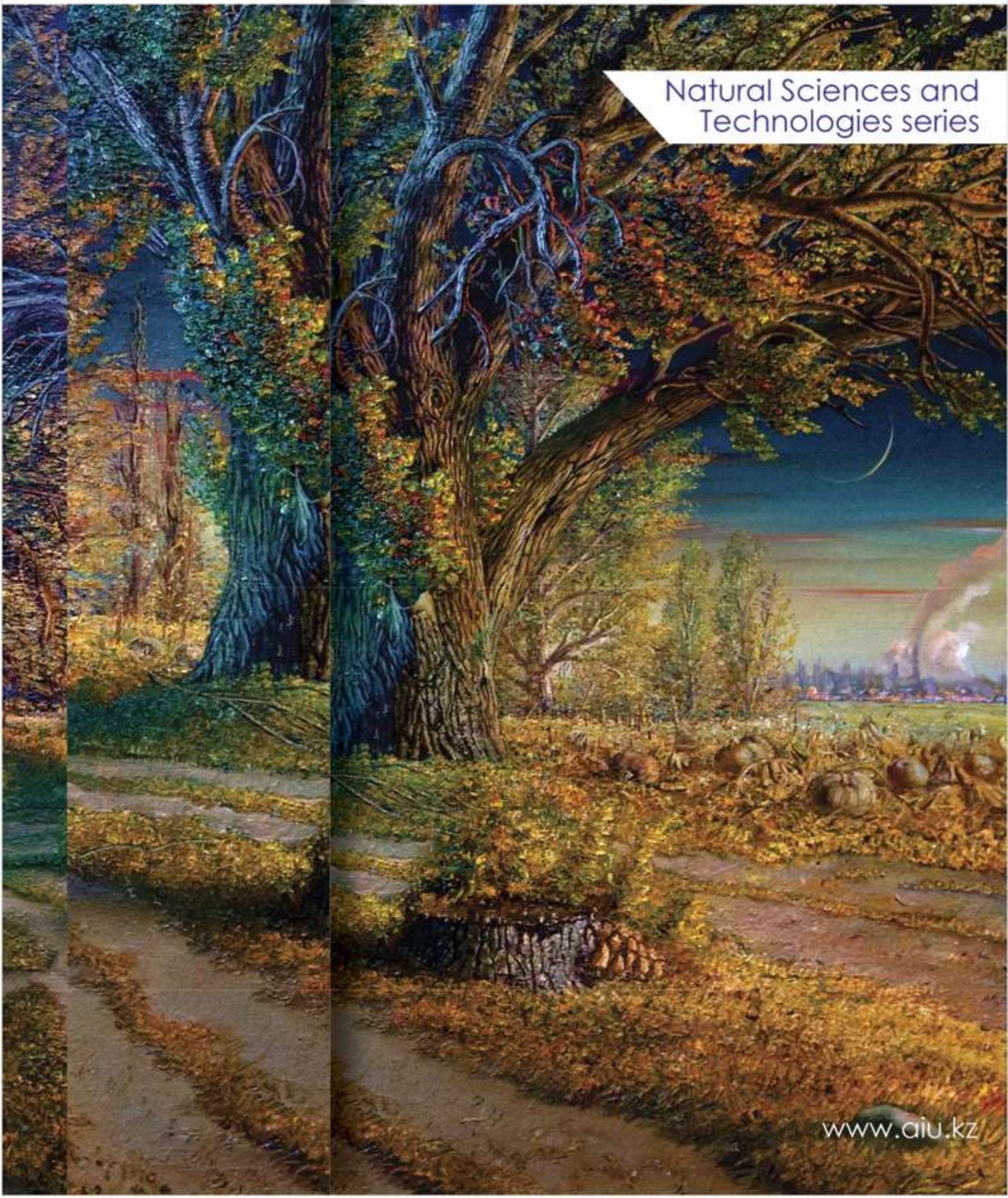


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EVALUATION OF THE ENVIRONMENTAL POLICY EFFECTIVENESS OF THE OIL AND GAS SECTOR OF ATYRAU REGION

Gimranova G.K., Nikanorova A.D.

Annotation. Modern trends in the management of industrial enterprises is the introduction of approaches aimed at preserving the environment and reducing the negative impact. Atyrau region is a large oil and gas region, where there are more than 48 oil and gas enterprises, whose activities cause geo-environmental problems. The aim of the work is to develop mechanisms to improve the environmental policy of enterprises in the oil and gas sector of the Atyrau region to reduce their negative impact on the environment. In the framework of the study, a methodology was developed for assessing the environmental responsibility of enterprises, based on publicly available data on their activities, an analysis of the effectiveness of their environmental policy was carried out, and mechanisms were proposed to stimulate enterprises to introduce environmentally oriented approaches to production management.

Keywords: environmental policy of enterprises; environmental responsibility rating; corporate transparency; environmental management.

INTRODUCTION

Modern trends in the management of large industrial enterprises is the introduction of approaches aimed at preserving the environment and reducing the negative impact on it. International standards require enterprises to develop and implement “green” principles and approaches into management processes, and to commit themselves to fulfill environmental requirements.

In accordance with the Concept of the transition to a green economy of the Republic of Kazakhstan, activities aimed at greening the economy are carried out in the following areas: saving energy and increasing the efficiency of energy costs, improving the system waste management, development of renewable energy sources, sustainable consumption of water resources, conservation and effective management of ecosystems [1].

The essence of the environmental policy of industrial enterprises is to develop a system of economic, legal, environmental, educational measures aimed at managing the anthropogenic impact of enterprises and ensuring rational environmental management. Its main purpose is to protect ecosystems, respect the same social, economic and environmental interests, as well as to control and monitor the environmental impact of the enterprise[2].

Atyrau region is a large oil and gas region, where there are more than 48 oil and gas enterprises that belong to the enterprises of the highest first category of danger [Department of Ecology of Atyrau region]. The region both has a high economic growth in the country. The development of the oil and gas sector allows opening up new jobs and attracting foreign investors. At the same time, serious geo-environmental problems

are associated with the functioning of oil and gas enterprises. [3]. Improvement of the environment depends on the decisions made by their management in the field of ecology and nature management. The aim of this work is to develop mechanisms to improve the environmental policy of enterprises in the oil and gas sector of the Atyrau region to reduce their negative impact on the environment. For this, a methodology for assessing the environmental responsibility of major enterprises was developed and an analysis of the effectiveness of their environmental policy implementation was conducted.

MATERIALS AND METHODS

The developed methodology for assessing the environmental responsibility of enterprises in the oil and gas sector is based on point-rating approaches for assessing the environmental responsibility of enterprises [4]. Despite the large number of different ratings and indices, there is still no single and universally accepted method for assessing the environmental responsibility of companies, which would serve as the basis for a comparative analysis of the activities of companies in different regions and countries of the world[5].

In the framework of this study, the task was to develop a universal assessment system, which is based on open and accessible data. To calculate the rating, 3 main groups of parameters were used: 1) indicators reflecting the environmental impact of the enterprise; 2) indicators characterizing the level of environmental management; 3) indicators of corporate transparency (Fig. 1).

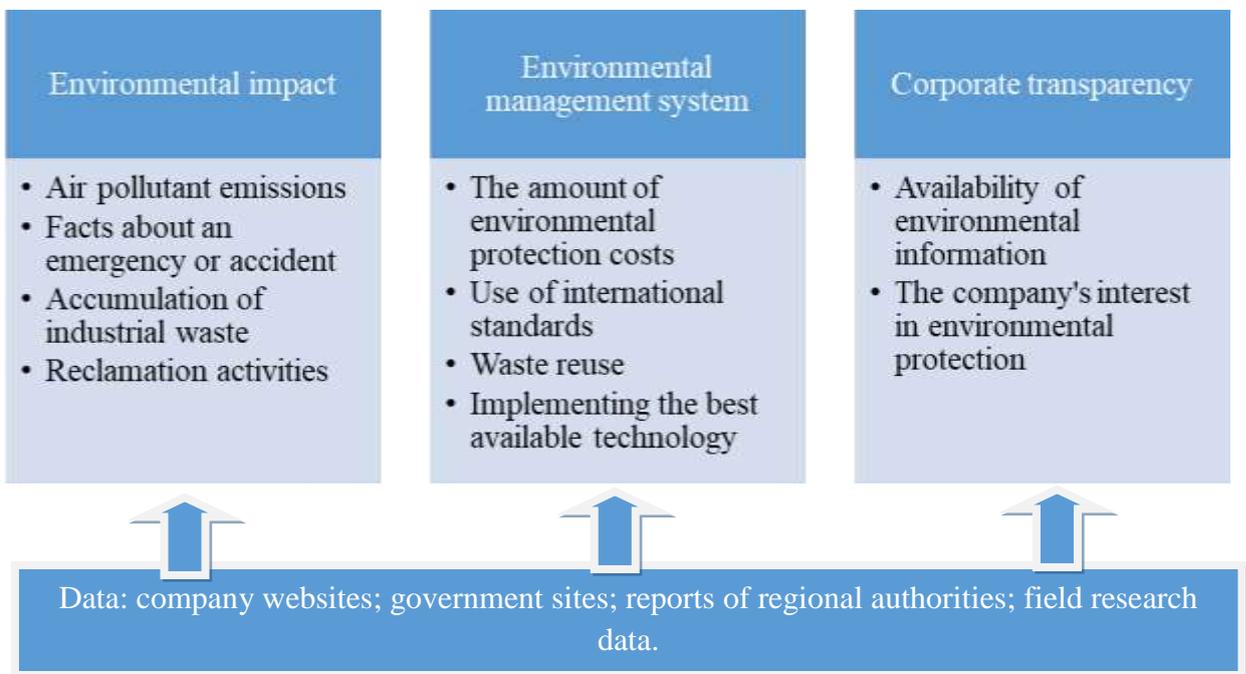


Figure 1. The structure of calculating the environmental responsibility rating of enterprises in Atyrau region.

The environmental impact of the enterprise. The specific emissions of pollutants into the atmosphere, the volume of accumulation of industrial waste and the dynamics of changes in these indicators characterize the efforts of enterprises to reduce the impact on environmental components through the use of new technologies, air filter installations that capture air pollutants, the introduction of new waste processing chains, etc. The facts about the occurrence of emergencies or accidents indicate the lack of effective measures to prevent environmental threats, and the lack of remediation activities indicates disinterest and the inability of enterprises to minimize the anthropogenic load.

Environmental management system. Access to the environmental management system is provided through national (ST RK / ISO 14001-2006) and international environmental standards of the ISO 14000 family. These standards include several aspects for the environmental planning of production: management system; assessment of environmental monitoring; production life cycle management system. The introduction of planning procedures increases the efficiency of enterprises in accordance with applicable environmental requirements at the national and international levels. The level of environmental costs in relation to the income of the enterprise also indicates the degree of involvement of the enterprise in environmental protection, on average, oil companies spend from 1 to 5% of their profits[6].

Corporate transparency. An important principle in building an environmental policy is the principle of transparency, which implies the company's willingness to substantially, reliably and fully disclose information about its environmental activities to society. Enterprises must adhere to the principle of transparency, which consists in their willingness to disclose environmental information on their environmental impact through a public reporting system.

Each parameter was rated on a scale of 0 to 10 points. Enterprises that score from 0 to 40 points are characterized by low environmental responsibility, in the range 41-73 - medium, in the range 74-100 - high.

RESULTS AND DISCUSSION

The rating was calculated for 10 major oil and gas enterprises in the region (Fig. 2) based on information from 2016-2018 published on the official websites of companies, state executive bodies, as well as data from the Department of Ecology of Atyrau Oblast. To verify the data, the authors of the study asked the enterprise administrations to provide the missing information.



Figure 2. Environmental responsibility rating of oil and gas enterprises in Atyrau region

The group of enterprises with high environmental responsibility includes the enterprises of «Tengizchevroil» LLP, and «Embamunaigas» JSC. Each year, these companies publish non-financial reports in the public domain in accordance with the international standards, together with which they hide the ecologically important data on the environmental impact. Through mass media and on the official websites of companies, they are improving environmental policies, and they are incorporating the best available technologies and environmental standards. The total cost of environmental protection measures is 5.62% of profit for «Tengizchevroil» LLP and 1.9% for «Embamunaigas» JSC.

The group with medium environmental responsibility «North Caspian Operating Company», «Caspian Neft» JSC, «Atyrau Refinery» LLP, «Sazankurak» LLP, «Sveltland-Oil» LLP. At some of these enterprises, environmental management standards have not been implemented («Caspian Neft» JSC, «Sazankurak» LLP, «Sveltland-Oil» LLP), there is an increase in pollutant emissions and an increase in waste accumulation («North Caspian Operating Company», «Caspian Neft» JSC, «Atyrau Refinery» LLP, «Sazankurak» LLP, «Sveltland-Oil» LLP). The disclosure of the environmental data of these enterprises on the websites is not fully displayed, a significant part of the information is missing. The group with average environmental responsibility includes («North Caspian Operating Company», «Caspian Neft» JSC, «Atyrau Refinery» LLP, «Sazankurak» LLP, «Sveltland-Oil» LLP. At some of these enterprises, environmental management standards have not been implemented («Caspian Neft» JSC, «Sazankurak» LLP, «Sveltland-Oil» LLP), there is an increase in pollutant emissions and an increase in waste accumulation («North Caspian Operating Co

EVALUATION OF THE ENVIRONMENTAL POLICY EFFECTIVENESS OF THE OIL AND GAS SECTOR OF

Oil» LLP). The disclosure of the environmental data of these enterprises on the sites is not fully displayed, a significant part of the information is missing
«Potential Oil» LLP, «Maten petroleum» JSC, «Kozhan» JSC enterprises received the least points and were assigned to the group of enterprises with low environmental

responsibility. This is primarily due to the low level of corporate transparency: on official websites of enterprises or there are no sections devoted to environmental issues, or the information presented on them has general environmental content.

The World Wildlife Fund (WWF), an international non-governmental organization, is also developing its rating of transparency of environmental responsibility of oil and gas enterprises in Kazakhstan [4]. The WWF rating is calculated on the basis of universal criteria proposed as generally accepted requirements for oil and gas companies. Criteria are evaluated in the field of environmental management, the scale of anthropogenic damage to the natural environment, transparency of information on environmental impact. In 2018, 4 companies in Atyrau region were included in this rating. The group with a high WWF rating «Embamunaigas» JSC, «North Caspian Operating Company». The low-rated group includes «Tengizchevroil» LLP, « Caspiy Neft » JSC, due to the low points scored in terms of environmental impact and environmental management [4].

The differences in the results of the two ratings are due to the difference in the indicators used and the methods of obtaining data. The methodology proposed by the authors for calculating the environmental responsibility rating of enterprises does not require serious administrative resources to obtain reliable information, while the WWF indicators used require close contact with company management to disclose it.

CONCLUSIONS

The Republic of Kazakhstan is actively involved in improving policies in the field of environmental protection and nature management. The state is gradually encouraging private enterprises to switch to environmental standards and approaches in organizing their activities by encouraging investments in green technologies, increasing the efficiency of water use, decarbonizing production and reducing their waste [1]. However, the initiative remains primarily with private companies.

The analysis of the environmental responsibility of enterprises in the oil and gas sector of the Atyrau region showed that the production system and the current environmental principles for organizing the work of enterprises are heterogeneous. Enterprises with different approaches and the level of perception of environmental responsibility operate in the region. An analysis of the environmental responsibility of enterprises in the oil and gas sector of the Atyrau region showed that the production system and the current environmental principles for organizing the work of enterprises are heterogeneous. There are enterprises in the region with different approaches and a level of perception of environmental responsibility.

The enterprises «Tengizchevroil» LLP, «North Caspian Operating Company», whose shareholders are leading world companies, as well as state-owned national enterprises «Embamunaigas» LSC, «Atyrau Refinery» LLP are more inclined to introduce green technologies and environmental disclosure. Small private companies are less interested in introducing environmental management systems and increasing

transparency. This is largely determined by the lack of direct legislative requirements and economic motivation.

To increase the environmental responsibility of enterprises, it is necessary, firstly, to involve the public in monitoring the activities of oil and gas sector companies in informing in the field of environmental policy. Secondly, the development of government incentive and binding measures to transfer enterprises to the best available technologies. Thirdly, an increase in the liability of enterprises for the emission of pollutants and a review of administrative fines towards an increase in the field of environmental offenses. Integrated implementation of measures in the field of public and state control, economic and administrative incentives will increase the number of enterprises implementing environmental policy principles, which will help reduce the negative impact of the oil and gas sector on the nature of the Atyrau region.

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ОЦЕНКА ЭФФЕКТИВНОСТИ ЭКОЛОГИЧЕСКОЙ ПОЛИТИКИ НЕФТЕГАЗОВОГО СЕКТОРА АТЫРАУСКОЙ ОБЛАСТИ

Гимранова Г.К., Никанорова А.Д.

Аннотация. Современными тенденциями в управлении промышленными предприятиями является внедрение подходов, направленных на сохранение окружающей среды и снижение негативного воздействия. Атырауская область - крупный нефтегазовый регион, в котором действуют более 48 нефтегазовых предприятий, деятельность которых связана с геоэкологическими проблемами. Целью работы является разработка механизмов совершенствования экологической политики предприятий нефтегазового сектора Атырауской области с целью снижения их негативного воздействия на окружающую среду. В рамках исследования была разработана методология оценки экологической ответственности

предприятий на основе общедоступных данных об их деятельности, проведен анализ эффективности их экологической политики и предложены механизмы стимулирования предприятий к внедрению экологически ориентированные подходы к управлению производством.

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CARBON NANOPARTICLES RESEARCH PROGRESS IN KAZAKHSTAN

Qing Yang, Ayan Nurkesh

Abstract: The research area of carbon dots (C-dots) is widely known for variety of applications, including bioimaging, biomedical science, and sensors. Moreover, recent findings suggest the usage of carbon nanoparticles as an effective alternative for drug therapies. Synthesis of carbon dots is relatively cheap, fast, and green process. The results of C-dots treated bacteria and cancer cells, fluorescent imaging for detection of temperature and water pollutants all provides an interesting and promising approach of C-dots applications in different fields. Therefore, C-dots research has an important value for the scientific community and society. The following mini review provides a summary of relevant articles published by Kazakhstani scientists.

Keywords: carbon nanoparticles; cancer therapy; bioimaging; sensors

INTRODUCTION

Carbon-based nanomaterials including carbon dots (C-dots) have gained much attention within the areas of medicine, bioimaging, and sensors. C-dots have low cost and time of the synthesis, biocompatible, and represents a green type of the nanomaterial. The C-dots can be made different sources and different elemental doping are utilized to improve the properties of C-dots (Lim, Shen, & Gao, 2015; Zhang et al., 2018; Zheng, Ananthanarayanan, Luo, & Chen, 2015). Recently the field of carbon nanoparticles began to advance in Kazakhstan. The scientist studied the properties of synthetic or food-derived C-dots and their applications as antibacterial and cancer therapy drugs, sensors, and bioimaging tools. Here we will review the research progress of this field in Kazakhstan by providing a brief summary of some of the recent articles.

In one article date pits (*Phoenix dactylifera*) derived carbon dots (C-dots) were determined to have an anti-cancer effect on *in vitro* treatments of cancer cell lines. Carbon dots of about 1.1 nm size were synthesized using a hydrothermal method with addition to phosphoric acid. The particles observed to have strong fluorescence at 338 nm wavelength (near to blue). FT-IR transmittance spectrum demonstrated that C-dots composed of functional groups of RO-H, RN-H, C=O, and C=C. In concentration of 0.1 mg/ml the proliferation and migration of the human lung cancer A549, prostate cancer PC3, and breast cancer MCF7 cell lines significantly attenuated (61%). Interestingly, healthy kidney HEK293 cells growth treated with C-dots was inhibited only for 14% demonstrating the potential cancer selective cell growth inhibition. Moreover, the authors showed that C-dots exhibited fluorescence when incubated with cells which can be used for bioimaging (Yingqiu Xie et al., 2017). Imaging application of date pits derived C-dots was also observed in treating *Escherichia coli* (*E. coli*) bacteria on a gold surface. The fluorescence on the gold surface was increased in comparison to glass and showed bacterial staining or labeling properties of C-dots (Bukasov, Filchakova,

Gudun, & Bouhrara, 2018). Another usage of C-dots including date pits derived samples were semi-3D cell culturing on glass beads for the further cancer targeting. The nanoparticles were shown to have a positive electric charge in except for date pits derived particles. Then glass beads treated with C-dots were used for DNA extraction from *E.Coli* DH5 α bacteria. Culturing of cancer and healthy cell lines (PC3 and NRK) in C-dots treated glass beads surface revealed distinct growth of cancerous cells that has potential in cancer therapy applications (Yingqiu Xie, Ayan Nurkesh, Keneskhanova, Altaikyzy, & Fan, 2018). Bacterial growth inhibition was also achieved by date-derived C-dots along with water pollution sensory material properties. The antibacterial effect tested on both gram negative and positive bacteria being an analog for common antibiotics. Further the interaction of particles with bacteria was used to develop bacterial pollution sensor-like material (Altaikyzy, Fan, & Xie, 2018). Further, the cell growth inhibition of date pits derived C-dots was determined to be via DNA damage. The cytotoxicity assay applied for NRK and PC3 cells demonstrated that C-dots kills both cell lines but affects cancer cells in a different way. This feature can be used for selective cancer treatment. The possible pathway was through inducing pH value drop in the cellular environment which was also observed in peroxidase activity inhibitory effect. The direct binding to the DNA resulted in fluorescence changes associated with nucleotide strands disruption or damage. C-dots may disrupt the DNA which resulted in the selective arrest of the cellular replication cycle process. Additionally, mutant bacterial strains treated with C-dots showed different degrees of growth inhibition. The application of anti-cancer drug along with C-dots suggested potential mechanisms of action such as via mammalian target of rapamycin (mTOR) and Pim-1 pathways. Overall nanoparticles were shown to be effective and low-cost green nanomaterial (Nurkesh et al., 2019).

The process of the carbon dots synthesis can be achieved by single step hydrothermal method (Figure 1). Common potato was used for nanoparticle production. The resulting particles had 1.5 nm size distribution as observed under the atomic force microscope (AFM) and amorphous structure X-ray diffraction (XRD) pattern. The analysis revealed the presence of NH₃, N-(C)₃, and NO₃ groups. The fluorescent emission was depended on the acidity of the environment. Application of C-dots was suggested for detection of cephalexin which is anti-infection drug. Concentrated amounts of the drug are harmful to human and C-dots provides a possible application as a fluorescent detection of the cephalexin (Wang et al., 2015).

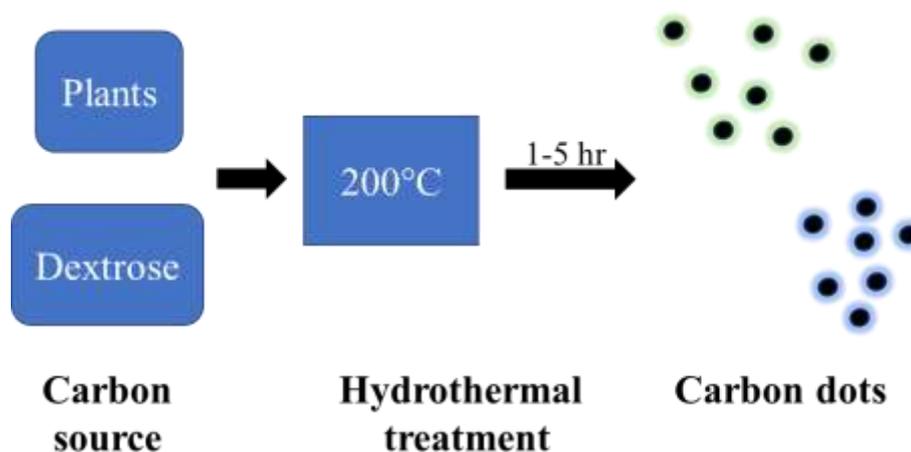


Figure 1. Carbon dots synthesis.

Similarly, beet derived carbon dots were applied for the detection of Amoxicillin (AMO) antibiotics. The beet derived C-dots were placed with different concentrations of the AMO and the fluorescence increased proportionally to the antibiotic concentration. Thus, the beet C-dots exhibited AMO sensory potential (Wang et al., 2018). The application of carbon nanoparticles was effective for the detection of ferric ions in water and showed the “thermometer-like” properties. Specifically, fluorescent nitrogen and phosphorus doped C-dots synthesized from dextrose as a carbon source. The synthesis required only about 1 hour of hydrothermal treatment at 200°C (Figure 1). The nitrogen and phosphorus doped C-dots with approximately 31-36 nm size used to detect the presence of the ferric ions in the water. C-dot probe had distinct fluorescent emissions in response to ferric ion concentrations in water. Thus, the reports demonstrated the alternative cheap method of water pollutant detection (Molkenova, Amangeldinova, Aben, Sayatova, & Atabaev, 2019; Molkenova & Atabaev, 2019). Moreover, the nitrogen doped C-dots were shown to be useful in optical temperature sensing applications. During measuring the emission of the C-dots in 25-95°C liquid solutions, the temperature increase resulted in changes of the fluorescence. The fluorescence decreased with the rise of the liquid temperature, demonstrating temperature sensing feature of the C-dots and possibility for usage in thermometry (Atabaev, Sayatova, Molkenova, & Taniguchi, 2019).

The combinatorial effect of black tea derived C-dots with rapamycin enhanced the cancer cell growth inhibition. ARF/ β -catenin/YAP signaling pathway discovered in the article is important as a cancer therapy target. YAP is yes-associated protein 1 involved in cancer progression in nuclear form. The inhibition of the associated mTOR protein is one of the approaches to treat cancer. In the article, authors determined the interaction of alternative reading frame protein (ARF) with YAP and identified that C-dots accelerated the activity of ARF. Thus, the addition of C-dots may have a therapeutic advantage as a combinatorial drug to effectively treat cancers (Y. Xie et al.,

2017). One more study of the prostate cancer treatment via soybean derived C-dots was related to nuclear mesenchymal epithelial transition factor (nMET) and ARF proteins interactions. The paper identified the critical role of ARF for nMET in prostate cancer development through *in vivo* studies. The experiments confirmed the colocalization of ARF and nMET in cancer cells and decreasing the activity of either of the proteins significantly arrest cancer growth. The experimental findings also demonstrated that C-dots inhibited nMET, thus showing clinical significance in cancer therapy (Yingqiu Xie et al., 2019).

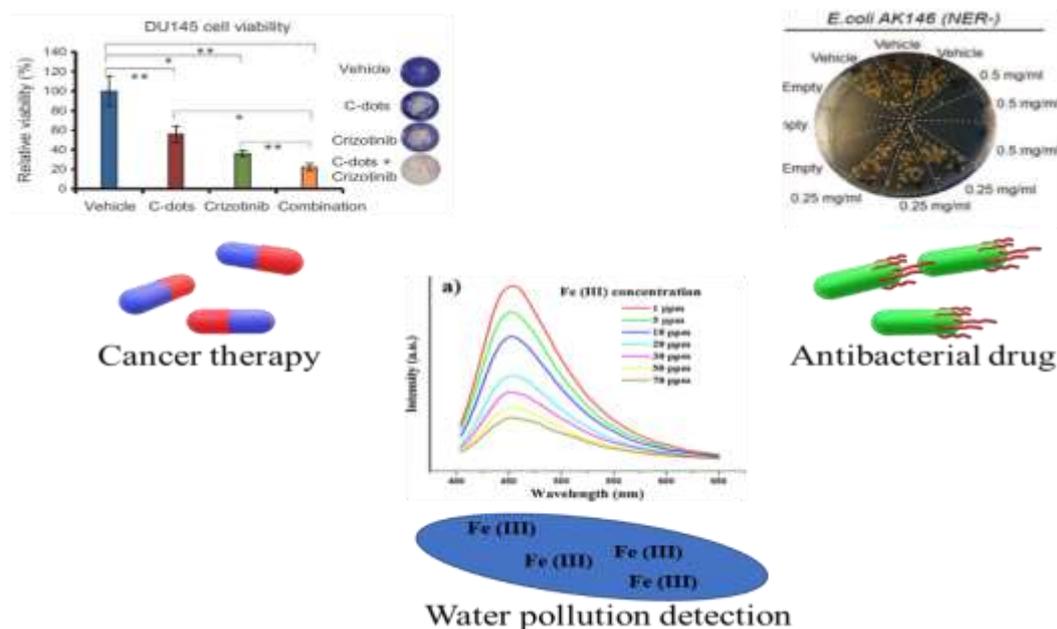


Figure 2. Applications of carbon dots.

Overall, the publications from Kazakhstani scientists about carbon dots shows quick methods for C-dots synthesis and provides numerous examples of their applications (Figure 2). The research progress in this field is important for broad scientific community and society.

Abbreviations

C-dots	Carbon dots
<i>E. coli</i>	<i>Escherichia coli</i>
AFM	Atomic force microscope
XRD	X-ray diffraction
mTOR	Mammalian target of rapamycin
YAP	Yes-associated protein 1
ARF	Alternative reading frame protein
AMO	Amoxicillin
nMET	Nuclear mesenchymal epithelial transition factor

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ПРОЦЕСС ИССЛЕДОВАНИЯ УГЛЕРОДНЫХ НАНОЧАСТИЦ В КАЗАХСТАНЕ

Цин Ян, Аян Нуркеш

Аннотация: Область исследований углеродных точек (С-точек) широко известна благодаря разнообразным применениям, включая биоизображение, биомедицинскую науку и датчики. Более того, последние данные свидетельствуют об использовании углеродных наночастиц в качестве эффективной альтернативы лекарственной терапии. Синтез углеродных точек является относительно дешевым, быстрым и экологически чистым процессом. Результаты обработки С-точками бактерий и раковых клеток, флуоресцентная визуализация для определения температуры и загрязнителей воды обеспечивают интересный и многообещающий подход к применению С-точек в различных областях. Поэтому исследование С-dots имеет важное значение для научного сообщества и общества. Следующий мини обзор содержит краткое изложение соответствующих статей, опубликованных казахстанскими учеными.

Ключевые слова: углеродные наночастицы; лечение рака; биоимиджинг; датчиков

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EFFICIENCY OF USING ALAMARBLUE CELL VIABILITY REAGENT TO STUDY EFFECTS OF CARBON NANOPARTICLES ON CANCER CELLS

Qing Yang

Abstract. *Background:* Nanoparticles have been widely used to deliver drugs, image tumors inhibit cancer cells, and to apply in other diseases. In cancer treatment, we usually need to test viability on cell lines *in vitro*. Cell counting or viability testing reagents have been applied. However, special characteristics of nanoparticles such as color, fluorescence, and organelle binding may interfere the dye binding. Here we studied the effects of alamarBlue Cell Viability reagent staining conditions on cell viability measurement efficiency.

Objective: To test more effective staining time to investigate the cytotoxicity of human cancer cell using alamarBlue Cell Viability reagent.

Methods: The carbon nanodots were used as nanoparticles and from alamarBlue Cell Viability Reagent staining method was used to measure cell viability. The A549 cells were used for measurement their cell growth inhibition and survival.

Results: In cancer cells, alamarBlue Cell Viability Reagent showed some efficiency of measurement of cell viability upon nanoparticles treatment with the best optimal time of 3hrs. The 1hr and 24hr staining did not show the better results of measurement of cell viability according to the concentration dependent trend.

Conclusion: Our results confirm alamar Blue Cell Viability Reagent method can be used by optimized condition to detect cell survival in cells *in vitro*.

INTRODUCTION

Cell viability assay is widely used in anti-cancer drug screening and pre-clinical testing *in vitro*. Differential reagents are used based on cell characteristics upon drug treatment. For example, cell counting, MTT assay, crystal violet assay. Many methods are based on the characteristics of live cells with high energy release of mitochondria, or cell DNA intact, or metabolic intact.

Nanoparticles have been used for drug delivery, bioimaging and anti-cancer drugs. Carbon-based materials have been applied in nanomedicine. To test the nanotoxicity and anti-cancer effect, nanoparticles cannot be removed from cells and the measurement of cell survival may not be accurate. This is because of potential fluorescence from nanoparticles. When use fluorescence dyes to bind organelle or metabolite, there might be organelle or metabolic competitive binding if nanoparticle can cause cell death through these mechanisms. Therefore, it is needed to test the efficiency of the viability measurement when studying nanoparticles effects.

The mechanism of cell viability interruption by nanoparticles can vary. For

example, Carbon nanodots (CDs) can cause DNA damage, cell cycle arrest, DNA conformation switch even more details remain unclear. Here we applied tomato derived CDs to test their effect on inhibition of cell growth.

MATERIALS AND METHODS

Alamar Blue Cell Viability Reagent was obtained commercially from ThermoFisher (<https://www.thermofisher.com/order/catalog/product/DAL1025#/DAL1025>). It is used for regular cell viability assay of drugs. The alamarBlue Cell Viability Reagents are ready-to-use that detect the reducing of living cells to test cell survival.

Here we applied alamarBlue™ Cell Reagent to measure the cell viability to optimize the best staining condition and test the potential efficiency of nanoparticles from tomato on anti-cancer effect.

1. Cell viability testing reagent: alamar Blue™ Cell Viability Reagent Alamar Blue Cell Viability Reagent (ThermoFisher <https://www.thermofisher.com/order/catalog/product/DAL1025#/DAL1025>). It is used for cell viability assay using carbon nanoparticles drugs.

2. Cell lines A549 cells were originally developed 50 years ago through the explant tumor of a 58-year-old white male, metastasized and cultured lung tumor tissue in medium. The cells are squamous, which can spread substances such as water and electrolytes through alveolar diffusion. The cell line was purchased from ATCC (ATCC® CCL-185™) and can be used to screen for anti-cancer drug or test.

3. Cell culture method Cells were seeded in Dulbecco's Modified Eagle Medium (DMEM). DMEM is the most widely applicable medium for culturing adherent cells. Here we added 10% serum of FBS, and antibiotics of penicillin/streptomycin based on protocol provided by the reagent manufacture (Life Technologies).

4. Cell density for cell growth inhibition assay Usually in 96-well plates, cells were seeded as 5 000 and 2 500 per well in 24hrs in advance followed by treatment of nanoparticles drug. Due to many concerns of cell attachment due to nanoparticles targeting cell surface, we applied 5 000 cells per well in this test.

5. Cell staining method by alamarBlue™ Cell Viability Reagent Cells were stained for 1hour, 3hours and 24 hours respectively and followed the standard protocol from manufacturer by spectrophotometer.

6. Carbon nanoparticles Carbon nanodots were used as nanoparticles which were synthesized by Chemistry Department. Cells were undergone treatment in a 100 ul total volume in 96-well plates by differential concentration of nanoparticles calculated and medium used for making up total same volume finally.

RESULTS AND DISCUSSION

We used carbon nanodots to test the differential times effect on cell staining for cell viability assay. As shown on Figure 1, cells stained for 1hour showed the significant toxic effect on cells at low concentration but not high concentration. It is likely due to nanoparticles uptake efficiency in cells. High concentration may cause cluster of nanoparticles and big enough to be blocked by cell membrane.

A549 cells are big sized compared to other cells. There may be other factors for drug effect in different cells, such as cell signaling and surface protein receptors or transporters. Moreover, the dye itself may interfere the stain and update of dyes due to cell size, nanoparticles size, cell membrane signaling.

As shown on Figure 2, at 3hrs staining, we found the same problem. However, 3hrs staining is much better for concentration trend.

As shown on Figure 3, 24 hrs staining may cause over lone stain and 1-3 hrs significant different toxicity showed no significant difference in 24 hrs. Thus, based on Figure 1 and 2, 24 hrs data is not consistent and over stain may cause false effect.

In conclusion, our data suggest 3hrs staining is the most effective time among tested and more time points maybe tested in future to get the best optimized results.

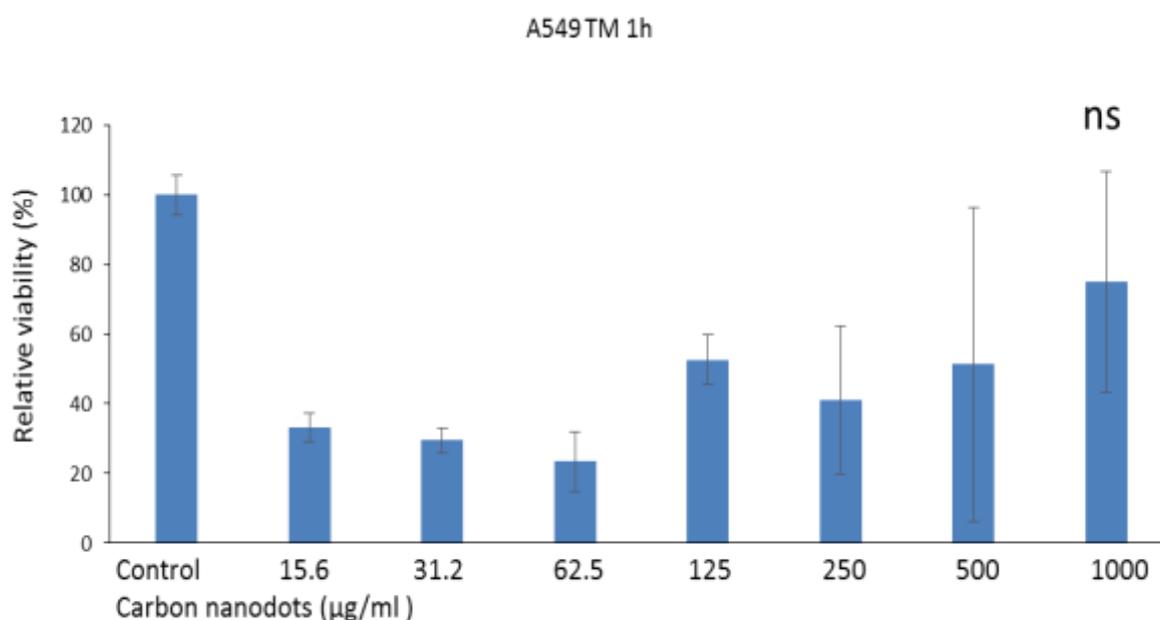


Figure 1

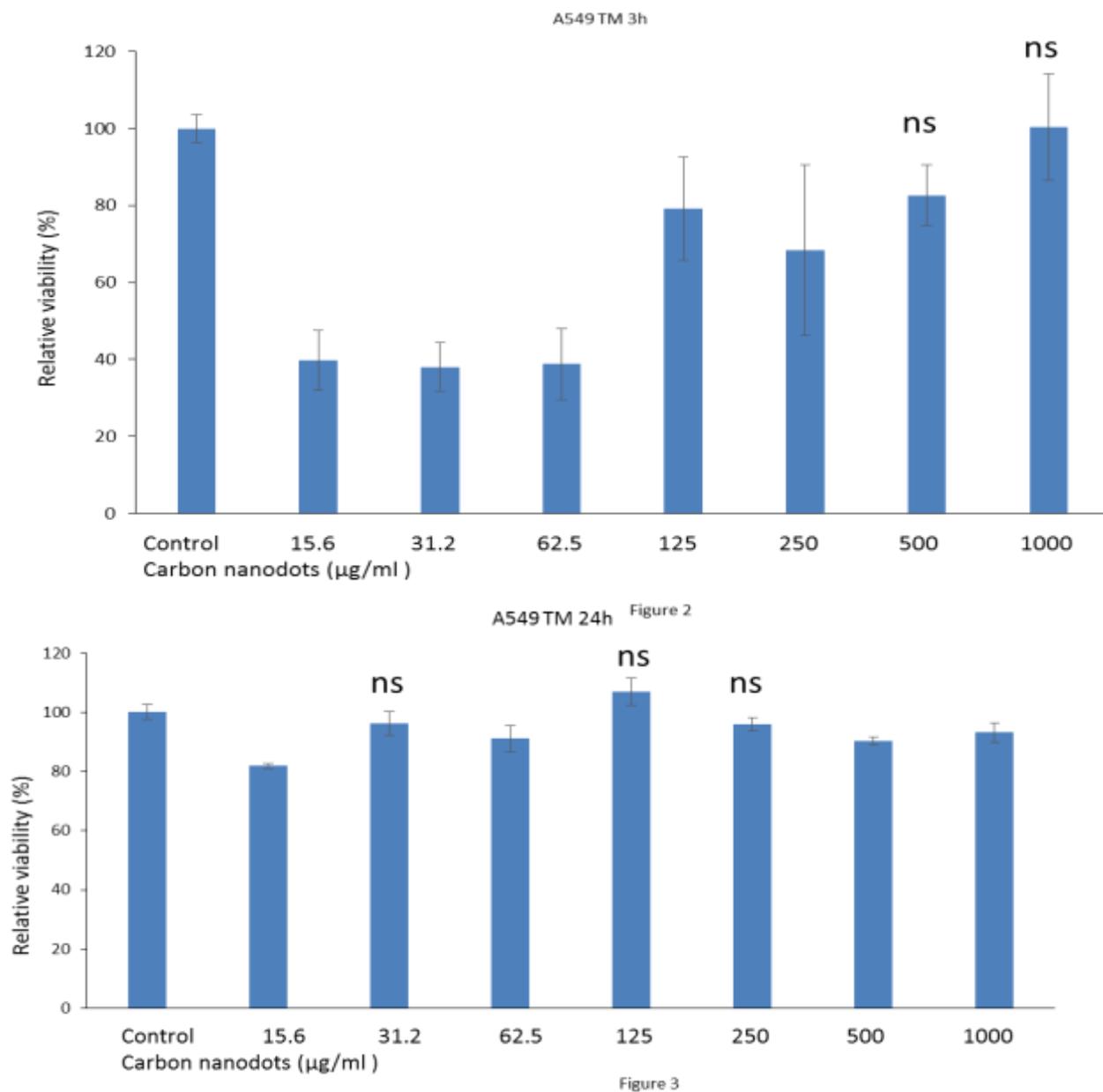


Figure 1-3 Carbon dots of tomato (TM) effect on A549 cancer cell by dye staining of 1hr, 3hr and 24hrs. Not significant results are shown as ns, while all others are significant without marker shown.

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ЭФФЕКТИВНОСТЬ ИСПОЛЬЗОВАНИЯ РЕАГЕНТА VIABILITY КЛЕТОК ALAMARBLUE ДЛЯ ИЗУЧЕНИЯ ВЛИЯНИЯ УГЛЕРОДНЫХ НАНОЧАСТИЦ НА РАКА

Цин Ян

Аннотация. *Справочная информация:* наночастицы широко используются для доставки лекарств, опухолевые изображения подавляют раковые клетки и применяются при других заболеваниях. При лечении рака нам обычно необходимо тестировать жизнеспособность на клеточных линиях *in vitro*. Были использованы реагенты для подсчета клеток или тестирования жизнеспособности. Однако особые характеристики наночастиц, такие как цвет, флуоресценция и связывание с органеллами, могут препятствовать связыванию красителя. Здесь мы изучили влияние условий окрашивания реагента AlamarBlue Cell Viability на эффективность измерения жизнеспособности клеток.

Цель: Qing Yang
раковых клеток человека с использованием реагента AlamarBlue Cell Viability.

Методы: углеродные наноточки были использованы в качестве наночастиц, а из метода окрашивания реагентов Alamar Blue для определения жизнеспособности клеток был использован метод измерения жизнеспособности клеток. Клетки A549 использовали для измерения их ингибирования роста клеток и выживания. *Результаты:* В раковых клетках реагент жизнеспособности клеток Alamar Blue показал некоторую эффективность измерения жизнеспособности клеток после обработки наночастицами с наилучшим оптимальным временем 3 часа. 1-часовое и 24-часовое окрашивание не показывало лучших результатов измерения жизнеспособности клеток в соответствии с зависимой от концентрации тенденцией.

Заключение: наши результаты подтверждают, что метод реагента Alamar Blue Cell Viability Reagent может быть использован в оптимизированных условиях для определения выживаемости клеток в клетках *in vitro*.

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USE OF ELECTRONIC TRAINING MANUAL AS INFORMATION TECHNOLOGY DURING DISTANCE LEARNING

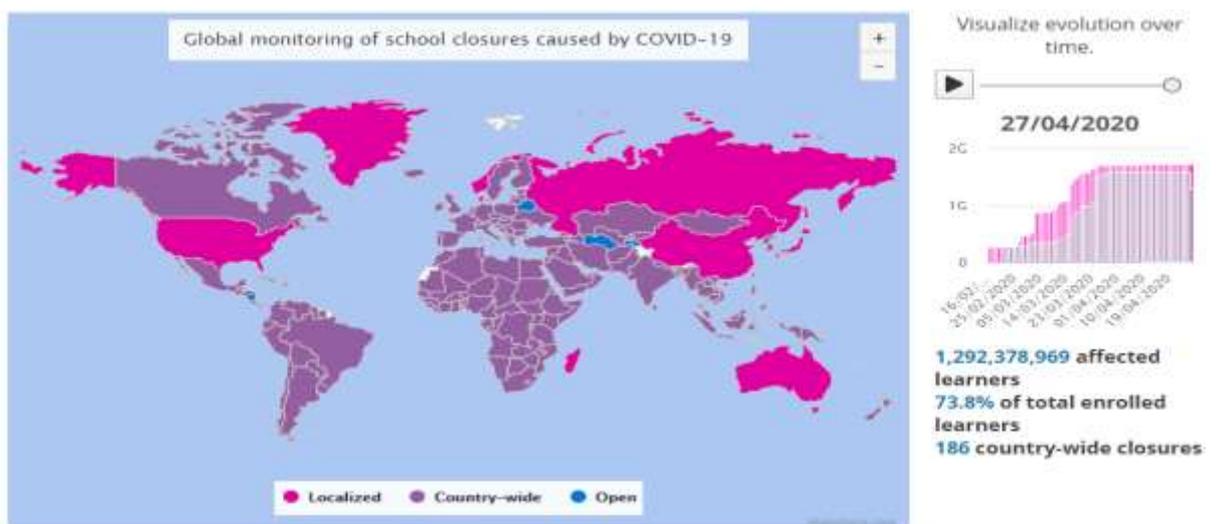
Medet Abdirakhman

Abstract. In this article, examined the effectiveness and advantages of an electronic training manual. The spread of the Covid-19 virus in the world in 2020 caused many difficulties in the field of education around the world, that's why education has switched to distance learning. At the same time, needed to create the right information and educational space in teaching students. It is very important to use effective technology. As a computer science teacher at school, a survey was taken from students to know which technologies are more convenient and better for them to receive learning. The use of electronic training manuals in the classroom can be considered as a new type of teaching technology in the quality education of the younger generation in line with modern requirements.

Key words: distance education, e-learning tool, Teaching and Learning, electronic training manual, computer science.

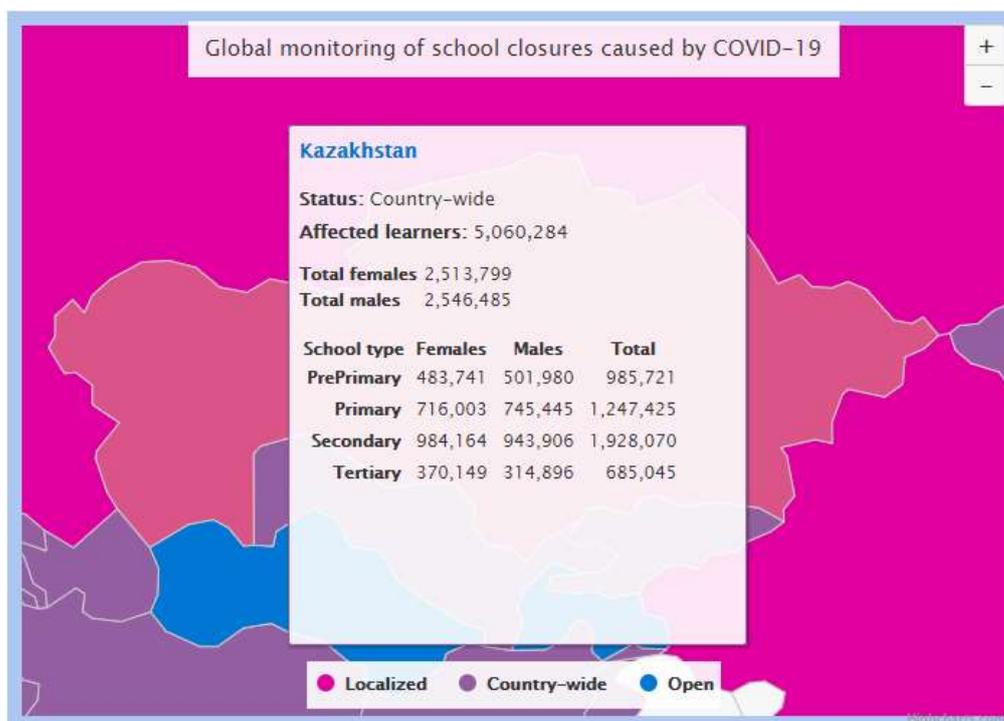
INTRODUCTION

Governments around the world have decided to close educational institutions in an attempt to contain the global COVID-19 pandemic. According to UNESCO, more than 100 countries have closed schools nationwide, affecting more than half of students worldwide. Some other countries have closed schools locally, and if these countries also order schools and universities to be closed nationwide, this will disrupt the learning process for millions of other students. The statistics for April 27 (<http://data.uis.unesco.org/>, 2020).



Note: Figures correspond to number of learners enrolled at pre-primary, primary, lower-secondary, and upper-secondary levels of education [ISCED levels 0 to 3], as well as at tertiary education levels [ISCED levels 5 to 8]. Enrolment figures based on latest [UNESCO Institute for Statistics data](https://data.uis.unesco.org/).

In accordance with the legislation of the Republic of Kazakhstan, a state of emergency has been declared in the territory of the Republic of Kazakhstan since March 16, 2020 in order to protect the lives and health of citizens in connection with the World Health Organization's declaration of a new COVID-19 coronavirus pandemic. That is why education has shifted to distance learning. Statistics of students in Kazakhstan on April 27, 2020.



Enrolment figures based on latest [UNESCO Institute for Statistics data](http://data.uis.unesco.org/) (<http://data.uis.unesco.org/>, 2020).

Distance learning is a learning carried out with the use of information and communication technologies or telecommunications in the indirect (remote) or incomplete indirect interaction of the student and the teacher.

Minister of Education and Science Askhat Aimagambetov opened the gap between distance learning and online education.

According to him, students can receive distance learning in four different ways. First of all, video lessons will be shown on "Balapan" and "Elarna" TV channels.

3,360 video lessons have been shot, all of which will be uploaded to the Internet. In addition, classes are held on the radio. Kazakh Radio will have appropriate audio lessons. Students who do not have a TV at home can use the radio as an additional tool.

The third way of training is to use the postal service. Pupils in settlements where there are no schools study by mail.

An agreement was signed with Kazpost JSC. There are 1,200 settlements without schools in the country. There are 5-7 children there. Earlier, they moved to another village to study. Those children are educated by mail.

Other students can also use the postal service for feedback.

On April 1, pilot classes were held in the country. Educational technologies in schools include systems such as "Google Classroom", "Kundelik.kz", "BilimLand", "Daryn.online", "Microsoft Teams", "Zoom", "Opiq.kz"; offered to use messengers: "Whatsapp", "Telegram".

In particular, the use of the streaming system "Zoom" proved ineffective. At the same time, when people living in their homes use these technologies for education, the quality of the Internet has deteriorated and the systems have not been able to cope with the workload. This, in turn, has had a negative impact on teachers' ability to teach effectively, students' learning difficulties, their inability to obtain information correctly, and their ability to test their knowledge.

According to the Minister of Education and Science, at that time only 1 million 250 children were taught online. In total, 2.5 million children across the country took part in this pilot lesson on various platforms. During the test sessions, different issues were observed. The online mode does not support such a connection, so there was a lot of inconvenience. There are enough technical problems. The Internet could not support this system. Instead of online learning, it is necessary to conduct distance learning through the platforms mentioned by the Minister.

To cope with such challenges in the future, we need to develop the right technologies. The purpose of e-learning in the State Program for the Development of Education in the Republic of Kazakhstan for 2011-2020 is: to ensure equal access to the best educational resources and technologies for all participants in the educational process; equalization of education levels in rural and urban schools; training of students with high thinking ability and technological literacy.

At present, computer resources are available in all spheres of society. In other words, the world of the XXI century has begun to move to the information society. It is possible to achieve the sign of informatization in all spheres of education, science, economics and management in society.

Currently, it is mainly engaged in the development of electronic training manuals for all levels of the education system. An electronic training manual is a source of information for the student, as well as work with electronic training manuals is an individual study of each student, taking into account their capabilities.

The use of electronic training manuals in the classroom can be considered as a new type of learning technology in the quality education of the younger generation in line with modern requirements.

THE ROLE OF ELECTRONIC TRAINING MANUALS IN EDUCATION

This section addresses questions that might be posed by a teacher who is considering which education technology to use in teaching a student.

2.1 Electronic training manual definition

Currently, many versions of computer training tools (CTT) are being developed and presented. However, it is not enough to systematically analyze them, identify their advantages and disadvantages, set requirements for their quality, and make recommendations for future CTT. Research in this area is being conducted abroad, the

prepared CTTs are being analyzed and their shortcomings are being identified. The analysis revealed that the main shortcoming in the design of the CCS is that it is created only as an electronic copy of a traditional textbook.

An electronic training manual is a training course in which all information on the lesson is provided in the form of text, pictures, videos, audio recordings, animations and other graphic tools.

The advanced communication and search system allows you to move from one section of the tool to another or from one fragment to another in one breath. The level of mastery of materials can be determined immediately after the completion of interactive tasks. There are online and offline versions of the electronic training manual. It can be placed on a CD or other media, or on the Internet.

Until now, in the field of education, the use of only what the teacher says or the textbook does not meet modern requirements. Therefore, in today's information society, it is impossible to move forward without the use of these textbooks. As a result, students became more interested in the subject and had ample opportunities to work creatively.

The main purpose of electronic training manual and training: "Continuous and complete monitoring of the learning process, as well as the development of information retrieval skills." It facilitates the formation of a system of thinking, creative work in any field of education.

The work schedule of electronic training manuals can be highlighted:

- uncontrolled learning;
- controlled learning is accompanied by special control questions for each studied chapter (paragraph);
- The final control ends with a test.

No country in the world has yet completely abandoned the book. However, there are countries that have successfully introduced electronic training manuals in schools. These include Spain, Hungary, Brazil, Singapore, Finland and Estonia.

Mass introduction of electronic training manual was in South Korea, Russia and other countries. For example, in 2011, JSC "Rosnano" presented to Russian schools a promising e-textbook Plastic Logic 100.

2.2. Difference between electronic training manual and regular book

The first textbooks in electronic format were really duplicates of books. There are several textbooks on the Internet in PDF, DOC, EPUB, FB2 formats. Among them are textbooks in Power Point format. All this can be called an electronic version of the textbook.

Electronic training manual - a computer-based teaching, control, modeling, testing, etc., containing the main scientific content of the subject set of programs. To create an electronic training manual, it is not enough to convert the contents of the book into an electronic version. It should be supplemented with videos, illustrations, games.

Consider effective tools for the preparation of electronic training manuals. They are:

- traditional algorithmic languages;

- general purpose tools;
- multimedia tools;
- hypertext and hypermedia tools.

An electronic training manual provides an effective addition to ordinary textbooks. In particular, the provision of feedback in practice as soon as possible; since the search for information in a simple textbook takes some time, the electronic training manual allows you to quickly find the textbook you need; save time when switching to hypertext explanations; person-centered, checking his knowledge on a particular section and codes in short text to show it, narrate, model, etc. features are implemented quickly.

The publishers of electronic training manual in Kazakhstan

According to Sayat Omarov, Deputy Director of the Republican Scientific and Practical Center "Oqulyq", over the past two years, the following publishers have sent their e-textbooks for examination:

- "Keleshek-2030";
- "Almatykitap Publishing House";
- "Bilim Media Group" educational portal;
- National Scientific and Practical Education Center "Bobek";
- "Center of pedagogical technologies of informatization of education";
- JSC "National Center for Informatization";
- "New educational technologies" LLP;
- "Arman-PV" Publishing House.

There are other developers whose products have not yet been officially tested.

To use e-textbooks of "Bilim Media Group" LLP it is enough to register on bilimland.kz, itest.kz, twig-bilim.kz and imektep.kz.

"Keleshek-2030" publishes electronic training manuals for grades 7-11 in the form of a disk in accordance with the list approved by the Ministry of Education and Science.

The library of electronic training manuals "Almatykitap Publishing House" is available on the platform opiq.kz. It can be accessed from any device: laptop, tablet, smartphone. The site will automatically start working in that format.

2.4. The requirements for a good electronic training manual

Like the book, they undergo a Level 8 examination by the "Oqulyq" Center. The package of publications and documents arrives here through the state corporation "Government for Citizens". The examination is conducted for 60 days. As a result, experts write one of the following conclusions:

- "Recommended for use in educational institutions";
- "Amendments required";
- "Not recommended for use in educational institutions."

Authors are given 30 days to make corrections after receiving the conclusion. Then they have to re-examine the textbook and wait for new results. Corrections will not be resubmitted for a second time.

3. Advantages and disadvantages of electronic training manual

In the near future, electronic training manual will become an integral part of education due to their advantages. They can be used as different channels for transmitting information while reading.

If the child perceives information well by hearing, he can listen to it, and if he needs to see it, he can watch video clips and animations.

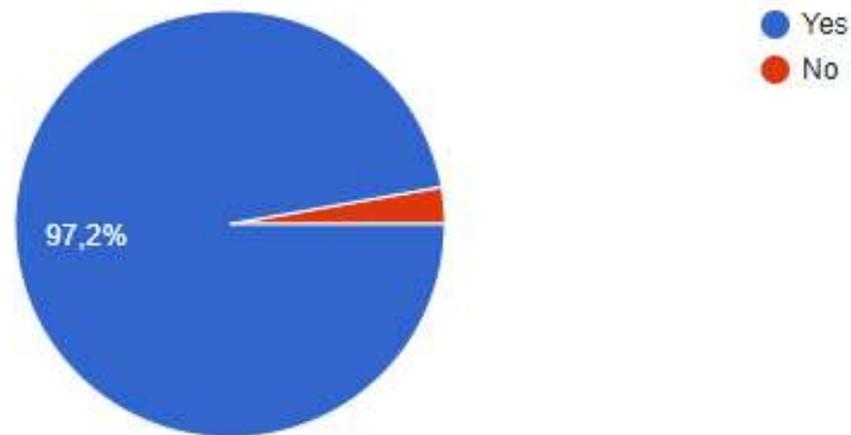
An electronic training manual for teachers is an open methodological system that is constantly evolving, which can be further improved by each teacher, supplementing it with materials from their pedagogical practice.

Advantages	Disadvantages
<ul style="list-style-type: none"> • Electronic training manual saves students' time; • does not look for educational material; • the student can learn any basics of computer science without the need for a textbook; • uses additional video, clips, audio recordings to cover large, difficult parts of the topic; • practical work is quickly explained; • Test questions for mastering the program are provided; • reduces the need for visual aids; • Allows the teacher to work with each student individually; • promotes the expansion of the student's field of thought, worldview, the process of cognition, • High efficiency in preparation for the Unified National Testing • You can access it from anywhere, from any device; • Ability to search for information; • Interactivity; • Objectivity in scoring; • Different levels of complexity of tasks; • Conditions for advanced study; • Ability to repeat past materials. 	<ul style="list-style-type: none"> • Lack of psychological and pedagogical requirements; • lack of interdisciplinary communication; • uniform selection of visual aids; • disregard for the direction of study in the specialty; • Full coverage or full translation of textbooks; • Taking into account the individual characteristics of the student, the state of health; • variety of computer graphics capabilities; • Decreased language skills of students, inability to communicate "alive"

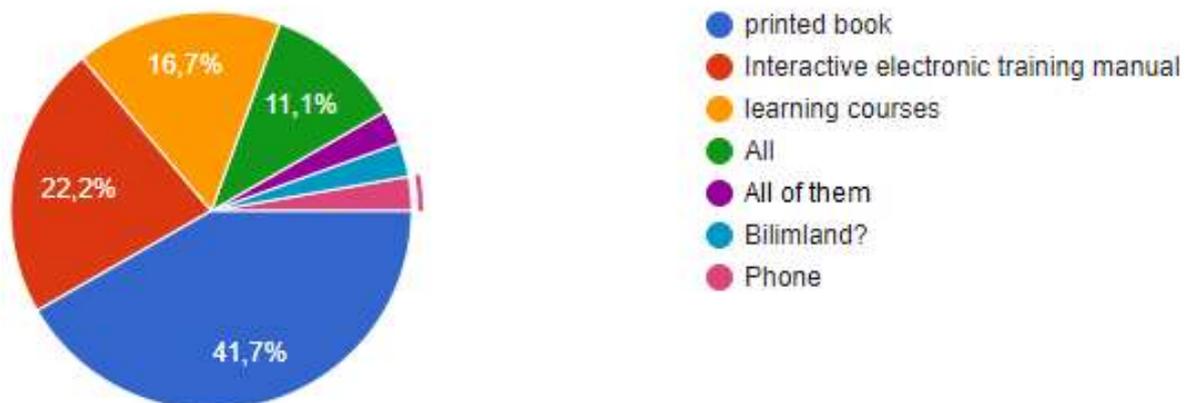
RESULTS

As a computer science teacher at school, a survey was taken from students to know which technologies are more convenient and better for them to receive learning. There was used Google Forms. 36 students were participated in survey.

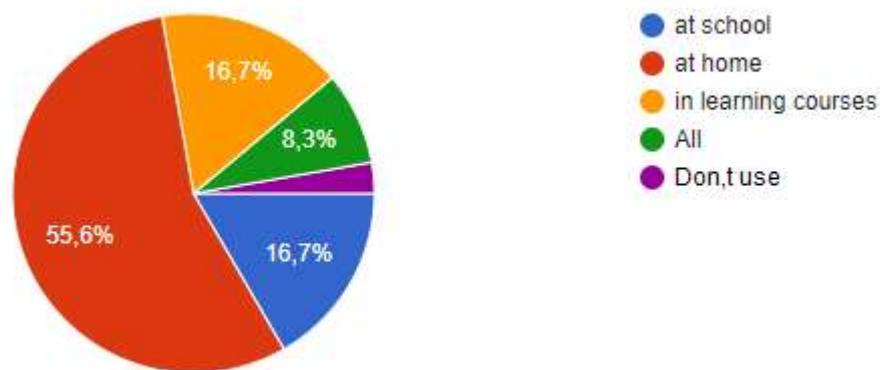
As a result, to the question "Do you know what is the Interactive Electronic Training Manual?" 97,2% of students answered "Yes".



To the question "Which educational resources do you use in distance learning?" we see that 41,7% of them use printed books, 14,9% use all of the resources.



From the next pie chart we see that 55,6% of students use Training manuals at home.



CONCLUSION

The use of modern new technologies, including electronic training manuals, builds students' ability to work with information.

An electronic training manual for students is a source of information that allows them to supplement their knowledge and prepare for targeted final exams during their school years. And for teachers it is an open methodological system that can be supplemented and developed through their pedagogical experience.

As a result of the survey, we saw that most students know the electronic training manual, but half of them use printed book in distance learning. And because of the distance learning students who know training manual use it at home.

In addition to improving the quality of e-learning systems, there are a number of benefits.

First, each student works at his or her own pace. Develops the necessary endurance to achieve the goal.

Second, the student sees the results of his work and evaluates himself. Independent work does not affect the student's knowledge, but has a significant impact on behavior.

It educates students to perseverance, to finish what they started; awakens responsibility. This, in turn, develops the student's curiosity and creativity.

The use of electronic training manuals is very effective in the professional training of future teachers. Students supplement their knowledge on their own, prepare for exam materials and develop their cognitive thinking skills through informational knowledge. And an open methodical system for students allows them to accumulate experience, supplement, develop and improve the textbook on the basis of creative pursuits. Expands the electronic active worldview and the scope of independent work, helps to analyze the learning process, comprehensive information, humanization of educational content.

Informatization of teaching in Kazakhstan improves the quality of education, ensures the level of methodological growth of students. We will have the opportunity

to improve the quality of professional training of future teachers in secondary special education institutions and to revitalize the educational process through informatization.

As a result, the use of electronic training manual significantly increases the interest of students in the lessons. Teachers can also get a lot of necessary methodological and didactic aids. The use of electronic training manuals in the classroom can be considered as a new type of teaching technology in the quality education of the younger generation in line with modern requirements. Our work will be productive and clear if we share experiences and share our strengths and weaknesses in order to carry out the common task of educating the young generation, which is well-developed and not lagging behind the foreign education system and proven to be fit for work.

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ИСПОЛЬЗОВАНИЕ РУКОВОДСТВА ПО ЭЛЕКТРОННОМУ ОБУЧЕНИЮ В КАЧЕСТВЕ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ ПРИ ДИСТАНЦИОННОМ ОБУЧЕНИИ

Медет Абдирахман

Аннотация. В этой статье рассматриваются эффективность и преимущества электронного учебного пособия. Распространение вируса Covid-19 в мире в 2020 году вызвало много трудностей в области образования по всему миру, поэтому образование переключилось на дистанционное обучение. В то же время необходимо создать правильное информационное и образовательное пространство в обучении студентов. Очень важно использовать эффективные технологии. Как учитель информатики в школе, был проведен опрос среди студентов, чтобы узнать, какие технологии более удобны и лучше для них, чтобы получить обучение. Использование электронных учебных пособий в классе можно рассматривать как новый тип технологии обучения в качественном образовании молодого поколения в соответствии с современными требованиями.

Ключевые слова: дистанционное обучение, инструмент электронного обучения, преподавание и обучение, электронное учебное пособие, информатика.

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ELLO FLOOD ATTACK AND WAYS OF PROTECTION IN WIRELESS SENSOR NETWORKS

Zhukabayeva T.K., Abdildayeva A.A., Mardenov E.M.

Annotation. There are many vulnerabilities to attack in wireless sensor networks. Wireless sensor network has become an important application of the paradigm of special networks, for example, for monitoring the physical environment. These sensor networks have limitations on system resources such as battery power, communication range, and processing capabilities. Low computing power and wireless connectivity make these networks vulnerable to various types of network attacks. One of them is the hello flood attack, in which an attacker who is not a legal host on the network can send a hello request to any legitimate host and violate the security of WSN. The current solutions for these types of attacks are mainly cryptographic, which suffer from high computational complexity. Therefore, they are less suitable for wireless sensor networks.

Keywords: Wireless Sensor Network; hello flood attack; attack detection;

INTRODUCTION

The importance of using FSU is growing every year. This is directly related to the increasing need for monitoring, monitoring, measurement and solving many other operational problems in such areas as industry, medicine, commerce, science, and everyday life. The most famous applications of FSU: military equipment, medicine, environmental programs, household appliances, etc. [1].

The Wireless Sensor Network (WSN) consists of thousands of dedicated sensor nodes with processing, transmission and storage capabilities, as well as computing capabilities. Security is becoming a serious concern for many mission-critical applications that wireless sensor networks are supposed to support. By their nature, the vulnerable characteristics of WSNs make them susceptible to various types of attacks.



Picture 1. Classification of attacks on the WSN.

There are various types of attacks that threaten LEACH services: Sybil attack, black hole, selective forwarding and Hello hello attack. Hello flood attack is one of the

main attacks at the WSN network layer. The welcome attack is caused by an attacker with a high transmission power who can send or play welcome packets, which are used to detect neighbors. Thus, an attacker creates the illusion of proximity to other nodes, and the main routing protocol may be violated, which facilitates further types of attacks. An attacker transmits packets with such high power that a large number of nodes in the network select it as the parent node. Figure 2 shows a Hello flood attack scenario.

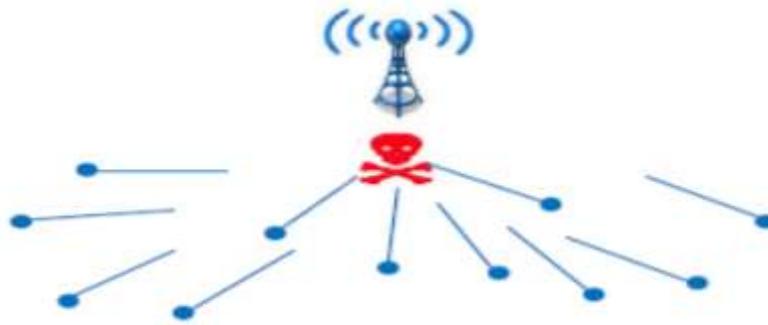


Figure-2 Hello flood –attack

All messages that will be broadcast to the WSN are routed through this parent, which increases the delay. An attacker sends these welcome messages to a large number of nodes in a wide WSN area. Then these nodes must be convinced that the attacker's node in the network is their neighbor. All nodes will respond to this HELLO message from an attacker and will spend their energy. This leads to confusion in the WSN. Figures 3 a and b show a Hello flood attack on the network. In this diagram, circles, a rectangle, and a triangle represent the nodes of the sensor, base station, and attacker, respectively.

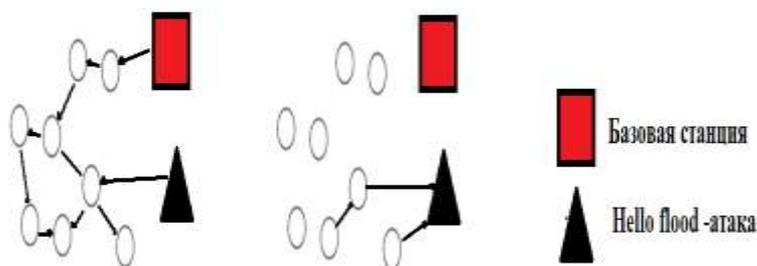


Figure 3 - Hello flood attack

a) Shows the transmission of hello packets by an attacker with a higher transmission power than the base station.

b) shows legitimate nodes that consider the attacker to be their neighbor

In the message "Hello, flood" captures the sensor node, broadcasts greeting messages on the network and proclaims itself to be their neighbor. When any node on

the network receives this greeting message, it assumes that the sender node is in the communication range, and starts transmitting this node and makes an entry in its routing table as a neighbor. All sensor nodes communicate with the base station through their neighbors. When an attacker captures a legitimate node in the network or creates a fake node, he sends a greeting message to all nodes in the network with high power, this creates confusion that the message comes from neighboring nodes. Thus, all nodes in the network assume that the hello message path is the shortest path from the base station, assuming that the attacker (malicious) node is the base station and begins communication with the attacker. Thus, an attacker can control the network, since the base station is completely disconnected from the WSN, and also affects its routing. Hello flood attack is one of the main attacks at the network level in WSN.

Hello flood attack support

A large number of attacks are supported by a hello attack, including flooding, hardening and grabbing a node, false replication of a node, etc. These auxiliary attacks are described below:

1) Flood

In a flood attack, the attacker continually sends a new connection request to his neighbor in order to seize resources. This leads to severe resource constraints for legitimate sites.

2) Quenching and capture of the node

Falsification is associated with attacks on components, which include changing the internal structure of a single chip. Consultations can easily capture him and can be used to attack hi flood. Host capture attacks give an attacker full control over the sensor host, but host capture is not so simple. To capture a site, an attacker requires expert knowledge, as well as expensive equipment and other resources. Complex is the removal of nodes from the network for a large amount of time.

3) False node replication

In an attack with a false replication of a node, an attacker implants a new touch node using a legitimate user identifier. The attacker first removes the legitimate node from the network and at this point deploys the false. This false node replication can lead to huge destruction in the WSN, supporting a complimentary flow attack. An attacker can control the entire network most of the time, so the damage from this attack is very large

SUGGESTED METHODS AGAINST HELLO FLOOD ATTACK

In [2], a technology was proposed for sending data over multipath base stations, in which the sensor node supports the number of different secrets (keys) in a multiple tree. Using these secrets, the sensor node can forward its detected data to multiple routes. There are several base stations in the network that control a certain number of nodes, and there are also general communication tools between the base stations. Each base station has all the secrets that are shared by all the sensor nodes covered by it, in accordance with the key assignment protocol. Given the shared secret and the

generated new key between the two nodes of the sensor, the route configuration process requires a lot of processing, therefore, it is inefficient.

In [3], the authors proposed a security solution structure adapted to the base station for protection against DoS attacks. After the initial discovery of DoS, the base station offers customers cryptographic puzzles to protect themselves from various types of attacks. Compared to traditional puzzle schemes, they introduce new reputation-based client puzzles that apply a dynamic policy to adjust the complexity of the puzzle for each node in terms of the value of the node's reputation. Consequently, the punishment for malicious nodes becomes more and more urgent without imposing unnecessary unnecessary burdens on most ordinary nodes.

In [4], the author suggests that greetings can be counteracted by an "identity verification protocol". This protocol checks the bidirectionality of a channel with an encrypted echo-return mechanism before taking meaningful actions based on the message received from this link. This defense mechanism becomes effective when the attacker has a highly sensitive receiver and a powerful transmitter. If an attacker compromises a node before the feedback message, it can block all of its descending nodes by simply discarding the feedback messages. Thus, such an attacker can easily create a wormhole for each node within reach. Since the connections between these nodes and the attacker are bidirectional, the approach described above is unlikely to locally detect or prevent a "greeting".

Given the lack of energy resources of the sensor nodes, the authors proposed in [5] a probabilistic approach, which forces several randomly selected nodes to inform the base station about greeting requests. The base station then further analyzes the authentication request.

In [5], the cryptographic method is used to prevent a greeting attack. Any two sensors have the same secret key. Each new encryption key is generated on the fly during communication. This phenomenon ensures that only reachable nodes can decrypt and verify the message and, therefore, prevent an attacker from attacking the network. But the main drawback of this approach is that any attacker can fake his identity and then generate attacks.

[6] This article proposes a non-cryptographic solution for HELLO flood detection, which does not. once the test packet is transmitted is greatly reduced. The simulation results showed the detection of adversary nodes with minimal communication costs, since the number of test packets sent for detection decreases from 20-35 to 10-14 (approx.). A non-cryptographic solution for detecting a HELLO attack is proposed in this article, which does not. once the test packet is transmitted is greatly reduced. The simulation results showed the detection of adversary nodes with minimal communication costs, since the number of test packets sent for detection decreases from 20-35 to 10-14 (approx.). A non-cryptographic solution for detecting a HELLO attack is proposed in this article, which does not. once the test packet is transmitted is greatly reduced. The simulation results showed the detection of adversary nodes with minimal communication costs, since the number of test packets sent for detection decreases from 20-35 to 10-14 (approx.).

A security mechanism based on signal strength and geographical information was proposed in [7] to detect malicious nodes that trigger hi-flood and wormhole attacks. The idea is to compare the level of the receive signal with its expected value calculated using geographic information and a predetermined transceiver specification. The frequency of detection of a solution depends on various parameters, such as network density, the transmit power multiplier of the malicious node, the probability of checking the message, etc.

SUGGESTED ALGORITHM

This project aims to provide a simple and convenient way to generate simulations and deploy malicious nodes for the wireless sensor network (WSN), which uses the routing protocol for low-power and lossy devices (RPL) as the network layer.

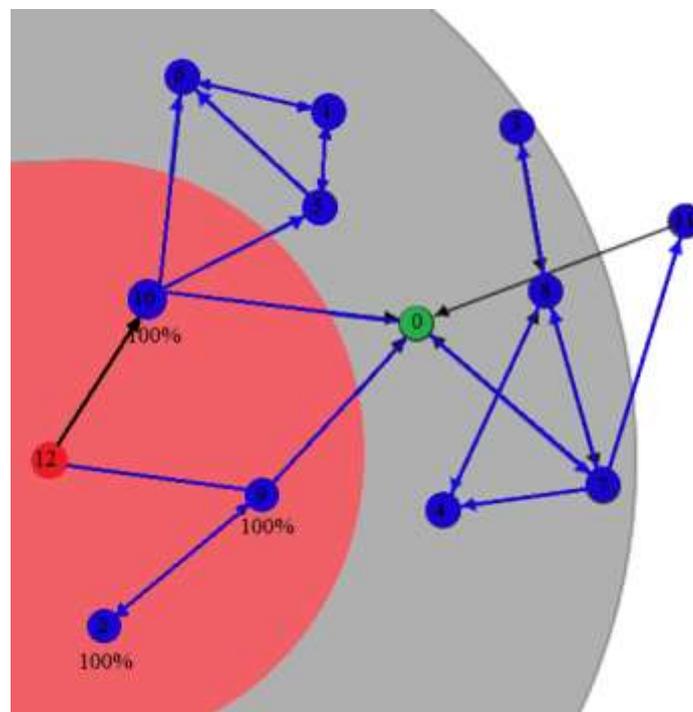


Figure 5. General Hello Flood Attack Model

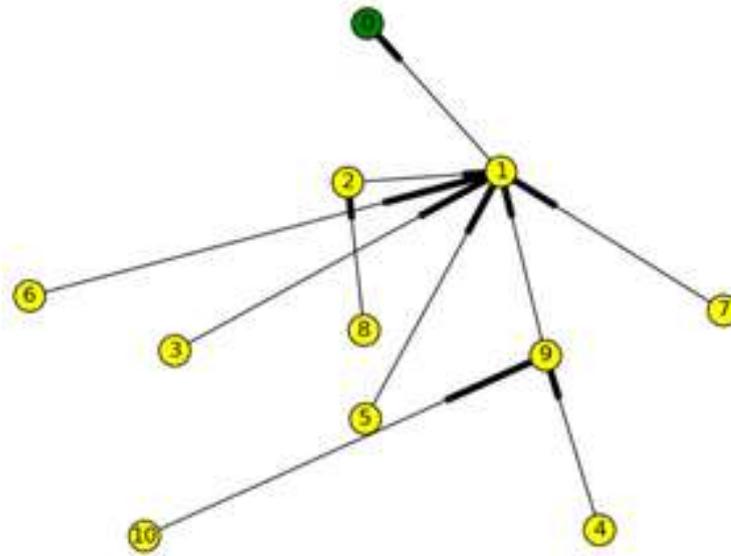


Figure 6. Hello Flood attacks in a node

```

{
  "BASE": {
    "simulation": {
      "number_notes": 10,
      "target": "z1",
      "duration": 300
    },
  },
  "test1": {
    "simulation": {
      "title": "Test simulation",
      "goal": "Create a new simulation",
      "notes": ""
    },
    "malicious": {
      "type": "sensor",
      "building-blocks": [
        "sinkhole"
      ]
    }
  },
  "test2": {
    "simulation": {
      "title": "Another test simulation",
      "goal": "Create another new simulation",
      "notes": ""
    },
    "malicious": {
      "type": "sensor",
      "building-blocks": [
        "hello-flood"
      ]
    }
  }
}

```

Figure 7. Program code

CONCLUSIONS

Security plays a crucial role in the proper functioning of wireless sensor networks. Our proposed security structure for detecting greetings using the signal and the client puzzle method requires less processing power and energy and, therefore, is quite suitable for sensor networks.

Based on existing work, most researchers are trying to find ICT solutions for the detection, identification and resistance to failures in the FSU. The researchers used a different intrusion detection scheme. Very few researchers have been able to test their security system using a true FSU. Also, some results showed a low detection rate. The future solution must be verified in a real sensor network. Thanks to such a check, it will be easy to check whether their solutions correspond to the available BSS resources.

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HELLO FLOOD ATTACK И СПОСОБЫ ЗАЩИТЫ В БЕСПРОВОДНЫХ СЕНСОРНЫХ СЕТЯХ

Жукабаева Т.К., Абдилдаева А.А., Марденов Е.М.

Аннотация. Существует множество уязвимостей для атак в беспроводных сенсорных сетях. Беспроводная сенсорная сеть стала важным приложением парадигмы специальных сетей, например, для мониторинга физической среды. Эти сенсорные сети имеют ограничения на системные ресурсы, такие как заряд

батареи, дальность связи и возможности обработки. Низкая вычислительная мощность и беспроводная связь делают эти сети уязвимыми для различных типов сетевых атак. Одним из них является атака приветствия, при которой злоумышленник, не являющийся законным хостом в сети, может отправить запрос приветствия любому легитимному хосту и нарушить безопасность WSN. Текущие решения для этих типов атак в основном криптографические, которые страдают от высокой вычислительной сложности. Поэтому они менее подходят для беспроводных сенсорных сетей.

Ключевые слова: беспроводная сенсорная сеть; привет атака наводнения; обнаружение атаки;

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ABOUT VIRTUAL AND AUGMENTED REALITY (VR/AR) AND GAMIFICATION OF TRAINING IN THE POWER INDUSTRY

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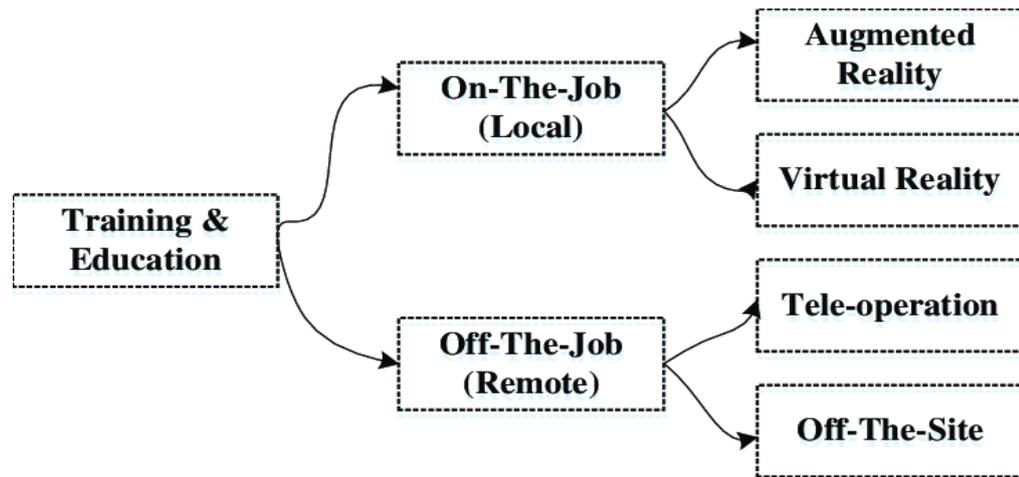
Abstract. The application of innovative IT technologies remains one of the current and important challenges facing education in the digitalization of modern society. The capabilities of mobile devices have led to the emergence of technologies that have opened up new opportunities in the process of teaching and learning, namely augmented reality (AR) and gamification (Gamification).

The scientific significance is due to the application of deep, modern mathematical results and the creation of new own methods of research and analysis, as well as the development of an educational platform based on the example of one section of discipline and the use of the latest VR/AR technologies and gamification in the educational process.

Key words: augmented reality, gamification, modern mathematical results, VR/AR technologies, the educational process

INTRODUCTION

The proposed study is in line with the strategic goals and objectives of the development of the digitalization of the industry and electricity industry of the State Program "Digital Kazakhstan" and the Strategic Development Plan of the Republic of Kazakhstan until 2025, in accordance with the roadmap for the digitalization of the industry and electricity industry of the Republic of Kazakhstan. On the basis of the above-mentioned state programs, the task of developing the domestic electricity system will be to modernize its methodological approaches based on the transfer of advanced world standards and concepts system. At present, the world, as well as Kazakhstan, are exploring and forming new concepts for the development of the electricity system on a global and national scale, which are in line with the new goals and trends of the world and national economies and the new nature of threats of economic, environmental and social nature. but interconnected technical elements that, in real time, carry out the processes of production, transmission and distribution of electric energy and realize a common strategic goal - to provide reliable electricity supply to energy consumers. As virtual environment technologies and artificial intelligence evolve, this system will find its use for staff training and management of complex processes. that allows you to remove the many restrictions imposed on the amount of visualized information, as well as quickly and efficiently develop the orientation-motor skills of the trained personnel by fully immersing the operator or trained personnel in a virtual environment.



Taxonomium of the use of VR/AR systems in training and education in the electricity industry

The move to Industry 4.0, where VR (virtual reality) technology is at the center of the new production system. At the same time, Kazakhstan, as well as all over the world, has launched the process of digitalization of the economy and industry. For Kazakhstan, the process of digitalization of electric power complexes is a technological response to external challenges against the backdrop of global trends.

The development of visual information processing techniques creates new technologies to explore the world around us and to construct an informational picture of the world. Visual modeling develops two directions: replacing reality by creating its virtual model in an artificial information field, and complementing reality by creating a multi-layered informative model that is not inherent in human perception.

Evidence suggests that augmented reality is a useful tool in education (Sumadio and Rambli, 2010). In education, the use of VR/AR software plays an active role in the learning process. Accordingly, students are absorbed and motivated to learn new problem-solving skills (Norman and Spohrer, 1996). Studies have shown that augmented reality can be a motivational factor in increasing interest and curiosity, leading to improved academic performance (Campos, Pessanha and Jorge, 2011; Yusoff, zaman, and Ahmad, 2011; Shea, Mitchell, Johnston and Dede, 2009). Augmented reality has the potential to become a pedagogical tool that motivates students because it improves learning experience and allows you to experiment. Motivation is an important component in learning. A motivated student will participate in the learning process and receive more from the educational experience (Ames, 2003; Sull, 2007).

Also about the days of the current trends in the development of educational technologies is gamification. Video games are the dominant form of entertainment of our time, which is why they are a powerful tool for motivating a new generation of students.

The gamification research shows that it is effective in attracting and motivating people to manage behavior and achieve desired outcomes (Brigham, 2015; Caton & Greenhill, 2014; Cheong, Filippou and Cheong, 2014; Leaning, 2015). There is a growing

interest in the use of gamification in education; Many educators have tried to apply their concept to Isotani, 2014). Durelli Reis Borges direction, in order for learning activities.

Student involvement means the degree of his active participation, the degree of attention, interest that the student shows when participating in the learning process (Reeve, 2012; Trowler, 2010). Student participation is one of the most important factors associated with improved learning, and much of the research to date points to the importance of student motivation leading to a positive effect on learning outcomes (e.g. Carini, Kuh & Klein, 2006; Klem & Connell, 2004; McMahon & Portelli, 2004). The more students engage in learning, the more they will learn and progress in their learning. As an evolving technology (Martin-Gonzalez, Chi-Put and Uk-Cetina, 2015; Johnson et al., 2014; Van Arnhem & Spiller, 2014), augmented reality (AR) not only complements the dynamic notion of teaching methods (Thornton, E Clarke, 2012) but also includes sensory modalities such as touch, sight, and hearing (Pérez-López & Contero, 2013). Except for the addition of a wide range of sensory modalities, there is a huge body of research to identify the potential benefits of AR in education, such as improving student achievement (Estapa, & Nadolny, 2015; Lu, & Liu, 2015; Civelek, Ucar, Ustunel, & Aydın 2014), motivation (Ferrer-Torregrosa et al. 2015), memorization (Pérez-López & Contero, 2013) and engagement (Bressler & Bodzin Bodzin, 2013; Zarraonandia, Aedo, Díaz & Montero, 2013). To achieve these critical learning outcomes, Thornton, Ernst, and Clarke (2012) envisage a continuous use of “modern and advanced” technology applications in teaching and learning, one of which is AR. The growing interest in the use of AR in education has led to the creation of AR learning, a learning experience that is supported by AR (M.E.C. Santos et al., 2014). D. Micela, D. Raskin, I. Sutherland, S. Siltanen, S. Feiner, G. Fitzmaurice, D. Schmalstiga, D. Engelbart et al.), Have made significant contributions to the development of information systems theory, the development of human-computer interaction issues, user interfaces and VR / AR.

AR research has created learning experience for almost every level of education from the very beginning, from childhood education to higher education, where a lot of research has been done. The results of this large and growing volume of LITERATURE on AR in education reveal the many advantages, opportunities, limitations and challenges of this technology in education.

Modern requirements for becoming a future specialist necessitate improving the educational system of secondary vocational education, applying innovative teaching methods and ways of perceiving new information. The Society of Information Technology needs people thinking independently, able to self-fulfillment.

EXAMPLES OF SERVICES THAT USE IFICATION FOR EDUCATION

Codecademy - teaching programming in JavaScript, HTML, Python, Ruby., Code School - another service for teaching programming with gamification elements, Motion Math Games - mobile games in mathematics make learning fun and exciting, Mathletics - a program for schools aimed at engaging children to mathematics through games and challenges, Khanacademy - free video courses in various subjects, Spongelab - a

platform for personalized science education, Foldit - solving scientific problems like puzzles. Gradual transition of users to online platforms carries a lot of advantages: the ability to learn from anywhere in the world at a convenient time, choose courses based on personal interests, not a pre-formed curriculum, etc., but there is a problem: freedom involves a lack of control and discourages the student. Gamification works on the principle of competition and helps to maintain a long-term interest in learning.

Augmented reality can add expressive animation to the static pages of a book, turn reading into a fun game, and make it easier to play audio and video content attached to a paper book. At present, the application of innovative technologies is of important social importance. Analyzing the global trends in the modernization of the economies of developed countries, the introduction into the national institutions of innovative approaches in management and technological processes, it is impossible not to touch on the issues of innovative energy development as a socio-economic system. The innovativeness of the project is to use the latest virtual reality technologies in the electricity system. Learning using virtual reality, allows visual training, show students all aspects of a real object or process, which in general gives a colossal effect, improves the quality and speed of educational processes and reduces their cost.

CONCLUSIONS

The application of innovative IT technologies remains one of the current and important challenges facing education in the digitalization of modern society. The capabilities of mobile devices have led to the emergence of technologies that have opened up new opportunities in the process of teaching and learning, namely augmented reality (AR) and gamification (Gamification).

The scientific significance is due to the application of deep, modern mathematical results and the creation of new own methods of research and analysis, as well as the development of an educational platform based on the example of one section of discipline and the use of the latest VR/AR technologies and gamification in the educational process..

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**О ВИРТУАЛЬНОЙ И ДОПОЛНЕННОЙ РЕАЛЬНОСТИ (VR / AR) И
ГАМИФИКАЦИИ ОБУЧЕНИЯ В ЭНЕРГЕТИЧЕСКОЙ ПРОМЫШЛЕННОСТИ
Жукабаева Т.К., Абдилдаева А.А., Марденов Е.М.**

Применение инновационных ИТ-технологий остается одной из актуальных и важных задач, стоящих перед образованием в области цифровизации современного общества. Возможности мобильных устройств привели к появлению технологий, которые открыли новые возможности в процессе преподавания и обучения, а именно дополненной реальности (AR) и геймификации (Gamification). Научная значимость обусловлена применением глубоких, современных математических результатов и созданием новых собственных методов исследования и анализа, а

также разработкой образовательной платформы на примере одного раздела дисциплины и использованием новейших VR / AR технологии и геймификация в образовательном процессе.

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