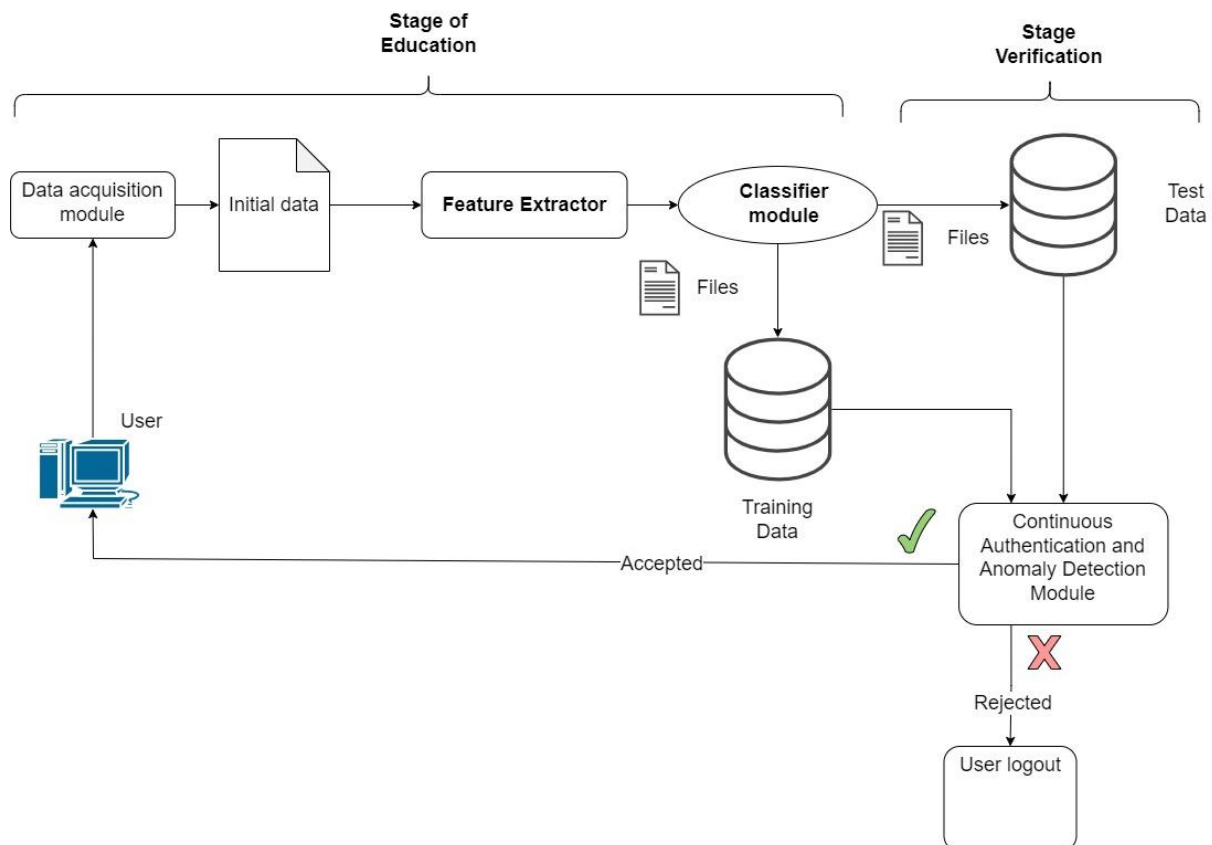


Figure 5. Stages of the proposed model's operation.

The use of the described methods in training and independent assessment of employees' qualifications will increase the reliability and reliability of classical tools for working with network infrastructure [9]. The use of biometrics will reveal unscrupulous participants, which will affect the quality of training and recruitment.

REFERENCES:

1. R. Wang, C. Han, and T. Guo. A novel fingerprint classification method based on deep learning. In 2016 23rd International Conference on Pattern Recognition (ICPR), pages 931–936. IEEE, 2016
2. Computer program name: Program interface for interaction of participants of WorldSkills competitions in competence 39 "System and network administration" with remote network infrastructure [https://www.fips.ru/registers-doc-](https://www.fips.ru/registers-doc-view/fips_servlet?DB=EVM&DocNumber=2021614735&TypeFile=html)

[view/fips_servlet?DB=EVM&DocNumber=2021614735&TypeFile=html](https://www.fips.ru/registers-doc-view/fips_servlet?DB=EVM&DocNumber=2021614735&TypeFile=html)

3. pyHook. 2021. Available online: <https://pypi.org/project/pyHook/> (accessed on 8 April 2021).

4. AF S. M., Marhusin M. F., Sulaiman R. Instrumenting API Hooking for a Realtime Dynamic Analysis //2019 International Conference on Cybersecurity (ICoCSec). IEEE, 2019, pp. 49-52.

5. Ahmed, A.A.E.; Traore, I. Dynamic sample size detection in continuous authentication using sequential sampling. In Proceedings of the 27th Annual Computer Security Applications Conference, Orlando, FL, USA, 5–9 December 2011; pp. 169–176.

6. Ahmar A. S. A comparison of α -Sutte Indicator and ARIMA methods in renewable energy forecasting in Indonesia //Int. J. Eng. Technol. - 2018. - Vol. 7. - no. 1.6. - pp. 20-22.

7. Sen S., Sugiarto D., Rochman A. Komparasi Metode Multilayer Perceptron (MLP) dan Long Short Term Memory (LSTM) dalam Peramalan Harga Beras //Ultimatics: Journal Teknik Informatika. – 2020. – T. 12. – №. 1. – C. 35-41.
8. Agarap A. F. Deep learning using rectified linear units (relu) //arXiv preprint arXiv:1803.08375. – 2018.

9. Uymin A. G., Melnikov D. A. REVIEW OF NETWORK INFRASTRUCTURE MODELING TOOLS FOR TRAINING SPECIALISTS IN ENLARGED SPECIALTY GROUPS 09.00. 00, 10.00. 00 //The science. Informatization. Technologies. Education, 2021, pp. 392-405.

THERMAL CALCULATION METHODS OF A SOLAR COLLECTOR FOR HOT WATER SUPPLY

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Abstract

Thus, it can be seen that the use of flat solar collectors is an economically justified measure that can reduce the cost of traditional types of energy intended for heat supply. Solar collectors are the ideal solution to replace the seasonal load in heat supply, great for both warm and temperate climates. The advantages of using of a solar collector are ideal for seasonal operation in conditions of high solar insolation.

Keywords: Solar radiation, solar collector, heat engineering calculation, heat supply.

Solar heating systems (STS) are becoming more and more popular in many countries around the world. The success of STS is particularly impressive in Europe.

This problem acquired particular importance when, along with the development and increase in the efficiency of the use of traditional fuel and energy resources, there was a need to attract new energy sources such as solar energy and wind energy.

The energy of the sun is primarily characterized by constant renewal and, at the same time, its usage is not accompanied by a harmful effect on the environment.

The coastal strip of the Azerbaijani sector of the Caspian and especially the Absheron Peninsula have unique solar and wind resources suitable for widespread use of STS. A set of basic climatic requirements necessary for the rational and efficient use of solar energy is also considered.

In connection with this and the existing methodology of "State Citizenship", a thermal engineering calculation of the SVP was carried out according to the recommended data of the month with the highest intensity of solar radiation $\sum q_i = 4439 \text{ Bt/m}^2$.

Assuming the inlet temperature $t_1=22^\circ\text{C}$ (for the month of June), the temperature at the outlet of the solar collector $t_2=55^\circ\text{C}$ the ambient temperature $t_{\text{cp}}=25^\circ\text{C}$ and the efficiency factor $\eta=0,44$.

All types of installations with backup sources are calculated according to the data of the month with the largest amount of solar radiation over the period of operation, and systems without a backup source are calculated from the smallest.

The required area of the sun-absorbing surface of the installation collectors without backups A , m^2 , should be determined by the formula:

$$A = G / \sum g_i \quad (1)$$

Where G is the daily consumption of hot water in the hot water supply system G , kg , is taken according to SNiP. g_i - hourly productivity of the installation, referred to 1 m^2 of the surface of the solar collector, kg / m^2 ; i - estimated hours of operation of the installation.

In case of uneven consumption of hot water by months in installations without backups, the calculation of the area of solar collectors should be performed according to the daily consumption of hot water each month and take the largest of the obtained areas.

The hourly productivity of the installation, kg/m^2 , is determined by the formula:

$$g_i = \frac{0.86 U}{\ln \frac{t_{\text{max1}} - t_1}{t_{\text{max1}} - t_2}} \quad (2)$$

Where U is the reduced heat loss coefficient of the solar collector ($\text{W/m}^2 \cdot \text{K}$), in the absence of passport data, $8 (\text{W/m}^2 \cdot \text{K})$ can be accepted for single-glass collectors and $5 (\text{W/m}^2 \cdot \text{K})$ for double-glass; t_1, t_2 coolant

temperature at the inlet and outlet of the solar collector, °C.

The temperature t_2 at the inlet and outlet is determined by the formula:

$$t_2 = t_{w2} + 5 \text{ } ^\circ\text{C},$$

where t_{w2} is the required hot water temperature.

The inlet temperature is determined by the formula:

$$t_1 = t_{w1} + 5 \text{ } ^\circ\text{C},$$

where t_{w1} — is the required cold water temperature.

In single circuit systems $t_1 = t_{w1}$ and $t_2 = t_{w2}$

During the first hour of operation of the unit, the inlet temperature is assumed to be equal to the temperature of the water in the storage tank.

When the solar collectors deviate from the southern orientation to 15°, the amount of absorbed radiation decreases by 5%, with a deviation of up to 30-10%.

The area of the sun-absorbing surface of installations with backup A, m², should be determined by the formula:

$$A = \frac{1.16G(t_{w2}-t_{w1})}{\eta \Sigma q_i} \quad (3)$$

where q_i - is the intensity of the incident solar radiation in the plane of the collector, W/m², is determined by in the range from 08:00 to 17:00 for solar collectors of southern orientation. With a deviation from south to east or west for every 16 °, the time interval begins earlier or later by 1 hour; η - CUP (coefficients of useful performance) of the solar hot water installation.

The coefficients of useful performance of the installation is determined by the formula:

$$\eta = 0,8 \left\{ \theta - \frac{9U[0,5(t_1+t_2)-t_e]}{\Sigma q_i} \right\} \quad (4)$$

where θ - is the reduced optical characteristic of the collector. In the absence of passport data, it can be taken equal to 0.73 for single-glass collectors and 0.63 for double-glass collectors; t_θ — average daily air temperature °C.

If the maximum hourly heating capacity of the solar hot water installation with forced circulation is higher than required according to the water withdrawal schedule, then storage tanks must be installed in the installations. The volume of the storage tank V, m³, should be determined according to the daily schedules

for heating water in the installation and water consumption, and in their absence, depending on the climatic region according to the formula $V = (0.06 - 0.08) A$, taking a larger value for 1U climatic district.

With a variable flow rate of the coolant in the heat-receiving circuit and the heated water circuit, the pumps are selected according to the maximum flow rate. At a constant flow rate of the coolant, its specific flow rate should be taken in the range of 20-40 kg (m² · h).

When designing installations with a variable flow rate of the coolant, the calculation of heat exchangers should be made according to the average hourly values of the flow rates of water and coolant.

The calculation of fuel savings due to the use of solar energy should be made according to the formula:

$$B = 0.0342 Q / \eta_{\text{pot}}$$

where Q - the total amount of heat GJ / year, generated by the solar hot water supply installation for the season (year), determined according to Annex 4; η_{pot} is the efficiency of the heat source to be replaced.

The calculation of the solar hot water installation is performed by the hourly sums of direct and diffuse solar radiation and the outdoor air temperature. The magnitude of the intensity of solar radiation, the temperature of the outside air is taken, as a rule, according to the "Handbook on climate", Gidrometeoizdat.

The intensity of the incident solar radiation for any spatial position of the solar collector and each hour of day light hours q_i , W / m² should be determined by the formula:

$$q_i = P_S I_S + P_D I_D$$

where I_S - is the intensity of direct solar radiation incident on a horizontal surface, W/m² I_D - intensity of scattered solar radiation incident on a horizontal surface, W/m²;

P_S, P_D — - solar collector position coefficients for direct and diffuse radiation, respectively.

The coefficients of the position of the solar collector for scattered radiation should be determined by the formula:

$$P_D = \cos^2 b / 2$$

where b - is the angle of inclination of the solar collector to the horizon.

The coefficients of the position of the solar collector P_S for direct solar radiation should be determined from the table in this appendix.

Angle of inclination of the collector to the horizon b, deg	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Latitude 40°												
25	1,76	1,49	1,30	1,13	1,04	1	1,01	1,08	1,22	1,4	1,66	1,85
40	2,24	1,72	1,36	1,11	0,97	0,90	0,93	1,03	1,24	1,55	2,03	2,45
55	2,46	1,79	1,33	1,03	0,86	0,78	0,81	0,94	1,17	1,56	2,18	2,72
90	2,30	1,48	0,91	0	0	0	0	0	0,75	1,17	1,96	2,61
Latitude 45°												
30	2,14	1,71	1,42	1,19	1,07	1,02	1,04	1,13	1,30	1,56	1,96	2,31
45	2,86	1,99	1,49	1,17	1,00	0,92	0,95	1,08	1,33	1,74	2,47	3,27
60	3,13	2,07	1,45	1,09	0,89	0,8	0,84	0,99	1,26	1,76	2,66	3,64
90	3,04	1,81	0,99	0,71	0	0	0	0	0,89	1,37	2,5	3,63

The reduced intensity of absorbed solar radiation, q_i W/m², should be determined by the formula:

$$q_{\theta i} = 0,96 (P_s \theta_s I_s + P_D \theta_D I_D)$$

where θ_s and θ_D – respectively are the given optical characteristics of the solar collector for direct and diffuse solar radiation. In the absence of passport data, the following can be accepted: $\theta_s = 0,74$; $\theta_D = 0,64$ - for single-glass and $\theta_s = 0,63$; $\theta_D = 0,42$ - for double-glazed solar collectors.

The annual (seasonal) efficiency is determined according to the graph of the area of solar collectors $\hat{A}$,

m², / (GJ·day), and the capacity of the battery tank - m³ / (GJ·day), per unit of daily heat load of hot water supply, which are calculated by the formulas:

$$\hat{A} = 10^6 A / [4,19 G (t_{w2} - t_{w1})];$$

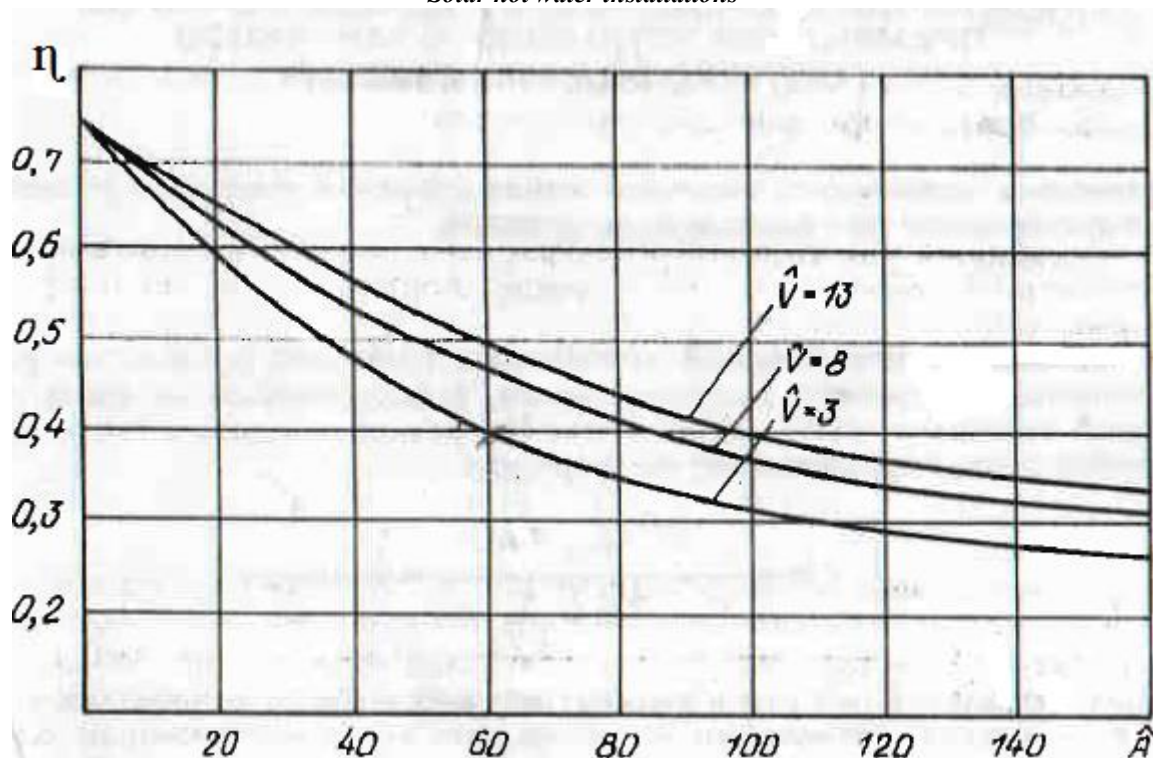
$$\hat{V} = 10^6 V / [4,19 G (t_{w2} - t_{w1})];$$

The total amount of heat GJ generated by the plant is determined by the formula:

$$Q = A \eta \sum_{z,j,l} q_i$$

where z - is the number of months of plant operation; j - is the number of days in a month.

Solar hot water installations



Dependence of the seasonal of the solar CUP of solar hot water installation on the values of $\hat{A}$ and $\hat{V}$.

REFERENCES:

1. Установки солнечного водоснабжения нормы проектирования. Москва 1988
2. Саламов О.М., Аббасова(Салманова) Ф.А., Рзаев П.Ф. Расчет солнечной водоподогревательной системы для горячего водоснабжения сельской семьи. Международный научный журнал «Альтернативная энергетика и экология» Москва, 2006, № 10, s.s. 30-36.

3. Тарнитевски Б.В. Оценки эффективности применения солнечного теплоснабжения в России. Теплоэнергетика №5, 1996г.

4. ГОСТ Р 51595-2000 "Нетрадиционная энергетика" Солнечная энергетика коллекторы солнечные. Общие технические условия.

5. У. Бекман, С. Клейн, Дж. Даффи. Расчет систем солнечного теплоснабжения. Москва, "Энергоатомиздат" 1982.

APPLICATION OF THE LEAST SQUARE METHOD FOR EVALUATION OF UNCERTAINTY OF MEASUREMENTS

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*PhD, professor**Almaty University of Power Engineering and Telecommunications named after G.J. Daukeev Almaty, Republic of Kazakhstan*<https://doi.org/10.5281/zenodo.6594891>**Abstract**

The article studies the least squares method and its application for estimating measurement uncertainty. The article shows how the parameters obtained by fitting, the intercept and the slope of the linear dependence, together with estimates of their variances and covariance, can be used to determine the correction values and its standard uncertainty from the calibration characteristic.

Keywords: measurement uncertainty, least squares method, GUM method, Monte-Carlo method, Kragten method, guidance on expressing measurement uncertainty, combined standard uncertainty, expanded uncertainty.

Introduction. When processing the results of measurements obtained during international comparisons of standards, testing, calibration or verification of measuring instruments for foreign countries, in the study of primary national standards, measurement uncertainty is used as a characteristic of the quality of measurements. In this regard, the task of ensuring international unity in the approach to presenting and estimating the uncertainty of the measurement result is relevant.

Currently, metrological services require a transition from error assessment to measurement uncertainty assessment. A review of various methods for estimating measurement uncertainty has shown that the following methods are available:

- 1) classical GUM method;
- 2) Kragten method (spreadsheet method);
- 3) Monte-Carlo method;
- 4) least squares method (LSM).

Analytical methods are widely used to estimate measurement uncertainty [1]. Their implementation is based on the law of propagation of uncertainty, which consists in approximating the original model equation by linear terms of the Taylor series, which, in combination with the method of summing variances and covariances, makes it possible to obtain an expression for calculating the combined standard uncertainty (classical GUM method).

The Kragten method is a spreadsheet method [2] that can be used to simplify calculations when finding measurement uncertainty using the GUM method. The automated program for calculating measurement uncertainty by the Kragten method developed by the authors is described in the article [3].

The analysis of uncertainty estimation by the classical GUM method shown in the Guide to the Expression of Uncertainty in Measurement [1] is not exhaustive. There are many situations, sometimes quite complex, requiring the use of different statistical methods.

The most universal numerical method is the method of statistical modeling (Monte Carlo) [4],

which is based on generating input values in the form of random numbers with a given distribution law and finding the distribution law of the measured (output) value for the corresponding set of obtained random numbers.

In relatively simple measurement problems, uncertainty components can often be estimated by means of dispersion analysis of the results of hierarchical experiments for a given number of hierarchy levels [5]. Sample estimates of variances and standard deviations of functional dependence parameters, as well as the values predicted from this functional dependence, can be easily calculated using well-known statistical procedures. Therefore, to obtain an estimate x_i of the input value X_i , you can use the functional dependence obtained from the experimental data by the least squares method.

Research method. One of the main mathematical methods for processing experimental data is the least squares method. The numerical parameters are selected from the condition of the minimum sum of the squared deviations of the measured values from the calculated values of the approximating function. The meaning of this condition is that the reliability of the approximation results obtained using this condition is the higher, the smaller the sum of the squared deviations.

The example below illustrates the application of the least squares method to construct a linear calibration characteristic for thermometer calibration. The example shows how the parameters obtained by fitting, the intercept and the slope of the linear dependence, together with estimates of their variances and covariance, can be used to determine the correction values and its standard uncertainty from the calibration characteristic [5].

Experiment. The thermometer is calibrated by comparing $n = 11$ temperature readings t_k of the thermometer, having negligible uncertainty, with the corresponding reference temperature values $t_{R,k}$ in the range from 21°C to 27°C to obtain correction values $b_k = t_{R,k} - t_k$ to the readings. The measured corrections and

the measured temperatures t_k are the input values for the evaluation. The linear calibration characteristic is adjusted to the measurement data of corrections and temperatures using the least squares method:

$$b(t) = y_1 + y_2(t - t_0), \quad (1)$$

The two measured (output) values are the parameters y_1 and y_2 – respectively the free term and the slope of the calibration characteristic. The temperature t_0 is chosen by agreement as some fixed point, so it is not among the independent parameters to be determined by the least squares method. Once estimates of y_1 and y_2 of their variance and covariance have been obtained, formula (1) can be used to calculate the correction to be applied to the temperature reading t of the thermometer and its standard uncertainty.

Fitting by the least squares method. In view of the above, estimates of the output values y_1 and y_2 , their variances and covariances by the least squares method are obtained by minimizing the sum:

$$S = \sum_{k=1}^n [b_k - y_1 - y_2(t_k - t_0)]^2, \quad (2)$$

which leads to the following formulas for y_1 and y_2 , their sample variances $s^2(y_1)$ and $s^2(y_2)$ and the sample correlation coefficient $r(y_1, y_2) = s(y_1, y_2) / (s(y_1)s(y_2))$, where is the sample covariance:

$$y_1 = \frac{(\sum b_k)(\sum \theta_k^2) - (\sum b_k \theta_k)(\sum \theta_k)}{D}, \quad (3)$$

$$y_2 = \frac{n \sum b_k \theta_k - (\sum b_k)(\sum \theta_k)}{D}, \quad (4)$$

$$s^2(y_1) = \frac{s^2 \sum \theta_k^2}{D}, \quad (5)$$

$$s^2(y_2) = n \frac{s^2}{D}, \quad (6)$$

$$r(y_1, y_2) = -\frac{\sum \theta_k}{\sqrt{n \sum \theta_k^2}}, \quad (7)$$

$$s^2 = \frac{\sum [b_k - b(t_k)]^2}{n - 2}, \quad (8)$$

$$\begin{aligned} D &= n \sum \theta_k^2 - \left(\sum \theta_k \right)^2 \\ &= n \sum (\theta_k - \bar{\theta})^2 \\ &= n \sum (t_k - \bar{t})^2; \end{aligned} \quad (9)$$

In the above formulas, summation is carried out over k from 1 to n ; $\theta_k = t_k - t_0$; $\bar{\theta} = \frac{\sum \theta_k}{n}$; $\bar{t} = \frac{\sum t_k}{n}$. The expression $[b_k - b(t_k)]$ is the difference between the correction b_k measured at temperature t_k and the

correction $b(t_k)$ calculated for temperature according to the calibration characteristic $(t) = y_1 + y_2(t - t_0)$. The sample variance s^2 is a general measure of the uncertainty of fitting the calibration characteristic to experimental data, and the coefficient $1/(n - 2)$ reflects the fact that, since estimates of two parameters y_1 and y_2 are obtained based on n observations, the number of degrees of freedom for estimating s^2 will be $v = n - 2$.

If an estimate of one single parameter, the arithmetic mean, is obtained from n independent observations, then the number of degrees of freedom v will be equal to $n - 1$. If n independent observations are used to derive the intercept and slope estimates in the least squares straight line equation, then the number of degrees of freedom to determine the sample standard deviations of these estimates will be $v = n - 2$. When calculating the least squares method of m curve parameters from n experimental points, the number of degrees of freedom to determine the sample standard deviation of the estimate of each parameter will be $v = n - m$ [3].

Results. The data on which the adjustment is carried out are presented in the second and third columns of Table 1. As a fixed point t_0 , $t_0 = 20^\circ\text{C}$ is taken. Then from formulas (3)-(9) we obtain:

$$\begin{aligned} y_1 &= -0,1712^\circ\text{C}; \\ y_2 &= -0,00218; \\ s(y_1) &= 0,0029^\circ\text{C}; \\ s(y_2) &= 0,00067; \\ s &= 0,0035^\circ\text{C}; \\ r(y_1, y_2) &= -0,930 \end{aligned}$$

The fact that the angular coefficient y_2 is more than three times greater than its standard uncertainty indicates the need to use a calibration characteristic, and not a fixed correction, common for the entire temperature range.

After obtaining numerical estimates, the calibration characteristic can be written as:

$$\begin{aligned} b &= -0,1712(29)^\circ\text{C} \\ &\quad + 0,00218(67)(t \\ &\quad \quad - 20^\circ\text{C}), \end{aligned} \quad (10)$$

where the numbers in brackets correspond to the least significant digits of the estimates of the free term and the slope of the calibration characteristic and show the numerical values of the standard uncertainties of these parameters. Formula (10) allows you to calculate the correction to the thermometer readings for any temperature t , including the values $b(t_k)$ for $t = t_k$. Corrections $b(t_k)$ are indicated in the fourth column of Table 1, and in its last column the differences between the calculated and measured values of the correction $b_k - b(t_k)$ are given.

The analysis of these differences can be used to check the validity of the choice of a linear model as a calibration characteristic using well-known hypotheses testing procedures.

Table 1

Data used to obtain a linear calibration characteristic of a thermometer by the least squares method

Indication number k	Thermometer readings $t_k, ^\circ\text{C}$	Measured correction $b_k = t_{R,k} - t_k, ^\circ\text{C}$	Estimated correction $b(t_k), ^\circ\text{C}$	Difference between measured and calculated corrections $b_k - b(t_k), ^\circ\text{C}$
1	21,521	-0,171	-0,1679	-0,0031
2	22,012	-0,169	-0,1668	-0,0022
3	22,512	-0,166	-0,1657	-0,0003
4	23,003	-0,159	-0,1646	+0,0056
5	23,507	-0,164	-0,1635	-0,0005
6	23,999	-0,165	-0,1625	-0,0025
7	24,513	-0,156	-0,1614	+0,0054
8	25,002	-0,157	-0,1603	+0,0033
9	25,503	-0,159	-0,1592	+0,0002
10	26,010	-0,161	-0,1581	-0,0029
11	26,511	-0,160	-0,1570	-0,0030

Uncertainty of the calculated correction. The expression for the combined standard uncertainty of the calculated correction is obtained by taking the functional dependence from formula (1), $\mathbf{b}(t) = \mathbf{f}(y_1, y_2)$ and taking $\mathbf{u}(y_1) = \mathbf{s}(y_1)$ и $\mathbf{u}(y_2) = \mathbf{s}(y_2)$:

$$u_c^2[b(t)] = u^2(y_1) + (t_1 - t_0)^2 u^2(y_2) + 2(t - t_0)u(y_1)u(y_2)r(y_1, y_2). \quad (11)$$

The variance estimate $u_c^2[b(t)]$ has a minimum at the temperature $t_{min} = t_0 - u(y_1)r(y_1, y_2)/u(y_2)$, which in this case is $t_{min} = 24,0085 ^\circ\text{C}$.

As an example of the use of formula (11), suppose that it is necessary to find a correction to the readings of a thermometer and its uncertainty at a temperature $t = 30 ^\circ\text{C}$, which is outside the calibration range. Substituting $t = 30 ^\circ\text{C}$ into formula (10) gives:

$$b(30 ^\circ\text{C}) = -0,1494 ^\circ\text{C},$$

and formula (11) after substituting the same value takes the form

$$u_c^2[b(30^\circ\text{C})] = (0,0029^\circ\text{C})^2 + (10^\circ\text{C})^2(0,00067)^2 + 2(10^\circ\text{C})(0,0029^\circ\text{C})(0,0067)(-0,930) = 17,1 \cdot 10^{-6} ^\circ\text{C}^2$$

or

$$u_c^2[b(30^\circ\text{C})] = 0,0041 ^\circ\text{C}.$$

Thus, the correction at $30 ^\circ\text{C}$ is $-0,1494 ^\circ\text{C}$ with a combined standard uncertainty $u_c = 0,0041^\circ\text{C}$ for $v = n - 2 = 9$ degrees of freedom.

Assume that the output is normally distributed and estimate the expanded uncertainty with probability $P=95\%$, for which the coverage factor is approximately $k=2$. Then the expanded uncertainty is:

$$U = 2 \cdot u_c = 2 \cdot 0,0041 = 0,0082^\circ\text{C} \approx 0,008^\circ\text{C}.$$

Measurement result:

$$t = (30 \pm 0,008)^\circ\text{C}, k = 2, P = 95\%$$

Conclusion. The least squares method is used for calibration purposes to assess the uncertainties associated with short-term and long-term random changes in the results of comparisons of material standards with unknown sizes of units of quantities (for example, gage blocks, mass standards) with comparison standards with known transmitted sizes of units of quantities.

In the course of the results of the measurement uncertainty estimation by the least squares method, it was concluded that the least squares method is a practical alternative to the GUM uncertainty estimation method, in many cases it is easier to use and also provides a high reliability of measurement uncertainty estimation.

The combination of the classical GUM method, the Kragten method, the Monte Carlo method, and the least squares method is useful for developing an appropriate strategy, since each of the four approaches illuminates different sides of the problem.

REFERENCES:

1. Guide to the Expression of Uncertainty in Measurement: First edition. ISO, Geneva, 1993.
2. EURACHEM/CITAC Guide Quantifying Uncertainty in Analytical Measurements, Third Edition, 2012.
3. Khan S.G., Serikova A.A. Development of an automated program for calculating measurement uncertainty by the Kragten method, "The Europe and the Turkic World: Science, Engineering and Technology": Materials of the VII International Scientific-Practical Conference. In three volumes. Volume I – Mersin, Turkey: Regional Academy of Management, 2022. – 363 p.
4. Cox M., Harris P., Siebert B.R.-L. Estimation of measurement uncertainty based on the transformation of distributions using Monte Carlo simulation // Izmeritelnaya tekhnika. - 2003. - No 9. - P. 9–14.
5. ISO/IEC Guide 98-3:2008 «Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)»

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