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Contact information

Website: https://conference-w.com/

E-mail: ger@conference-w.com

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Agricultural sciences

REVITALIZING WATER RESOURCES IN URBAN AREAS: A TECHNOLOGICAL APPROACH

Luan Bekteshi
Lecturer, Faculty of Applied Sciences and Creative Industries,
Barleti University, Tirana, Albania

Abstract

Water is the most valuable natural resource. As such, it is vital to the revitalization of wildlife, agriculture, and business as well as being one of the tools that promote regeneration (structural and economic), recreation, and tourism.

As a result of fast-paced demographic and economic developments, cities are undergoing continuous growth as a result of population migration from rural areas to urban areas. This growth of cities and their populations is simultaneously associated with the continuous increase in the population's demand for water and, consequently, with the continuous increase in the generation of sewage, which to guarantee sustainable management must be treated before being discharged into the environment.

River water quality has become a major concern for environmentalists and policymakers. With rapid population growth, industrialization, and urbanization, the quality of river water has deteriorated to a great extent. Information systems can play a vital role in river water quality management and can help in river water quality management by providing predictive analytics. By analyzing historical data, information systems can predict the future trend of water quality. This can help identify potential sources of contamination and take corrective action before the situation gets out of control.

This paper describes the current situation of water management in the Lana River basin in the city of Tirana, adopting the use of new technologies for the improvement and expansion of measures leading to greater efficiency of wastewater collection, treatment, and reuse in all phases of the water cycle.

The rapid growth of the population of cities and their continuous urbanization have developed cities towards a new model called "smart city" to continue towards U-Cities which are cities or urban centers that use artificial intelligence to enable the provision of basic services to the population in urban areas.

Keywords: water, quality, urbanization, data, information system

Introduction

Industrial development, urbanization, and intensive agriculture are just some of the factors that affect water pollution. Despite the continuous commitment, uncontrolled use of water resources and damage to river basin remains one of the forms of degradation of water resources. The pressures in the waters come mainly as a result of the increase in the volume of water discharged without adequate physical, chemical, and biological treatment. All this affects the increase in the values of physical, chemical, and microbiological parameters in water bodies. Other pressures from rainfall are the washing of agricultural lands and other polluting surfaces leading to the increase of suspended matter, inorganic matter (fertilizers-N, P, K, NH4, etc.), and organic matter (PCB, Herbicide, etc.). Industrial discharges from various activities are among the biggest pressures on water bodies.

Urbanization has a detrimental effect on water quality. Wastes including sewage, storm runoff, seepage, and leachates from landfills all pollute adjacent waters. The quality of urban runoff is a particular problem in developing communities and poor towns. Litter, e.g. plastic bags, refuse and even unwanted household items, are washed into conduits and may block them or restrict their capacity. Even dissolved chemical loads, due to atmospheric washout, concentrations at first flush, and illegal chemical discharges reach severe proportions. (Stephenson, 2003)

Pollution threatens the utility of water for municipal and irrigation uses and seriously despoils the aesthetic value of rivers—hence pollution control or water-quality management has become an important phase of water resources engineering. (Linsley et al., 2008)

Ecosystems have supported and nurtured human communities for several millennia. The restoration and protection of river basins is the best guarantee for the survival and well-being of large parts of the world’s population. (Both ENDS and Gomukh, 2005)

We have been victims of poor river basin management for longer than we have worried about climate change, for this only hiked up the environmental agenda during the 1980s and 1990s. (Cook, 2017)

Water has conventionally been managed within administrative rather than natural boundaries, in a fragmented rather than holistic manner, and in a technocratic rather than participatory way. Using principles of integrated water resource management, integrated river basin management (IRBM) or integrated catchment management, catchment management initiatives often involve moves toward governance within natural boundaries to manage water more holistically, equitably, efficiently, and sustainably. (Gourbesville, 2008)

The world is in the midst of a revolution in the thinking and practice of water management. A deep appreciation of the complex issues surrounding water resource development has led to new approaches that seek to meet the ecological, social, political and economic challenges posed by the prevalent practices. (Both ENDS and Gomukh, 2005)

Life can be improved in many ways using ICT and IoT solutions, and an important aspect is the improvement of water quality through improved management quality.

Water is now seen as a central plank of sustainable natural resources management, it is embedded in all aspects of development – food security, health, and poverty reduction – as it is an essential part of sustaining economic growth in agriculture, industry, and energy generation, and it sustains the natural ecosystems on which everything else depends. Managing water resources now means meeting both human and ecosystem needs. (Kadi, 2014)

Insufficient sewage in overpopulated sites, e.g. squatter camps, is frequent if services have not kept pace with growth. Monitoring Systems and awareness campaigns are necessary from the health point of view. (Wimberly, 1992)

According to Hoxha et al, Water pollution is often a local problem caused by the discharge of liquid waste into rivers or lakes. The study of water pollution poses an important environmental problem. Many chemical substances can cause water pollution, among the most common are: urban and industrial liquid wastes, chemical fertilizers, pesticides and other chemicals used in agriculture, synthetic wipes (detergents), petroleum and petroleum products, heavy metals, etc. (Hoxha *et* al., 2014)

With the development of ICT and the rapid growth of its use, in recent years the development trends of urban centers are smart cities, combining different sectors through the use of the Internet of Things and advanced computer technologies.

The rapid developments in computational technology, combined with this deeper, fundamental understanding of the chemical, biological, and physical processes involved in wastewater treatment and aquatic ecosystems, are causing this increased complexity in data management. Conversely, in many middle and low-income countries, scientists and practitioners are regularly experiencing data scarcity and facing the challenge of how to interpret the data they do have to generate useful information that would lead to the creation of knowledge and ultimately to increased wisdom. (Sperling *et* al., 2020)

According to Hall et al, a smart city should be "the urban center of the future, made safe, secure, environmentally green and efficient because all structures - whether for energy, water or transport - are designed, built and maintained, using advanced embedded materials, sensors, electronics and networks which interface with computerized systems and consist of databases, tracking and decision-making algorithms. (Hall *et* al., 2000)

According to the European Commission, A smart city is a place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and businesses. (EC, 2023)

River water quality has become a major concern for environmentalists and policymakers. With rapid population growth, industrialization, and urbanization, the quality of river water has deteriorated to a great extent. Information systems, by monitoring surface and groundwater parameters in real-time, can play a vital role in river water quality management. This can be achieved by installing sensors and other monitoring devices along the length of the river. These sensors can continuously monitor water quality and can provide real-time data to relevant authorities. These data can be used by the local government, entities in charge of monitoring the quality of surface and underground waters, interest groups, etc., to identify possible sources of pollution and to take corrective measures to prevent pollution further.

Information systems can help manage surface and groundwater quality by providing predictive analytics. By analyzing historical data, information systems can predict the future trend of water quality. This can help identify potential sources of contamination and take corrective action before the situation gets out of control.

So, information systems can play a vital role in river water quality management. By providing real-time monitoring, predictive analysis, and decision support, information systems can help identify potential sources of pollution and take corrective action to prevent further pollution. It is therefore important that policymakers

and environmentalists use information systems to protect our rivers and ensure they remain a clean source of water for generations to come.

The trend towards a smart city includes in itself a series of measures, processes, services, and technologies throughout all phases of the water use cycle, and all this must be realized to improve the efficiency of sewage management in different cities.

Sustainable river basin management can be achieved through the conservation-utilization balance between the sustainable use of water and the conservation of its quality. (Selek & Selek, 2020)

In this context, water basins must be monitored and managed so that the waters are clean, that is, they are not under the pressure of organic, nutrient, or dangerous substances. In the European Union, water quality is regulated based on the Water Framework Directive (EU, 2000) and WHO (WHO, 2017), which have determined the parameters that determine water quality.

Water quality situation of the Lana River basin

EU water policy is one of the cornerstones of environmental protection in the EU. The rules protect water resources, freshwater, and saltwater ecosystems and ensure that our drinking and bathing water is clean. EU legislation for the protection of groundwater and surface water focuses on achieving good chemical status and good quantitative status.

The Urban Waste Water Treatment Directive1 (UWWTD) is one of the core elements of EU water policy. Adopted in 1991 its objective is to protect the environment from the adverse effects of discharges of urban wastewater from settlement areas and biodegradable industrial wastewater from the agro-food sector. (Circabc, 2017)

As a country that aspires to join the EU, Albania has a complete legal and institutional basis for surface and underground water management. The administration of river basins in SEE countries/territories is influenced by the structural and political organization, in some countries, it is based on national water laws, EU directives, as well as relevant by-laws.

Water quality is very significant in a monitoring scheme, as water is often a reflection of the overall condition of the entire watershed. A water quality monitoring program should always take into account the type of land use in the watershed, the sources, and the pollutants that accompany it. Regarding water management, there are some strategic documents:

- National Integrated Water Resource Strategy 2018-2027,
- National Water Supply and Sewerage Strategy 2011-2017,
- National Irrigation and Drainage Strategy 2019-2031 and action plan.
- The national and international legal references that are followed in Albania regarding the assessment of water quality parameters are:
- Directive 2000/60/EC of the European Parliament and the Council establishing a framework for Community action in the field of water policy
- Law no. 111/2012 amended - "On the integrated management of water resources"
- VKM no. 1189, 2009 "Rules and procedures for the drafting and implementation of the PKM"
- VKM no. 267/2014 "On the approval of priority substances for the aquatic environment"
- VKM no. 246/2014 "On the determination of quality standards in the environment for surface waters"
- The decision of the Council of Ministers no. 268 dated 06/04/2016
- The decision of the Council of Ministers no. 550 dated 15/07/2020
- The decision of the Council of Ministers no. 993 dated 09/12/2020
- The decision of the Council of Ministers no. 1122 dated 30/12/2020

The goal is to ensure integrated and functional management of water resources by establishing a monitoring and management system for the risk of flooding and the insufficiency of water resources.

According to Law No. 111/2012, "On the Integrated Management of Water Resources", which was drafted by Directive 2000/60/EC of the European Parliament: "The National Strategy for the Management of Water Resources is a planning document that defines the vision of state policies, mission, goals, and objectives in the field of integrated water management for a long-term period".

Albania is rich in water resources. Seven rivers together with their tributaries flow into the Adriatic Sea. A total of 250 lakes occupy 4% of the Albanian territory. The hydrographic basin that feeds Albania's waterways has a total area of 43,305 km2, i.e. about 50% larger than the country's territory.

The case we are analyzing is related to the Lana River, which is part of the Ishëm water basin and passes through the city of Tirana from east to west. It is 29 km long and flows in a systemized concrete channel along the stretch within the city of Tirana. At the entrance to the city of Tirana, the water quality is close to drinking

water. During the passage through the city, many liquid and solid discharges transform it into a sewer and pollutants increase significantly

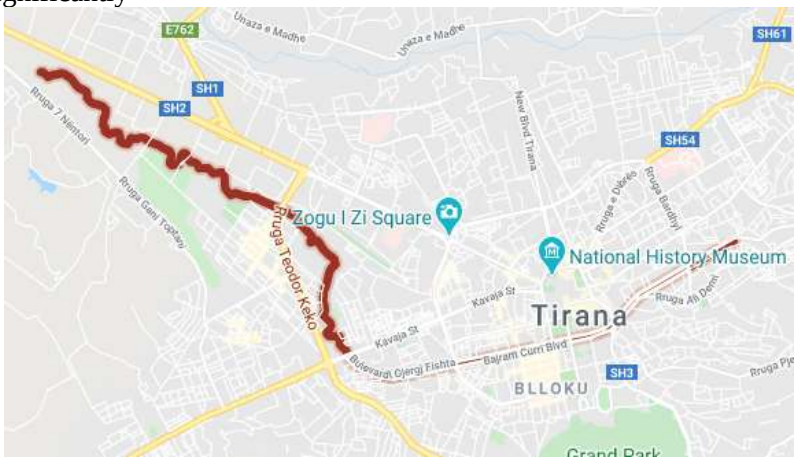

Figure 1: View of the Lana River basin along the city of Tirana

The city has focused on the development of water supply, surface water collection, and sewerage services to have a better-quality impact on the public health of citizens, but the Lana River constitutes an environmental problem for the city of Tirana as in many points of this untreated sewage from residential areas is discharged into the river, further deteriorating the water quality of this river.

The existing wastewater collection system is a combined sewage system for draining urban wastewater mixed with rainwater. Although in its natural form, untreated urban waters carry fairly high levels of BOD5.

Figure 2: View of the Lana River

Considering that the city of Tirana has the largest population in all of Albania and a large area, it is understood that we have a significant number of sewage discharge points. The city of Tirana does not have a discharge plant and in many cases, we do not have separation of wastewater discharges. The main discharges (of residents and businesses) take place in the Lana River and the Tirana River. In the suburban areas of the city, wastewater is discharged into septic tanks or into streams or canals that pass in their vicinity, individually.

Water quality monitoring aims to collect qualitative information on the physical, chemical, and biological characteristics of water through statistical sampling. At the same time, measurements were made with a duration of 1 week during June 2024, October 2024, and November 2024 to record the water quality parameters in the Lana River. These results are summarized in the following tables:

Measurement points	Gurrë, near Dajti Mountain	Lana River, near the Ministry for Europe and Foreign Affairs	Lana River, near the Pyramid	Lana River, near Hilton Garden Inn Tirana Hotel	Lana River, near Green City	Lana River, near Buzi Store	Lana River, near Salus Hospital
Latitude	41.210836	41.194851	41.192649	41.191364	41.195663	41.202822	41.203980
Longitude	19.553230	19.500009	19.491893	19.474253	19.471955	19.462657	19.454192
pH	8,84	7,52	8	8,34	8,84	8,18	8,18
EC	334	838	727	508	345	529	717
DO	10,4	3	3,3	2,7	3,4	2,8	3,4
BOD5	1	250	190	160	210	170	225
COD	1,56	475	211	250	256	190	256
TSS	44	215	256	68,3	52	1	104
NH4	0,36	38,65	32	11,17	18,36	19,40	27,40
NO3	0,3	12,7	12	10,7	10,3	10,9	11,1
NO2	0,00	0,007	0,050	0,051	0,182	1,4	0,016
PO4	0,077	2,499	2,999	0,022	2,190	0,499	1,635
Alkalinity	166	375	325	176,5	190	270	320

Table 1: Measurements of water quality indicators of the Lana River (measurement no. 1, June)

Measurement points	Gurrë, near Dajti Mountain	Lana River, near the Ministry for Europe and Foreign Affairs	Lana River, near the Pyramid	Lana River, near Hilton Garden Inn Tirana Hotel	Lana River, near Green City	Lana River, near Buzi Store	Lana River, near Salus Hospital
Latitude	41.210836	41.194851	41.192649	41.191364	41.195663	41.202822	41.203980
Longitude	19.553230	19.500009	19.491893	19.474253	19.471955	19.462657	19.454192
pH	8,54	7,36	7,89	8,12	8,62	8,11	7,84
EC	315	683	611	442	272	436	564
DO	9,2	3	2,6	3,1	3,1	3,2	2,9
BOD5	1	286	234	153	213	260	314
COD	1,68	563	324	183	280	283	328
TSS	52	108	132	56	34	21	84
NH4	0,64	15,8	16	15,12	16,27	17,1	15,23
NO3	0,9	11,4	11,2	10,5	10,2	10,7	10,7
NO2	0,1	0,22	0,4	0,14	0,24	1,2	0,11
PO4	0,2	2,35	2,14	1,12	1,21	0,36	1,01
Alkalinity	152	361	286	164,2	230	264	284

Table 2: Measurements of water quality indicators of the Lana River (measurement no. 2, October)

Measurement points	Gurrë, near Dajti Mountain	Lana River, near the Ministry for Europe and Foreign Affairs	Lana River, near the Pyramid	Lana River, near Hilton Garden Inn Tirana Hotel	Lana River, near Green City	Lana River, near Buzi Store	Lana River, near Salus Hospital
Latitude	41.210836	41.194851	41.192649	41.191364	41.195663	41.202822	41.203980
Longitude	19.553230	19.500009	19.491893	19.474253	19.471955	19.462657	19.454192
pH	8,42	7,11	7,2	7,96	8,4	7,81	7,17
EC	302	641	603	453	296	415	547
DO	8,8	4	2,3	2,5	2,9	2,8	2,4
BOD5	1,2	224	234	176	221	270	282
COD	1,46	431	287	196	296	290	276
TSS	41	198	158	81	47	19	96
NH4	0,39	18,5	14	15	14,4	19,31	22,15
NO3	0,5	11,7	11,1	10,6	10,4	10,8	10,7
NO2	0,2	0,3	0,3	0,2	0,16	1,3	0,16
PO4	0,14	2,1	2,2	0,9	1,9	0.52	1,32
Alkalinity	146	322	301	153,4	205	242	297

Table 3

Measurements of water quality indicators of the Lana River (measurement no. 3, November)

PARAMETERS	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
Average temperature	6.8	7.3	9.5	12.9	17.9	22.2	24.5	25.1	21.8	16.2	13.1	7.2
The amount of precipitation. (in mm)	139	124	124	84	65	24	32	58	63	117	158	142
Evapotranspiration 51	34	47	67	91	132	167	176	163	114	52	43	51
Evapotranspiration 52	21	30	65	97	129	161	32	39	68	73	39	26

Table 4: Average temperatures and amount of precipitation in the city of Tirana during 2024

Meanwhile, according to the extracted statistics, the following table results with other data related to 4 other parameters which are as in table no. 4

By comparing the sample data of the measurements carried out at several points along the Lana River basin in three different periods, with the normal values of river water parameters, it results that the waters of the Lana River have high levels of pollution. This is also reflected in the graph presented below, but we can also draw this conclusion if we simply compare the measurement data at different points concerning the data obtained from the measurements at the point "Gurrë, near Dajt mountain" which coincides with a from the points on the bed of the Lana river in which the wastewater of the residents or different businesses has not started to flow. As the data collected from the measurements show, the more the water of the Lana River flows inside the city of Tirana, the more polluted and contaminated it becomes due to the continuous discharge of water by citizens and businesses.

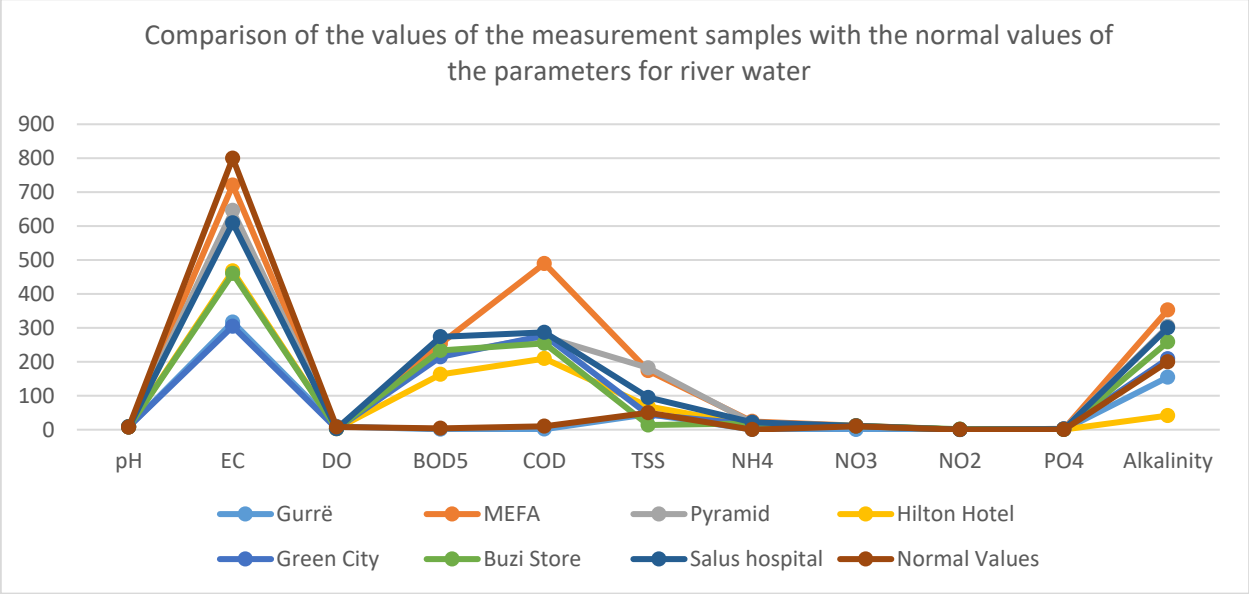

Table 5: Comparison between values of measurement samples with normal values

Although significant investments have been made in the improvement and rehabilitation of the Lana riverbed and the project for the construction of the sewage treatment plant in the city of Tirana has also begun, the situation is problematic.

Industrial and urban development influenced the population growth in the city of Tirana. This has caused the increase of water discharges, without any preliminary treatment, beyond the possibility of self-purification of the waters.

When due to urban and industrial development, the growth of environmental problems is affected, then one of the main sectors of the economy of Albania, which is tourism, can be affected since the city of Tirana is not considered a suitable year-round tourist destination.

In such situations it is good to follow effective solutions successfully implemented in many cities in different countries which are based on the use of ICT and IoT and which have influenced the improvement of the monitoring process of water parameters in time real, simultaneously leading to faster and more efficient decision-making to guarantee the allowed water parameters.

Since the field collection of samples that will be analyzed in laboratories is associated with several problems related to data quality, timeliness, frequency and cost of their collection, etc., an optimal solution is to automate the process of measuring parameters that determine the quality of water through the use of new technologies, which are numerous nowadays.

New in-situ sensors have been developed to measure water quality parameters in the field and in real-time, known as the manual in-situ monitoring approach, to overcome some limitations of the manual lab-based monitoring approach. In this approach, users use the in-situ water quality sensors to measure water quality parameters on-site and take real-time readings from the handled device connected to the sensor. The continuous monitoring of water quality can be achieved by leaving the sensor on-site to collect and store the data inside the sensor unit, however, data cannot be automatically sent to users for processing and visualization. Wireless Sensor Networks (WSN) have become a better solution for water quality monitoring with the development of wireless communication technology. (Adu-Manu et al., 2017)

As in many other countries, in Albania, field specialists and researchers face the lack of data and the challenge of how to interpret the data they have to obtain useful information. Nowadays, the collection of data necessary to assess water quality is mainly carried out manually and at the same time is accompanied by additional costs due to the commitment of a large number of people who must make the measurements of the relevant parameters that determine the quality of the waters as well as with a quality that leaves much to be desired of the collected data.

Only during 1 year, hundreds of water samples are analyzed for physicochemical and organoleptic indicators such as electrical conductivity, pH, turbidity, temperature, taste, smell, chlorides, nitrites, nitrates, ammonia, sulfates, calcium, iron, aluminum, oxidizability, general hardness, alkalinity, hydrogen sulfide, etc., as well as analyzes of the bacterial load for total coliforms, E.coli and S-fecal, etc. were performed.

An appropriate monitoring system, following European standards, will help to collect the necessary data as well as to assess trends and national development of the environment. In this way, it will provide more

accurate and more frequent information to the interested public, helping to involve more subjects and individuals in environmental decision-making.

One of the most important elements of the monitoring infrastructure in Albania would be the creation of a National Monitoring Network, which must be designed under the requirements of the environmental legislation implemented today in Europe. The National Monitoring Network for the components: air, water, land, and biodiversity, should be composed of a certain number of monitoring stations distributed according to the relevant fields (air, surface water, underground water, biodiversity) which should collect data in real-time and these data are stored in a central server necessary for such a system.

Materials and methods

The design of a suitable system for monitoring the qualitative and quantitative parameters of the waters of the Lana River, the data that must be collected through sensors, and the modules that must be part of such a system, are the subject of this section

To build a water quality management information system, we must begin by identifying the key components that are necessary for an effective water quality management system. These components include:

1. Data collection: There are various ways to collect and analyze data, such as through remote sensors, water quality monitoring stations, and laboratory tests. The key is to have a comprehensive data collection plan that can capture all relevant variables.
2. Data storage: Data collected must be stored in a database that is secure and accessible. An effective database must be able to handle large amounts of data, be reliable, and have a backup system.
3. Data manipulation: Once data is collected and stored, it must be analyzed and interpreted. This includes analyzing trends, identifying outliers, and comparing data to regulatory standards.

To implement a water quality management information system in Albania, we can consider using a combination of technologies, including remote sensors, mobile applications, and cloud-based databases. These technologies can be used to collect data from multiple sources such as water quality monitoring stations, weather sensors, and sampling sites. Collected data may be stored in a centralized database that can be accessed by authorized personnel.

The proposed system should include the necessary components that work together in an automated system to guarantee the monitoring of water quality parameters in the Lana River:

1. Sensors are devices that measure various water quality parameters such as pH, temperature, dissolved oxygen, and turbidity. Sensors are usually connected to a data logger using wires or cables, and they are powered by batteries or external power sources.
2. Data logger which is a device that collects and stores data from sensors. It is typically used to record sensor readings at regular intervals, such as every minute or every hour. The data logger may also have built-in sensors for measuring temperature, pressure, and other environmental parameters. The data logger stores sensor data in internal memory or on an external memory card.
3. A telemetry device is a device that transmits sensor data collected by data logging to a central database. It may use wireless or cellular communications to send the data to the database, or it may use satellite communications in remote or inaccessible areas. The telemetry device may also include a GPS receiver to provide location information.
4. The communication network which is the infrastructure that connects the telemetry device to the central database. It can be a mobile network, a satellite network, or a dedicated radio network. The communications network may also include data servers, routers, and other network devices.
5. A data management system which is a software application or database that stores and processes sensor data. It receives the data from the telemetry device and stores it in a database, where it can be accessed and analyzed. The data management system may also include data analysis algorithms, data visualization tools, and data notification features.
6. Data analysis software which is a set of algorithms and tools used to process and analyze sensor data. These algorithms may include statistical analysis, machine learning, and pattern recognition. Data analysis software may also include data visualization tools, such as charts and graphs, that allow stakeholders to view sensor data in a meaningful way.
7. The user interface which is the graphical representation of the sensor data that allows interested parties to view and analyze the data. It can be a web-based dashboard, a mobile app, or a desktop app. The user interface may include real-time sensor readings, historical data, trend graphs, and other visualization tools.

In an automated system used to monitor water quality parameters in a river, these components are linked in a chain. The sensors are connected to the data logger, which is connected to the telemetry device. The telemetry device is connected to the communication network, which is connected to the data management

system. The data management system is linked to data analysis software and a user interface that provides stakeholders with the information they need to make informed decisions about water management and security.

One of how information systems can help manage river water quality is by providing real-time monitoring of water quality. This can be achieved by installing sensors and other monitoring devices along the length of the river. These sensors can continuously monitor water quality and can provide real-time data to relevant authorities. This data can be used to identify potential sources of contamination and take corrective action to prevent further contamination.

One of the ways in which information systems can help manage river water quality is by providing real-time monitoring of water quality. This can be achieved by installing sensors and other monitoring devices along the length of the river. These sensors can continuously monitor water quality and can provide real-time data to relevant authorities. This data can be used to identify potential sources of contamination and take corrective action to prevent further contamination.

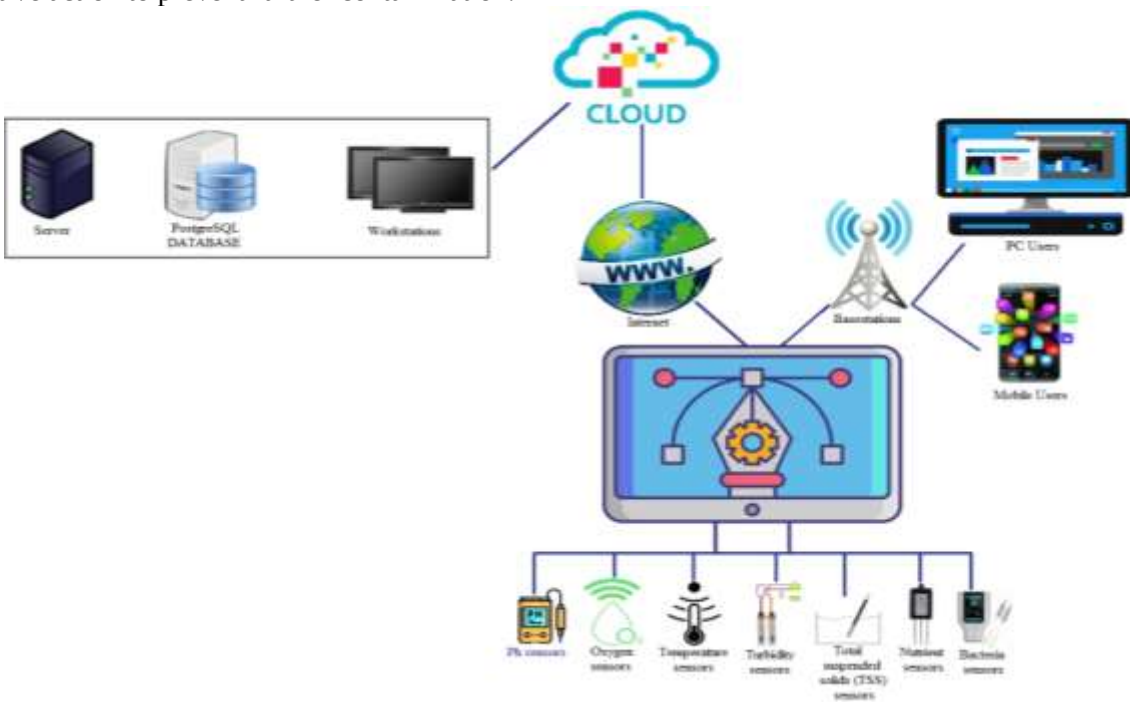

Figure 4: General block diagram of the Water Parameters Monitoring System.

Another way in which information systems can help manage river water quality is by providing predictive analytics. By analyzing historical data, information systems can predict the future trend of water quality. This can help identify potential sources of contamination and take corrective action before the situation gets out of control.

Furthermore, information systems can help manage river water quality by providing decision support systems. These systems can help identify the most effective measures to take to improve water quality. Decision support systems can also help in analyzing the cost-effectiveness of different measures and choosing the most appropriate ones.

Conclusions

Water is our most precious natural resource. As such, it is vital to wildlife, agriculture, and business. Moreover, it is also one of the tools that promote regeneration (structural and economic), recreation, and tourism. Therefore, this paper presents an effort that, after identifying the pressures and impacts on water resources, suggests the implementation of a water monitoring system, because such a system will contribute to the improvement of the quality of the water environment. of the Lana River basin in particular and of all other basins in Albania through sustainable management.

In Albania, significant investments have been made in the water sector in connection with the construction of large infrastructures in river water basins, water treatment, and sewerage plants, including distribution, irrigation, drainage, and wastewater collection networks, etc., but few investments have been made in terms of data collection and information management in this sector. Although numerous investments have been made in the infrastructure, it is necessary to build the sewage treatment plant as soon as possible, to

avoid their discharge into the Lana River basin, eliminate water pollution, the health of the population and tourists, and improve the tourist image of the city.

Despite this, there is a need for significant investments both in terms of infrastructure and also in terms of data collection and processing or the implementation of monitoring systems as only in this way can sustainable development in the monitoring sector be ensured and water management.

Since we face the reality of the lack of necessary and sufficient data to interpret and make the right decisions for the monitoring of river water quality parameters, the implementation of a monitoring system following European standards is the most suitable solution for enabling the collection of reliable and real-time data and thereby helping the interested public, other interest factors, and state entities to obtain the correct information necessary for the respective decision-making depending on the situations. The monitoring system of water quality parameters of the Lana River basin can play a very important role in the water quality management of this river basin.

Such an information system can help manage river water quality by providing real-time monitoring, data analysis, and decision support to relevant authorities. It can also help generate reports and provide a user-friendly interface to access data and recommendations.

The water basins must be monitored and managed so that the waters are clean, that is, they are not under the pressure of organic or dangerous substances, but at the same time, it is quite important to avoid the discharge of untreated water into the river basins as the negative effects are multifaceted.

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Biological sciences

INVESTIGATION OF THE GENETIC DIVERSITY OF LOCAL AND INTRODUCED POTATO GENOTYPES

Hajiyev E.S.
PhD on Biological Sciences, Associate Professor, Head of department
Genetic Resources Institute, Ministry of Science and Education, Baku, Azerbaijan
Research Institute of Vegetable growing, public legal entity, Baku, Azerbaijan
Hajiyeva S.V.
Researcher
Genetic Resources Institute, Ministry of Science and Education, Baku, Azerbaijan
Karimova A.M.
Researcher
Genetic Resources Institute, Ministry of Science and Education, Baku, Azerbaijan
Mammadova A.D.
Doctor of Biological Sciences, Associate Professor, Researcher
Genetic Resources Institute, Ministry of Science and Education, Baku, Azerbaijan
Aliyev R.T.
Doctor of Biological Sciences, Professor, Head of department
Genetic Resources Institute, Ministry of Science and Education, Baku, Azerbaijan

Abstract

In the research, the genetic diversity of 50 potato samples was investigated using 10 ISSR primers. A total of 155 fragments were identified, of which 134 (86.5%) were polymorphic, and 21 (13.5%) were monomorphic. The number of polymorphic fragments ranged from 3 to 12. Overall, the average polymorphism level detected by ISSR analysis for the collection was high, reaching 85.5%. The average value of the Genetic Marker Index (GMI) for the studied collection was 0.73 units. The Polymorphism Information Content (PIC) index for the 10 primers used in the study varied between 0.24 and 0.45, with an average of 0.38 units. To determine the genetic relationships among the potato genotypes, cluster analysis was performed based on ISSR profiles, and a dendrogram was constructed. The genotypes were grouped into 5 main clusters. The genetic similarity index among the samples ranged from 0.021 to 0.92.

Keywords: potato, ISSR, genetic diversity

Intraduction

Potato (*Solanum tuberosum* L.) is the most widely cultivated tuber crop and ranks as the fourth most important food crop globally, following wheat, rice, and maize [1]. It belongs to the Solanaceae family and the genus Solanum, with a basic chromosome number of 12 (x = 12) [2]. Molecular markers play a crucial role in assessing genetic diversity, especially since commercial potatoes have a narrow genetic base [3]. Ideal DNA markers should be polymorphic, detectable at the DNA level, and expressed across all tissues, organs, and developmental stages of the plant. These markers can significantly enhance the efficiency and effectiveness of breeding programs compared to traditional methods. Various molecular techniques, including RAPD, SSR (microsatellite markers) [4-6], AFLP, chloroplast RFLP, and nuclear RFLP, are employed for genetic diversity assessment and other applications in potato breeding.

In summary, the studies mentioned above highlight the importance and effectiveness of ISSR markers in assessing genetic diversity and identifying genetic relationships and differences across a wide range of crops. ISSR markers are also widely used in studying the genetic diversity of potatoes. For example, Onamu et al. [7] analyzed 35 potato accessions from Mexico, Europe, and the USA using 19 Random Amplified Polymorphic DNA (RAPD) and 5 ISSR primers to evaluate genetic diversity and relationships among genotypes. The study reported polymorphism rates of 81.45% for RAPD and 82.98% for ISSR primers, with ISSR markers demonstrating greater effectiveness than RAPD markers.

In another study, Pechenkina et al. [8] examined 12 potato varieties of Russian origin to determine genetic diversity using ISSR-based DNA polymorphism analysis. Out of 20 ISSR primers, four were identified as the most effective for the studied *S. tuberosum* varieties, including two dinucleotide and two trinucleotide primers. The authors recommended these markers for analyzing *S. tuberosum* cultivars.

Building on the insights from these studies, the aim of this research is to investigate the genetic diversity of potato genotypes using ISSR markers.

Material and Metods

DNA extraction was performed according to the CTAB (cetyltrimethylammonium bromide) protocol proposed by Doyle and Doyle (1985). The concentration and purity of DNA was determined using a nanodroplet (Thermo, NANO DROP, 2000).

Ten ISSR primers were used in the study. The total reaction volume for each sample was 20 µL. Each 20 µl reaction mixture consisted of 2 µl DNA, 2 µl buffer (10 mM Tris-HCl, pH 8.0, 50 mM KCl, 1.5 mM $MgCl_2$), 1.5 µl $MgCl_2$, 2 µl dNTPs, 2 µl primers and 0.1 µl Taq polymerase enzyme. Polymerase chain reaction in a thermal cycler for 5 minutes. started with DNA denaturation at a temperature of 94°C and 3 stages - denaturation for 1 minute. 94°C, 45 seconds for primer to adhere to DNA. 50-52°C (subject to change depending on primer) and 5 minutes stretch. 35 cycles at 72°C were carried out sequentially.

Amplification products were separated by electrophoresis on a 2% agarose gel, stained with ethidium bromide, and visualized using Bio-Rad Gel Documentation (Gel Imaging).

Genotypes were analyzed using the Jaccard method in PAST (version 4.11) to group genotypes based on ISSR loci.

Resalts and discution

After the trial amplification of DNA samples, 10 out of 15 primers were selected as the most effective for subsequent analyses. A total of 155 fragments were identified across 50 potato samples, of which 134 (86.5%) were polymorphic, and 21 (13.5%) were monomorphic. The number of fragments per locus ranged from 4 to 18, and the length of the fragments varied between 50 and 1200 base pairs. On average, 7.5 fragments were synthesized per primer. The highest number of amplicons was obtained with the UBC 812 primer. The number of polymorphic fragments ranged from 3 to 12, with the minimum observed for primers UBC 811 and UBC 827, and the maximum for primers UBC 834 and UBC 857. The average number of polymorphic fragments per primer was 6.4. The percentage of polymorphism varied between 60% and 100%, depending on the primer, with the UBC 808 primer exhibiting 100% polymorphism. Overall, the average polymorphism level detected by ISSR analysis for the collection was high, reaching 85.5%. The high polymorphism of ISSR markers is explained by their multi-allelic and hypervariable nature. Among the studied loci, dinucleotide repeats (AG)8 were found to be the most polymorphic.

During the study, the Genetic Diversity Index (GDI) was calculated for each ISSR locus. The average GDI value for the studied collection was 0.73 units. High values of 0.85 and 0.90 units were obtained with primers UBC 812 and UBC 811, respectively. The high GDI values indicate that potato genotypes from different regions of Azerbaijan possess rich genetic diversity. It is known that for dominant markers like ISSR, the Polymorphism Information Content (PIC) index ranges from 0 to 0.5. For the 10 primers used in the study, the PIC index varied between 0.24 and 0.45, with an average of 0.38 units. The findings of this study exceed those of Torabi-Giglou et al. [10], who reported an average PIC value of 0.25 across 45 potato accessions. The lowest PIC value was observed for ISSR3, while the highest was recorded for the UBC 840 primer. Among the 134 polymorphic loci identified, 48 were found to be more informative (PIC > 0.45).

The Marker Index (MI) and Effective Multiplex Ratio (EMR) are key indicators of the informativeness of marker systems and were calculated separately for each primer. In the collection, MI ranged from 0.67 to 3.65, and EMR ranged from 1.0 to 10, with average values of 2.12 and 4.6, respectively. The maximum values of MI and EMR were recorded for primer UBC 808, while the minimum values were observed for primers ISSR3 and UBC 827. A positive correlation ($r = 0.967$, $P < 0.01$) was found between EMR and MI. Primers with a higher number of polymorphic fragments were characterized by higher EMR and MI values. A positive correlation was observed between these parameters and the number of polymorphic fragments (PFS), while a negative correlation was found between EMR and PIC indices.

The Resolving Power (Rp) is a parameter that determines the discrimination potential of primers. For all loci studied, Rp varied between 1 and 6.84, with an average value of 2.73. The Mean Resolving Power (MRp) ranged from 0.32 to 0.95. Additionally, the mean resolution power, which assesses the discriminatory potential across a large volume of material [9], ranged from 0.07 to 0.25 for the studied potato accessions.

To determine the genetic relationships among potato genotypes, cluster analysis was performed based on ISSR profiles, and a dendrogram was constructed. The genotypes were grouped into 5 main clusters. The genetic similarity index among the samples ranged from 0.021 to 0.92. Esfahani et al. [12] observed the clustering of European and North American potato genotypes based on their origin. Likewise, in the study of Bornet et al. [11] potato genotypes were differentiated according to their origins in Europe and Argentina.

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SYNTHESIS AND ASSESSMENT OF NOVEL HYBRID COMPOUNDS AGAINST MULTIDRUG-RESISTANT MICROORGANISMS

Binate Gaoussou
PhD student, Baku State University
Ismailov Valeh
Professor, Baku State University
Yusubov Niftali
Professor, Baku State University
Ganbarov Khudaverdi
Professor, Baku State University

Abstract

The antimicrobial properties of four hybrid compounds were investigated against opportunistic bacteria and fungi, using agar well diffusion method. The largest inhibition zones of 31.0 mm and 32.0 mm were found with compound IV **(**Hydrogen (1-carboxy-1-chloroethyl)phosphonate pyridine-1-ium) and compound II (Ethyl 2-chloro-2-(dichloro phosphoryl) propanoate) against *Candida tropicalis,* respectively. *Klebsiella pneumoniae* was the most susceptible gram-negative bacterium to compound I (3-chloro-2-methoxy-3-methyl-1,5,2-diaza-phosphinane-4,6-dione 2-oxide), with an inhibitory zone of 22.0 mm. compound III ((*Z*)-(1-chloro-1-((diethoxy phosphoryl) prop-1-en-2-yl) phosphono chloridic acid) was the most effective against *Staphylococcus aureus,* with 21.3 mm of inhibition zone. These four compounds were all efficient against gram-positive and gram-negative bacteria, as well as *Candida* species. However, the largest diameter of inhibition zone (32.0 mm) was found against *Candida tropicalis*.

Keywords: Antimicrobial properties; organic compounds; opportunistic bacteria and fungi

Introduction

Antibiotic resistance is a major challenge in modern medicine, reducing the effectiveness of treatments and leading to difficult-to-treat infections. This resistance arises not only from genetic mutations in microorganisms but also from their ability to form biofilms, which protect them from antibiotics and immune responses [4, 5]. These biofilms make it difficult to eliminate pathogens, allowing microorganisms to persist and evade treatments. Given the rise in resistant infections, there is a pressing need for new approaches to antimicrobial therapy [1, 3]. Pharmaceutical companies are focusing on developing drugs with novel mechanisms to target resistant strains. This study aims to assess the antimicrobial properties of four hybrid compounds against ten multidrug-resistance microorganisms.

Materials and methods

The Organic Chemistry Department of Baku State University in Azerbaijan provided all four organic compounds. Gram-negative bacteria (*Acinetobacter baumannii* BDU-32, *Escherichia coli* BDU-12, *Klebsiella pneumoniae* BDU-44 and *Pseudomonas aeruginosa* BDU-49), gram-positive bacteria (*Bacillus mesentericus* BDU-51, *Bacillus subtilis* BDU-50 and *Staphylococcus aureus* BDU-23) and yeasts (*Candida albicans* BDU MI-44, *Candida guilliermondii* BDU-217 and *Candida tropicalis* BDU LK-30) were used as test cultures.

The antimicrobial activity of compounds was evaluated using the agar well diffusion method at 0.1% concentration. Dimethyl sulphoxide (DMSO) was used as a solvent to dissolve the compounds, and for a negative control. The pathogenic bacteria were cultivated on nutrient agar, while the fungal strains were grown on sabouraud dextrose agar [2]. All experiments were repeated four times.

Results and discussion

The table summarizes the antimicrobial efficacy of organic compounds against harmful bacteria and fungi. In gram-negative bacteria, compound I (3-chloro-2-methoxy-3-methyl-1,5,2-diazaphosphinane-4,6-dione 2-oxide) was 1.2, 1.6, and 1.8 times more efficient against *Klebsiella pneumoniae* than *Pseudomonas aeruginosa, Escherichia coli,* and *Acinetobacter baumannii,* respectively. The maximum inhibition zone found against *Klebsiella pneumoniae* was 22.0 mm. Compound II (Ethyl 2-chloro-2-(dichlorophosphoryl) propanoate) had 1.5 times the activity against *Pseudomonas aeruginosa* than *Klebsiella pneumoniae*. In contrast, this chemical exhibited the same effect on *Acinetobacter baumannii* and *Escherichia coli,* with an inhibitory zone of 13.0 mm.

Table

Antimicrobial activity results of compounds against bacteria and fungi

Microorganisms		*Diameter of inhibition zone (mm), M ± m*			
		I	**II**	**III**	**IV**
Gram negative bacteria	*Acinetobacter baumannii*	12.0±0.3	13.0±0.3	14.0±0.4	14.0±0.4
	Escherichia coli	14.0±0.4	13.0±0.3	12.0±0.3	13.0±0.4
	Klebsiella pneumoniae	22.0±0.7	11.0±0.2	18.3±0.5	16.0±0.5
	Pseudomonas aeruginosa	18.0±0.5	17.0±0.5	17.3±0.5	18.0±0.5
Gram positive bacteria	*Bacillus mesentericus*	16.0±0.5	15.0±0.4	13.0±0.3	14.0±0.4
	Bacillus subtilis	18.0±0.5	13.0±0.3	15.0±0.5	14.0±0.4
	Staphylococcus aureus	17.0±0.5	16.3±0.5	21.3±0.7	19.3±0.6
	Candida albicans	15.0±0.4	17.0±0.5	17.0±0.5	16.0±0.5
Fungi	*Candida guilliermondii*	15.0±0.4	15.0±0.4	18.3±0.5	16.0±0.5
	Candida tropicalis	20.0±0.6	32.0±1.0	21.0±0.8	31.0±1.0

Note: **I**-3-chloro-2-methoxy-3-methyl-1,5,2-diazaphosphinane-4,6-dione 2-oxide; **II-** Ethyl 2-chloro-2-(dichlorophosphoryl) propanoate; **III**-(*Z*)-(1-chloro-1-((diethoxyphosphoryl) prop-1-en-2-yl) phosphonochloridic acid; **IV**-Hydrogen (1-carboxy-1-chloroethyl)phosphonate pyridine-1-ium

Compound III ((Z)-(1-chloro-1-((diethoxy phosphoryl) prop-1-en-2-yl) phosphono chloridic acid) was 1.3 and 1.5 times more effective against *Klebsiella pneumoniae* than *Acinetobacter baumannii* and *Escherichia coli*, respectively. However, this compound demonstrated equivalent activity against *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Compound IV (hydrogen (1-carboxy-1-chloroethyl) phosphonate pyridine-1-ium) was 1.1, 1.3, and 1.4 times more effective against *Pseudomonas aeruginosa* than *Klebsiella pneumoniae, Acinetobacter baumannii*, and *Escherichia coli*, respectively. Thus, among gram-negative bacteria, *Klebsiella pneumoniae* was the most susceptible pathogen, with an inhibition zone of 22.0mm. Compound I, on the other hand, outperformed compounds II, III, and IV in terms of gram-negative bacteria inhibition. In gram-positive bacteria, compound I had almost the same antibacterial activity against *Bacillus mesentericus, Bacillus subtilis* and *Staphylococcus aureus*, with inhibition zones of 16.0, 18.0 and 17.0 mm, respectively. Compound II was 1.1 and 1.2 times more effective against *Staphylococcus aureus* than *Bacillus mesentericus and Bacillus subtilis*, respectively. Compound III was 1.4 and 1.6 times more active against *Staphylococcus aureus* than *Bacillus subtilis* and *Bacillus mesentericus*, respectively. The largest inhibitory zone for *Staphylococcus aureus* was 21.3 mm. Compound IV was 1.4 times more effective against *Staphylococcus aureus* than *Bacillus subtilis* and *Bacillus mesentericus*. The highest inhibitory zone, 19.3 mm, was found against *Staphylococcus aureus*. *Bacillus mesentericus* and *Bacillus subtilis*, on the other hand, were equally sensitive to compound IV, with inhibition zones of 14.0 mm. Therefore, *Staphylococcus aureus* was the most sensitive gram-positive bacteria. All four chemicals prevented the growth of gram-negative bacteria.

Comparing the activity of these four compounds against bacterial strains found that compound I was 1.2, 1.3, and 1.4 times more efficient against *Klebsiella pneumoniae than Bacillus subtilis, Staphylococcus aureus*, and *Bacillus mesentericus*. Compound II was 1.3 times as effective against *Pseudomonas aeruginosa* as *Bacillus subtilis*. Compound III was 1.2, 1.5, and 1.8 times more efficient against *Staphylococcus aureus* than *Pseudomonas aeruginosa, Klebsiella pneumoniae, Acinetobacter baumannii*, and *Escherichia coli*, respectively. Compound IV was 1.2, 1.4, and 1.5 times more effective against *Staphylococcus aureus* than *Klebsiella pneumoniae, Acinetobacter baumannii*, and *Escherichia coli*. Thus, the findings revealed that all four compounds limited the development of these bacterial strains. *Klebsiella pneumoniae* was the most sensitive gram-negative bacteria, and *Staphylococcus aureus* was the most sensitive gram-positive bacteria.

In fungal strains, compound I was 1.3 times more effective against *Candida tropicalis* than *Candida albicans* and *Candida guilliermondii*. However, this compound had the same antifungal action against *Candida albicans* and *Candida guilliermondii*, with an inhibition zone of 15.0 mm. Compound II was 2.0 and 2.1 times more active against *Candida tropicalis* compared to *Candida albicans* and *Candida guilliermondii*. Compound III was 1.1 and 1.2 times more effective against *Candida tropicalis* than *Candida guilliermondii* and *Candida albicans*, respectively. Compound IV was 1.9 times more efficient against *Candida tropicalis* than *Candida albicans* and *Candida guilliermondii*. However, this compound demonstrated the same activity against *Candida albicans* and *Candida guilliermondii*, with an inhibition zone measuring 16.0 mm. The results revealed that *Candida tropicalis* was the most susceptible fungal strain to compounds I, II, III, and IV, with inhibition zones of 20.0, 32.0, 21.0, and 31.0 mm. Furthermore, these four compounds have essentially identical effects

against *Candida albicans* and *Candida guilliermondii*. However, compounds IV and II had the highest inhibition zones against *Candida tropicalis*, measuring 31.0 mm and 32.0 mm, respectively.

By comparing the antibacterial and antifungal activities of compounds, the results clearly showed that all four compounds inhibited the growth of bacteria and fungi. On the other side, *Candida tropicalis* was the most susceptible microbial strain, with inhibition zones ranging from 20 to 32.0 mm. Furthermore, compound I (3-chloro-2-methoxy-3-methyl-1,5,2-diazaphosphinane-4,6-dione 2-oxide) was 1.2 and 1.5 times more effective against *Klebsiella pneumoniae* than *Bacillus subtilis, Candida albicans,* and *Candida guilliermondii*. Compound II (Ethyl 2-chloro-2-(dichloro phosphoryl) propanoate) was 2.0 times more effective against *Candida tropicalis* than *Staphylococcus aureus* and *Pseudomonas aeruginosa*, respectively. Compound III ((Z)-(1-chloro-1-((diethoxy phosphoryl) prop-1-en-2-yl) phosphono chloridic acid) was more potent against *Candida tropicalis* and *Staphylococcus aureus than Klebsiella pneumoniae*. Compound IV (hydrogen (1-carboxy-1-chloroethyl) phosphonate pyridine-1-ium) was 1.6 and 1.7 times more effective against *Candida tropicalis* than *Staphylococcus aureus* and *Pseudomonas aeruginosa*, respectively. *Klebsiella pneumoniae, Staphylococcus aureus,* and *Candida tropicalis* were the most susceptible microbial strains in both gram-negative and gram-positive bacteria, as well as fungi.

Conclusion

The susceptibility of bacterial and fungal strains to four organic compounds was demonstrated during the experiment. *Klebsiella pneumoniae* was the most sensitive to compound I in gram-negative bacteria, with 22.0 mm of inhibition zone. *Staphylococcus aureus* was the most sensitive to compound II in gram-positive bacteria, with 21.3 mm of inhibition zone. The largest size of inhibition zones, 31.0 mm and 32.0 mm were observed against *Candida tropicalis* for compounds IV and II, respectively.

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TECHNOLOGY OF DYE FROM WILD RUE (PEGANUM HARMALA L) IN THE WESTERN REGION AND WOOL FIBER DYE

Imran Gasimov
Latifa Atakishiyeva
Elnara Isayeva
Vusala Abbasova
Institute of Bioresources
Ganja, Azerbaijan

QƏRB BÖLGƏSİNDƏ YAYILMIŞ ÜZƏRLİK (PEGANUM HARMALA L) BİTKİSİNDƏN BOYA ALINMASI TEXNOLOGİYASI VƏ YUN LİFİN BOYADILMASI

İmran Qasımov
Lətifə Atakişiyeva
Elnarə İsayeva
Vüsalə Abbasova
Bioresurslar İnstitutu
Gəncə, Azərbaycan

Abstract

As a result of the conducted research, plant species, dye plants, colors and shades obtained from these plants have been studied. The technology of obtaining natural dyes obtained from the common dye plants in the region, physico-chemical parameters were determined through experiments. Studying and researching the vegetation of these areas has a great role in the protection of human health and the partial or complete elimination of many diseases. The physico-chemical parameters of the technology of obtaining natural dye obtained from one of these plants, Peganum harmala L, were studied in the laboratory.

Xülasə

Aparılan tədqiqatlar nəticəsində bu regiona aid olan bitki növləri, boyaq bitkiləri, bu bitkilərdən alınan rəng və çalarları öyrənilmişdir. Regionda yayılmış boyaq bitkilərindən alınan təbii boyaların alınması texnologiyası, fiziki-kimyavi parametrləri aparılan təcrübələr vasitəsi ilə təyin edilmişdir. Bu ərazilərin bitki örtüyünün öyrənilməsi və tədqiq olunması, insan sağlamlığının qorunmasına, bir çox xəstəliklərin müalicəsində qismən və ya tamamilə aradan qaldırılmasında böyük rolu vardır. Bu bitkilərdən biri olan üzərlikdən (Peganum harmala L) alınan təbii boyanın alınma texnologiyası fiziki-kimyəvi parametrləri laboratoriyada tədqiq olunmuşdur.

Keywords: vegetation, landscape, dye plant, paint, color shades
Açar sözlər: bitki örtüyü, landşaft, boyaq bitkisi, boya, rəng çalarları

Azərbaycan Respublikası Qafqaz regionunda ən zəngin təbii sərvətə malik ölkədir. Rayonların bitki örtüyünün dərindən və hərtərəfli öyrənilməsi böyük maraq doğurmaqla yanaşı, müəyyən praktiki əhəmiyyətə malikdir. Respublikamızda floranın zənginliyinə və rəngarəng bitki örtüyünün olmasına səbəb onun fiziki, coğrafi və tarixi təbii şəraitinin müxtəlif olması həmçinin 11 iqlim qurşağından 9-nun ölkəmizdə olmasıdır. Faydalı bitkilər aşkar etmək məqsədi ilə Bioresurslar İnstitutu (Gəncə)" Boyaq emalı texnologiyası labortoriyası" əməkdaşları, Qərb bölgəsi ərazisində tədqiqat işləri aparmış bu bölgədə bitən müalicəvi və boyaq bitkilərinin yayıldığı ərazilər təyin olunmuşdur. Azərbaycanda yayılan boyaq bitkiləri bölgələrimizdə əsrlər boyu yerli əhali tərəfindən müxtəlif məqsədlər üçün istifadə edilərək, dövrümüzə qədər öz əhəmiyyətini itirməmişdir. Respublikamızın florasında 1500- dən artıq boyaq bitkisi mövcuddur ki, onun çoxundan toxuculuqda istifadə edilir. Azərbaycan florasının tərkibində çoxlu sayda dərman bitkiləri, aşı təbiətli, boyaq xüsusiyyətli, bəzək üçün yararlı, dekarativ-incəsənət sahəsində qida sənayesində istifadə olunan bitki növləri vardır.[1. S.6-9].

Gəncəbasara aid olan ərzilərdə aparılan tədqiqat işləri nəticəsində müəyyən olunmuşdur ki, bu bölgə boyaq əhəmiyyətli bitkilərlə daha çox zəngindir. Qərb bölgəsinə xas olan boyaq tərkibli bir çox bitkilərdən yemişan, həmişəyaşıl bir göz, sürvə, gülxətimi, kəndələş, zambaq, nar qabığı, qoz qərzəyi, sarıçiçək, ardıc, bənövşə, turpəng, indiqo, mahmızçiçəyi, üzərlik və s. bir çox bitkilərdən yun, ipək, pambıq liflərdən hazırlanmış məmulatların boyadılmasında geniş istifadə olunmuşdur. [2. S. 22-23].

Qida kimi qədim zamanlardan bəri istifadə edilən bitkilərdən gülümbahar, gülxətmi, əmənköməncı, qırxbuğum, cincilim, qantəpər, sumaq, albalı, çiyələk, yemişan, şomu, bozpencər, razyana və s. bitkilərdən istifadə edilir. Həm qida sənayesində, həm də boyaqçılıqda təbii boyaq bitkilərindən alınan boyaq maddələrindən istifadəsi istiqamətində ölkəmizin alimləri bir sıra elmi tədqiqat işləri aparmışlar və müasir dövrdə də bu sahədə tədqiqatlar davam etdirilir.

Bu məqsədlə Qərb bölgəsində bitən boyaq bitkilərindən olan üzərlik bitkisinin toxum kök hissəsindən təbii boyağın alınması və yun lifin boyadılması texnologiyasına uyğun araşdırmalar aparmışlar. [3. S.10-14].

Şəkil. Üzərlik bitkisi.

Üzərlik (Peganum harmala L) bitkisinin kök və toxumlarında alkaloidlər, peqanin və s. vardır. Kökündə ancaq qarmin və boya piqmentləri vardır. Toxumunda 3-4% alkoloid, rəngverici piqment vardır ki, onunla parçanı müxtəlif rənglərə boyamaq olar.

Üzərlikdən həm boyaq bitkisi kimi, həm də müalicəvi xüsusiyyətlərindən xalq təbabətində bir çox xəstəliklərin müalicəsində istifadə edilir. Üzərlikdən sinir xəstəliklərinin (parkinconizmin) müalicəsində dəmləmə formasında istifadə olunur. Üzərliyin yerüstü hissəsi bitki çiçək açan dövrdə toplayıb qurudur, sonra çay kimi dəmləyib ürək ağrılarında, qıcolmada dəri xəstəliklərində otundan üyüdüb kərə yağı qataraq məlhəm hazırlayıb istifadə edilir. Üzərliyi baytarlıqda əmələ gələn yaraların müalicəsində yarasağaldıcı kimi istifadə edirlər. [4. S.72-74].

Üzərlikdən müəyyən miqdarda götürülür, xırdalanır toxumları və kök hissəsi bir-birindən ayrılaraq əzilir. Toxum və kökdən ayrı-ayrı müəyyən miqdar götürülür suda isladılır. Sonra 90 dəq müddətində 95º C də qızdırılır qismən soyuduqdan sonra süzülür boya ekstraktı alınır. Əvvəlcə toxumdan 100 ml götürüb üzərinə 5%-li sirkə turşusu, aşqarlanmış yun lif əlavə edilir və boyama prosesi aparılır pH-5.52. Boyama prosesindən sonra yun yaşılı qəhvəyi rəngə boyanır. Boyanın möhkəmləndirilməsi məqsədilə yun lif 5%-li xörək duzunda yoxlanılır. Sonda boyanın yuyucu vasitələrə işığa qarşı möhkəmliyi yoxlanması və DÜİST müəyyən olunur.

Üzərliyin kökündən alınmış boya ekstraktından müəyyən miqdar götürülür. Boyama prosesi yuxarıda göstərilən ardıcıllıqla aparılır. Sonda yun lif qəhvəyi rəngə boyanır.

Həm üzərliyin toxumlarından həm də kökümdən alınmış boya ekstraktından nümunə götürməklə üzərinə müxtəlif rəngablar-mis sulfat, kalim bixromat, dəmir qırıntıları və s. əlavə etməklə boyama prosesi aparılır və daha çox rəng çalarları alınır. Kök və toxumdan alınan boya ekstraktının fiziki-kimyəvi parametrləri cədvəl 1-də göstərilmişdir.

Rəngablar əlavə etməklə üzərliyin kök və toxumundan alınan boya ekstraktının fiziki-kimyəvi parametrləri

Cədvəl 1

Boyaq bitkisi	Rəngab	PH	Xüsusi çəki	Şüasındırma əmsalı	Optiki sıxlıq	ABC abror	Dalğa uzunluğu	Alınan rəng
Üzərlik toxumu	əsas məhlul	5.07	0.9224	1.3357	T-6%	1.222	600	Açıq qəhvəyi
	$CuSO_4.5H_2O$	3.07	0.9208	1.3352	T-2%	1.699	460	Tünd qəhvəyi
	$K_2Cr_2O_7$	4.98	0.9228	1.3342	T-3%	1.523	600	Yaşılı qəhvəyi
Üzərlik kökü	əsas məhlul	5.48	0.9190	1.3361	T-3%	1.520	520	Qəhvəyi
	$CuSO_4.5H_2O$	4.91	0.9190	1.3361	T-3%	1.523	540	Yaşılı qəhvəyi
	$K_2Cr_2O_7$	5.18	0.9195	1.3372	T-2%	1.301	600	Tünd qəhvəyi

Üzərlikdən alınan boya ekstraktı ilə yun lifin boyadılması müxtəlif mərhələlərdə, bir neçə rəngab əlavə etməklə tədqiq edilmişdir. Üzərliyin əsas məhlulunda yun lif qəhvəyi rəngə, mis sulfat, kalium bixromat, dəmir qırıntıları, alüminum zəyi əlavə etməklə tünd qəhvəyi, yaşılı qəhvəyi, qırmızımtıl qəhvəyi və s. rəng çalarlarına boyadılmışdır. Alınan boyanın natrium- xlorid məhlulu ilə möhkəmləndirlməsi, rəngin kimyəvi yuyucu vasitələrə, işığa, günəş şüalarına qarşı davamlılığı Dövlət standartlarına uyğun olaraq yoxlanılmışdır.

Nəticə: Aparılan tədqiqat işlərinin nəticəsi olaraq üzərlikdən alınan təbii boyaq ilə yun lifin boyadılmasının yeni üsulları araşdırılmışdır. Alınan boya ekstraktına müxtəlif rəngablar əlavə edilərək, müxtəlif rəng çalarları alınmış və yun lif boyadılmışdır. Boyama prosesinin temperaturdan, zamandan pH-dan asılılığı, fiziki-kimyəvi parametrlərin tədqiqi öyrənilmişdir.

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SPERMOHILUS PYGMAEUS AS A DISTRIBUTOR OF *BRUCELLA MELITENSIS* DURING VARIOUS ACTIVITY PERIODS

Tursunov Olim Toshtemir o‘g‘li
Kholboev Fakhriddin Rakhmonkulovich

National University of Uzbekistan

Today, rodents cause various epidemiological situations. Representatives of the genus have been studied for many years as the main source of transmissible diseases. Brucellosis (*brucella melitensis*) is also a disease transmitted by rodents. Rodents are considered one of the natural sources of disease pathogens. Various measures have been taken to combat the pathogens and carriers of this disease. Avakumov cited in his works the natural foci of the pathogen and measures to combat them.[1] Anina-Radchenko scientifically studied the natural enzootic foci of brucellosis and their prevalence in relation to ixotic and argasid ticks.[2] At the same time, in nature, infection is found not only among carriers of infection, but also among wild rodents. The majority of Vershilova's work focuses on studying the susceptibility of ground squirrelto brucellosis[3;4]. Dorofeev and Gaisky identified a large number of ground squirrelthat positively reacted by agglutination reaction with a specific antigen in enzootic brucellosis foci. To combat the disease, it attaches great importance to the destruction of ground squirrel[5;6]. Finally, in addition to this work, experimental work was conducted on the transmission of brucellosis infection from an infected animal to a healthy one through the flea of small ground squirrel(*Spermohilus pygmaeus*) *ceratophyllus tesquorum* and *neoromia setosa*, and it was found that the specified species of fleas infected brucella melitensis from an infected animal to other animals. Experiments have shown that brucellosis infection can persist in the body of fleas for up to 60 days, and it has been established that these fleas can infect a healthy animal by ectoparasitic activity. Some ecological and biological signs of small ground squirrelare not determined by the absence of infection. The spread and epidemiological damage of the disease are characterized by the fact that rodents are infected with ectoparasites such as fleas or ticks.

We conducted some experiments on brucellosis (*brucella melitensis*) infection and its transmitters, small ground squirrel(*Spermohilus pygmaeus*).To conduct the experiments, we used ectoparasites described as disease carriers from ground squirrels and cattle from areas where brucellosis is not found. The mice caught for the experiment were infected with a 2-day culture of the virulent strain *brucella melitensis* at different doses (10 m/body) and in different ways (subcutaneously and through the mouth). The ground squirrels taken for the experiment were infected in two ways. In the first method, various doses of infection were introduced into the body and the small ground squirrel were infected. The emergence of the disease in gilded worms manifested in different number ratios. In the second method, the disease carrier was added to the food of the small ground squirrel , and no damage was observed. Infected ground squirrel were subjected to bacteriological and serological examinations at different times. During the examination, vital processes of the ground squirrel were examined: inguinal lymph nodes, spleen, liver, lungs, blood, and urine. Serological changes were also observed in some nocturnal ground squirrel, indicating that the rodents were infected with a disease-causing infection before going to hibernation. We also infected the experimental ground squirrel with various doses of infection before going to hibernation. Infection of rodents, regardless of sex, was observed in all cases. Our research yielded the same results for both male and female ground squirrel. The results obtained showed that in ground squirrel infected with a minimum dose of 10 m/body, the infection begins to spread throughout the body on the 20th day after infection. By this time, they usually have specific antibodies in the blood. Increasing the dose of infection accelerates the spread of the disease in the body. Thus, at a damaging dose of 10,000 m/body, the spread of infection and positive serological reactions begin to manifest on the 10th day from the moment of infection. At an infectious dose of 1 million m/body, infection spreads by the 3rd day, while positive doses give serological reactions by the 7th day. *Brucella melitensis* persists in the body of ground squirrel for 143 days even at all applied harmful doses. In the next experiment, taking into account the sex and age characteristics of the ground squirrel, as well as seasonal changes during their active life, subcutaneous infection of the ground squirrel was performed at a dose of 10,000 m/body 2 months after awakening from hibernation. During the active life of ground squirrel, their response to brucellosis infection is uneven. In adult male ground squirrel and young ground squirrel, the spread of infection at the same infectious dose begins on the 3rd day from the time of infection and positive serological reactions begin to appear. By the 10th day, the spread of infection in adult females begins to be noticeable only by the 10th day, and positive serological reactions occur by the 15th

day. The results of bacteriological and serological studies of infected ground squirrelimmediately after awakening from hibernation and infected ground squirrel 2 months after awakening from hibernation (at the same infecting dose - 10.000 m/body) were compared. Research results showed that male ground squirrel are more susceptible to brucellosis infection than females. Young ground squirrelwere also highly sensitive to brucellosis infection, being close in sensitivity to male ground squirrel. It is known that ground squirrels are characterized by two distinct periods of life activity throughout the year: the spring-summer active period and the autumn-winter hibernation period. To determine whether the causative agent of brucellosis persists in the body of rodents even after entering hibernation, we conducted the following experiment. The ground squirrels collected for the experiment were infected with a damaging dose of the infection before entering their winter hibernation. To provide a natural environment for infected rodents, they were placed in a dark place at a temperature of 5°C. In this case, the ground squirrel were allowed to sleep until February of the following year. After that, in February, the laboratory was transferred to a temperature of 20°C and quickly recovered from sleep. Some ground squirrel underwent bacteriological and serological examinations upon awakening from sleep, while others were examined after 13-78 days of activity. In 32 experimental ground squirrel, immediate examination after awakening from hibernation yielded a positive bacteriological test result in only 15 out of 32 cases, and positive serological reactions with different titers were detected in this group of ground squirrel. No changes were observed in the remaining 17 ground squirrel. The results showed serological changes in 53.13%. The 25 ground squirrels, selected for the experiment after emerging from hibernation and transitioning to an active state, were also examined, and the following results were obtained. Out of 25 ground squirrels, 18 exhibited various serological changes, while the remaining 7 ground squirrels showed no such changes. In this case, serological changes occurred in 72%. The percentage of brucella melitensis infection and serological reactions in the studied ground squirrels varied in their manifestations immediately after emerging from the hibernation stage and after a certain period of active life (Table 1).

Table 1.

Cross-stage table of disease manifestations in the experimental ground squirrels

Verification status	Total number of ground squirrels taken for testing	Changes (%)	No changes observed (%)
hibernation	32	17 (29,82%)	15 (26,32%)
After activation	25	18 (31,58%)	7 (12,28%)
total	57	35	22

Note: the disease infection was transmitted to the ground squirrel before they went to hibernation

Based on the results of experiments, it was found that ground squirrelare highly sensitive to brucellosis infection of the genus *brucella melitensis*. They can be infected with infection at a rate of 10 m/body. During the period of hibernation, brucellosis infection in both male and female ground squirrelis practically the same. During the summer period of their active life, adult males and young ground squirrelare more susceptible to brucellosis than adult females. *Brucella melitensis* can persist in the body of ground squirrelfor up to 259 days. If a large dose (10000 m/body and above) of ground squirrelinfects the body, the infection persists throughout the entire winter sleep period. Brucellosis infection is activated in infected ground squirrel before hibernation, after awakening, and during subsequent life activities.

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ANTI-MUTAGENIC EFFECT OF ANTIOXIDANT UNDER INFLUENCE OF ELECTROMAGNETIC WAVES OF HIGH AND LOW FREQUENCY ON WHEAT SEED ROOTS

Babaev M.Sh.
Doctor of Biological Sciences,
Professor of the Department of Genetics
Baku State University
Bagirova Parvin Vahid kyzy
construction college teacher
at the Azerbaijan Construction and
Architectural University

АНТИМУТАГЕННЫЙ ЭФФЕКТ АНТИОКСИДАНТА ПРИ ВОЗДЕЙСТВИИ ЭЛЕКТРОМАГНИТНЫХ ВОЛН ВЫСОКОЙ И НИЗКОЙ ЧАСТОТЫ НА КОРЕШКИ СЕМЯН ПШЕНИЦЫ

Бабаев М.Ш.
доктор биологических наук,
профессор кафедры генетики
Бакинский Государственный Университет
Багирова Парвин Вахид кызы
преподаватель строительного колледжа
при Азербайджанском строительном и
архитектурном Университете

Abstract

The article is devoted to the study of dry seeds of soft wheat variety “Chemrion” (Triticum aestivum L), where 0.1% and 1.0% solutions of chromic salt of 2,6-dichloroethyl-1-phenolpropionic acid were used as an antioxidant. Also, during this study, wheat seed roots were exposed to various doses of electromagnetic waves with a frequency of 50 MHz and 100 MHz. The time periods of exposure to electromagnetic waves on the objects of study were 5, 10 and 15 minutes. The results of the study are presented in 4 tables.

Аннотация

Статья посвящена исследованию сухих семян мягкой пшеницы сорта «Чемрион» (*Triticum aestivum L*), где в качестве антиоксиданта применялись 0,1% и 1,0% растворы хромовой соли 2,6-дихлорэтил-1-фенолпропионовой кислоты. Также в ходе данного исследования корешки семян пшеницы были подвергнуты воздействию различных доз электромагнитных волн частотой – 50МГц и 100МГц. Временные отрезки воздействия ЭМВ на объекты исследования составляли 5, 10 и 15 минут. Результаты исследования приведены в 4-х таблицах.

Keywords: mutagenesis, electromagnetic waves, wheat roots, antioxidant, experiments.

Ключевые слова: мутагенез, электромагнитные волны, корешки пшеницы, антиоксидант, эксперименты.

Введение

Применение электромагнитных магнитных волн в биологических экспериментах свидетельствует о существенном и разностороннем влиянии их на метаболизм различных организмов. свидетельствуют

О специфическом влиянии электромагнитных волн различной частоты на биологические объекты свидетельствуют экспериментальные данные многочисленных исследователей. Следует отметить, что применение антиоксиданта различной концентрации для выявления антимутагенного эффекта в этих исследованиях пока еще относительно малоизученная область.

Современная генетика располагает различными сферами применения в области исследования растений. Антимутагенез считается одной из таких областей, который широко изучается у растений, животных, микроорганизмов и людей. Это область, используемая для предотвращения хромосомных изменений и считается сегодня самой перспективной областью исследований. Для этого очень важно использовать как природные, так и синтетические антиоксиданты (АО). В области синтеза антиоксидантов химики проделали большую работу, а генетики продолжают изучение их антимутагенных эффектов.

Генетики также пытаются получить от природы высокие антимутагенные антиоксиданты для повышения урожайности той или иной культуры. Для этого используют корни, плоды, ягоды, листья и т. д. различных растений. Нет сомнений в том, что водорастворимые антиоксиданты обладают более высоким антимутагенным действием. Этот факт отражен в работах многих генетиков-исследователей (У.К. Алекберов, 1984, М.Ш. Бабаев, 1991).

Доказано, что антимутагенный эффект антиоксидантов проявляется при соблюдении ряда условий: 1) растворимость антиоксиданта в воде или органических растворителях; 2) концентрация антиоксиданта, использованная в исследовании (в процентах); 3) использование антиоксиданта до или после воздействия мутагенного вещества; 4) естественное или искусственное происхождение антиоксиданта; 5) дата приготовления антиоксиданта; 6) концентрация антиоксиданта; 7) природа биологического объекта, на который действует антиоксидант и т.д.

Вышеизложенное свидетельствует о том, что в нашем исследовании мы пытаемся изучить антимутагенный эффект вновь приготовленного антиоксиданта на корешки семян пшеницы до и после воздействия ЭМВ высокой и низкой частоты.

Цель и задача исследования

Целю исследования было экспериментальное определение закономерностей воздействия электромагнитных волн различной частоты (50МГц и 100МГц) на частоты хромосомных аберраций *при* различной концентрации антиоксиданта.

Материалы и методы

Объектом исследования явились сухие семена мягкой пшеницы сорта «Чемрион» (*Triticum aestivum L*), а в качестве антиоксиданта применяли растворы 0,1% и 1,0% (2E,4E)-1-(2-гидроксифенил)-5фенилпента-2, 4-диен-1-on, синтезированной в лаборатории химии Бакинского Государственного Университета.

Сухие семена пшеницы подвергались воздействию электромагнитных волн (ЭМВ) 50 и 100 МГц. Как уже отмечалось, продолжительность воздействия ЭМВ на объекты для каждой дозы составляла 5, 10 и 15 минут.

В первом варианте исследования семена сначала были подвергнуты воздействию ЭМВ, а затем обрабатывали антиоксидантами, а во втором варианте семена сначала обрабатывали антиоксидантами, а затем подвергали воздействию ЭМВ. Далее семена укладывали в чашки Петри и помещали в термостат для прорастания при температуре 24-25°C. При достижении длины главных корешков семян до 0,8-1,0 см. фиксировали их прорастание.

Далее путем регистрации нормальных и измененных анафаз для каждого препарата рассчитывали частоту хромосомных изменений. В исследовании использовали генератор электромагнитных волн произвольной мощности AWG410 с частотным диапазоном от 10 кГц до 200 МГц производства ведущей американской компании Tektronix.

Результаты исследования и их обсуждение

Для определения антимутагенного воздействия антиоксиданта на биологические объекты необходимо воздействовать на них физическими и химическими мутагенами. При этом следует учитывать различное процентное содержание (концентрацию) раствора антиоксиданта, используемого в этом процессе. В нашем исследовании были использованы растворы антиоксидантов как с высокой (1,0%), так и с низкой (0,1%) концентрацией.

При этом мы пытались определить нормальные и измененные анафазы в первом митозе проростков семян пшеницы до и после воздействия ЭМВ различной частоты. Работая с антиоксидантами, готовили временные давленные препараты, которые были раздавлены из главных корешков пшеницы. Таким образом, антимутагенным действием антиоксиданта мы определили анафазный метод.

Частота хромосомных аберраций, зарегистрированных в корешках семян пшеницы, обработанных антиоксидантами, до воздействия ЭМВ, отражена в таблице 1.

Таблица 1.

Влияние антиоксидантной обработки на частоту хромосомных аберраций в корешках семян пшеницы до обработки электромагнитными волнами

Варианты опытов	Изучено		Измененные анафазы		Достоверность разницы - td	
	Корешки	Анафазы	количество	% ± m	по отношению к контролю	по отношению к ЭВМ
Контроль (д.в.)	10	571	20	3,50±0,79	—	—
100 МГц	10	435	47	10,80±1,48	4,26	—
АО 1,0%)+ЭМВ – 5 мин.	10	529	25	4,72±0,93	0,64	3,63
АО (1,0%)+ЭМВ – 10 мин.	10	499	28	5,61±0,48	1,99	3,52
АО (1,0%)+ЭМВ – 15 мин.	10	442	29	6,56±1,17	1,81	2,42

Как видно из таблицы 1, для изучения в каждом из вариантов опыта применены 10 корешков. В контроле изучено 571 анафаз, при этом процент измененных анафаз составило 3,50±0,79. В варианте опыта с воздействием ЭМВ частотой 100 МГц изучено 435 анафаз и при этом количество измененных анафаз составило 47 (10,80±1,484,26). В варианте опыта с применением 1,0% антиоксиданта и далее воздействием на корешки ЭМВ частотой 100 МГц в течении 5 минут бы4,72±0,93ло изучено 529 анафаз. При этом число измененных анафаз составило 529 (4,72±0,93).

В варианте опыта с применением 1,0% антиоксиданта и далее воздействием на корешки ЭМВ частотой 100 МГц в течении 10 минут было изучено 499 анафаз. При этом число измененных анафаз составило 28 (5,61±0,48). В варианте опыта с применением 1,0% антиоксиданта и далее воздействием на корешки ЭМВ частотой 100 МГц в течении 20 минут было изучено 442 анафаз. При этом число измененных анафаз составило 29 (6,56±1,17).

Следующая часть нашего исследования была посвящена изучению антимутагенного действия антиоксиданта после воздействия ЭМВ. Результаты, полученные в этом случае, отражены в таблице 2.

Таблица 2.

Частота хромосомных изменений в корешках семян пшеницы, обработанных антиоксидантами, после воздействия ЭМВ

Варианты опытов	Изучено		Измененные анафазы		Достоверность разницы - t_d	
	корешков	анафазы	Количество	% ± m	по отношению к контролю	по отношению к ЭМВ
Контроль (д.в.)	10	578	22	3,66±0,78	—	—
100 MHs	10	434	47	10,67±1,48	4,20	—
ЭМВ – 5 мин.+АО (1,0%)	10	523	29	5,39±0,98	0,98	2,98
ЭМВ – 10 мин.+АО (1,0%)	10	485	28	5,59±1,04	1,07	2,81
ЭМВ – 15 мин.+АО (1,0%)	10	452	29	6,16±1,01	1,34	2,56

Из таблицы 2, основанной на результатах исследования, видно, что антимутагенное действие антиоксиданта несколько отличалось. Таким образом, модифицированные анафазы в препаратах из корешков семян, которые сначала выдерживали в среде воздействия ЭМВ в течение 5 минут, а затем обрабатывали в 1,0%-ном растворе антиоксиданта, составляли 5,39 ± 0,98%. Также следует отметить, что достоверность разницы в этом варианте не была достоверной по отношению к контролю ($t_d=0,98$). При этом измененные анафазы увеличились до 5,59 ± 1,04 процента в препаратах, приготовленных из корешков семян, выдержанных в среде ЭМВ в течение 10 минут. Наконец, мы определили, что измененные анафазы в корешках семян, выдержанных в среде ЭМВ в течение 15 минут, а затем обработанных антиоксидантами, составили 6,16 ± 1,01%. Таким образом, очевидно, что частота хромосомных изменений намного выше, когда семена подвергаются предпосевному электромагнитному воздействию. В этом случае количество анафаз меняется в зависимости от среды хранения, то есть от продолжительности нахождения семян в среде воздействия ЭМВ.

Из материала и методической части исследования видно, что определена частота хромосомных изменений в корешках семян пшеницы, обработанных также 0,1%-ным раствором антиоксиданта до и после воздействия ЭМВ различной частоты. Полученные результаты представлены в таблицах 3 и 4.

Таблица 3.

Частота хромосомных изменений в корешках семян пшеницы, обработанных антиоксидантом, до воздействия ЭМВ.

Варианты опытов	Изучено		Измененные анафазы		Достоверность разницы - t_d	
	корешков	анафазы	количество	% ± m	по отноше-нию к контролю	по отношению к ЭМВ
Контроль (д.в.)	10	577	22	3,66±0,78	—	—
50 MHs	10	513	40	7,63±1,17	2,84	—
АО (0,1%)+ЭМВ – 5 мин	10	489	23	4,52±0,94	0,71	1,80
АО (0,1%)+ЭМВ – 10 мин	10	494	25	4,88±0,95	1,00	1,60
АО (0,1%)+ЭМВ – 15 мин	10	502	27	5,20±0,99	1,23	1,59

Из таблицы 3 видно, что частота хромосомных изменений в корешках семян, подверженных воздействию ЭМВ в дозе 50 МГц, но не обработанных антиоксидантом, в контрольном варианте, составила 7,63 ± 1,17%. Однако, частота хромосомных изменений в корешках семян, сначала обработанных антиоксидантом, а затем подвергнутых воздействию ЭМВ в течение 5 минут, снизилась до 4,52 ± 0,94%. Частота хромосомных изменений составила 4,88 ± 0,95% после обработки семян 0,1%-ным раствором антиоксиданта и выдерживания в среде воздействия ЭМВ в течение 10 минут. Наконец, частота хромосомных изменений в корешках семян, выдержанных в среде воздействия ЭМВ в течение 15 минут после первой обработки антиоксидантом, увеличилась до 5,20 ± 0,99%. Это говорит о том, что частота хромосомных изменений увеличивается с увеличением времени хранения семян в среде воздействия ЭМВ. В таблице 4 представлены результаты хромосомных изменений после воздействия ЭМВ на корешки семян пшеницы, а затем обработанных антиоксидантом,

Таблица 4.

Частота хромосомных изменений в корешках семян пшеницы, обработанных антиоксидантом, после воздействия ЭМВ

Варианты опыта	Изучено		Измененные анафазы		Достоверность разницы, t_d	
	корешков	анафазы	количество	% ± m	по отношению к контролю	по отношению к ЭМВ
Контроль (д.в.)	10	577	22	3,66±0,78	—	—
50 MHs	10	513	40	7,63±1,17	2,84	—
ЭМВ – 5 мин.+ АО (0,1%)	10	467	25	5,16±1,02	1,20	1,60
ЭМВ – 10 мин.+АО (0,1%)	10	454	26	5,53±1,07	1,22	1,40
ЭМВ – 15 мин.+АО (0,1%)	10	400	24	5,78±1,17	1,52	1,13

Из таблицы 4 видно, что частота хромосомных изменений в обоих контрольных вариантах взята за основу данных, приведенных в таблице 3. Однако в экспериментальных вариантах эти показатели были разными. Так, частота хромосомных изменений составила 5,16 ± 1,02% в препаратах, изготовленных из корешков проросших семян пшеницы, выдержанных в среде ЭМВ в течение 5 минут, а затем обработанных 0,1%-ным раствором антиоксиданта.

В следующем варианте, то есть после выдерживания в среде ЭМВ в течение 10 минут, частота хромосомных изменений в популяциях клеток концевой меристемы главных корешков, обработанных антиоксидантом и проросших семян, увеличивалась до 5,53 ± 1,07%. Как видно, этот показатель выше, чем у спонтанных мутаций, но несколько ниже, чем у индукционных мутаций.

В другой версии исследования этот показатель немного вырос. Точнее, частота хромосомных изменений в корешках семян, проросших после воздействия ЭМВ частотой 50 МГц в течение 15 минут, а затем обработанных 0,1%-ным раствором антиоксиданта, составила 5,78 ± 1,17%. Как видно, частота хромосомных изменений здесь увеличилась, но достоверность разницы как спонтанных, так и индуктивных мутаций была маловероятной.

Исходя из результатов эксперимента, следует отметить, что до воздействия ЭМВ на семена пшеницы антиоксидант оказывает профилактическое действие, однако, после воздействия ЭМВ антиоксидант оказывает восстанавливающее действие

Выводы

Принимая во внимание результаты, приведенные в таблицах, можно отметить следующее:

• Исследование показало, что частота хромосомных аберраций (антимтагенный эффект антиоксиданта) дает различные результаты при работе с семенами до и после воздействия ЭМВ.

• Установлено, что антимутагенный эффект антиоксиданта варьируется в зависимости от его концентрации, используемой в опытах.

• Частота хромосомных изменений варьируется в зависимости от дозы ЭМВ разной частоты, т. е. и от продолжительности хранения семян в среде электромагнитного воздействия.

Заключение.

Полученные результаты показали, что обработка сухих семян пшеницы антиоксидантом различной концентрации до воздействия ЭМВ различной частоты показывает наиболее лучший антимутагенный эффект. Установлено, что 0,1%-ая концентрация антиоксиданта обладает более высоким антимутагенным эффектом.

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Chemical sciences

SYNTHESIS AND PROPERTIES OF NEW TRINARY PHASES IN TB-BI-SE SYSTEM

Aliyeva Kamala Ismail
Baku State University, PhD, teacher
Ismayilov Zakir Islam
Baku State University, technical science, associate professor
Sultanova Samina Gayis
Baku State University, research worker

TB-Bİ-SE SİSTEMİNDƏ YENİ ÜÇLÜ FAZALARIN SİNTEZİ VƏ XASSƏLƏRİNİN TƏDQİQİ

Əliyeva Kəmalə İsmayıl
Bakı Dövlət Universiteti, k.ü.f.d., müəllim
İsmayılov Zakir İslam
Bakı Dövlət Universiteti, t.e.n, dosent
Sultanova Səminə Qeyis
Bakı Dövlət Universiteti, elmi işçi

Nadir torpaq elementləri ilə zəngin üçlü birləşmələr, unikal maqnit, optik və elektron xüsusiyyətləri sayəsində materialşünaslıq sahəsində mühüm maraq doğurmuşdur. Son dövrlərdə perspektivli araşdırma sahələrindən biri nadir torpaq elementləri olan terbium (Tb), vismut (Bi) və selenyum (Se) tərkibli üçlü fazaların incələnməsidir. Bu materiallar, maqnetizm, termoelektrik cihazlar və spintronika kimi müxtəlif sahələrdə tətbiq oluna bilən yeni fiziki və kimyəvi xüsusiyyətlərin aşkarlanmasına imkan yaradır. Məqalədə, Tb-Bi-Se sistemində yeni üçlü fazaların sintezi və onların fiziki-kimyəvi xüsusiyyətlərinin araşdırılması mövzusu müzakirə olunur.

Tb-Bi-Se sistemi, müxtəlif kimyəvi xassələrə sahib olan elementlərin qarşılıqlı təsir göstərdiyi kompleks çoxfazalı bir sistemdir. Terbium (Tb), güclü maqnit xüsusiyyətlərinə malik nadir torpaq elementi olmaqla yanaşı, vismut (Bi) və selenium (Se) da unikal elektron quruluşları ilə seçilən və optoelektronik cihazlarda istifadə potensialı yüksək olan yarımkeçirici birləşmələrin yaranmasında rol oynayır. Nəzəri araşdırmalar göstərir ki, Tb-Bi-Se sisteminin ehtimal olunan fazaları, nadir torpaq və yarımkeçirici elementlərin qarşılıqlı təsiri ilə həm maqnit, həm də elektrik anomaliyalarının ortaya çıxmasına səbəb ola bilər.

Tb-Bi-Se sistemində yeni fazaların sintezi üçün molekulyar şüa epitaksiyası (MBE), metalotermik reduksiya kimi müasir üsullar və həmçinin idarə olunan atmosfer təzyiqli sobalarda ənənəvi yüksək temperatur sintez metodları tətbiq edilir. Əsas çətinlik isə faza sabitliyini təmin etmək və birləşmələrin tərkibinə düzgün nəzarət etməkdir. Mühüm bir digər cəhət isə istənilən fiziki xassələrin əldə edilməsi üçün komponentlərin nisbətlərinin dəqiq şəkildə tənzimlənməsidir.

Perspektivli sintez üsullarından biri, yüksək təmizlik və müəyyən bir quruluşa malik birləşmələrin əldə edilməsinə imkan verən kimyəvi buxar çökdürmə (CVD) metodunun tətbiqidir. Xüsusilə Tb-Bi-Se sistemi kontekstində, CVD texnologiyası, gələcək tədqiqatlar və tətbiqlər üçün vacib xüsusiyyətlərə sahib nazik təbəqələrin istehsalında istifadə oluna bilər.

Tb-Bi-Se sistemindəki yeni üçlü fazalar, rombik, kubik və heksaqonal simmetriyalara malik fərqli kristal strukturların yaranmasına imkan verə bilər. X-şüalarının difraksiyası (XRD) vasitəsilə aparılan tədqiqatlar, sintez edilən nümunələrin faza tərkibini dəqiq müəyyən etməyə, həmçinin temperatur və təzyiq dəyişiklikləri zamanı onların sabitliyini araşdırmağa imkan yaradır. Diqqətə çatdırmaq lazımdır ki, bu cür fazalar müəyyən şəraitdə faza keçidlərini göstərə bilər, bu da kristal qəfəsinin və yerli simmetriyanın dəyişməsi ilə əlaqəlidir.

Yeni üçlü fazaların xüsusiyyətlərini araşdırmaq üçün tez-tez diferensial skan edən kalorimetriya (DSC) üsulu tətbiq olunur, bu da faza keçidlərini və ərimə nöqtələrinin istiliyini təhlil etməyə şərait yaradır. Bu, yalnız faza təsnifatını deyil, eyni zamanda sabit və yüksək keyfiyyətli nümunələrin əldə edilməsi üçün sintez şəraitinin optimallaşdırılmasına da köməklik göstərir.

Tədqiq edilən birləşmələrin ən diqqətçəkən xüsusiyyətlərindən biri onların maqnit quruluşudur. Terbium, nadir torpaq elementi olaraq, sistemin ümumi davranışına mühüm təsir göstərə bilən maqnit xüsusiyyətlərə sahibdir. Maqnit-optik xüsusiyyətlərin ölçülməsi, maqnit rezonans spektroskopiyası və maqnit histerezis əyrisi ölçmələri kimi üsullar vasitəsilə aparılan maqnit tədqiqatları göstərir ki, Tb-Bi-Se sisteminin

fazaları, xarici amillər (temperatur, təzyiq və maqnit sahəsi) dəyişdikdə, maraqlı maqnit xassələri və anomaliyalar ortaya çıxara bilər. Fotoelektron spektroskopiyası (XPS), skan edən tunel mikroskopiyası (STM) və kvant maqnito-optik effekti kimi üsullardan istifadə edərək, yeni fazaların elektron xassələri də tədqiq olunur. Tb-Bi-Se sistemindəki birləşmələrin bəzi xüsusi şərtlər altında yüksək elektrik keçiriciliyi göstərməsi ehtimal olunur ki, bu da onların yarımkeçirici materiallar və termoelektrik cihazlarda istifadəsi üçün müəyyən bir potensial yaradır.

Tb-Bi-Se sistemindəki üçlü fazalar müxtəlif sahələrdə istifadə oluna biləcək xüsusiyyətlərə malikdir. Xüsusilə, bu materiallar unikal maqnit və elektrik xüsusiyyətlərinə görə maqnetoelektrik transformatorlar və spintronik cihazlar üçün potensial təqdim edir, həm də yeni növ termoelektrik materialların inkişafında əsas rol oynaya bilər. Nadir torpaq elementləri və yarımkeçirici xüsusiyyətlərin bir sistemdə birləşməsi, yüksək səmərəli termoelektrik generatorlar və soyutma cihazlarının inkişafı üçün yeni imkanlar yaradacağı ehtimal olunur.

Bundan əlavə, bu materialların xüsusiyyətlərinin öyrənilməsi kvant hesablamaları sahəsində əhəmiyyətli rol oynaya bilər, çünki unikal keçiricilik və maqnetizmə malik materialların hazırlanması kvant interfeysləri və kvant nöqtələrinin inkişafı üçün əsas əhəmiyyət kəsb edir.

Tb-Bi-Se sistemi, unikal maqnit və elektron xüsusiyyətlərə malik yeni materialların inkişafı üçün perspektivli bir sahə təklif edir. Bu sistemin üçlü fazasının öyrənilməsi, nadir torpaq elementlərinin yarımkeçiricilərlə qarşılıqlı təsirinin fizikasını daha dərindən anlamağa kömək etməklə yanaşı, spintronika, termoelektrik və kvant texnologiyaları sahəsində müxtəlif tətbiqlər üçün yeni materialların yaradılmasına imkan verəcək. Yeni fazaların sintezi və xüsusiyyətlərinin təhlilində əldə olunacaq əlavə irəliləyişlər, onların tətbiq sahəsinin gələcəkdə mühüm dərəcədə genişlənməsinə səbəb olacaq.

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Cultural sciences

FROM HOME MUSEOLOGY TO ONLINE EXHIBITIONS: THE PATH OF DEVELOPMENT

Seyidova Zenfira Sarvar
Nakhchivan State University

Abstract

In ancient Greece, aristocrats collected exotic and valuable items, both living and inanimate, in cabinets known as "curiosity rooms." Although these objects were displayed in palaces and homes for a select few, over time, and with the influence of the Industrial Revolution, they began to be exhibited in public spaces, laying the foundation for museum activities. These activities, now accessible to all social classes, have evolved rapidly, and with technological advancements, they have expanded to online exhibitions through the internet and social media. Research in the field of home museology plays a significant role in preserving the past for future generations and utilizing social networks. Home museology, a field that has attracted attention throughout history, contributes to the development of museology and provides artists with new opportunities to showcase their works to a broader audience. The growth of home museums has introduced a unique exhibition space that allows artists to establish closer connections with the public. Exhibition design, which falls within the scope of graphic design, has also evolved with technological advancements. The challenges brought by rapidly changing and developing technologies are easily overcome through the digital world. The most significant contribution of digitalization to this field has been the transition from home museums to online exhibitions, enabling artworks to reach a wider audience.

Keywords: Museum, curiosity cabinets, digitalization, online exhibitions

Introduction

In ancient Greece, curiosity rooms were used to collect valuable tools and equipment, while war trophies were displayed as symbols of power. Before the emergence of museums, works of art were primarily exhibited in churches and palaces and later showcased in private galleries. The technological advancements initiated by the Industrial Revolution profoundly transformed public life and the arts. In the past, the aristocracy needed considerable wealth to collect rare artifacts. However, today, designs can be presented on websites without financial constraints through the internet. In a changing world, technology and art interact dynamically. The development of interdisciplinary designs through computer programs has led to the emergence of "digital art," a new artistic field that continuously evolves, maintaining its relevance and impact. As artists gained more freedom, artworks moved beyond traditional exhibition spaces and began to be displayed in digital environments through technology. Visual sharing enables the rapid dissemination of information online while fostering communication among people. Digital websites significantly contribute to the evolution of creativity in design. The advancement of technology has also altered the perception and reception of art, reshaping its modes of expression and exhibition formats, which are constantly renewed and redefined.

The internet allows individuals to access designs and designers' works at any time and from any location. At the same time, designers can easily explore subjects of interest and find images relevant to their work. The rapid progress of technology and the contributions of social media applications to creativity and new perspectives highlight the power and influence of these platforms.

Home Museums

In ancient Greece, aristocrats collected both living and inanimate objects and displayed them in rare cabinets known as "curiosity rooms." These objects were only accessible to their owners. Initially, valuable artworks were exhibited in palaces and homes, but over time, they began to be displayed as symbols of status and power. These collections later transitioned into public exhibitions, leading to the foundation of museums. Like the Greeks, the Romans also dedicated sculptures, paintings, and other artistic treasures as offerings to temples. This practice led to the emergence of the first private collections in Rome. Wealthy Romans started establishing libraries, painting galleries, and sculpture collections in their homes, fostering the dissemination and public appreciation of art (Mengeş, 2012:4). The curiosity rooms or "cabinets of wonders" that emerged in Europe before the Enlightenment era are considered the ancestors of modern museums in terms of exhibition practices (Çalışkan, 2016:28-29).

In Italy, these cabinets were called "studioli," while in Germany, they were known as "kunstkammer" (art chamber) or "wunderkammer" (chamber of wonders). The collected items in these cabinets were categorized based on their rarity: *naturalia* (natural objects), *artificialia* (artifacts), *artificium* (man-made objects), *mirabilia* (extraordinary items), and *bibliotheca* (books). These collections included rare specimens such as dried plants, reptiles, ancient coins, paintings, and cultural medals. Additionally, peculiar exhibits like a three-headed lamb or sculptures animated by dwarfs were among the fascinating displays in these cabinets (Artun, 2012:28-30). In the 15th century, cabinets created out of personal interest by traveling generals who collected war trophies began expanding in the 16th and 17th centuries into royal and imperial collections. These cabinets evolved beyond mere personal hobbies to become symbols of power for kings and emperors. The size of a rare cabinet was considered a reflection of a ruler's knowledge of the universe and its mysteries, serving as a demonstration of their power and influence (Aydın, 2017:185). Following the discovery of the Americas, every new object brought to Europe was deemed collectible, leading to a surge in the establishment of curiosity cabinets across European countries. The first cabinets were founded in France during the 14th and 15th centuries and continued to grow rapidly across multiple nations until the 17th century. These cabinets became the primary centers for displaying the wealth and rare objects from newly discovered lands (Artun, 2006:32).

The Evolution of Museums

Museums have existed in various forms throughout history and civilizations. Valuable artifacts and artworks were stored in tombs, palaces, and temples, where they could be visited by the public. The Greeks showed great interest in art collections, leading temples to gradually take on the function of galleries. Meanwhile, the Romans not only collected artworks but also developed reproduction methods, allowing for the wider dissemination of artistic works and making art more accessible to the masses (Keleş, 2003:2-3).

One of the earliest public exhibition spaces, the Paris Salon Exhibitions, was organized in 1673 at the Royal Academy of Painting and Sculpture. However, it was in the 18th century that it truly established its function, becoming a significant center in the art world. These exhibitions played a crucial role in presenting artworks to the public and fostering interest in the arts (Mengeş, 2012:102-103). With the impact of the Industrial Revolution, artworks and artifacts moved from royal palaces to museums and art galleries. The concept of exhibition design gained prominence with the fair model introduced at the 1851 London Universal Exhibition. This event played a key role in the development of large-scale exhibition organization and modern exhibition design (Çalışkan, 2016:27).

The Paris Salon, opened to the public in 1737, was instrumental in elevating French painters' reputations and shaping the art market of its time. Similarly, the Royal Academy, founded in London in 1769, quickly strengthened its position in the art market. The Louvre Museum, regarded as a symbol of the French Revolution and the first national museum, inspired the establishment of many other museums, leading the way in the development of museum culture. Curiosity cabinets were symbols of royal power and authority. Cultural and artistic artifacts brought from conquered lands were considered war trophies, just like material treasures. Over time, these royal collections evolved into national museums and were opened to the public. By the 19th century, particularly with advancements in technology, museums became centers for displaying the world's cultural heritage and scientific achievements through large-scale exhibitions (Aydın, 2017:183). Curiosity cabinets were created to reflect the existence of the world, depict diversity, make the world comprehensible, and uncover the unknown. These cabinets aimed to collect all kinds of living and inanimate objects from the universe, emphasizing the extraordinary and remarkable. The passion behind these collections was to gather the most beautiful, rare, and extraordinary objects. Initially intended to unify the natural and artificial aspects of the universe, these cabinets later evolved into scientific collections, playing a crucial role in research and scientific discovery (Konukçu, 2007:14).

Digitalization in Museology

Digitalization is the process of converting analog data into a digital format that can be recognized and processed by computers. This transformation allows visual and auditory elements to be encoded into digital formats, making them accessible for storage, processing, and recognition by computers (Deren, 2006:28). Since the 2000s, with the rapid advancement of technology, digitalization has been widely applied to preserve and securely transmit information to future generations. Objects created throughout history are considered cultural heritage, and they undergo digitalization at various stages in line with technological advancements. The reuse, sharing, protection, and storage of digital objects resulting from this process open up new opportunities in the field and are extensively applied (Karadağ, Külcü, 2019:330). Museums serve as key institutions for obtaining information about different societies and cultures. As societies and eras evolve, keeping up with technological progress is crucial for development. Today, museums reach a broad audience and introduce innovations in the arts through technology and exhibition techniques. Initially, artworks were displayed in homes, then in galleries and museums, and finally, on the internet. This transformation has made

the traditional museum concept more accessible and modern, leading to the emergence of digital museums. New presentation techniques applied through websites allow viewers to navigate museum spaces in three dimensions, capturing their attention and increasing engagement. With these presentation methods, visitors can explore museums with just one click, without leaving their homes. For instance, viewers can take a 360-degree virtual tour of Frida Kahlo's museum house in Mexico, experiencing cultural heritage in a novel and accessible format.

A remarkable example of digital museums is the Mori Building Digital Art Museum, located in Odaiba, Tokyo, an entertainment hub that integrates high technology. Equipped with 520 computers and 470 advanced projection devices, this museum presents the world and nature in an innovative style. By combining science, art, design, and technology, it offers visitors a unique experience. Its first exhibition, teamLab Borderless, aims to transcend the boundaries between art and audience, promoting unlimited interaction. Interactive animations recognize visitors' movements and respond accordingly, creating unique digital artworks using light, color, and various graphic elements (Bostancı, 2019:37). Through digital technological applications, museums now provide interactive presentations, fostering direct engagement with visitors. Another significant example is the Louvre Museum, which allows online visits, enabling audiences to explore artworks through virtual tours. Technology has simplified access to cultural heritage, making it possible to visit museums and exhibitions anytime from home through the internet.

Internet Exhibitions

Exhibition design is one of the fields of interest in graphic design and is applied in various domains. Exhibitions can be permanent or temporary and serve commercial, cultural, or educational purposes. When designing an exhibition, the concept should align with the content of the artworks displayed in museums or galleries. However, traditional exhibitions often require significant time and financial investment. To overcome these limitations, modern artists increasingly prefer to showcase their designs online.

Since the 1980s, contemporary art has become interdisciplinary, surpassing the boundaries of traditional visual art spaces. Modern artistic forms such as video, performance, installation, photography, and digital media have transformed the traditional functions of art museums—collecting, preserving, exhibiting, and mediating—by integrating new methods and tools (Yücel, 2012:25). The development of digital art began when artists started embracing technological tools alongside traditional artistic techniques. After the 1960s, artists experimented with digital structures, initially using photography, cinema, and television. By the 1980s, they had incorporated video, cameras, and computers, and by the 1990s, they began utilizing the internet as a creative medium. Consequently, the term digital art refers to artworks in which artists use computers as real tools, instruments, or creative assistants (Yücel, 2012:30). While art became digitalized with electronic technologies and computers in the 20th century, it entered a new phase in the 21st century—post-digital art. This era deepened the impact of digital tools and technologies on art, introducing new expressive forms such as interactive, virtual, and augmented reality. These advancements expanded the boundaries of art, allowing for more complex and multidisciplinary experiences (Tuğal, 2018:259).

The proliferation of personal computers and the development of the internet in the 1990s brought significant changes to digital art. As the internet spread globally, it facilitated intercultural communication and provided artists with new channels to engage with global audiences. The presence of these communication tools transformed the internet into an innovative creative space, enabling artists to reach broader audiences, transcend cultural boundaries, and develop new artistic expressions (Yücel, 2012:31).The rise of social media has also influenced design and art, as these platforms offer interactive engagement and effective networking opportunities. The widespread use of social media and its accessibility allow users to reach larger audiences and achieve greater visibility. Social media facilitates fast communication, unrestricted access to real-time information, and knowledge sharing within extensive networks (Uluçay, 2017:378).

The ease and broad accessibility of the internet have turned it into a significant development platform for many individuals. Visual websites allow users to enhance their skills, generate new ideas, and share their work with a global audience. By combining digital art, design, and technology, artistic expression is further strengthened, enabling artworks to be digitized and distributed worldwide. These platforms also help designers consolidate their interests and professional experiences, making their work accessible to wider audiences. In today's world, where design plays a crucial role, people contribute to the spread and advancement of design through social networks, engaging in sharing and communication. Social media platforms are widely accepted in professional circles and serve as a source of inspiration, providing designers with opportunities to showcase their ideas, reach large audiences, and shape new trends and styles in design.

Conclusion

The earliest examples of museums, known as cabinets of curiosities, were personal collections of rare and fascinating objects gathered by noble individuals to showcase their financial power and influence. Initially

closed to the public, these collections gradually began to be displayed in public spaces. The passion for exhibitions, which started in private homes, later found its place in museums. As the world evolved, habits changed, and with the internet becoming an inseparable part of life, museums opened their doors to audiences through online platforms. The traditional presence of art in museums and galleries has been transformed through digitalization, making it more accessible to wider audiences. Social media applications now serve as virtual galleries, and just as in other fields, social interactions have found their place in the art world. The integration of the internet into our daily lives has turned it into a crucial communication tool for disseminating and sharing information. Through the internet, art can reach broader audiences, making it a potential new artistic form of the 21st century. Thanks to technological advancements, art enthusiasts can quickly and easily access artworks online. Digitalization ensures that artworks are preserved for long periods and remain easily accessible, emphasizing the importance of online sharing. Alongside this, digitalization continuously reshapes and modernizes the modes of artistic expression and exhibition environments, making art more available to the public.

Today, it is possible to visit online museums in fields such as painting, sculpture, plastic arts, and architecture. In this evolving exhibition landscape, graphic design enthusiasts showcase their work through portfolio websites. Popular platforms like Behance, DeviantArt, and Pinterest allow artists to exhibit their creations beyond closed walls, reaching a global audience. These platforms are widely preferred due to their free accessibility, and exhibitions, artists, and their works are actively promoted through social media. Since experiencing international artworks in person can be financially and logistically challenging, supporting and advocating for online exhibitions is essential. Additionally, these platforms enable artists to share their work and serve as references for fellow artists or students studying visual arts. Despite its many advantages, the digitalization of art also has drawbacks. Alongside high-quality, thoughtfully designed works, many pieces lacking aesthetic value or design principles are also shared on these platforms. However, as technology and digitalization continue to evolve, the accessibility and reach of art are expanding, reshaping the way artistic works are exhibited and experienced.

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Economic sciences

ARTIFICIAL INTELLECT SYSTEMS IN TODAY'S ECONOMIC ENVIRONMENT

Rahim Alizade
PhD in Economics, Director of R.N Account Consulting and Business LLC
https://orcid.org/0009-0009-2603-2450
Mayil Orujov
Honorary Professor of SMBS, Odlar Yurdu University, Baku, Azerbaijan
https://orcid.org/0009-0001-8177-3851

Abstract

The article provides analysis of artificial intellect (AI) system development at the current stage of socio-economic relation progress. Processes of technological, finance and social system transformation are connected with application of AI technologies and systems. As processes of digitalization advance deep changes in socio-economic and social relations take place, style and nature of production forces keep altering and new forms of organizations and links turn up. The authors provide examples of AI technologies that are used in different fields of human life. Special attention is paid at using AI technologies in power-intensive spheres, such as agro-industrial complex and industrial-technological one, as they build the economic basis for sustainable development. In order to promote further development of AI systems at enterprises it is necessary to carry out a vast volume of job on digitalization of all business-processes (data-fixation and soft-verification). The article demonstrates future trends of digital transformation in production and technological systems and identifies barriers hindering the development of data technologies in the Russian Federation. Finally, conclusions were drawn about trends of AI system development

Keywords: sustainable development, computer learning, algorithm, big data, intellectual data processing, smart business, predictive analysis, data-fixing, soft-verification.

Introduction

The modern stage of the development of economic systems is characterized by the wide implementation of artificial intelligence systems in various spheres of human activity. Artificial intelligence systems are very diverse and can be built into any process, provided that tools and technologies are used that correspond to the goals and tasks to be solved, as well as when the necessary set of data is available.

AI technologies contribute to the achievement of the goals of sustainable development, which in turn are designed to ensure smooth quantitative and qualitative growth in all spheres of society, as well as improving the quality of life and reducing the risks of geopolitical, economic and technological threats.

In recent years, the number of publications by Azerbaijani and foreign scientists devoted to the study of technologies of the application of modern technological solutions, especially artificial intelligence systems, has increased significantly.

Discussion

At the World Economic Forum held in Davos in 2024, the discussion of artificial intelligence became one of the key topics. This is due to the fact that AI technologies have greater flexibility and are able to solve a wide range of tasks in various branches of human activity. As noted by S. R. Ibrahimov in the article "Analysis of structural change in the national agricultural field and assessment of dependence on imports", namely "the universality of AI makes it a valuable tool for sustainable development" [1]. The main advantage of artificial intelligence systems is its ability to optimize many processes and generate forecasts with a high degree of probability in various spheres of activity: from business processes to state administration. The main problem with the implementation of AI in the process is the quality collection and preparation of the array of data, since the compilation of forecasts requires a set of data describing the object of analysis with a high degree of accuracy, collected from the object of study for long time intervals, which can be the basis for their construction. Otherwise, the obtained forecasts will not be realistic.

Let's list the most sought-after directions for the development of artificial intelligence systems:

– production and technological sphere and agro-industrial complex: optimization of technological processes and prevention of emergency situations;

– financial and economic sphere: monitoring of questionable transactions;

– ecology: monitoring of the state of the environment based on analytical data on various resource indicators (air, water, soil, vegetation);
– emergency and critical monitoring systems: analytics of the probability of occurrence of natural disasters, which is essential when making urgent critical decision;
– transport and logistics sphere: optimization of transportation;
– medicine: diagnostics of diseases, clarification of medical diagnoses, creation of new medicines and forecasting.

The successes in using AI systems in the agro-industrial complex, which is a labor-intensive sector of the national economy, are especially indicative. In addition, it is characterized by seasonality, as well as dependence on natural and time-limited factors.

In this regard, studies devoted to the development of precision farming systems based on the optimal distribution of resources - obtaining consistently high yields at minimal costs - are of particular relevance. Orujov M.M. et al. Artificial intelligence systems in the modern economic environment.

In particular, the publication by A.V. Grachev "Application of neural network technologies for forecasting the state of operation of agricultural facilities" is of great scientific interest, in which the author presents the results of studies on the use of AI for the agro-industrial complex. The object of the study was technical devices involved in the production cycle of plant cultivation, their key characteristics were determined, a model was formulated and the neural network was trained. As a result of the experiment, a forecast of the model's functioning was obtained, and conclusions were made that with the help of AI it is possible to make more effective management decisions compared to traditional practice [2].

The use of AI systems in the agro-industrial complex began in foreign countries quite a long time ago. From the moment of its implementation, it became clear that, despite significant investments in its development, AI is capable of significantly facilitating the performance of labor-intensive and monotonous operations. Initially, separate software products were created. Later, software developers and direct participants in production processes came to the understanding that in order to build effective technological systems using the capabilities of artificial intelligence, it is necessary to create complex products that will include a combination of robotic devices, machine vision tools, and management decision-making systems. Such a system is based on the synergy effect of its components and shows higher efficiency compared to analogues.

Thus, in the USA in 2011, the Blue River Technology project was developed and applied based on a combination of artificial intelligence, computer vision and robotics. As a result, a new generation of agricultural equipment was created that allows saving chemicals and manual labor. The computer vision system inspects the grown plants, the AI system analyzes the received data, and robotics carries out direct processing of the plant.

Another effective example of using AI in the agricultural sector is the Xarvio digital platform (developed by Bayer), which offers users of the Scouting application to analyze the condition of cultivated plants based on photo processing. The algorithm allows you to identify plant diseases, nutrient deficiencies that affect normal development, and also to identify plant pests. The notification function for the occurrence of large clusters of potentially dangerous insects near the site allows users of the system to take protective measures in advance.

A high degree of efficiency is demonstrated by the Plantix mobile application (developed by Peat), which allows the user to diagnose over 60 plant diseases based on a library of photographs. The application algorithm sorts requests by various criteria: depending on the type of plant, disease, pests, etc. In addition, the system is capable of self-learning with an increase in the number of photographs and shows more accurate results [3]. Artificial intelligence systems include various digital models and tools for modeling and visualization, combined into integrated systems that allow monitoring, optimizing and preventing failures in the operation of process equipment, as well as forecasting.

The authors have already published a series of works devoted to the implementation of artificial intelligence systems in various areas of human activity, and the Bulletin also analyzed their features and development prospects.

Summarizing the above, it can be generalized that at the stage of Industry 4.0, most organizational and economic processes were digitized and automated using information technologies, and technological processes are managed based on the information interaction received by the system from sensors.

With the transition to the Industry 5.0 model, human-machine interaction has reached a qualitatively new level. Data is exchanged between system objects equipped with sensors without human intervention. With the help of machine learning algorithms and artificial intelligence, information is processed and, depending on the program, further actions are implemented (adjustment of the technological process, blocking equipment, acceptance of control, etc.).

Such organization of production shows a significant advantage over the traditional form, as it reduces the risks of emergency situations by increasing the forecasting of risks and equipment failures associated with a decrease in human concentration and fatigue. In turn, reducing technological downtime and equipment failures allows saving energy and material resources, which contributes to an increase in labor productivity. Further development of artificial intelligence systems lies in the plane of smart business. As S.R. Ibragimova notes in her research, a fundamentally new business model on-line to off-line has already been developed, the construction of which is based on artificial intelligence [4].

The functioning of such a system is carried out using enormous computing power, cloud technologies and big data under the control of artificial intelligence. The principle of the system is based on network coordination and intelligent data processing, which ensures ultra-high speed of data distribution, reduced cost of coordination and necessary transactions [4].

In the future, such a business model should be introduced into the practice of most domestic companies. However, the difficulty of its distribution and implementation is that the existing practice of digitalization of domestic companies is based on collecting data for a specific purpose.

Typical systems for automating business processes (CRM, ERP, ERM) usually do not reflect the real state of affairs, as they are often incompatible with the existing software, and do not take into account all business processes of the organization. But the biggest omission in this case is the lack of digital interaction with the external ecosystem that surrounds the company and has a direct impact on business processes within it, while the main advantage of smart business is to ensure active and seamless interaction between participants, which is achieved through the use of common interfaces [5].

For the successful functioning of smart business at the enterprise, it is necessary to use predictive analytics, which is a comprehensive analysis tool based on the principle of predicting an event taking into account previous experience. In this case, methods of mathematical analysis, statistics and game theory are used. The key elements of this model are big data and artificial intelligence. Machine learning allows you to test the operation of the system based on available data, and then adapt to changing conditions. With the help of this tool, you can predict the occurrence of certain events with a high degree of probability. To do this, it is necessary to describe the object as accurately as possible using the parameters that are key to it. This tool is especially valuable for predicting hidden risks and trends of a non-obvious nature that cannot be tracked by traditional analytical tools [6]. Tracking such trends is especially important in the field of banking and financial services, especially in the context of combating the legalization (laundering) of proceeds from crime and the financing of terrorism [7].

According to domestic and foreign scientists, the implementation of AI systems is almost always associated with great difficulties and financial costs. But a radical restructuring of existing production and technological systems almost always brings a tangible effect in the future. However, to achieve it, large-scale preparatory work is necessary in such areas as:

– datafication – the process of transforming the objects of the system's activity, which were not initially defined in quantitative terms;

– softwareization – translation of existing business processes into computer programs.

At the same time, datafication and softwareization of the company must be comprehensive, i.e. ensure the digitalization of all objects without exception. To do this, at the preparatory stage, it is necessary to clearly define and describe the main and auxiliary business processes at each stage of the creation and production of the product, as well as the processes of interaction with the external environment.

Further development of AI systems in the production and technological direction will be aimed at the creation and operation of digital factories.

A digital factory is a system of software and technological solutions that ensure the design and production of a new product, starting from the research stage, creating a digital model and ending with its release. The main distinguishing feature of digital factories is the complete automation of the production process based on interaction and data exchange via cloud storage, the Internet of Things, big data, etc. To create digital factories, it is necessary to carry out a significant amount of work on the digitalization of all stages of the product building, i.e. its life cycle, including all stages: design (engineering work), definition and selection of manufacturing technology, determination of suppliers of raw materials and materials, financial and economic calculations and the actual process of manufacturing a sample. At the same time, it is necessary to ensure the integration and compatibility of all software of all participants in the process to form a single information system and build a common logic of work [9].

The level of digitalization of processes at such a factory reaches 95%. Thus, it can be noted that the creation of digital factories is a new stage in the development of AI. We can agree with S. K. Shalova that the

introduction of digital factories will entail the transformation of existing infrastructures and will radically change the nature of production relations.

The capabilities of artificial intelligence systems and the variety of software tools used significantly expand the prospects for further development of integrated technological solutions in digital factories, as well as their integration into a network and the creation of a digital ecosystem with external elements (suppliers, contractors, warehouse and transport and logistics complexes). In the future, digital factories will be able to produce highly intelligent products without human intervention. They will be called "smart". Their intelligent system will be able to independently receive and analyze the necessary information and develop new management decisions. For such systems to function, algorithms based on a deep study of semantics, modality, and multidimensionality are needed. However, this is a complex task that requires new approaches and solutions.

Modern neural network models can be used in various areas of human activity [10]. The main problem is the creation of a full-fledged model (with a full set of quantitative and qualitative characteristics) and the complexity of processing models with different types of data.

Despite the apparent simplicity of the scheme, the "data" block is a voluminous task - a full description of the object, on which the resulting result subsequently depends.

The main advantage of introducing AI into various areas of activity is increased labor productivity. However, this process cannot be called directly proportional. The fact is that the introduction of AI into any processes (production, financial, logistics, etc.) is associated not only with the restructuring of organizational and management systems, but with the restructuring of the thinking of the employees of the organization where the AI system is being introduced, as well as the management of the organization. Just a few years ago, the heads of many organizations were extremely negative about the possibilities of introducing AI into the company. Now the situation has changed for the better. Managers have come to understand that AI systems not only will not interfere with work, but can also be a source of additional profit. To do this, it is necessary to optimize the organizational and management environment so that the staff can work more efficiently with the help of AI achievements.

Researcher N. A. Nikiforova confirms this thesis. In her article “Labor Productivity and the Use of Artificial Intelligence,” the author notes that “in industrial production and task performance, a human-centered approach is needed to fully take advantage of the benefits of technology.”

Of course, such a restructuring of companies involves serious financial, time and intellectual costs. For most Russian enterprises, such processes are currently very costly, as they require a radical restructuring of entire sectors of the national economy, which in turn requires the development of state support programs.

A delay in completing these tasks slows down the implementation of sustainable development goals, since the development of AI systems is designed to promote economic growth.

According to scientists, the main barriers to achieving sustainable development goals in Azerbaijan are legal and organizational. In the article “The current state of the Azerbaijani economy against the backdrop of changes in the world economy” M.M. Orujov notes the need to eliminate these barriers, as well as to align sustainable development goals with the goals of state programs implemented in the country on the basis of a single mechanism at the federal and regional levels [18].

Conclusion

In conclusion, we will note the risks that may be caused by the use of AI:

– risks associated with providing access to confidential data by third parties;

– risks of loss and theft of financial funds; – malfunction of the system with ИИ при

large financial investments in its creation and in short terms

testing/testing systems etc. d.

However, all these complexities cannot affect the development of AI systems and smart business in the future. It is worth understanding that the development of economic systems in the near future will be based on the further advancement of AI technologies in all spheres of human activity, and despite high investments and risks, this process will continue. Therefore, it is necessary to rebuild not only technological capacities, but also the mindset of people in accordance with new technologies. Understanding the true causes of transformations, the desire to change the organizational-technological, management and information-communication environment in the XXI century. - the key to successful problem solving.

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THE IMPACT OF ELECTRONİC BANKİNG ON BANK PROFİTABİLİTY: THE CASE OF AZERBAİJAN

Nematli E.M.
Baku Engineering University
Faculty of Economics and Administrative Sciences
Department of finance and accounting, Senior Lecturer

Abstract

This research investigates the impact of electronic banking on the profitability of banks in Azerbaijan. The study analyzes the development stages of electronic banking, the influence of digital services on banking operations, and their effect on financial indicators. It examines the digitalization process in Azerbaijan's banking sector and compares it with international practices. The results demonstrate that electronic banking enhances operational efficiency, increases revenue, and expands the customer base. Recommendations for further digital transformation in the banking sector are provided.

Keywords: electronic banking, bank profitability, digital services, Azerbaijani banking sector, financial indicators, digitalization, customer base, international comparison, mobile banking

Introduction

In the modern era, electronic banking (e-banking) plays an important role in increasing the competitiveness of the banking sector and improving customer service. The integration of digital technologies into banking services contributes to reducing transaction costs, expanding the customer base, and increasing the profitability of banks (OECD, 2020). In particular, the Azerbaijani banking sector has been investing heavily in the development of electronic banking in recent years. According to the Central Bank (2023) report, the number of customers using online banking services in the country is increasing, and this trend directly affects the profitability of banks.

Electronic banking is a system that ensures the management of financial transactions through the Internet, mobile applications, and other digital channels. The main features of this system are as follows:

Service automation: Digital platforms optimize banking operations and reduce dependence on human resources, which leads to a decrease in costs.

Increasing operating income: Online banking services increase profit margins by reducing traditional branch costs.

Expanding the customer base: Expanding access to services through mobile and internet banking helps banks attract more customers.

Reducing risks and losses: Blockchain and artificial intelligence-based security systems enable banks to manage financial risks and minimize fraud (World Bank, 2021).

The expansion of digital services in the Azerbaijani banking sector, in addition to increasing profitability, strengthens competition in the sector.

This study aims to assess the impact of electronic banking on the profitability of Azerbaijani banks. The main issues of the study include the impact of electronic banking on revenues, the relationship between reducing operating costs and profitability, the level of development of digital banking, and the impact of customer behavior on bank profitability. At the same time, the risks of electronic banking and their potential impacts on the banking sector are analyzed.

The study will be conducted using empirical and statistical analysis methods. During the analysis, the financial statements of Azerbaijani banks, statistical data of the Central Bank, and reports of international organizations on digital banking will be examined.

Theoretical framework for electronic banking and bank profitability

Electronic banking has become one of the most dynamically developing areas of the financial sector in recent years. The digital transformation of banks is directly related to factors such as reducing transaction costs, expanding the customer base, and improving service quality (OECD, 2020).

The concept and development stages of electronic banking

Electronic banking (e-banking) refers to the provision of banking services via the Internet, mobile technologies, and other digital platforms. This system reduces dependence on bank branches and creates conditions for the rapid and uninterrupted execution of banking transactions (World Bank, 2021).

The development of electronic banking can be classified into the following stages:

• Traditional banking period (until the middle of the 20th century) – Banking transactions were carried out entirely in branches. Customers were required to physically visit the bank.

• Introduction of ATM and card systems (late 20th century) – Customers were provided with the opportunity to use banking services 24/7 through ATMs and plastic cards.

• Internet banking (after the 1990s) – It became possible to conduct banking transactions over the Internet. Customers could access accounts, make payments, and take out loans.

• Mobile banking and digital payments (since the 2000s) – Banking applications developed with the spread of smartphones. Mobile banking allows customers to conduct financial transactions in real-time (OECD, 2020).

• Artificial intelligence and blockchain-based systems (the 2020s and beyond) – Blockchain technology, cryptocurrencies, and AI-based personalized services began to be widely applied in the banking sector (Nakamoto, 2008).

In the modern era, the digitalization of banks has radically changed their revenue structure and approach to customer service.

Classification of digital banking services

Electronic banking services are provided through different channels and technologies. Banks use various digital solutions to improve customer satisfaction and increase profitability (BIS, 2022).

The main digital banking services can be classified as follows:

1. Internet banking – Customers connect to online banking systems to monitor their accounts, transfer money, and perform other financial transactions.

2. Mobile banking – Using banking services through special applications for smartphones. It allows customers to conduct financial transactions from anywhere and at any time.

3. POS (Point of Sale) terminals – Devices used to make electronic payments at commercial facilities.

4. Online payment systems – PayPal, Apple Pay, Google Pay, and other digital payment platforms allow customers to conduct secure and fast electronic transactions.

5. Cryptocurrencies and blockchain technologies – Decentralized financial systems (DeFi) and blockchain-based transactions create new opportunities for the banking sector (Nakamoto, 2008).

These digital tools allow banks to diversify their revenue sources and increase operational efficiency.

Bank profitability indicators and their measurement

Several key indicators are used to measure bank profitability:

- ***Net Interest Margin (NIM):*** It shows the ratio of a bank's interest income to interest expenses. A high NIM indicator indicates that the bank has high-interest income.
- ***Return on Assets (ROA)***: It measures how much income a bank's total assets generate.
- ***Return on Equity (ROE):*** It assesses how much income a bank generates for investors (Liu, 2021).
- ***Cost-to-Income Ratio (CIR):*** It is one of the key indicators that measures a bank's efficiency.

The development of electronic banking has a direct and indirect impact on these indicators.

Mechanisms of impact of electronic banking on bank profitability

Electronic banking is one of the main factors that increases the profitability of banks and strengthens their financial stability. Its impact mechanisms can be considered in the following directions:

Cost optimization: Electronic banking reduces traditional branch costs and allows for the optimization of operating costs (World Bank, 2021).

Customer base expansion: The availability of online banking services facilitates banks' access to new customer groups.

Risk reduction and security: Blockchain and AI-based security systems help banks combat fraud and cyber risks (Nakamoto, 2008).

Diversification of revenue sources: Electronic payments, internet banking, and other digital services make banks' revenue structures more sustainable.

Studies show that the introduction of electronic banking increases banks' operating income and enhances their competitiveness (OECD, 2020).

Application of electronic banking in the Azerbaijani banking sector

In recent years, the Azerbaijani banking sector has accelerated the digital transformation process and has devoted a large amount of space to the development of electronic banking. Stimulating electronic payments, expanding digital services, and implementing the cashless economy strategy has been one of the main directions in the modernization of the country's financial system.

History and current status of development of electronic banking in the Azerbaijani banking sector

The banking sector of Azerbaijan began to take shape in the early 1990s, and during this period, banking services were mainly based on the traditional branch-based model. The first electronic banking systems began to be implemented in the early 2000s with the expansion of Internet banking and ATM networks (Central Bank of Azerbaijan, 2022).

In recent years, the expansion of electronic banking services has become a priority issue within the framework of the digital transformation strategy of Azerbaijani banks. According to statistical data for 2023:

- The number of customers using internet banking in the country has exceeded 3 million people.
- The number of mobile banking users has more than doubled in the last five years (Central Bank of Azerbaijan, 2023).
- By the end of 2022, more than 2 000 ATMs and more than 80 000 POS terminals were operating in Azerbaijan.

The Azerbaijani banking sector is currently focused on the full integration of digital banking services and the expansion of the cashless economy.

Main electronic banking services operating in the country and their dissemination

The Azerbaijani banking sector offers customers a wide range of opportunities through mobile banking, internet banking, electronic wallets, and other digital services. The main electronic banking services currently active in the country are as follows:

1. Internet and mobile banking:

- Leading banks such as Kapital Bank (BirBank), ABB (ABB Mobile), and Pasha Bank (PASHA Mobile) provide full electronic banking services through mobile applications.
- Customers can conveniently perform payments, currency exchange, and credit transactions through Internet banking (Azerbaijan Association of Banks, 2022).

2. Electronic payment systems and cashless payments:

- MilliPay, eManat, ExpressPay, PayPal, and other digital payment platforms are widely used.
- While the share of card-based payments was 70% in 2021, this figure reached 80% in 2023 (Central Bank of Azerbaijan, 2023).

3. POS terminals and digital commerce capabilities:

- The widespread use of POS terminals in the trade and service sectors of Azerbaijan has increased the share of cashless payments.
- According to 2023 data, more than 100 000 POS terminals operate in the country.

4. Electronic credit and financial services:

- IBA, Unibank, and Kapital Bank provide online credit and microfinance services.
- Digital credit applications increased by 30% in 2023.

This rapid development of electronic banking has had a positive impact on the revenue structure of banks and optimized their operating costs.

Growth of electronic payment systems and cashless economy strategy

The Azerbaijani government is taking strategic steps to develop cashless payments and expand digital banking. The following measures have been implemented within the framework of the Digital Payments Strategy of the Central Bank of Azerbaijan for 2021-2023:

Integration of electronic government and cashless payments: 95% of government payments are now made electronically.

Strengthening Azerikart and other national payment systems: New technologies are being applied to accelerate internal banking operations and increase security.

Expansion of microfinance and digital credit services: Digital credit opportunities for SMEs have been expanded.

Development of Blockchain and FinTech applications: Work is underway to introduce blockchain-based solutions in the electronic banking system (Central Bank of Azerbaijan, 2023).

These measures have a significant impact on the acceleration of digitalization in the financial sector of Azerbaijan and the change in the income structure of the banking sector.

The role of the Central Bank of Azerbaijan and other regulatory bodies in the field of electronic banking

The Central Bank of Azerbaijan and other regulatory bodies have taken a number of strategic decisions in the field of electronic banking and support the development of this sector.

The Central Bank of Azerbaijan:

- Strengthened the regulatory and legal framework for the development of digital payment systems.
- Introduced new regulatory frameworks for the security of electronic banking.
- Improved the digital payment ecosystem to accelerate the digitalization of banks.

The Association of Banks of Azerbaijan:

• Implements measures to promote digitalization in the banking sector.

• Supports the development of digital services in cooperation with FinTech companies.

The State Tax Service and the Ministry of Economy:

• Implements a policy of stimulating non-cash payments for the development of electronic commerce.

The policy implemented by these bodies supports the rapid development of electronic banking and strengthens the digital transformation of the banking sector.

Empirical analysis of the impact of electronic banking on bank profitability

The development of electronic banking has directly affected the profitability of banks by changing their income and expense structure. In addition to reducing operating costs, the introduction of digital services has expanded banks' income sources, increased their customer base, and improved service quality (OECD, 2021). At the same time, the development of electronic banking has also created new challenges such as risks and security issues.

Impact of electronic banking services on income and expenses

The widespread introduction of electronic banking has had a significant impact on the financial performance of banks. The reduction in operating costs and the increase in income from digital services have increased the overall profitability of banks (World Bank, 2022).

Impact of electronic banking on bank income:

Increase in service fees: Commissions and service fees on transactions carried out through Internet and mobile banking occupy a significant place in banks' income.

Attracting new customer segments: Electronic banking allows you to serve customers outside the traditional branch model, which leads to an increase in bank revenues.

International transactions: As a result of the widespread use of digital payment platforms, banks receive additional income from international transactions.

Impact of electronic banking on bank costs:

Reducing branch costs: The reduction in the need for traditional bank branches optimizes operating costs. According to data for 2022, the transition to electronic banking can reduce branch costs by 30-40% (IMF, 2022).

Staff optimization: Banks' personnel costs have decreased and are directed towards technological investments.

Increased technological investments: Digital banking necessitates the implementation of new technologies, which, although increasing costs at the initial stage, increases efficiency in the long term (BIS, 2022).

These indicators show that the implementation of electronic banking increases revenues and strengthens bank profitability by optimizing costs.

Assessing the impact of banks on operational efficiency and financial indicators

One of the key indicators of bank profitability is operational efficiency. E-banking has had a positive impact on banks' interest income, net profit margin, and operational efficiency (OECD, 2021).

Key financial indicators:

Net Interest Margin (NIM): It shows the ratio of banks' interest income to interest expenses. E-banking increases banks' interest income with a high NIM indicator (IMF, 2022).

Return on Equity (ROE): The introduction of e-banking has increased banks' return on equity.

Return on Assets (ROA): Digital services increase the profitability of bank assets.

For example, according to a study conducted by McKinsey & Company (2022), banks that invest more in digital banking have a 5-7% higher ROE than traditional banks.

E-banking also increases the quality of banks' customer service and expands their market share.

Expanding customer base and improving service quality

Digital banking has created fundamental changes in the bank-customer relationship and has led to the expansion of the customer base (Kaplan & Nadler, 2020).

Fast and convenient services: Customers have 24/7 access to banking services, which increases customer satisfaction.

Interactive user experience: Mobile applications and chatbot technologies automate customer services.

Microcredits and personal financial services: Digital banking offers customers more convenient credit and financial management opportunities.

Empirical indicators show that as the number of mobile banking users increases, the overall profitability of banks also increases (World Bank, 2022).

Risks and security issues of electronic banking

In parallel with the development of electronic banking, risks and security issues have also become relevant.

Cyberattacks and data breaches: The banking sector is vulnerable to cybersecurity risks (BIS, 2022).

Fraud and fraudulent transactions: With the increase in electronic transactions, fraud risks have also increased.

Data privacy: Protecting customer data is one of the most important challenges of electronic banking.

To prevent these risks, banks use blockchain technologies, artificial intelligence-based security systems, and multi-factor authentication methods (OECD, 2021).

International comparison of electronic banking practices of Azerbaijani Banks

Electronic banking has played an important role in the global financial sector and has become one of the main strategies used by banks to reduce operating costs, improve service quality, and expand their customer base. Digital banking models, new technologies, and regulatory mechanisms applied in different countries are among the main factors affecting the development of electronic financial services.

Comparative analysis of electronic banking in developed countries

The United States, Great Britain, Germany, and Sweden, which are the world leaders in the field of electronic banking, have taken important steps in the implementation of digital financial systems.

Cashless economy model in Sweden

• Sweden is one of the countries where a fully digital banking system has been implemented.

• Mobile applications and online payment platforms have minimized the use of cash (Arvidsson, 2019).

• Digital identification and payment systems such as Swish and BankID provide fully digital services to bank customers.

FinTech revolution in the US and UK

• The Fintech (Financial Technology) sector has radically changed banking services in these countries (Zachariadis & Ozcan, 2017).

• Mobile payments, online banking, and blockchain-based services are widespread.

• Electronic transactions are rapidly increasing through platforms such as Apple Pay, Google Pay, PayPal, and Venmo (World Bank, 2022).

Digital banking and security regulations in Germany

• Germany is distinguished by its robust regulatory mechanisms and cybersecurity standards (European Central Bank, 2021).

• Open banking models are widespread within the framework of PSD2 (Revised Payment Services Directive).

The experience of these countries shows that the application of modern technologies, the development of innovative customer-oriented solutions, and a strong regulatory framework are essential for the successful development of electronic banking.

Global trends and application prospects in the Azerbaijani banking sector

In recent years, the Azerbaijani banking sector has taken important steps towards the development of electronic banking. Various local and international banks have expanded the range of online services, improved mobile banking applications, and strengthened the infrastructure of digital payment systems (Central Bank of Azerbaijan, 2023). According to data as of the end of 2023, the number of mobile banking users in the country exceeded 4 million, and the share of non-cash payments reached 80% (Azerbaijan Association of Banks, 2023).

However, compared to the experience of developed countries around the world, it is necessary for the Azerbaijani banking sector to further deepen the digitalization process and adapt it to international trends. The global financial sector is developing in key directions such as accelerating digitalization, customer-oriented innovations, and strengthening cybersecurity (OECD, 2022).

Global trends and key development directions for Azerbaijani banking

1. Development of FinTech ecosystem

• FinTech companies and startups in developed countries are making a significant contribution to the digitalization of banking services. In countries such as the US, UK, and Sweden, the FinTech sector is focused on the development of innovative financial services and increasing customer satisfaction (Zachariadis & Ozcan, 2017).

• Regulatory mechanisms and state support should be strengthened for the expansion of the FinTech sector in Azerbaijan. In 2023, the Central Bank prepared new rules regulating the activities of FinTechs, but a favorable investment environment and support programs for startups are important for the broader development of the sector.

2. Artificial intelligence and automated banking services

• Artificial intelligence (AI)-based systems are already used in many countries in the areas of customer service and security. AI chatbots, automatic credit analysis systems, and risk management tools are being implemented in US and European banks (McKinsey & Company, 2022).

• There is a need for new technological solutions and highly qualified personnel training for the development of artificial intelligence-based digital banking services in Azerbaijan.

3. Cybersecurity and data protection

• Security regulations in accordance with international standards such as PSD2 and GDPR should be implemented in the Azerbaijani banking sector (European Central Bank, 2021).

• The role of blockchain technologies in increasing operational security should be investigated (Nakamoto, 2008).

4. Implementation of open banking and API-based systems

• Open banking models are widely applied in the UK and EU countries. This model allows the offering of more personalized financial services to customers (OECD, 2022).

• A regulatory framework should be developed for the implementation of the open banking model in the Azerbaijani banking sector and commercial banks should take steps in this area.

The development of electronic banking is one of the main directions shaping the future of the financial sector of Azerbaijan. The development of the FinTech sector, the introduction of artificial intelligence-based services, open banking, and strengthening cybersecurity measures should be priorities for Azerbaijani banking in the coming years.

Based on international experience, the public and private sectors should cooperate to increase the level of digitalization of Azerbaijani banks, develop innovative payment systems, and strengthen cybersecurity standards.

Conclusions and recommendations

Summary of key findings

Electronic banking has become an integral part of the modern banking sector. The application of digital technologies has accelerated banking operations, optimized transaction costs, and increased customer satisfaction (World Bank, 2022). In line with this trend, the Azerbaijani banking sector has also taken important steps towards digitalization in recent years.

Azerbaijani banks have expanded mobile banking services, developed online payment systems, and started implementing artificial intelligence-based solutions to improve the quality of customer services (Central Bank of Azerbaijan, 2023). At the same time, the experience of developed countries around the world shows that the Azerbaijani banking sector needs to implement more technological reforms to increase its international competitiveness.

In the current situation, strengthening cybersecurity, developing the FinTech sector, and wider implementation of customer-oriented innovative solutions are required for Azerbaijan's digital banking sector to unleash its full potential (OECD, 2022).

Recommendations for the development of electronic banking

1. Strengthening Technology and Innovation Incubators

• Banks' investment in innovative solutions based on artificial intelligence and blockchain can further improve customer experience (McKinsey & Company, 2022).

• Financing and support programs for the development of FinTech startups should be expanded.

• The innovation center model applied in Sweden, the United Kingdom, and Singapore should be used (Zachariadis & Ozcan, 2017).

2. Cybersecurity and Data Protection

• Banks should implement modern technologies to protect data privacy in accordance with international security standards such as PSD2 and GDPR (European Central Bank, 2021).

• The application of blockchain technologies can help increase the security of transactions and prevent fraud (Nakamoto, 2008).

• Banks should expand artificial intelligence-based risk analysis systems to protect customer data.

3. Expanding Digital Banking Services

• Infrastructure should be improved to make electronic banking services more accessible in the regions.

• More affordable digital financial solutions should be developed for small and medium-sized enterprises.

• Mobile banking and online credit services should be expanded (World Bank, 2022).

4. Improving Regulatory Frameworks

• Azerbaijani banking legislation should be aligned with international digital financial regulations.

• Legal mechanisms should be created to support the development of FinTech companies.

• The Open Banking model applied in the European Union should also be applied in Azerbaijan (OECD, 2022).

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COMPENSATION CHARACTERISTICS, PROVIDED TO EMPLOYEES FOR WORKING IN HARMFUL CONDITIONS AND DANGEROUS WORKING CONDITIONS

Iskakova Aigul
1st year doctoral student 8D04105 "Accounting and Auditing"
L.N. Gumilyov Eurasian National University, Astana
Raihan M.S.
Senior Researcher of the Department of Economic Measurements and Statistics RSE with REM "Republican Research Institute for Labor Protection of the Ministry of Labor and Social Protection of Population of the Republic of Kazakhstan"

Abstract

Working conditions are a combination of factors of the production environment and the labor process that affect the worker's performance and health. Those conditions that can negatively affect the employee's health are considered harmful. Harmful working conditions are working conditions that are characterized by the presence of harmful production factors. Harmful working conditions include environmental conditions and the labor process, the impact of which on a worker in certain conditions can cause occupational disease, decreased performance, and lead to a violation of the health of offspring. For workers in industries accredited as harmful (especially harmful), or in dangerous working conditions, the legislation provides for various types of incentives. These include benefits for employees of harmful production, additional paid annual leave, and reduced working hours, etc. It is known that the current level of technology and technology development cannot guarantee proper working conditions for all employees and exclude the impact of harmful industrial factors on the human body. In this regard, in order to protect or mitigate the effects of harmful production factors, workers engaged in heavy work, work with harmful and dangerous working conditions are provided with a number of guarantees. One of them is additional paid work leave and reduced working hours. It is believed that these types of guarantees are intended to reduce the time spent by workers in harmful production conditions and create additional opportunities for the reproduction of vital forces.

Keywords: Social guarantees, compensations, harmful and dangerous working conditions, special social benefits, employees, employers.

Harmful working conditions are working conditions characterized by the presence of harmful production factors. Harmful working conditions include environmental conditions and labor process, the impact of which on the worker in certain conditions can cause occupational disease, reduced working capacity, lead to a violation of the health of offspring.

A harmful production factor is a factor in the workplace that, if exposed to for a long period of time or repeatedly, may adversely affect the health of an employee. Harmful production factors can cause various occupational diseases, damage to organs or systems of the body, as well as lead to deterioration of general health.

A hazardous production factor is a factor in the workplace that leads to injury, including fatal injury, due to short-term high-intensity impact on the employee.

So, usually harmfulness of production is associated with factories and workshops, work in mines. The exact names of occupations are represented by dozens of names, which can be divided into groups:

mining operations - related to the extraction of minerals, geological exploration works, as well as construction, reconstruction, technical re-equipment and overhaul of mines, mines, mines, subway mines, subway canals, tunnels and other underground structures;

ore preparation, beneficiation, pelletizing, roasting of ores and non-metallic minerals - i.e. work in shops, factories and mills operating in these areas;

metallurgy - occupations in the production of ferrous and non-ferrous metals and metal products, including maintenance of equipment and steel plants;

chemical and nuclear industry - when working with radioactive and harmful substances; light industry - production of paper, clothing, leather, textiles and so on;

production of medicines, medical and biological products and materials - these areas may also be associated with harmful substances.

The following compensations for work in harmful or hazardous working conditions are currently established:

- reduced working hours

- additional paid annual leave
- wages at an increased rate
- issuance of personal protective equipment, rinsing and neutralizing agents
- issuance of milk and therapeutic and preventive nutrition

For workers in industries accredited as harmful (especially harmful) or in hazardous working conditions, the legislation provides incentives of various kinds. These include allowances for workers in harmful production, additional paid annual labor leave, reduced working hours, etc.

According to Article 250 of the Social Code of the Republic of Kazakhstan - mandatory professional pension contributions payable to a single accumulative pension fund, for workers employed in jobs with harmful working conditions, professions of which are provided by the list of industries, jobs, professions of workers, approved by the authorized state body, are set at the rate of 5 percent of the monthly income of the employee, taken for the calculation of mandatory professional pension contributions[1].

Records of working time in harmful (especially harmful) working conditions are kept in documents determined by the employer.

Social protection of the population is an integral function of any state. Its structure includes the following:

1. the basic guarantees provided to individuals when they lose their health and when they come of age;
2. Secondary guarantees, aimed at improving health or maintenance;
3. ordinary additions, providing for the possibility of increasing the guarantees against various kinds of risk;
4. Provision of personal protection at the expense of earnings.

And consists, as a rule, of the following links:

1. Social security - legally established and regulated provision of systematic material assistance;
2. Social assistance - material support of citizens who, under certain circumstances, have been temporarily exposed to unfavorable consequences;
3. Social guarantees - social benefits and services established by law and provided to citizens;
4. Social insurance - a well-established mechanism of material compensation in case of temporary disability, reaching retirement age, as well as the order of systemic protection against specific types of risk.

Social guarantees are a mechanism of long-term action, statutory obligations of the state aimed at the realization of the constitutional rights of citizens.

Only after considering and understanding the meaning of social guarantees and social protection of the population, we can say with certainty that these phenomena can exist and effectively "work" towards the realization of the principles of the social state only in the aggregate and in interaction.

It is known that the existing level of development of techniques and technology cannot guarantee proper working conditions for all employees and exclude the impact of harmful production factors on the human body.

In this regard, in order to protect or mitigate the impact of harmful production factors, employees engaged in heavy work, work with harmful and hazardous working conditions are provided with a number of guarantees. One of them is additional paid labor leave and reduced working hours. It is believed that these types of guarantees are designed to reduce the time workers spend in harmful production conditions and create additional opportunities for reproduction of vital forces.

In the Republic of Kazakhstan, these state guarantees are established in accordance with the List of industries, shops, professions and positions with harmful working conditions (hereinafter - List), the list of industries, shops, professions and positions, the list of heavy work, work with harmful and (or) hazardous working conditions, work in which entitles to reduced working hours, additional paid annual leave and increased wages [2].

According to paragraph 17 of the Methodological Recommendations for the Development of the Remuneration System, all additional payments and allowances are divided into two types: compensatory and incentive. Compensatory allowances include additional payments made to employees for: combining positions; extending the area of service or performing (replacing) the duties of a temporarily absent employee; working in heavy work, work in harmful and (or) hazardous working conditions; mentoring and overtime work in piecework pay and other. At the same time, according to Article 105 of the Labor Code of the Republic of Kazakhstan, remuneration of employees engaged in heavy work, work with harmful and (or) hazardous working conditions is set at an increased rate (increased rates or additional payments) [3].

According to paragraph 19 of the above rules, employers are not entitled to independently determine the amount of additional payments for work in such conditions. Their amount is determined by a collective agreement or an act of the employer, taking into account industry coefficients classifying working conditions by

degree of harm and danger, determined by an industry agreement. It is pointed out that it is important that the collective agreement, employment contract and (or) act of the employer clearly differentiate the amount of additional payments depending on working conditions, taking into account the results of certification of workplaces and the specifics of the organization. Also, they should not be formal, but should reflect the real difference in comparison with the labor remuneration of employees working in normal conditions.

And if the employer has not carried out certification of the workplace in terms of working conditions, the right to bonuses and other benefits will have employees whose positions and professions are included in the list of industries, shops, professions and positions with harmful and hazardous conditions. In other words, Kazakhstani workers in harmful and heavy industries should receive an increased level of payment, and these measures of compensation for harm should be enshrined in collective and labor agreements or an act of the employer.

In order to establish benefits and compensations for harmful and hazardous working conditions, the results of a special assessment of working conditions are required. It is on the basis of the assigned class of working conditions that benefits and compensations are established for employees. Benefits and compensations are established for all employees with a working condition class higher than 2 (except for remote workers, employees who have employment relations with an employer-physical person and an employer-religious organization).

Article 1 of the Labor Code defines the concept of "guarantees" as the means, methods and conditions by means of which the rights granted to employees in the area of social and labor relations are ensured.

Prescriptive guarantees for employees engaged in heavy work, work with harmful working conditions are the following requirements :

- Reduced working hours for workers engaged in heavy work, work with harmful (especially harmful) and (or) hazardous working conditions (Article 69 of the Labor Code of the RK); For workers engaged in heavy work, work with harmful and (or) hazardous working conditions, reduced working hours of no more than 36 hours per week are established according to the List of industries, shops, professions and positions, the list of heavy work, work with harmful and (or) hazardous working conditions.

The reduced working hours established by this paragraph shall apply to employees whose work in severe, harmful and (or) hazardous conditions is confirmed by the results of certification of production facilities in terms of working conditions. If the employer fails to certify production facilities for labor conditions, as well as workplaces that are not subject to certification, the reduced working hours shall be provided in full in accordance with the List of industries, shops, professions and positions, the list of heavy work, work with harmful and (or) hazardous working conditions;

- Provision of additional paid annual labor leave for this category of workers (Article 89, LC RK); Additional paid annual labor leave is provided to: workers engaged in heavy work, work with harmful and (or) hazardous working conditions, the duration of not less than six calendar days according to the List of industries, shops, professions and positions, the list of heavy work, work with harmful and (or) hazardous working conditions. Additional paid annual labor leave is granted to employees whose work in difficult, harmful and (or) dangerous conditions is confirmed by the results of certification of production facilities in terms of working conditions. Like basic labor leave, additional leave can be taken in full or in parts, and the employee is entitled to appropriate compensation for unused additional leave. It should be noted that employees of third-party organizations, such as repair or construction companies, are also entitled to additional leave and reduced working hours under the same conditions as the main employees for the time they work in production workshops with harmful working conditions.

The employer is obliged to organize, at its own expense, periodic medical examinations and check-ups of employees engaged in heavy work, work with harmful and (or) hazardous working conditions, in accordance with the procedure established by the legislation of the Republic of Kazakhstan.

Additional paid annual labor leaves are granted to employees whose work in difficult, harmful and (or) dangerous conditions is confirmed by the results of certification of production facilities in terms of working conditions.

- Establishment of increased wages for employees engaged in heavy work, work with harmful (especially harmful), hazardous and other special working conditions (Article 105 of the Labor Code of the RK);

- The payment of OPV is made to employees who have worked in harmful (especially harmful) working conditions for at least 80% of the working time per month.

Where harmful working conditions confirmed by the results of certification of production facilities are excluded, the payment of compulsory occupational pension contributions by agents ceases from the moment harmful working conditions are excluded;

- free issue of milk, medical and preventive nutrition, special clothing, special footwear and other personal protective equipment, provision of workers with collective protection equipment, sanitary and household facilities and devices (Article 182 of the Labor Code of the Republic of Kazakhstan)[1].

For many decades, these compensatory guarantees have been provided in accordance with the list of industries, shops, professions and positions, the list of jobs, work with harmful and (or) hazardous working conditions, approved by the authorized labor authority[2].

According to paragraph 17 of the Methodological Recommendations on the development of the labor remuneration system, all additional payments and allowances are divided into two types: compensatory and incentive. Additional compensatory payments include additional payments made to employees for: combining positions; expansion of the service area or performing (replacing) the duties of a temporarily absent employee; for working in heavy work, work with harmful and (or) hazardous working conditions; for mentoring and overtime work in piecework pay and other.

At the same time, according to Article 105 of the Labor Code of the Republic of Kazakhstan, remuneration of employees engaged in heavy work, work with harmful and (or) hazardous working conditions is set at an increased rate (increased rates or additional payments) [3].

According to paragraph 19 of the above rules, employers are not entitled to independently determine the amount of additional payments for work in such conditions. Their amount is determined by a collective agreement or an act of the employer, taking into account industry coefficients classifying working conditions by degree of harm and danger, determined by an industry agreement. It is pointed out that it is important that the collective agreement, employment contract and (or) act of the employer clearly differentiate the amount of additional payments depending on working conditions, taking into account the results of certification of workplaces and the specifics of the organization. Also, they should not be formal, but should reflect the real difference in comparison with the labor remuneration of employees working in normal conditions[3].

All these measures aimed at improving working conditions and preserving the health of employees do not bring the employer a reduction in the financial burden of benefits and compensations, because practicing a list approach to their appointment, the state neglects the practice of economic incentives for employers.

To date, a special social payment has been introduced, which can be received by citizens who work in harmful working conditions for a long time. It is provided to those working in 19 industries, including mining and manufacturing, metallurgy and energy.

The list of industries, jobs and professions of employees engaged in work in harmful working conditions includes more than 2,000 items.

According to statistics, more than 490 thousand people work in harmful working conditions in the country.

Taking into account the mandatory conditions for the appointment of a special social benefit, according to the Unified Accumulative Pension Fund, it will be possible to qualify for it:

in 2024 - more than 37 thousand employees,

in 2030 - over 58 thousand,

in 2035 - over 95 thousand.

Thus, the number of potential beneficiaries will increase each year[4].

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Geographical sciences

ASSESSMENT OF THE IMPACT OF ANTHROPOGENIC FACTORS ON LAKE BALKASH

Akbayeva Lyailya
Candidate of Biological Sciences, Associate Professor, Department of Management and Engineering in the Field of Environmental Protection, L.N.Gumilyov Eurasian National University
Kulatayeva Kamila Dumanovna
Master's student of the Department of Management and Engineering in the Field of Environmental Protection at the L.N.Gumilyov Eurasian National University
Rymbayeva Roza Bauyrzhankyzy
Master's student of the Department of Management and Engineering in the Field of Environmental Protection at the L.N.Gumilyov Eurasian National University

ОЦЕНКА ВЛИЯНИЯ АНТРОПОГЕННЫХ ФАКТОРОВ НА ОЗЕРО БАЛКАШ

Акбаева Ляйля Хамидуллаевна
Кандидат биологических наук, доцент кафедры «Управление и инжиниринг в сфере охраны окружающей среды» Евразийского национального университета им. Л.Н.Гумилева
Кулатаева Камила Думановна
Магистрант кафедры «Управление и инжиниринг в сфере охраны окружающей среды» Евразийского национального университета им. Л.Н.Гумилева
Рымбаева Роза Бауыржанқызы
Магистрант кафедры «Управление и инжиниринг в сфере охраны окружающей среды» Евразийского национального университета им. Л.Н.Гумилева

Abstract

The article is devoted to the analysis of anthropogenic factors that affect Lake Balkash, one of the largest reservoirs in Kazakhstan and throughout Central Asia. The drainage basin of the Balkash includes several tributaries, of which the Ili River, which carries water from the Tien Shan range, is considered the main one. Due to this feature, the lake has an extremely fragile ecosystem, vulnerable to external influences. The authors emphasize that in the context of the growing industrial and agricultural development of the Lake Balkash basin, there is a threat of irreversible changes affecting both water quality and the biodiversity of coastal areas.

The purpose of the work is to calculate the degree of impact of anthropogenic factors on the ecosystem of Lake Balkash. Data collection and analysis consisted of the application of an integrated assessment of the degree of influence of anthropogenic factors based on a comparison of the results with established standards and indicators. To assess the degree of influence of man-made factors on Lake Balkash, a point-weight assessment method was applied, where informative indicators for risk management purposes are selected based on expert analysis and their relative importance (weighting coefficients) is determined.

To carry out a comprehensive assessment, the study identified key sources of pollution: industrial enterprises in the mining and metallurgical sectors, as well as urban and agricultural runoff. Considerable attention is paid to the problem of accumulation of heavy metals and toxic elements in bottom sediments, which can affect the physiological state of aquatic organisms and humans. A separate section of the article is devoted to a critical analysis of ways to use water resources, including irrigation projects and water abstraction from rivers feeding the lake. The researchers point to the need to improve wastewater treatment systems and introduce modern monitoring methods, since timely detection of pollutants will allow for a more rapid response to emerging threats. A special place in the article is occupied by the consideration of the climatic factor: changing precipitation regimes and air temperatures can contribute to a reduction in the volume of fresh water and enhance mineralization processes. The results obtained demonstrate that anthropogenic impacts on Lake Balkash are complex and cover a wide range of industries: from industrial and agricultural production to urbanization and recreational use of the reservoir. The authors emphasize that in order to preserve Lake Balkash, it is necessary to use a comprehensive interdisciplinary approach in which economic, social and environmental interests will be balanced. Thus, Lake Balkash is a unique natural system not only for Kazakhstan, but also for the entire continent: its conservation is of paramount importance in terms of biological diversity, water resources and socio–economic development of coastal areas.

Аннотация

Статья посвящена анализу антропогенных факторов, которые оказывают воздействие на озеро Балкаш — один из крупнейших водоёмов Казахстана и всей Центральной Азии. Водосборный бассейн Балкаша включает несколько притоков, из которых главным считается река Или, несущая воды с хребта Тянь-Шань. Благодаря данной особенности озеро обладает чрезвычайно хрупкой экосистемой, уязвимой к внешним воздействиям. Авторы подчёркивают, что в условиях растущего промышленного и сельскохозяйственного освоения бассейна озера Балкаш возникает угроза необратимых изменений, затрагивающих как качество воды, так и биоразнообразие прибрежных районов.

Целью работы: рассчитать степень воздействия антропогенных факторов на экосистему озера Балкаш. Сбор и анализ данных представлял собой применение интегрированной оценки степени влияния техногенных факторов на основе сравнения результатов с установленными нормативами и показателями. Для оценки степени влияния техногенных факторов на озеро Балкаш был применен балльно-весовой метод оценки, где на основе экспертного анализа выбираются информативные показатели для целей управления риском и определяется их относительная значимость (весовые коэффициенты).

Для проведения комплексной оценки в ходе исследования выявились ключевые источники загрязнения: промышленные предприятия горнодобывающего и металлургического секторов, а также городские и сельскохозяйственные стоки. Значительное внимание уделяется проблеме накопления тяжёлых металлов и токсичных элементов в донных отложениях, которые могут влиять на физиологическое состояние водных организмов и человека. Отдельный раздел статьи посвящён критическому анализу способов использования водных ресурсов, включая ирригационные проекты и забор воды из рек, питающих озеро. Исследователи указывают на необходимость совершенствования систем очистки сточных вод и внедрения современных методов мониторинга, поскольку своевременное обнаружение загрязняющих веществ позволит более оперативно реагировать на возникающие угрозы. Особое место в статье занимает рассмотрение климатического фактора: изменяющиеся режимы осадков и температуры воздуха могут способствовать сокращению объёма пресной воды и усилению процессов минерализации. Полученные результаты демонстрируют, что антропогенные воздействия на озеро Балкаш являются комплексными и охватывают широкий спектр отраслей: от промышленного и сельскохозяйственного производства до урбанизации и рекреационного использования водоёма. Авторы подчёркивают, что для сохранения озера Балкаш необходимо задействовать комплексный междисциплинарный подход, в котором экономические, социальные и экологические интересы будут сбалансированы. Таким образом, озеро Балкаш представляет собой уникальную природную систему не только для Казахстана, но и для всего континента: его сохранение имеет первостепенное значение с точки зрения биологического разнообразия, водных ресурсов и социально – экономического развития прибрежных территорий.

Keywords: Lake Balkash, anthropogenic impact, industrial pollution, heavy metals, climate threats, biological diversity, water resources, environmental protection measures.

Ключевые слова: Озеро Балкаш, антропогенное воздействие, промышленное загрязнение, тяжелые металлы, климатические угрозы, биологическое разнообразие, водные ресурсы, природоохранные меры.

Введение

Озеро Балкаш является уникальным природным объектом в юго-восточной части Казахстана и относится к числу крупнейших внутренних водоёмов в Центральной Азии. [3] Его площадь варьируется в пределах 16.000–16.500 км² в зависимости от многолетних колебаний уровня воды. [4] Примечательна особая структура озера: узкий пролив разделяет Балкаш на две неравные части, различающиеся по химическому составу воды – западная часть обладает более пресным характером, а восточная отличается повышенным уровнем минерализации. [5] Средняя глубина озера составляет около 6–7 метров, однако в отдельных местах может достигать 25–26 метров, что сказывается на распределении флоры и фауны. [6]

Помимо своего значимого вклада в поддержание биоразнообразия, озеро Балкаш играет важную роль для социально-экономического развития региона. [7] Оно служит источником водных ресурсов для промышленных предприятий, сельскохозяйственных угодий и населённых пунктов, расположенных в бассейне озера. [8] Однако в последние десятилетия усиливаются процессы антропогенного воздействия: растущая добыча полезных ископаемых, промышленное производство, а также нерациональная система орошения приводят к загрязнению вод и ухудшению состояния прибрежных экосистем. [9] Ситуация усугубляется изменениями климата, которые влияют на уровень воды и температурный

режим, создавая дополнительные риски для озера Балкаш. [10] В связи с этим изучение его современного экологического состояния становится критически важным для сохранения природного баланса и обеспечения устойчивого развития региона. [11]

Методы исследования. Для определения степени воздействия экологических факторов на озеро Балкаш был применен балльно – весовой метод оценки. Балльно-весовой метод оценки (иногда его также называют весовым или рейтинговым методом) – это один из методов многокритериальной оценки и принятия решений, при котором определяются критерии, по которым будет оцениваться объект:

-Каждому критерию присваивается вес (в процентах/коэффициентах/баллах), отражающий степень его важности по сравнению с другими;

-По каждому критерию выставляются баллы, в зависимости от того, насколько хорошо оцениваемый объект удовлетворяет данному критерию;

-Баллы умножаются на соответствующие веса, после чего все результаты суммируются.

На основе итоговых сумм делается вывод о том, какой объект или решение имеет наиболее высокий (или низкий) рейтинг с учётом указанных приоритетов.

На основании публикаций исследователей нами были отобраны основные техногенные факторы воздействия на озеро Балкаш, а также присвоены веса для каждого фактора с учетом их влияния (Таблица 1). [1] Наибольший вес фактор имеет, если оказывает влияние на все три параметра водоема: гидрология, биоразнообразие и гидрохимический режим – 9 баллов. Далее производилась оценка интенсивности воздействия каждого фактора по 3-х балльной шкале: 1 – слабая степень воздействия, 2 – среднее воздействие, 3 – сильное воздействие (Таблица 2).

Таблица 1

Оценка веса каждого фактора по степени влияния на экосистему озера Балкаш

№	Факторы антропогенной деятельности	Гидрологический режим	Биоразнообразие	Гидрохимический режим	Вес (общий балл)
1	Промышленное загрязнение	3	3	3	9
2	Сброс городских и коммунальных сточных вод	3	2	3	8
3	Нерациональное использование водных ресурсов (забор воды)	3	3	-	6
4	Сельскохозяйственная нагрузка	3	2	-	5
5	Горнодобывающая деятельность	3	3	2	8
6	Мусор и твердые бытовые отходы	-	1	1	2
7	Рыболовство	-	3	-	3
8	Туристическая нагрузка	1	1	2	4
9	Климатические изменения	3	2	2	7
10	Урбанизация	1	2	3	6

Таблица 2

Оценка интенсивности влияния факторов антропогенной деятельности на озеро Балхаш по балльно-весовому методу

№	Факторы антропогенной деятельности	Вес (балл)	Оценка (балл) От 1 до 3 б.	Взвешенный и оцененный результат (вес·оценка)	Наиболее критичес-кий результат	Наименее безопас-ный результат
1	Промышленное загрязнение	9	3	27	27	9
2	Сброс городских и коммунальных сточных вод	8	2	16	24	8
3	Нерациональное использование водных ресурсов (забор воды)	6	3	18	18	6
4	Сельскохозяйственная нагрузка	5	2	10	15	5
5	Горнодобывающая деятельность	8	3	24	24	8
6	Мусор и твердые бытовые отходы	2	1	2	6	2
7	Рыболовство	3	2	6	9	3
8	Туристическая нагрузка	4	2	8	12	4
9	Климатические изменения	7	3	21	21	7
10	Урбанизация	6	2	12	18	6
	Суммарное значение действия факторов			**Σ=144**	**Σ=174**	**Σ=58**

Наиболее критический результат суммарного действия техногенных факторов можно рассчитать как сумма весов факторов умножена на максимальное количество баллов: 58·3=174.

Наименее безопасный для озера Балкаш результат суммарного действия техногенных факторов определяется как произведение суммы весов факторов на минимальное количество баллов оценки - 1: 58·1=58.

Результаты и обсуждение. Промышленное загрязнение занимает наиболее значимое место в ряду техногенных факторов, так как, во-первых, оказывает влияние как на гидрологический режим озера Балкаш, так и на степень загрязнения и влияния на биоразнообразие. Интенсивность данного фактора нами оценивалась как максимальная – 3 балла, ведь это связано прежде всего с деятельностью горнодобывающих и металлургических предприятий. Балхашский горно-металлургический комбинат (БГМК) - является подразделением корпорации «Казахмыс» (иногда фигурирует как «Kazakhmys Smelting»). [12] Основная деятельность — выплавка меди, переработка и обогащение руды, получение сопутствующих металлов (в том числе цинка и свинца). В процессе производства образуются промышленные сточные воды с повышенным содержанием тяжёлых металлов (медь, свинец, цинк, кадмий,мышьяк), сернистых соединений и других токсичных веществ (Таблица 3). [13] [1] Исторически (ещё со времён СССР) на территории рядом с комбинатом сформированы крупные хвостохранилища и шлакоотвалы, часть которых до сих пор может негативно влиять на качество воды в озере через фильтрационные и поверхностные стоки.

Таблица 3

Тяжелые металлы, выделяемые промышленными предприятиями на территории озера Балкаш

Параметр	Средняя концентрация (мг/л)	ПДК (мг/л)	Примечание
Медь (Cu)	0,01–0,02	0,001	Возможны превышения ПДК от 5 до 20 раз
Цинк (Zn)	0,02–0,04	0,01	Превышения ПДК обычно в 2–4 раза
Свинец (Pb)	0,003–0,006	0,001	Превышения 3–6 раз
Кадмий (Cd)	0,0005–0,001	0,0005	Может находиться на уровне ПДК или превышать её в 2 раза
Мышьяк (As)	0,001–0,005	0,0005	В отдельных точках фиксировалось 2–5-кратное превышение

* ПДК может отличаться в зависимости от нормативов (рыбохозяйственные, для питьевого водоснабжения и пр.). В таблице указан один из самых жёстких показателей — для рыбохозяйственных водоёмов.

Тяжёлые металлы и другие загрязнители частично оседают на дне, накапливаясь в илах, что может становиться источником вторичного загрязнения (при штормовых событиях, подъёме донных отложений и т. п.). Превышение ПДК по меди, свинцу и другим металлам негативно сказывается на рыбных ресурсах: может снижаться численность некоторых видов, изменяться их видовой состав. При употреблении рыбы, выловленной в зонах повышенных концентраций тяжелых металлов, а также при использовании воды без должной очистки, возможны негативные последствия для здоровья.[2]

Сброс городских и коммунальных сточных вод так же занимает значимое место в ряду техногенных факторов, так как в равной степени оказывает влияние как на гидрологию озера Балкаш, так и на гидрохимию и биоразнообразие. Интенсивность данного фактора нами оценивалась как средняя – 2 балла. При недостаточном уровне очистки в озеро попадают органические вещества, патогенные микроорганизмы и бытовые химикаты. Это стимулирует развитие цветения воды (эвтрофикацию), приводит к потреблению растворённого в воде кислорода и, в конечном итоге, провоцирует гибель рыб и других водных обитателей. К примеру, на юго-западном побережье озера расположен город Приозёрск (Жамбылская область). Здесь также есть система коммунальных стоков, которая, по официальным данным, частично проходит через локальные очистные сооружения. Однако качество очистки иногда не соответствует действующим нормам, что в итоге может приводить к сбросу в Балхаш недоочищенных вод. Еще небольшие посёлки и сёла (например, Сарышаган, Гульшат и др.) вокруг озера, как правило, имеют ограниченные возможности по эффективной очистке сточных вод. [9] В ряде случаев там используются выгребные ямы или септики без дальнейшей централизованной переработки; при отсутствии герметизации или при переполнении такие стоки могут попадать в поверхностные и грунтовые воды, а затем — в озеро.

Не менее важным фактором, во многом связанным с промышленностью, является *нерациональное использование водных ресурсов*. Интенсивность данного фактора нами оценивалась как максимальная – 3 балла. Связано это с тем, что в последние десятилетия на фоне роста сельскохозяйственного производства и промышленности в бассейне Или возрос забор воды для орошения полей, снабжения предприятий и городов. Суть проблемы данного фактора в том, что увеличение ирригационных систем в среднем и нижнем течении реки приводит к значительным потерям воды (особенно при неэффективном поливе, отсутствии современных технологий орошения). Промышленные предприятия (горнорудные, металлургические и др.) используют большие объёмы пресной воды, часть которой возвращается в виде недоочищенных стоков, ухудшая её качество. И в результате сокращается общий объём стока в

озеро Балхаш, что приводит к понижению уровня воды и изменению солёности (особенно в восточной части озера, более солёной по природе).

Дополнительную нагрузку создаёт *сельскохозяйственная деятельность***,** которая влияет на гидрологию и биоразнообразие, но не оказывает влияния на гидрохимию озера. Интенсивность данного фактора нами оценилась как средняя – 2 балла. По данным региональных исследований (например, в Алматинской области), при интенсивном использовании минеральных удобрений (азотных, фосфорных) их смыв с полей может достигать 20–30 кг/га в год. Концентрации азотистых и фосфатных соединений (особенно в период паводков, когда осуществляется массовый смыв удобрений) в воде реки Или и прибрежных районах озера Балхаш периодически превышают ПДК (предельно допустимые концентрации) в 1,5–2 раза и более. Накопление биогенных элементов (азота, фосфора) в водоёме стимулирует эвтрофикацию, «цветение» воды и ухудшение кислородного режима, что негативно сказывается на рыбных запасах и общем состоянии экосистемы. Из-за увеличения ирригационных заборов и климатических колебаний среднегодовое поступление воды из Или в Балхаш (ранее оценивавшееся в 12–13 куб. км в год) в некоторые периоды снижалось до 7–8 куб. км.

Сокращение притока пресной воды в западную часть озера ведёт к усилению солёности в восточной части и, как следствие, к расслаиванию водных масс, изменению состава ихтиофауны и рискам для рыбного хозяйства.

Мусор и твердые бытовые отходы занимает одно из наименее значимых мест в ряду перечисленных техногенных факторов, так как оно оказывает незначительное влияние на биоразнообразие и гидрохимию озера Балкаш. Интенсивность данного фактора нами оценивалась как минимальная – 1 балл. По данным экологических рейдов (например, регионального управления по охране окружающей среды Карагандинской области) в отдельные годы на расстоянии до 5 – 10 км от побережья озера фиксировали от 30 до 50 несанкционированных свалок, куда вывозился как строительный, так и бытовой мусор. [14] Общий объём мусора на таких незаконных свалках может достигать 2 – 3 тыс. м³ (по совокупности) только в пределах городской зоны и ближайших пригородах. Оттуда часть отходов (особенно пластик, полиэтилен, мелкий мусор) разносится ветром и водой в непосредственную акваторию озера. Город Балкаш (население около 75 тыс. человек) ежегодно генерирует примерно 25 – 30 тыс. тонн твёрдых бытовых отходов. [15] Официально существует один или два централизованных полигона, однако их инфраструктура и оснащение (система гидроизоляции, сортировки, переработки) зачастую не соответствуют современным экологическим нормам. В периоды пиковой нагрузки (например, во время ремонтов, строительства, сезонного скопления туристов) часть мусора оказывается в неорганизованных местах сброса, включая прибрежную зону. В летний сезон (июль–август) на пляжах и базах отдыха озера Балкаш регистрируется до 50 – 70% увеличения объёмов бытового мусора (пластиковые бутылки, упаковки, одноразовая посуда и т.д.) по сравнению с некурортными месяцами. Согласно одному из отчётов местных экологических объединений, ежегодно на популярных береговых участках (в пределах 15 – 20 км от города Балкаш) после окончания сезона отдыхов остаётся до 1,5 – 2 тыс. мешков смешанного мусора (примерно 15 – 20 тонн), который не всегда своевременно вывозится. Нередко встречаются очаговые скопления мусора (по 0,5 – 1 м³) в труднодоступных зонах (скальные берега, мелководья), где уборка осложнена отсутствием инфраструктуры.

Очень сильно влияя на биоразнообразие озера Балкаш*, рыболовство* занимает одно из наименее значимых мест в ряду перечисленных техногенных факторов, имеет минимальное значение на гидрохимию и гидрологию озера. Интенсивность данного фактора нами оценивалась как средняя – 2 балла. Исторически, что озеро Балкаш было одним из ключевых рыбопромысловых водоёмов в Казахстане. Суммарный промысловый улов в лучшие годы мог достигать 15 – 20 тыс. тонн рыбы в год. В последние десятилетия официальные данные по вылову колеблются в диапазоне от 5 до 10 тыс. тонн в год (цифры сильно зависят от состояния ихтиофауны, квот и контроля). Однако эксперты предполагают, что реальные объёмы, с учётом браконьерского вылова, могут быть на 20 – 30% выше официальных показателей. Сазан (карп), лещ, судак — традиционно считаются наиболее ценными промысловыми видами озера Балкаш. Также вылавливают сом, окунь, некоторые представители эндемичных и интродуцированных видов (например, маринка, карп зеркальный и др.). В связи с изменением солёности и уровней воды в разных частях Балкаша, наблюдается перераспределение отдельных видов и периодический спад численности отдельных популяций.

Ещё один фактор, часто недооцениваемый, — *туристическая нагрузка***.** *Она* занимает одно из наименее значимое место в ряду техногенных факторов, так как туристическая нагрузка не так сильно влияет на гидрологию и биоразнообразие, как на гидрохимию озера. Интенсивность данного фактора нами оценивалась как средняя – 2 балла. По разным оценкам (от местных акиматов и туроператоров),

в наиболее активные сезоны в курортной зоне озера Балкаш (город Балкаш, Приозёрск, многочисленные базы отдыха на южном и северном побережье) может отдыхать до 200 – 300 тыс. человек за летний период. Сильная сезонная концентрация туристов создаёт значительную нагрузку на экологию за короткий промежуток времени. В местах массового отдыха (пляжи, туристические базы) не всегда хватает баков для мусора, своевременных вывозов ТБО. Часть туристов оставляет отходы в прибрежных зонах или выбрасывает в ближайшие кустарники. В прибрежных территориях озера Балкаш ежегодно фиксируются десятки несанкционированных свалок, где объёмы мусора могут исчисляться десятками кубометров**.** Пластик и другой мусор постепенно попадает в воду (ветром или при подъёме уровня), ухудшая качество воды и представляя опасность для водных обитателей. Во многих местах отдыха отсутствуют централизованные очистные сооружения или они устарели. При большом числе отдыхающих нередко происходит сброс неполностью очищенных или даже неочищенных сточных вод прямо в прибрежные зоны. В частном секторе, на дачах, часто используют септики или выгребные ямы без необходимой герметизации. При переполнении эти стоки просачиваются в грунтовые воды, которые могут выходить в озеро. При массовых посещениях часто страдают пляжи и прилегающая растительность, ведь люди вытаптывают траву, кустарники, нарушают прибрежные места гнездования птиц. Возведение дополнительных туристических объектов (домики, кафе) в водоохранной зоне порой происходит с нарушением экологических норм, что приводит к берегоукрепительным работам без должного проекта и, как следствие, к эрозии берегов или засыпке участков водоёма. Постоянные шумы от моторной техники могут негативно влиять на поведение рыб и других водных организмов, а также на птиц, гнездящихся рядом.

Не менее важным фактором, во многом связанным с антропогенной деятельностью, является *климатическое изменение.* Интенсивность данного фактора нами оценивалась как максимальная – 3 балла, так как основная причина современных климатических изменений — нарастающая концентрация парниковых газов (CO_2, CH_4, N_2O и др.) в атмосфере вследствие сжигания ископаемого топлива (промышленность, транспорт, энергетика), вырубки лесов и других видов хозяйственной деятельности. Главным притоком озера Балхаш является река Или, питающаяся водой горных ледников и снежников Заилийского Алатау и Центрального Тянь-Шаня. Из-за потепления ледники тают быстрее, причём при продолжительном антропогенном потеплении уменьшается и их общий объём, и сезонный запас снега. [16] В долгосрочной перспективе это ведёт к снижению годового стока в реке Или и, соответственно, к обмелению озера Балкаш. Также, повышение температуры воздуха в Прибалхашье увеличивает скорость испарения воды с поверхности озера. При стабильном или даже сокращающемся притоке воды это дополнительно снижает уровень озера и ускоряет процесс его обмеления. Антропогенные изменения климата, накладываясь на местные источники загрязнения и высокий забор воды, способны привести к необратимым последствиям: значительной деградации экосистемы озера, сокращению биоразнообразия и ухудшению качества жизни в регионе. Понимание климатических изменений именно как техногенного фактора подчёркивает, что решение проблемы требует не только природоохранных мер на местном уровне, но и сокращения выбросов парниковых газов, использования водосберегающих технологий, рационального управления водными ресурсами и международной кооперации (особенно с учётом трансграничного бассейна реки Или.

Из таблицы 2 видно, что в исследуемом случае взвешенная сумма всех техногенных факторов составила 144 балла. Если при наименее безопасном воздействии этих факторов сумма баллов равна 58, а при наиболее интенсивном их воздействии 174 балла, то в настоящее время суммарное действие техногенных факторов составляет 248% по отношению к безопасному влиянию антропогенных источников и 83% по отношению к наибольшему негативному воздействию факторов. Таким образом, степень антропогенного влияния уже почти в 2,5 раза превысила безопасную техногенную нагрузку и осталось только около 20% интенсивности действия до критических уровней.

Такая систематизация помогает расставить приоритеты при выработке природоохранных и управленческих мер, направленных на сохранение и восстановление экосистемы озера Балкаш.

Вместе с тем потенциальные возможности по сохранению озера Балкаш и улучшению его экологического состояния всё ещё велики. Системный подход, сочетающий научно обоснованные методы управления ресурсами и активное участие местных сообществ, позволит минимизировать последствия антропогенного воздействия и обеспечить дальнейшее устойчивое развитие региона.

Заключение

В результате проведённого исследования по оценке влияния антропогенных факторов на озеро Балхаш можно сделать обобщающий вывод, позволяющий более полно представить масштабы и характер негативных изменений в экосистеме озера, где нами выявлено, что современная антропогенная нагрузка на озера Балкаш превышает безопасную нагрузку почти в 2,5 раза. Также нами отмечено, что

современная антропогенная нагрузка на экосистему не достигла полной интенсивности действия до критических уровней. Стоит выделить перспективы снижения антропогенной нагрузки и сохранения уникальной природы региона. Модернизация промышленного оборудования, строительство новых и реконструкция старых очистных сооружений, а также создание особо охраняемых природных территорий могут способствать частичной стабилизации ряда показателей качества воды и биологической продуктивности. Тем не менее, для значимого улучшения экологической обстановки необходим системный подход, включающий дальнейшее совершенствование правовой базы, расширение программ экопросвещения, привлечение инвестиций в экологически ориентированные проекты и развитие международного сотрудничества (учитывая трансграничный характер водных ресурсов региона). Применение комплексного подхода к управлению экосистемой озера Балкаш и систематическому контролю антропогенной нагрузки позволит обеспечить сохранение уникального водоёма и его природного богатства для будущих поколений, а также будет способствовать повышению устойчивости экономики и социального благополучия местного населения.

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ECOGEOMORPHOLOGICAL ASSESSMENT OF THE NAKHCHIVAN AUTONOMOUS REPUBLIC BASED ON MORPHOMETRIC INDICATORS

Giyas H. Gurbanov
PhD Candidate at the Nakhchivan Division of the National Academy of Sciences of Azerbaijan

Abstract

The Nakhchivan Autonomous Republic is distinguished by its unique orographic structure, containing various mountainous and plain areas. Hipsometric analyses show that a significant portion of the region lies within high mountainous zones. The relief of this area affects the development of slope processes, leading to natural destructive events such as floods, landslides, and erosion. These natural processes alter the landscape complexes and structure of the region, accelerating anthropogenic processes. The study notes that the landscape-ecological potential of mountainous geosystems in the Nakhchivan Autonomous Republic is low. To prevent natural disasters and enhance security, the ecogeomorphological stress levels of the region were determined. For this purpose, morphometric analysis and the Weighted Overlay Method (WOM) were applied to analyze various relief parameters, and based on the results, stress maps were created. The area was divided into regions with low, moderate, medium, and high stress levels. Low-stress areas mainly consist of plains and areas with minimal erosion. Moderate-stress areas are characterized by accumulation processes and alluvial plains. Medium-stress areas are located in foothill regions and some intermountain depressions. High-stress areas mainly include mountainous zones where physical weathering and gravitational processes occur most frequently.

Keywords: natural destructive processes, horizontal fragmentation, vertical fragmentation, slope, visibility, Weighted Overlay Method.

Introduction. The Nakhchivan Autonomous Republic, situated at the border of three major orographic zones (the Caucasus, Erzurum-Kars, and Iran mountain plateaus), forms a unique orographic structure and morphostructural plan. Looking at hipsometric maps, the absence of green color in the maps immediately catches attention. The lowest area in the Araz River valley—Kotam railway station—is situated at an elevation of no less than 600 meters above sea level. In many cases, plains are found not only at altitudes of 600-800 meters but also at heights of 1000 meters and, in some instances, at 1200 meters, occupying a considerable area.

The plain area constitutes 47.73% of the total area of the autonomous republic (up to 1200 meters). The remaining 52.27% belongs to mountainous regions. The average relief elevation is 1450 meters, which is approximately 2.2 times higher than the average elevation of Azerbaijan (657 meters) [1; 2]. The contrasting orographic and hipsometric conditions have a significant impact on the development of slope processes.

A comparative analysis method of the scientific innovations from the literature and our own field studies reveals that the landscape-ecological potential of the mountainous geosystems in the Nakhchivan Autonomous Republic is at a very low level. The primary reason for this is the occurrence of intense recurring natural destructive slope processes, such as floods, landslides, rockfalls, and erosion. As a result of unplanned human intervention in nature, the natural landscape complexes and natural-landscape structures of the region have turned into regenerated landscapes, accelerating the anthropogenization of the natural landscapes. Preventing such situations requires zoning based on their degree of danger, making possible predictions, and developing effective methods for combating these processes, which are highly relevant and await solutions.

Research Object. The Nakhchivan Autonomous Republic, an integral part of Azerbaijan, has an exclave geographic location, situated between 38°51'-39°47' North latitude and 44°46'-46°10' East longitude. To the north and northeast, it borders Armenia, to the south and southwest, it borders the Islamic Republic of Iran, and at a short distance, it shares a border with Turkey.

Methodology. Various methods for creating ecogeomorphological maps are available in the literature, each with its strengths and weaknesses. Statistical methods, such as the Weighted Overlay Method (WOM), are widely used to analyze the relationship between natural destructive slope processes and their influencing factors, providing a quantitative approach to risk assessment. To determine the ecogeomorphological conditions of the area, morphometric analysis was carried out on key relief parameters (vertical fragmentation, horizontal fragmentation density, surface slope, and visibility), and corresponding maps reflecting these parameters were created based on relevant studies. Based on the complex analysis of the morphometric maps, an ecogeomorphological stress map was developed for the area.

Level of Research on the Problem. Currently, morphometry and morphometric analysis are recognized as indispensable methods in geomorphology. Therefore, like scientists around the world, Azerbaijani geographers have shown significant interest in the field of morphometry. In particular, recent doctoral dissertation works by M.M.Mehbalıyev and S.A.Tarixazar have contributed to the development of both the application and theoretical aspects of morphometry, furthering the deepening of this field both domestically and internationally [3; 6].

In their works, V.A.Quluzada, R.S.Abdullayev (2014), X.A.Tanrıverdiyev, A.S.Safarov (2014), and others have approached the subject under investigation from this perspective. As a result, the findings from research conducted in previous years have been analyzed [4; 5].

Research Aim and Objectives. The aim of the study is to search for ways to mitigate the destructive impacts of natural disasters that create extreme situations in human life, which is one of the most complex and significant tasks of societal development in the modern era. To achieve this, various morphometric indicators were determined, and the areas were grouped according to their ecogeomorphological stress levels.

Results and Discussion. When grouping by ecogeomorphological stress levels, maps were first created for each of the four selected parameters individually (map). The selected parameters were obtained from the 30 m spatial resolution SRTM DEM (Shuttle Radar Topography Mission Digital Elevation Model). Subsequently, using the Weighted Overlay Method (WOM), the process of weighted assessment was carried out by overlaying several raster layers [7; 8].

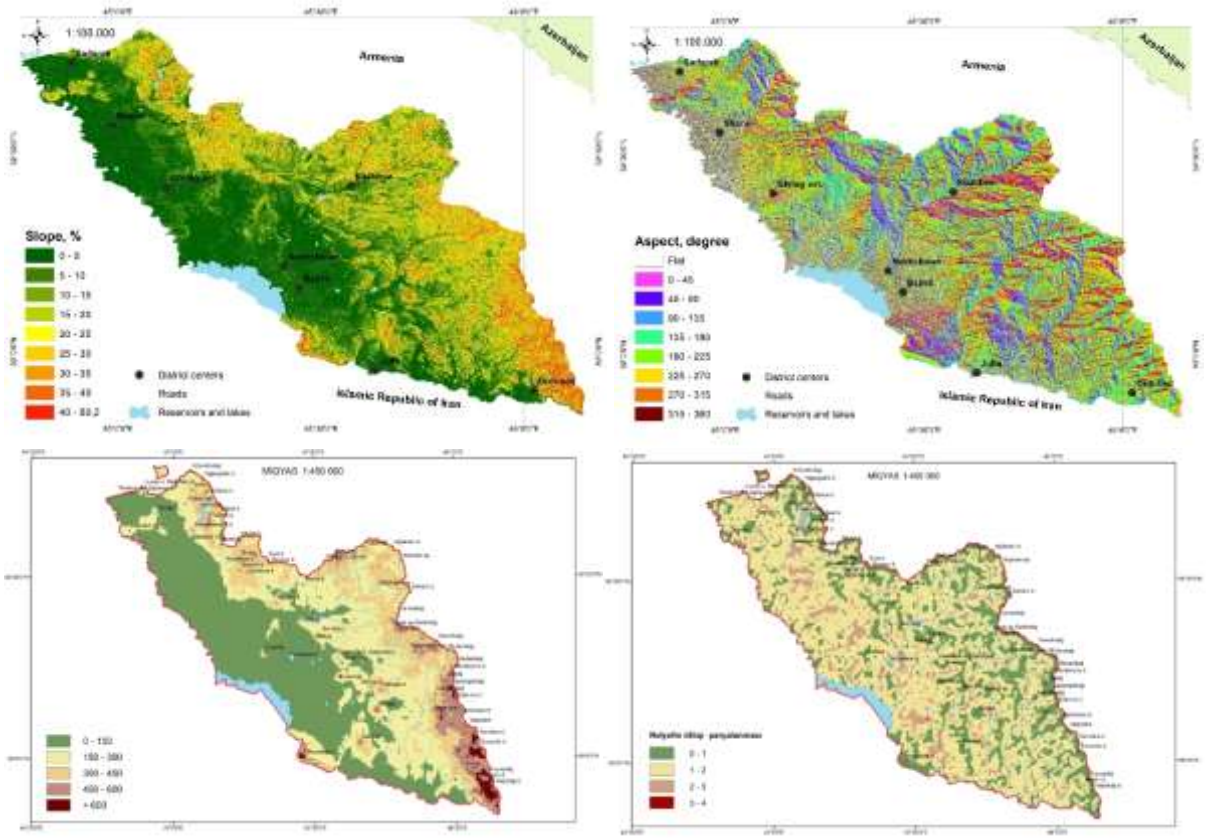

Figure 1. a) slope, b) asbect, c) vertical fragmentation, d) horizontal fragmentation

Figure 2. Ecogeomorphological Stress Levels of the Nakhchivan Autonomous Republic

Table 1.

Distribution of Ecogeomorphological Stress Levels by Area and Percentage Ratio

	Stress Levels	Area	
			%
1	Low Stress	km²	5,3
2	Moderate Stress	291,3	57,1
3	Medium Stress	3143,4	35,4
4	High Stress	1949,7	2,2
Total		5503	100

The low-stress areas, excluding anticlinal uplifts, cover the flat sections of the Araz Valley, where erosion is weak, and accumulation processes are intensively developed. The areas with moderate stress mainly consist of foothill sections of alluvial-proluvial plains affected by tectonic uplift, some intermountain depressions (such as Tirkeş, Nahacir, Şurut, Qaradara, etc.), large parts of ancient river valleys, and alluvial fans and interfan areas formed by small rivers, including the Alincaçay, Qaradaraçay, Gilançay, Vanandçay, Aylisçay, Ordubadçay, and others that flow from the southwest slope of the Zangezur mountain range into the Araz River. These areas are characterized by dry river valleys, ravine-gulley networks, deluvial fans, debris cones of flash floods, and various-sized sediment materials. The medium-stress areas are located in the southern-western slopes of the Zangezur mountain range, including the middle and low mountain areas, the Duzdağ and Qıvraq plateaus, and the Dahna and Validağ heights. These regions are fragmented by gully and underground erosion, and due to their relatively soft relief, they differ from high-stress areas.

The high-stress areas are located in the more geodynamically active regions, where physical weathering, gravitational processes, and intense gully erosion dominate. These include the high mountain zones of the Zangezur mountain range, the areas to the north and east of Ordubad city, and the upper sections of Vanandçay, Gilançay, Alincaçay, and Nakhchivanchay. Areas that form a line connecting the villages of Dırnıs-Parağaçay-Boyahmad-Arafsa-Keçili-Kolanı, as well as the upper parts of the Küküçay, Cahriçay, and Qabaxlıçay basins in the Daralayaz range, as well as the areas located above the Arpaçay reservoir, with high surface slope and complex relief, are identified as high ecogeomorphological stress areas.

It is worth noting that the results of this study are of significant importance for determining ways to increase resilience to natural disasters and ensure safety in the Nakhchivan Autonomous Republic. In addition, it can create a solid theoretical foundation for future scientific research in this field.

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Historical sciences

AZERBAIJAN-TURKEY CULTURAL RELATIONS (1991-2001)

Gadir Akbarov
Nakhchivan State University. Faculty of History and Philology, Department of History of Azerbaijan Republic of Azerbaijan, Nakhchivan
ORCID ID 0009-0005-8693-9338

Abstract

After regaining its independence, the Republic of Azerbaijan continued its relations with the Republic of Turkey in the socio-economic, political and cultural fields. Relations between Azerbaijan and Turkey are based on mutual trust. After regaining its independence in 1991, relations with the brotherly Republic of Turkey were brought to the highest level. Thus, Turkey was the first state to recognize Azerbaijan as an independent state. Diplomatic relations were established between Turkey and Azerbaijan in January 1992. During the years of leadership of the national leader of the Azerbaijani people Heydar Aliyev to the Supreme Assembly in Nakhchivan, economic and cultural relations with Turkey were given great importance, and mutual cooperation in the field of education was given special attention. Heydar Aliyev, who was on a visit to the Republic of Turkey on March 22-24, 1992, added the issue of 100 young people studying in Turkey to the cooperation protocol he signed with the brotherly country. According to the signed protocol, 100 young people from Nakhchivan were to be sent to study in Turkey every year. The agreement signed between the ministries of culture of Turkey and Azerbaijan in December 1992 opened up wider opportunities for cooperation in the field of culture. The first official visit of the President of the Republic of Azerbaijan Heydar Aliyev to Turkey, which lasted from February 8 to 11, 1994, gave a new impetus to the development of bilateral relations. After the negotiations in Ankara, a protocol on cooperation and mutual assistance was signed between the Republic of Azerbaijan and the Republic of Turkey on February 9. Also, an agreement on cooperation in scientific, technical, cultural and economic fields, an agreement on the development of friendship and comprehensive cooperation was signed. An agreement on political consultations, an agreement on mutual promotion and protection of investments and other important documents were signed between the two countries. When we pay attention to issues related to education against the background of cultural relations, we see that in 1991-1995, the number of Azerbaijani students studying in the Republic of Turkey was 1871, and the number of Turkish students studying in Azerbaijan was 2500. According to statistical data from the 1997-1998 academic year; Azerbaijani students studied in different specialties at universities such as Ankara, Gazi, Istanbul, Marmara, Ege, Dokkuz Eylül, Selçuk, Uludağ and Ondokkuz May.

PERSPECTIVES OF PUBLIC-POLITICAL RELATIONS IN NAKHCHİVAN-TURKEY (1991-2001 years)

Rahimov Rafig Vilayat oglu
PhD in History,
Nakhchivan State University

NAXÇIVAN –TÜRKİYƏ İCTİMAİ-SİYASİ ƏLAQƏLƏRİN PERPEKTİVLƏRİ (1991-2001-ci illər)

Rəhimov Rafiq Vilayət oğlu
Tarix üzrə fəlsəfə doktoru,
Naxçıvan Dövlət Universiteti

Abstract

Relations between Turkey and Azerbaijan, whether in political, economic or other areas, are built on ancient historical foundations. The policy organized on these historical foundations is still showing itself with a rising line today, and at the same time, the relations between the two states are being organized at a level that will be an example for other states and peoples. Our historical ties are seen as the main reference point for the joint policies pursued by our states today. At the beginning of the 20th century, especially during the establishment of the Republic of Azerbaijan, the friendly and brotherly Ottoman Empire extended its brotherly hand in the difficulties it faced and the invaluable assistance it provided to the establishment of the first democratic state in the East has been engraved in golden letters in all Turkish history.

As you know, the words of the great Turkish leader Mustafa Kemal Ataturk "Azerbaijan's joy is our joy, its sorrow is our sorrow" and the ideas of the great statesman and national leader Heydar Aliyev "one nation, two states" have always played the role of a bridge between the two states.

Xülasə

Türkiyə və Azərbaycan arasında istər siyasi, istər iqtisadi istərsə də digər sahələrdə əlaqələr qədim tarixi dayaqlar üzərində qurulmuşdur. Bu tarixi dayaqlar üzərində təşkil olunmuş siyasət günümüzdə də yüksələn xətt ilə özünü göstərməkdədir və bununla yanaşı iki dövlət arasında olan əlaqələr digər dövlətlərə, xalqlara örnək olacaq səviyyədə təşkil olunmaqdadır. Tarixi bağlılıqlarımız bu gün dövlətlərimizin yürütdüyü birgə siyasətlərin əsas istinad nöqtəsi kimi görülür. XX əsrin əvvəllərində xüsusi ilə Azərbaycan Cümhuriyyətinin yarandığı dövrdə qarşılaşdığı çətinliklərdə dost, qardaş Osmanlı imperiyasının öz qardaş əlini uzadaraq, Şərqdə ilk demokratik dövlətin yaranmasına verdiyi əvəssiz yardım bütün Türk tarixinə qızıl hərflərlə həkk olunmuşdur.

Bildiyiniz kimi, Türkiyənin böyük lideri Mustafa Kamal Atatürkün "Azərbaycanın sevinci sevincimizdir, kədəri kədərimizdir" kəlamı, böyük dövlət xadimi ümmilli lider Heydər Əliyevin "bir millət, iki dövlət" fikirləri hər zaman iki dövlət arasında körpü rolunu oynamışdı.

Keywords: leader, empire, independence, strategic cooperation, privileges**.**
Açar sözlər: lider, imperiya, imtiyazlar, strateji əməkdaşlıq, müstəqillik.

When Azerbaijan gained independence in 1991, the first state to recognize it was Turkey. Since then, economic, cultural, political, and trade relations between Turkey and Azerbaijan have developed at a high level. Turkey opened a consulate in Azerbaijan on May 25, 1991, and an embassy on January 14, 1992. The Azerbaijani embassy in Ankara began operating on November 2, 1992.

In addition, Azerbaijan was of great importance for Turkey's Caucasian policy. The blood ties between them and rich energy resources, as well as its integration into the international system, are of particular importance for Turkey. The study of Azerbaijani-Turkish diplomatic and political relations highlights the necessity of building mutual relations between the two peoples on common historical and national-spiritual foundations. When discussing the qualitative changes in relations after Azerbaijan gained independence, it is first necessary to clarify the general picture of the events caused by historical and socio-political conditions. Strengthening and further expanding relations with Turkey, a reliable strategic partner of Azerbaijan in the modern era, is a very important component of the foreign policy of the Azerbaijani state. Let us also emphasize that Nakhchivan is of the most important strategic importance in Turkey-Azerbaijan relations [1].

Turkey became the first country to recognize the Republic of Azerbaijan, which adopted the act of independence on October 18, 1991, less than a month later, on November 9. Diplomatic relations between Turkey and Azerbaijan officially began on January 14, 1992. From the moment it declared its independence, Azerbaijan turned its attention to Turkey and began to work with increasing speed year by year to elevate its relations to the level of strategic cooperation. It is worth noting that the representation of the "Turkish Oil" company in the consortium of foreign oil companies of the "Contract of the Century" signed on September 20, 1994 was a major step taken by the Great Leader Heydar Aliyev, who had a special geostrategic mindset, to achieve long-term goals between Turkey and Azerbaijan.

This process, which began with the "Contract of the Century", has become a fact and this fact is becoming stronger every year before our eyes. The confirmation of this fact is not only related to economic and social factors, but also to the correct assessment of the geopolitical situation in the Caspian basin and the South Caucasus by the Great Leader Heydar Aliyev after the collapse of the USSR. Azerbaijan, which gained its new independence, felt the need for Turkey's support and assistance in order to overcome the difficulties it would face as a young country. After Azerbaijan gained its independence, favorable opportunities, privileges and, more importantly, demands arising from the same desires and aspirations of the peoples emerged for the multifaceted development of Azerbaijan-Turkey relations [2].

The great friendship and brotherhood between the two personalities - Heydar Aliyev and Suleyman Demirel - played an important role in the establishment and development of our country's relations with Turkey during Heydar Aliyev's political activities during the Nakhchivan period. Even for many years, Heydar Aliyev's sweet address "Friend, my brother Suleyman Demirel" was memorized in people's tongues and sounded like a feeling of love and trust [5].

With the opening of the Sadarak-Dilucu bridge on May 28, 1992, relations between the two republics further developed and the economic blockade was broken. A delegation of Turkish ministers, officials and intellectuals, headed by Turkish Prime Minister Suleyman Demirel, arrived in Nakhchivan to participate in the official opening of the Sadarak-Dilucu bridge. Speaking at the opening ceremony of the bridge, the national leader said: "We have lived as friends and brothers on both sides of the Araz River. However, for 70 years, we have longed to meet each other and maintain contact. For 70 years, we have waited for this day with great longing. Now, these dreams and wishes of ours have come true. A huge bridge has been built connecting Nakhchivan, Azerbaijan and Turkey." [6].

By a decision dated July 9, 1992, this bridge was declared the official border crossing between the Republic of Turkey and the Nakhchivan Autonomous Republic of the Republic of Azerbaijan. In a short time, 63 megawatts of electricity was transmitted to Nakhchivan, which was connected to the Turkish electricity grid via the Iğdır-Nakhchivan power line. Even today, those who talk about the level of Turkey-Azerbaijan and Nakhchivan relations and the importance of the work done to realize the ideas of unity and integrity of the Turkic world attach special importance to the Sadarak-Dilucu bridge.

The negotiations and signed documents during Heydar Aliyev's subsequent visits to Turkey gave impetus to the development of Nakhchivan-Turkish relations and played an indispensable role in solving the socio-economic problems of the autonomous republic. The Nakhchivan period of Heydar Aliyev's political activity shows that he attached special importance not only to establishing relations with Turkey, but also to solving the problems of the Turkic world [9].

Time shows that the special place of Nakhchivan in Turkey-Azerbaijan relations and the solidarity of the Turkic world is one of the important facts of our recent history. The visits of Turkish prime ministers to Nakhchivan in 2008 and 2017, and the arrival of the Turkish President to Nakhchivan in 2009 to participate in the 9th Summit of Heads of State of Turkic-Speaking Countries are an expression of the importance that the brotherly country attaches to this ancient land. In 1991-1993, under the leadership of Heydar Aliyev, a foreign policy course based on national interests and taking into account political perspectives was determined in the Nakhchivan Autonomous Republic, and mutual relations were established with neighboring states and international organizations. Successful foreign policy served to recognize Nakhchivan, increase its international reputation as a reliable partner. Thanks to the decisive steps taken by Heydar Aliyev, the active position of our diplomacy was formed, and the inviolability of the borders of Nakhchivan was reflected in international legal normative documents. In other words, the national leader Heydar Aliyev had invaluable historical services for the comprehensive development of Turkish-Azerbaijani relations and the recognition of Nakhchivan in the international community [7].

CONCLUSION

Turkey has always kept its Caucasus policy in the spotlight and has tried to actively intervene in the processes taking place in the region. Currently, Azerbaijan is Turkey's largest ally and economic partner in the

Caucasus. Azerbaijan plays an important role in Turkey's relations with other states in the Caucasus, as well as in Central Asia and the Caspian region, especially with Turkic-speaking states. The expansion of continuous cooperation between Azerbaijan and Turkey in the field of transporting Caspian energy resources to world markets is a prerequisite for ensuring the political, economic and strategic interests of both states in the region.

At all times, Turkish-Azerbaijani relations have played a very important role for both the two countries and the region. Today, there are strategic partnership relations between our countries and our relations are developing successfully in all areas. For this reason, the head of state of Azerbaijan, Ilham Aliyev, has stated that no initiative, no project can be implemented in the region without Turkish-Azerbaijani cooperation and collaboration. At the same time, Turkey and Azerbaijan are active and key participants in the regional cooperation process. Both states effectively use their economic and energy opportunities, as well as their geopolitical position, to expand bilateral and regional cooperation. Today, oil and gas pipelines, which play a leading role in determining the long-term development strategy of the region and are very important elements of relations between the two countries, have significantly increased the prestige of our states not only in the region, but also throughout the world.

These projects provide a great guarantee for the energy security of Azerbaijan, Turkey, as well as other countries. At the same time, the expanding cooperation and strategic partnership between the two states has become an indicator of stability in the region. Thanks to the further development by the head of state Ilham Aliyev of the consistent and purposeful line aimed at developing relations with Turkey in the foreign policy course of the national leader Heydar Aliyev, further deepening of the strategic partnership of our countries has been achieved.

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Journalism

THE INTERSECTION OF MEDIA AND ARTIFICIAL INTELLIGENCE

Shahla Shiraliyeva
Doc. Dr., Nakhchivan State University, Faculty of History and Philology, Journalism and Literature of Foreign Countries Department, Nakhchivan
ORCID NO: 0000-0002-4197-064X

Abstract

The integration of Artificial Intelligence (AI) into the media industry has led to transformative changes in content creation, distribution, and consumption. From AI-driven journalism to personalized content recommendations, AI technologies are reshaping media production and business models. This article explores the multifaceted role of AI in the media landscape, identifying key opportunities, challenges, and ethical concerns, and discusses the implications for media organizations, journalists, and audiences in an AI-driven future.

Keywords: Artificial Intelligence, Media Industry, AI Journalism, Ethics in AI, Media Consumption, Algorithmic Journalism, Media Transformation

RESUME

This article investigates the impact of Artificial Intelligence (AI) on the media industry, focusing on content creation, distribution, personalization, and ethical considerations. The rapid adoption of AI technologies has led to automated journalism, personalized content, and data-driven decision-making in media organizations. While AI promises significant efficiency improvements, it also introduces challenges such as algorithmic bias, loss of human touch in journalism, and potential ethical concerns related to privacy and misinformation.

- AI is increasingly integrated into media, aiding in content production, data analytics, and user engagement.
- AI-driven systems automate routine tasks such as writing earnings reports, sports summaries, and election results, allowing journalists to focus on more in-depth stories.
- Media organizations, particularly in entertainment, leverage AI for personalized recommendations that cater to individual user preferences.
- Despite the benefits, AI introduces ethical issues like bias, privacy concerns, and the need for accountability in automated processes.

Introduction to Media and Artificial Intelligence

We now live in a world where artificial intelligence (AI) is no longer confined to the realm of science fiction. Computers that can think rationally, think like humans, imbibe human knowledge, and exhibit human-like capabilities such as vision, speech, and language have now become a reality. From research laboratories to society at large, computers are becoming increasingly sophisticated in mimicking our cognitive capabilities, and AI innovations are being diffused into our daily lives. Of the many applications that AI enables, those that bring about advances in media are particularly interesting because media has been playing a crucial role in shaping, framing, and controlling human knowledge, perceptions, beliefs, attitudes, and behaviors. In the digital media age, a critical mass of information and knowledge is generated, diffused, and consumed on an unprecedented scale. With its low cost and high efficiency, online media amplifies the impact of social media-incited disasters, crises, and political chaos. In an age when fake news and misinformation are flooding cyberspace, public trust in media is eroding. At the same time, new forms of media including virtual and augmented reality, enhanced visual effects, and synthetic characters are emerging as conduits of novel storytelling and entertainment experiences. Amidst these trends, there is an increasing trend of automated journalism and data-driven content creation. In this vein, we are generally interested in addressing the implications, questions, and impact of the intersection of media and AI.

Artificial Intelligence (AI) is revolutionizing the media industry, influencing how content is produced, distributed, and consumed. AI technologies, including natural language processing (NLP), machine learning (ML), and computer vision, are enhancing various aspects of media operations. These advancements have transformed newsrooms, social media platforms, and content production processes. As media industries adapt

to this technological shift, questions arise about balancing technological progress, creativity, and ethical responsibility.

Example: The Associated Press (AP) has been using AI to automatically generate earnings reports since 2015, freeing up journalists to focus on more complex stories (Baker, 2015). This case illustrates how AI can enhance operational efficiency but also presents challenges regarding editorial control and the loss of nuanced human analysis.

Definition and Scope of Media and Artificial Intelligence

"Wisdom and resources can only be brought into being, not assembled. They are brought into being by the natural urges within people. Bringing something into discourse, thinking about it, continually results in the emergence of new urges and new resources."

This book is concerned with the intersection of two powerful forces—media and artificial intelligence (AI). Both are at a stage in their development where their impact is profound, but their relationship is so far developed neither by proponents of media nor AI; neither group fully understands the potential existing in the nexus of the two—nor do they understand the manner in which they will shape one another. The goal of this book is to provide a framework for the inquiry and analysis of the intersection of media and AI. In doing so, we promise that it will be readily accessible to scholars who are new to the subjects.

Media and AI are inherently interrelated; this book establishes the origins of these developments and their potential implications. The book itself is the first of its kind in providing an in-depth, analytical perspective on media and AI, and features a diversified perspective in understanding the relationship and impact between the two technologies. It outlines the various intersections between media and AI, and explores and refines questions relating to the intersection of media and AI. Alongside outlining the trend of the collaboration, the book provides an updated nutshell of the state of respective fields in today's fast-developing era, canvassing the range of media forms including information, culture, entertainment, sports, advertising, and the arts, to discuss the overarching strategies in harnessing these domains in AI technology.

Methodology

This study employs a **qualitative research approach** to analyze the integration of AI in the media industry. A combination of **literature review**, **case studies**, and **expert interviews** was utilized to gain insights into the current state and potential future of AI in media. The methodology consists of the following steps:

Literature Review: A comprehensive review of academic articles, industry reports, and case studies from 2015 to 2025 was conducted to examine how AI is being used in journalism, media consumption, and production.

Case Study Analysis: Key case studies from major media organizations (e.g., The Washington Post's use of Heliograph, Netflix’s recommendation system, Adobe’s AI tools) were analyzed to understand how AI is applied in real-world scenarios.

Expert Interviews: Interviews were conducted with media industry professionals, AI researchers, and ethicists to gather perspectives on the current challenges and ethical implications of AI in media.

AI in Content Creation and Journalism

AI's impact on content creation is evident in journalism. Algorithmic journalism has emerged due to AI systems capable of writing articles, automating fact-checking, and assisting in investigative reporting.

AI's ability to generate news reports was succinctly summarized by Ken Doctor in The New York Times (2016): “Artificial intelligence is increasingly part of the journalism world...”

The Washington Post utilizes an AI system called Heliograph to generate automated reports on high school sports events, local elections, and even the Olympics. The AI system produces short, factual articles based on structured data (Friedman, 2017).

However, these AI-generated articles raise questions about accountability. Who is responsible for potential errors in an AI-written article? Could AI be used to perpetuate biased reporting?

Ethical Implications of AI in Media

The integration of AI into media raises profound ethical issues. A central concern is algorithmic bias, which can manifest in biased news recommendations, stereotypical portrayals, or the amplification of harmful narratives.

A study by ProPublica in 2016 highlighted how a risk assessment algorithm used in U.S. courts to predict the likelihood of a defendant re-offending was found to be biased against Black defendants (Angwin et al., 2016). Similarly, AI-powered media platforms can inadvertently reinforce racial and gender biases by training on biased data.

As Kate Crawford, Senior Principal Researcher at Microsoft, stated: "AI systems inherit the biases of the data used to train them, and media is no exception" (Crawford, 2019).

Furthermore, AI's role in data privacy has raised alarms. Streaming services, social media, and news outlets collect vast amounts of personal data, including viewing habits, clicks, and location information. This data can be used to fine-tune recommendations but also exposes users to potential privacy violations and exploitation.

In 2018, the Cambridge Analytica scandal revealed how Facebook had used user data to influence political outcomes, highlighting the ethical risks involved in AI-driven media.

The analysis focused on the following key areas:

Automation in Journalism:

AI-powered journalism tools are increasingly being adopted by major media outlets. For instance, **The Associated Press** and **The Washington Post** use AI to generate routine content like earnings reports and sports summaries. This automation improves efficiency but also raises concerns regarding the loss of human nuance in journalism.

Heliograf by **The Washington Post** generates articles for specific events based on structured data. While this tool helps cover a large volume of stories, it limits the depth of reporting that requires human judgment and analysis.

Ethical Implications of AI:

AI's role in media raises ethical questions related to privacy, bias, and accountability. The algorithms that drive content personalization often rely on vast amounts of personal data, leading to concerns about user privacy.

The **Cambridge Analytica scandal** demonstrated the dangers of data misuse, raising alarms about how AI-driven systems can be manipulated for political purposes.

Additionally, algorithmic bias has been a significant concern. AI systems can inadvertently reinforce societal biases present in training data, leading to skewed or inaccurate content dissemination.

Challenges:

AI's use in journalism, while improving productivity, brings up ethical concerns. Automated systems must be held accountable for errors, particularly when it comes to reporting facts. The lack of human oversight in AI-generated content could lead to misinformation or biased narratives.

Additionally, the **data privacy** issue is crucial, particularly with the increasing volume of personal data collected by media platforms. The risk of data misuse, as seen in scandals like **Cambridge Analytica**, is ever-present.

Ethical Considerations:

As AI continues to influence media, ensuring ethical responsibility will be paramount. Media companies must prioritize **transparency** in their AI systems, addressing issues such as bias and accountability. Striking a balance between efficiency and ethical integrity will be key to maintaining the credibility and trust of the public.

In conclusion, the future of AI in media lies in responsibly harnessing its power while mitigating its ethical risks. As AI continues to evolve, ongoing dialogue among industry professionals, researchers, and ethicists will be necessary to navigate these challenges.

Conclusion

AI's impact on media is undeniable, from enhancing production workflows to delivering personalized content and driving business strategies. While AI technologies offer significant potential, they also present challenges related to ethics, bias, accountability, and privacy. It is essential for stakeholders—media organizations, technologists, and policymakers—to address these issues and ensure that AI technologies are deployed responsibly in the media landscape.

In the words of **Timnit Gebru**, a leading AI ethicist: "AI in the media can be transformative, but it must be guided by human values and ethical principles to ensure it serves society, not harms it" (Gebru, 2020).

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Pedagogical sciences

DISTANCE EDUCATION IN UKRAINE DURING WARTIME: CHALLENGES, SOLUTIONS, AND FUTURE DIRECTIONS

Sergii Galetskyi
PhD in Pedagogy, Associate Professor
The National University of Ostroh Academy

The modern world is constantly evolving, demanding flexibility and adaptability from young people, especially in the face of global challenges such as the COVID-19 pandemic, military conflicts, and rapid technological advancements. The full-scale Russian invasion of Ukraine, which began in February 2022, has posed significant challenges to all aspects of life, including education. Distance learning, which was previously used primarily during the COVID-19 pandemic, has become the primary means of ensuring the continuity of education during wartime.

The shift to distance learning during wartime was forced but no less critical for maintaining the educational process. According to the Ministry of Education and Science of Ukraine, by the end of 2022, over 70% of secondary education institutions had transitioned to distance or blended learning formats (Global Partnership for Education (GPE), 2023). However, this transition was accompanied by numerous challenges, such as the lack of stable internet access, technical resources, and psychological difficulties among students and teachers (Ministry of Education and Science of Ukraine, 2024; Ukrainian Center for Educational Quality Assessment, 2024).

One of the most significant challenges is the unequal access to technical resources. Many students, particularly in rural areas and frontline regions, lack stable internet or personal devices for learning. According to the Institute of Educational Analytics, approximately 40% of schools in rural areas do not have sufficient high-speed internet for effective distance learning (Global Partnership for Education (GPE), 2023).

The war has caused severe psychological trauma for both children and adults. Students experience fear, anxiety, and depression, which negatively impacts their ability to concentrate and absorb new material (Ministry of Education and Science of Ukraine, 2024; Ukrainian Center for Educational Quality Assessment, 2024). Teachers also face emotional burnout due to constant stress and the need to adapt to new working conditions (Kyiv International Institute of Sociology, 2023).

Modern education increasingly employs innovative teaching methods, such as micro-modules, gamification, and interactive approaches. Micro-modules allow students to study material in small portions, enhancing information retention and reducing cognitive load. Gamification, which involves the use of game mechanics in education, makes the learning process more engaging and motivating.

At the same time, digital literacy has become an integral part of modern education. Young people actively use digital technologies for learning, communication, and work organization. According to studies conducted in 2024, over 70% of students consider digital skills critically important for a successful career (Global Partnership for Education (GPE), 2023). Ukrainian educational platforms, such as Diia.Education, are actively developing digital literacy courses, enabling young people to master new technologies and tools (Ministry of Education and Science of Ukraine, 2025).

The development of social skills is also crucial. Young people are increasingly participating in volunteer initiatives, which not only allow them to help others but also develop important social skills. During the COVID-19 pandemic and the war in Ukraine, volunteer movements became a key element of societal support. For example, initiatives like the "United Volunteers Platform" have engaged thousands of young people in providing aid to those in need (Institute of Educational Analytics, 2024; Ukrainian Center for Educational Quality Assessment, 2024).

Digital technologies play a vital role in coordinating volunteer activities. Social networks, messengers, and specialized platforms enable the rapid organization of aid, fundraising, and information dissemination. For instance, during the war in Ukraine, the "Help the Army" platform raised millions of hryvnias for the Armed Forces thanks to the active participation of young people (Ukrainian Center for Educational Quality Assessment, 2024).

However, adapting to new conditions often comes with psychological challenges, such as stress, anxiety, and burnout. Young people are learning to cope with these challenges by developing emotional resilience. The future of youth adaptation to new conditions is closely tied to the further development of digital technologies and innovative teaching methods. Therefore, the Ministry of Education and Science of Ukraine is actively

working to ensure the continuity of the educational process. Specifically, the Diia.Education platform has been launched, providing access to educational materials and courses for students (Institute of Educational Analytics, 2024).

International organizations, such as UNICEF and the Global Partnership for Education (GPE), provide financial and technical support to ensure digital devices and internet access for youth in underserved regions (Ministry of Education and Science of Ukraine, 2024; Ukrainian Center for Educational Quality Assessment, 2024). Platforms such as Google Classroom, Zoom, and Microsoft Teams are widely used for organizing distance learning. These tools enable online lessons, group assignments, and feedback between students and teachers (Kyiv International Institute of Sociology, 2023). Ukrainian developments, such as Edmaps and AR-book, also play an important role in providing personalized learning (State Service of Educational Quality of Ukraine, 2024). An important step is the integration of international experience, particularly through programs like Erasmus+, which allow young people to acquire new knowledge and skills.

In conclusion, distance learning during wartime has become a vital tool for maintaining the educational process in Ukraine. Despite numerous challenges, such as the lack of technical resources and psychological difficulties, Ukrainian education continues to develop thanks to the support of the state and international organizations. The implementation of hybrid learning models, which combine online and offline formats, ensures flexibility and accessibility of education for all students. The development of digital technologies and innovative teaching methods enhances the quality of education and prepares young people for the demands of the modern labor market.

The future of distance learning in Ukraine will depend on the development and implementation of innovative approaches and the continuous improvement of digital technologies. The adaptation of young people to new conditions is a key factor for success in the modern world. Changes in teaching approaches, the development of digital literacy, and active social participation enable young people not only to survive but also to thrive in the face of constant change and threats. The ability to quickly adapt and utilize new opportunities for personal and professional development is crucial.

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INCREASING THE PROFESSIONAL TERMINOLOGICAL BASIS AND ENGLISH-SPEAKING LEXICAL SKILLS FORMATING EFFECTIVENESS IN THE TECHNICAL UNIVERSITIES STUDENTS' TRAINING

Oksana Honcharova
PhD, Senior Research
Military Institute of Armored Forces of National Technical University "KhPI", Ukraine
ORCID:https://orcid.org/ 0000-0002-1000-9670
Makogon Helen
PhD, Associate Professor
Military Institute of Armored Forces of National Technical University "KhPI", Ukraine
ORCID: https://orcid.org/0000-0003-1112-8707
Yelyzaveta Trach
Military Institute of Armored Forces of National Technical University "KhPI", Ukraine
ORCID: https://orcid.org/0009-0002-5495-0426
Yevhen Kostiuchenko
Military Institute of Tank Troops of National Technical University "KhPI", Ukraine
ORCID: https://orcid.org/0009-0006-1050-970X
Yevhen Lapchenkov
Military Institute of Armored Forces of National Technical University "KhPI", Ukraine
ORCID: https://orcid.org/0009-0001-9032-8995
Hryhorii Zaverukha
Military Institute of Armored Forces of National Technical University "KhPI", Ukraine
ORCID: https://orcid.org/0000-0001-7447-2033
Ihor Barniak
Military Institute of Armored Forces of National Technical University "KhPI", Ukraine
ORCID: https://orcid.org/0009-0005-6862-974X

Relevance of the study

Modern globalization processes require effective professional interaction in foreign languages in various fields of knowledge. Communication with foreign colleagues is becoming increasingly valuable professionally; it influences the stabilization and development of fundamental, professional qualities, thereby ensuring the competitiveness of a specialist to a large extent. [1].

In order to qualitatively carry out their professional activities in the process of international interaction, graduates of a technical university, in accordance with current educational standards, must be able to continue their education and conduct professional activities in a foreign language environment.

State standards of higher, professional education set the task of developing new training technologies, the use of which will allow satisfying the social demand for highly qualified and professionally mobile specialists capable of adapting to rapidly changing modern conditions. Graduates of technical universities should be ready to participate in both domestic and international innovative projects using authentic terminology in their specialty.

The growing demands on the foreign language training student level at non-linguistic universities necessitate the development and implementation of new teaching methods that take into account changes related to the needs for the qualifications of specialists and the conditions of their training. When considering the issue of new requirements, it is necessary to proceed from the needs for both specialists who have a command of a foreign language in general and specialists who have a command of professional authentic terminology, which is becoming increasingly relevant in light of the global computerization and informatization.

Thus, the relevance of the study is due to the lack of developments (in theoretical and practical terms) of the effective formation of a professional terminological basis and English-language vocabulary skills in teaching students of technical universities.

The authors examine the methodology of teaching professional English-language terminology to technical university students, which allows developing the lexical competence of future specialists.

Features and current state of teaching a foreign language as a language for special purposes and identify the problems of such teaching in technical universities

The difficult situation of teaching a foreign language in non-linguistic universities and, related to this, the need for a special selection of educational material was revealed. The results of the study established the

need to develop work programs and methods that take into account the professional and other features of training physics students, meeting the requirements of educational standards.

The assimilation of professional English-language terminology by students occurs more effectively if a thesaurus is used during its presentation, which conveys the conceptual, logical and terminological connections of physics and facilitates the assimilation of terminology due to the context and the formation of a potential vocabulary in memory.

The place of terminology as a component of professional training and the specifics of forming the terminological basis of a subject area for the English for special purposes teaching purposes

A classification of terms is proposed, dividing them into basic, main, derivative, attracted, etc. This allows selecting terms for training purposes in a methodical way. Currently, due to the widespread introduction of computer technologies into all spheres of activity, thesaurus-type dictionaries are being revived. Thesaurus representation of the terminology of a specific subject area is the basis of a new scientific direction related to computer information technologies - knowledge management. The basis of the developing area is the work on compiling ontologies or thesauri, which are a reflection of the terminology systems of the corresponding areas of knowledge.

Subject terminology is words and word combinations. A stable phrase, which is what a term is, is a phraseological unit. When a phrase is transformed, the process of revitalization and actualization of the potential vocabulary occurs, which is the most important methodological feature for the process of teaching terminology. According to the authors, seventy percent of the terms of a particular subject area of physics are phrases. They contain both words from ordinary speech and are independent physical terms, which creates the possibility of contextual guesswork. From a psychological point of view, thesauri reproduce the mechanisms of our memory, and structuring, being a psychological tool, increases the effectiveness of learning. Syntagmatic connections are the level of linear deployment, i.e. the level of syntagma, or the connection of words into phrases and sentences, and paradigmatic connections are a kind of vertical section. In order to develop a lexical skill, according to experts, it is necessary to establish strong paradigmatic connections between words, since it is these connections that ensure the strength of memorization and influence the process of actualization of the term [2-4].

Conclusions

As the main methodological techniques that allow increasing the efficiency of mastering professional English-language terminology of a technical profile, the authors propose to develop a methodology for the formation of professional English-language terminology in students of technical universities, based on the formation of lexical competence in the professional field.

It is also proposed to use: professional speech situations created in the process of discussing texts on the specialty and in the formation of a thesaurus; reading and discussing popular science English-language texts from the professional field; computer databases containing scientific and technical texts and relevant terminology, as a natural way of immersing future specialists in a professional environment; heuristic learning as a way of forming a lexical minimum of a narrow specialty. The lexical minimum, presentation method and exercises developed according to the proposed methodology allow creating a training module that can be used both independently and included in the content of any educational and methodological complex.

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SOFTWARE DEVELOPMENT

Naubetova Rauza Shapkhatovna
Computer science teacher at the Atyrau agrarian technical college named after O. Kushekova"

Abstract

Software development is a crucial aspect of the modern technological era, enabling the creation of applications and systems that enhance efficiency, communication, and automation. This paper explores the key stages of software development, methodologies, and the latest trends shaping the industry. It highlights the significance of Agile methodologies, DevOps practices, and emerging technologies such as artificial intelligence and cloud computing. The goal is to provide an overview of best practices and challenges in software development, ensuring high-quality software solutions.

Keywords: Software Development, Agile Methodology, DevOps, Cloud Computing, Artificial Intelligence

Software development plays a vital role in modern business operations, providing solutions for automation, data management, and communication. The rapid evolution of technology has led to diverse development methodologies and tools that enhance productivity and software quality. This paper discusses the fundamental aspects of software development, focusing on methodologies, processes, and emerging trends that define the industry's future.

Key Stages of Software Development The software development lifecycle (SDLC) consists of several key phases:

-Requirement Analysis: Understanding user needs and defining software specifications.

-Design: Creating architectural and technical blueprints for the system.

-Implementation: Writing code and integrating various components.

-Testing: Identifying and fixing defects to ensure software reliability.

-Deployment: Releasing the software for end-users.

-Maintenance: Continuous updates and improvements.

These phases ensure that software meets quality standards and fulfills business requirements effectively.

Software Development Methodologies Several methodologies guide software development processes, including:

Waterfall Model: A linear and sequential approach, best suited for projects with well-defined requirements.

Agile Development: An iterative methodology emphasizing flexibility, collaboration, and customer feedback.

DevOps: A combination of development and operations, focusing on continuous integration and deployment (CI/CD).

Scrum: A subset of Agile that organizes development into sprints for faster delivery.

Each methodology has its advantages, depending on project scope, complexity, and business goals.

Emerging Trends in Software Development With rapid technological advancements, several trends are shaping the future of software development:

Artificial Intelligence (AI): AI-driven software enhances automation, predictive analytics, and decision-making processes.

Cloud Computing: Cloud-based solutions provide scalability, cost-effectiveness, and enhanced data security.

Microservices Architecture: Breaking applications into smaller, independently deployable services improves scalability and maintainability.

Cybersecurity Enhancements: With increasing cyber threats, developers integrate advanced security measures into software systems.

These trends redefine software development, making it more efficient, secure, and adaptable to user needs.

Challenges in Software Development Despite technological advancements, software development faces several challenges:

-Requirement Volatility: Changing user needs can disrupt development progress.

-Security Risks: Cybersecurity threats require constant vigilance and proactive measures.

-Integration Complexity: Combining multiple technologies and platforms can be challenging.

-Time and Cost Constraints: Balancing quality with budget and deadlines remains a significant challenge.

Addressing these challenges requires a strategic approach, adopting best practices, and leveraging modern development tools.

Software development is an ever-evolving field that demands adaptability, technical expertise, and innovation. By following best practices, utilizing efficient methodologies, and staying updated with emerging trends, developers can create high-quality software solutions that drive technological progress. Future advancements in AI, cloud computing, and cybersecurity will further shape the industry, making software development more dynamic and impactful.

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THEORETİCAL AND DİDACTİC FOUNDATİONS OF WORK ON READİNG COMPREHENSİON İN PRİMARY GRADES

Aliyeva Shabnam Ali
Phd student, Nakhchivan State University, Azerbaijan
ORCHİD İD: 0009-0005-2978-7884

Abstract

The article discusses the theoretical and didactic foundations of the work on reading comprehension in primary schools. The article substantiates the questions "What is consciousness", "What is conscious reading", and the ways to teach conscious reading to students in primary schools through examples. The results clearly show that students with high reading comprehension skills demonstrate faster progress in speech skills compared to their peers. The indicators emphasize the need to integrate purposeful reading programs into the primary education curriculum to support speech development. The study reflects recommendations for educators and primary school students on improving reading comprehension strategies to develop linguistic competence in the Azerbaijani context.

At the same time, strategic reading rules and the knowledge, skills, values, and qualities that will be formed in students by using these rules correctly are also discussed.

Keywords: identity, strategy, conscious reading, analysis - composition, comparison and contrast.

The events taking place in the independent Republic of Azerbaijan and in the life of our people in the national, cultural, political, social, etc. spheres have created an opportunity for the rapid development and enrichment of our native language. The care and attention shown by our state to the development of the native language imposes a great sense of responsibility on all employees working in the field of education. Thus, the main goal should be to correctly direct the educational, nurturing and developmental function of our native language and to accustom the younger generation to conscious reading habits.

Mastering the native language for students in Azerbaijan is not only about acquiring communication skills; it is also about establishing contact with cultural heritage, fully participating in their community and creating a basis for learning in future subjects. The focus of the study is on reading comprehension skills, which are the cornerstone of students' speech development. Despite the recognized importance of existing skills, there remains a gap in our understanding of their specific impact on the speech development of Azerbaijani-speaking primary school students. The study attempts to fill this gap by examining the central role that reading comprehension plays in the linguistic development of children in their formative years of education. Given the complex nature of language acquisition, which encompasses everything from vocabulary development to grammatical understanding and oral fluency, research is based on the fundamental connection of reading comprehension skills with broader linguistic competence (1, 92).

It is a fact that teaching native language lessons plays an important role in the formation of conscious reading habits in students. Experience and observations show that the majority of primary school teachers do not pay due attention to this issue. They focus on reading techniques, reading speed, and mastering the content of the material being read, while the issue of analyzing and composing the text is somehow relegated to the "background". As a result, students do not fully understand the essence of the text they are reading. One of the main reasons for this is the weakness of the theoretical preparation of teachers, their lack of theoretical knowledge about conscious reading.

Conscious organization of reading is a complex process. To implement this, teachers must first of all analyze the theoretical and didactic foundations of work on the consciousness of reading, in order to analyze the answers to such questions as "What is consciousness?", "What is consciousness?", "How does the interaction between the consciousness of the reader and other habits occur", etc.

The science of psychology teaches that consciousness, which is a reflection of social existence, reflects objective reality, events and processes taking place in the material world, and is its adequate. It allows us to determine the nature, content, and specific characteristics of the laws and regularities arising from the essence of objects and phenomena.

First, consciousness is a set of knowledge about nature and society. With the help of various processes of cognition, our knowledge is constantly enriched, refined, and exhausted.

Second, human consciousness compares and differentiates the relationships between itself and material existence, evaluates its own actions and daily activities.

Thirdly, consciousness ensures the formation of a set goal, purposeful activity: for example, let's say that the conscious assimilation of the content of any text, or the comparison of two positive and negative images that contradict each other, the comparative determination and characterization of their character is set as a goal for conscious reading. In this process, the image of the content expressed through words, expressions, complex speech constructions in the text is reflected in the minds of students, analyzed and composed, how, where and when the event begins, the dynamics of development and the finale are determined. Thus, the assimilation of the content, the characterization of the character of the images separately appear as a result of the student's purposeful practical activity. Therefore, the purposeful activity of a person ensures his consciousness. Reading performs a unique function in this process.

Conscious reading involves students in all three stages of thinking. Successful learning occurs in three stages of thinking: before reading, during reading and after reading.

Stage I - the planning stage prepares the brain for reading.

Stage II - the interaction stage ensures that you think and remember while reading.

Stage III - the thinking stage integrates, connects, and applies ideas after reading.

The planning stage is the most responsible stage, as it is the first step in reading. The learner analyzes the task and makes a plan for more efficient organization of the training. The higher the initial preparation, the higher the student's success (3, 112).

The training process stage requires the application of metacognitive (higher cognitive) strategies that ensure the student's thinking and evaluation of the training results. The student draws up graphs or prepares a summary that provides his own thinking during reading. Researcher George Miller shows that human memory simultaneously stores 7-2 pieces of information. In order to emphasize one of the most important pieces of information, it is very important to keep students in the training process, check them, consolidate and generalize knowledge.

The strategies applied in the post-reading stage are aimed at organizing the student's thinking after training. At this stage, the main goals are to analyze and compare the results achieved, to make students think more comprehensively about the issue, and to generalize conclusions.

The interactive stage of reading involves checking and organizing students' ideas about the reading material, which also serves to increase comprehension. If any passage is not clear, students stop reading, read the passage again, slowly or aloud, and make notes in the margin with a simple pen. Guiding students to ask questions about the material they are reading helps them organize the learning process. During reading, students have the opportunity to compare what they have just learned with what they already know and predict.

The great American educator and psychologist John Dewey said: “We learn when we think about what we are doing.”

For example, in order for students to consciously understand the content of the text, teachers can organize reading in the following way.

The teacher can teach the poem "Alley of Martyrs" by Abulfaz Nakhchivanli, which is included in the 2nd grade Azerbaijani language textbook, in approximately the following way for students to consciously assimilate it (2, 48).

Determining the students' initial knowledge.

M: Children, does the name Martyrs' Alley sound familiar to you? Where did you hear this word?

It is the place where brave sons who sacrificed their lives for the homeland and the land lie....

1. Connection

M: Remember what you saw about it on TV.

Martyrs' Alley is the pride of our people, the place of oath of those who love the homeland.

2. Questioning

M: Why is it the place of oath of those who love the homeland? Why is it the pride of our people? What makes this cemetery sacred?

Because our brave sons who loved their homeland and land more than their lives lie here.

3. Orientation to determining the goal

M: You have just talked about what you saw and heard on TV, in life, in your family, and around you. Let's match them with what we read.

Hundreds of our brave young men were martyred. Our innocent babies were shot. We must never forget the atrocities committed by the Armenians.

4. Verification of the transaction.

What does the author want to tell us with this small text? Let's re-enact what we read, what we see on TV, what we hear - imagine.

What do you think about this?

To study the attitude of children and add supporting ideas

So, in the process of conscious reading, "the universal mechanism of human mental activity and consciousness comes into play" (A. N. Sokolov), thinking operates independently. The content of the read material is imprinted in the memory of students as a whole, the student follows its various episodes, parts, separate images, their movement in a logical sequence, analyzes them, learns the subtleties of internal meaning and connections.

The student performs a kind of creative activity in the process of conscious reading, does not lose sight of the issues raised there, the smallest details, has an active attitude towards it. In this case, students do not remain only within the framework of what they read, but must correlate what they learn in the reading process with their observations, what they hear and personal experience. In this whole process, the content of the text is not the last instance, but rather creatively and logically passes through the sphere of the student's consciousness, is formed and developed there. (L.S. Vygotsky)

This organization of reading forms the initiative and creative abilities of students of grades I-IV, the ability to express independent thoughts, to have an objective attitude to facts and events, to give correct assessments.

By applying these strategies to the text, students of grades I-IV can fully reveal the content of the text they read, understand the character of individual characters, reveal the relationships between them, and correctly evaluate fair and unfair actions. The emotional-expressive impact of the content forms a unity between the content of the read material and real existence, training and life.

The study of the role of reading comprehension skills in the speech development of primary school students in Azerbaijan has yielded critical ideas that emphasize the complex relationship between literacy and broader educational success. One of the main results of this study is the profound influence of socio-economic and geographical factors on reading comprehension skills. Such disparities highlight the urgent need for equitable educational policies and practices that can address these gaps, ensuring that all students, regardless of their background, have access to the tools and support they need to learn language effectively. In addition, quality insights from teachers and students themselves highlight the critical role of engaging and contextually relevant teaching methods. While traditional approaches to language development instruction are foundational, they need to be complemented by interactive and dynamic strategies that foster genuine interest in reading and develop critical thinking skills (4, 87).

This research also points to the potential of technological resources to transform how reading comprehension skills are taught and learned. When thoughtfully integrated into the digital literacy curriculum, they offer a variety of opportunities for personalized and interactive learning experiences that can meet the diverse needs of students. Ultimately, the way forward requires a collaborative effort by educators, parents, and the wider community. It calls for a commitment not only to solving problems but also to laying the foundations for a future in which every child in Azerbaijan can acquire linguistic competence and thus embark on a richer, more fulfilling educational journey. The findings of this study not only contribute to the academic debate on language development, but also offer practical insights that can inform future educational strategies and interventions. As we move towards this goal, it is essential that we continue to explore, innovate, and promote practices that recognize the centrality of reading and comprehension in shaping the minds and lives of young learners.

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Philological sciences

DIGITAL RESOURCES IN EDUCATION

Lomova E.
Associate professor
Kazakh national pedagogical university named after Abay
Ibrayeva Zh.B.
Associate Professor
Kazakh National Pedagogical University named after Abay
Shoibekova A.
Master, senior lecturer
Kazakh National Agrarian Research University
Yarmukhamedova A.
Deputy Director for Academic Affairs
Gymnasium №35

Abstract

Pedagogical science and practice gives rise to confidence that the future of effective and comprehensive education is connected precisely with the support of information and communication technologies.

Mobile learning applications represent a new direction in the already established educational system, and thanks to them a new quality of the learning environment arises. Mobile applications have a high potential for improving the quality and availability of new information, and they are also very effective in the individual form of acquiring knowledge and skills.

Computer communication technologies contribute to the use of new techniques that significantly increase the level of cognitive abilities and the effectiveness of cognitive activity.

The activation of students' creative activities takes place on various topics that are possible on educational sites and thematic forums. This allows students to undertake collaborative creative projects with students and learners from other schools and institutions of higher learning.

Keywords: pedagogical science, established educational system, computer communication, activation of students' creative activities

Our era is a period of rapid development of all kinds of information technologies, the possession of which determines the level of training, a specialist in many branches of science and production.

Information technologies are becoming an important resource in the independent acquisition of knowledge and skills. They are also very effective in collecting and analyzing various scientific data, which allows us to come to the correct generalization and argumentation of the conclusions and results of research activities.

Global computerization has covered all significant areas of human activity and has taken an important place in the structure of the educational process. The introduction of information technology has fundamentally changed the nature and content of the learning process and increased the efficiency of working with authentic sources.

The advantage of computer-based training programs is that, unlike traditional teaching methods, they have become very effective resources for direct audiovisual interactive interaction between the teacher and the classroom.

The use of computer technology makes it possible to develop various types of speech activities and create communication situations. Such technologies ensure "the implementation of independent work of each student and contribute to increasing his cognitive activity" [1, 269].

Computer communication technologies contribute to the use of new techniques that significantly increase the level of cognitive abilities and the effectiveness of cognitive activity.

The activation of students' creative activities takes place on various topics that are possible on educational sites and thematic forums. This allows students to undertake collaborative creative projects with students and learners from other schools and institutions of higher learning.

Thus, "individualization of training as an important factor in increasing its productivity" occurs [2, 267].

Computer technology training is based on the principles of interactivity, multimedia and polymodality. Visualization of its content component also plays an important role in the educational process, which largely develops the creative and thinking activities of students.

Visualization of the educational process also "has the most positive effect on the level of psychological and emotional state of students" [3, 77].

The process of self-knowledge and self-improvement of the personality is thus due to the heuristic novelty that is present in the educational process.

The use of digital technologies is associated with the problem of their qualitative characteristics and purposes of use.

At the present stage of our life, computer resources have sufficient diversity: these are MPPCS courses, I-tunes Courses, various digital tools like Google Docs, Explain Everything, Camtasia. At the service of students there are encyclopedias and academic sources like Google Search, Wikipedia, all kinds of dictionaries, as well as Microsoft Office. Digital resources play an important role in the analysis, collection and synthesis of a wide variety of scientific information. Computer technologies are very effective for working in creative groups, as well as "at the stage of planning the research process" [4, 33].

When choosing a certain digital platform, the teacher sets himself the task of improving the understanding of new information, increasing its volume and learning time by independently using individual educational applications by students outside the classroom.

Computer technologies can significantly increase the level of teacher training and develop his skills in working with such digital resources. Students develop decisiveness in achieving the set educational goal, the general motivation to master new knowledge and skills increases.

When preparing a lesson using computer technology, it is very useful to get acquainted with such Internet resources as youtube.com, ted.com, and also use the platform ed.ted.com. In this case, it is productive to divide the video offered to the classroom into separate fragments and offer their discussion to students.

Thus, modern computer technology can help create favorable conditions for the comprehensive development of the personality in accordance with the requirements and trends of modern reality.

The introduction of modern information and communication technologies into the educational process, which make mobile learning possible, helps to optimize the development of educational material, increases the availability and efficiency of scientific information offered to students, and as a result, "active integration into the information and communication space is carried out" [5, 11].

The use of such auxiliary resources as tablet computers, smartphones, mobile phones, iPad and iPhone in the educational process led to the creation of the concept of e-learning (e-learning - Electronic learning).

Pedagogical science and practice gives rise to confidence that the future of effective and comprehensive education is connected precisely with the support of information and communication technologies.

Mobile learning applications represent a new direction in the already established educational system, and thanks to them a new quality of the learning environment arises. They have a high potential for improving the quality and availability of new information, and they are also very effective in the individual form of acquiring knowledge and skills.

In pedagogical science, active research is conducted on the degree of influence of mobile technologies depending on the social and economic situation of the studying audience, on its age, religious or ethnic affiliation. These projects are aimed at implementing a new virtual environment in which it is possible to gain new knowledge using mobile applications.

In the United States and Europe, special magazines and other periodicals are published that focus on the problem of learning using various mobile applications, for example, the Journal of Mobile and Blended Learning (since 2009) and the International Journal of Mobile Learning and Organization (since 2007).

Experts researching the problem of learning using mobile applications, including M. Fine, J. Trakper and H. Jorvis, see the uniqueness of this method of obtaining knowledge in that it is not associated with a strict schedule and does not depend on a predetermined day and hour [6, 11].

The difference from traditional teaching methods and modern methods like e-learning is that the informal nature of the learning environment arises, in which independent work is stimulated, which is not controlled by the teacher, but by the process subject himself.

When using mobile applications, there is no clear line between the time of study and free time, work directly in the school or university audience or outside it.

The success of using mobile applications in training is also explained by the fact that the subjects of the educational environment are young people, especially susceptible to all innovations and ready to perceive mobile devices as an effective resource for acquiring the necessary skills and abilities. Mobile applications can

be designed to solve various educational problems. They can help to improve a certain skill or skill or influence the development of a whole range of skills and abilities necessary in this field of professional activity.

Mobile applications can be successfully used to optimize and improve the quality of the educational process, as well as as a resource base in the preparation of educational materials for disciplines studied at school and in higher educational institutions.

The practical application of mobile applications has "a fairly high potential, and they can be successfully used, in particular, in learning a foreign language" [7, 7]. They develop listening skills and offer a wide range of recordings of texts, videos and speech fragments. These include Sounds Right (British Council) or Pronunciation App (MacMillian Education).

A fairly wide range and variety of available mobile resources allows you to choose them from the individual needs of students. Mobile applications should be consistent with the interests and level of professional training of the subject of the educational process. Their use ensures the effectiveness of independent work in obtaining new information, increases interest in the discipline under study and motivates the individual to increase his intellectual and educational level.

TED (Technology, Entertaining, Design) is a unique online platform that provides many conferences with leading experts in the fields of science, art, politics, culture, business and leading world technologies. The main goal of such a digital platform is to disseminate unique ideas contained in the concept of "ideas worth spreading" [8, 47].

The Ororo.tv site provides access to authentic materials, which is "an effective resource for increasing students' motivation to master new knowledge" [9, 231].

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THE USE OF ABBREVIATIONS IN THE ENGLISH LANGUAGE

Aygun Mammadova
Azerbaijan State Pedagogical University, English teacher
Republic of Azerbaijan

Abstract

Abbreviations are shortened forms of words, names, or phrases, formed from the first letters of the word. Abbreviations are also shortened words, which are the formed form of the original word. During pronunciation, the shortened parts of the words are restored and the words are pronounced in their original form. Abbreviations are widely used in the English language because they save time

Key words: Abbreviation, Acronym, Unit, Punctuation, to refer to

An abbreviation (from Latin brevis, meaning short) is a shortened form of a word or phrase. Usually, but not always, it consists of a letter or a group of letters taken from the word or phrase. For example, the word abbreviation can itself be represented by the abbreviation abbr., abbrv. or abbrev. In strict analysis, abbreviations should not be confused with contractions or acronyms (including initialisms), with which they share some semantic and phonetic functions, though all three are connoted by the term "abbreviation" in loose parlance. An abbreviation is a shortening by any method; a contraction is a reduction of size by the drawing together of the parts. A contraction of a word is made by omitting certain letters or syllables and bringing together the first and last letters or elements; an abbreviation may be made by omitting certain portions from the interior or by cutting off a part. A contraction is an abbreviation, but an abbreviation is not necessarily a contraction. However, normally, acronyms are regarded as a subgroup of abbreviations. Abbreviations can also be used to give a different context to the word itself, such as "PIN Number" (wherein if the abbreviation were removed the context would be invalid).

Many people are confused about the correct way to use an abbreviation. This article hopes to dispel that confusion.

An abbreviation is a short form of a word. Instead of the word, single alphabets representing the word are used. Sometimes, a full stop (period) is used.

The purpose or function of an abbreviation is basically for convenience. A word is compressed to a few letters to convey the same meaning as the full word.

It is always a good idea to use an abbreviation in a text when a word is frequently used. For example, instead of writing 'India Study Channel' in a text repeatedly, you can use it just once, mention in parentheses the abbreviation like this: (ISC), and use ISC then each time you are referring to it.

However, sometimes it is necessary to use the full word and not the abbreviation. For example, if you are referring to a doctor, you can use 'Dr.' before his name: Dr. Harish; but later in the text if you are referring to his fees you should not write 'The dr.'s fees are exorbitant' – you should use the full word and write 'The doctor's fees are exorbitant'.

It is very simple to make an abbreviation. As mentioned previously, only two or three letters are required. As you can see, abbreviations are not difficult to use or understand. Correct use of an abbreviation will greatly help you to write a better quality article.

Abbreviations have been used as long as phonetic scripts have existed, in some sense actually being more common in early literacy, where spelling out a whole word was often avoided, initial letters commonly being used to represent words in specific application. An increase in literacy has, historically, sometimes spawned a trend toward abbreviation.

During the growth of philological linguistic theory in academic Britain, abbreviating became very fashionable.

After World War II the British greatly reduced the use of the full stop and other punctuation points after abbreviations in at least semi-formal writing, while the Americans more readily kept such use until more recently, and still maintain it more than Britons.

Over the years, however, the lack of convention in some style guides has made it difficult to determine which two-word abbreviations should be abbreviated with periods and which should not. The U.S. media tend to use periods in two-word abbreviations like United States (U.S.), but not personal computer (PC) or television (TV). Many British publications have gradually done away with the use of periods in abbreviations.

Minimization of punctuation in typewritten material became economically desirable in the 1960s and 1970s, since a period or comma consumed the same length of non-reusable expensive ribbon as did a capital letter.

Widespread use of electronic communication through mobile phones and the internet during the 1990s allowed for a marked rise in colloquial abbreviation. This was due largely to increasing popularity of textual communication services such as instant and text messaging lengths. This brevity gave rise to an informal abbreviation scheme sometimes called Textese, with which 10% or more of the words in a typical SMS message are abbreviated. More recently Twitter, a popular social network service, began driving abbreviation use with 140 character message limits. In modern English there are several conventions for abbreviations, and the choice may be confusing. The only rule universally accepted is that one should be consistent, and to make this easier, publishers express their preferences in a style guide. If the original word was capitalized, then the first letter of its abbreviation should retain the capital, for example Lev. for Leviticus. When abbreviating words that are originally spelled with lower case letters, there is no need for capitalization. A period (full stop) is sometimes written after an abbreviated word, but there are exceptions and a general lack of consensus about when this should happen.

The short form of a word, name or a phrase is called an abbreviation and an acronym. Generally they are formed from the first letter of the basic word. The difference between an abbreviation and an acronym is that an abbreviation is the articulated form of the original word whereas the acronym is a form of new word. For example: UNESCO, Laser, Radar are some of the acronyms whereas UK, USA, CBI are the abbreviations.

An acronym Radar means Radio detection and ranging. This is totally a new description of the original word Radar. An abbreviation UK stands for United Kingdom, which is just the description of the old word only. Therefore one can say that all acronyms can be abbreviations, but all abbreviations cannot be acronyms. An acronym is formed from the first letters of a series of words. For example: AIDS; it is formed from the words Acquired Immune Deficiency whereas, an abbreviation may not include only the first letter from the words. For example: St.; It is formed from the word Saint. Dr.; it is formed from Doctor.

Another difference between an abbreviation and acronym is that an acronym is pronounced as a word. For example: NATO, it is formed from the word North Atlantic Treaty Organization, but is pronounced as a new word whereas an abbreviation is pronounced as a separate letter. For example: BBC; British Broadcasting Corporation. It is spoken as B, B, C letter by letter. Another difference between an abbreviation and an acronym is that an abbreviation contains periods in between for example I.D, Mr., I.Q etc. Whereas an acronym has no periods in between, it is a short description. An abbreviation is just a short compact version of the word whereas an acronym consists of words giving concepts or catchy phrases. For example dept. is the short form of department whereas TEAM denotes together everyone achieves more. An acronym is a combination of different letters denoting different words whereas an abbreviation is a concise form with one word and few letters. Acronyms can be of several types such as letter type; example laser, syllable type;; example WaSP, whereas abbreviations consist of short words. It can vary sometimes like ‘sgt’ for sergeant.

Acronyms that were originally capitalized (with or without periods) but have since entered the vocabulary as generic words are no longer written with capital letters nor with any periods. Examples are sonar, radar, laser, snafu and scuba.

Today, spaces are generally not used between single-letter abbreviations of words in the same phrase, so one almost never encounters "U. S."

When an abbreviation appears at the end of a sentence, only one period is used: The capital of the United States is Washington, D.C.

To form the plural of Runs Batted in simply add an s to the end of RBI.

RBIs

For all other rules, see below: To form the plural of an abbreviation, a number, or a capital letter used as a noun, simply add a lowercase s to the end.

A group of MPs

The roaring 20s

To indicate the plural of the abbreviation or symbol of a unit of measure, the same form is used as in the singular.

1 ft or 16 ft.

1 min or 45 min.

When an abbreviation contains more than one full point, Hart's Rules recommends putting the s after the final one.

Ph.D.s

M.Phil.s

the d.t.s

However, the same plurals may be rendered less formally as:

PhDs

MPhils

the DTs. (This is the recommended form in the New Oxford Dictionary for Writers and Editors.)

According to Hart's Rules, an apostrophe may be used in rare cases where clarity calls for it, for example when letters or symbols are referred to as objects.

The x's of the equation

Dot the i's and cross the t's

In Latin, and continuing to the derivative forms in European languages as well as English, single-letter abbreviations had the plural being a doubling of the letter for note-taking. Most of these deal with writing and publishing.

Publications based in the U.S. tend to follow the style guides of The Chicago Manual of Style and the Assoiated Press. The U.S. Government follows a style guide published by the U.S. Government Printing Office. The National Institute of Standards and Technology sets the style for abbreviations of units.

Many British publications follow some of these guidelines in abbreviation:

For the sake of convenience, many British publications, including the BBC and The Guardian, have completely done away with the use of full stops or periods in all abbreviations. These include:

Social titles, like Ms or Mr, Capt, Prof, etc.;

Two-letter abbreviations for countries ("US", not "U.S.");

Words seldom abbreviated with lower case letters ("PR", instead of "p.r.", or "pr")

Acronyms are often referred to with only the first letter of the abbreviation capitalized. For instance, the North Atlantic Treaty Organisation can be abbreviated as "Nato" or "NATO",

Initialisms are always written in capitals; for example the "British Broadcasting Corporation" is abbreviated to "BBC", never "Bbc". An initialism is similar to acronym, but is not pronounced as a word.

When abbreviating scientific units, no space is added between the number and unit.

Some titles, such as "Reverend" and "Honourable", are spelt out when preceded by "the", rather than as "Rev." or "Hon." respectively. This is true for most British publications, and some in the United States.

A repeatedly used abbreviation should be spelt out for identification on its first occurrence in a written or spoken passage. Abbreviations likely to be unfamiliar to many readers should be avoided.

In the International System of Units (SI) manual the word "symbol" is used consistently to define the shorthand used to represent the various SI units of measure. The manual also defines the way in which units should be written the principal rules being:

No periods should be inserted between letters – for example "m.s" (which is an approximation of "m·s", which correctly uses middle dot) is the symbol for "metres multiplied by seconds", but "ms" is the symbol for milliseconds.

No periods should follow the symbol unless the syntax of the sentence demands otherwise (for example a full stop at the end of a sentence).

The singular and plural versions of the symbol are identical – not all languages use the letter "s" to denote a plural. A syllabic abbreviation is an abbreviation formed from (usually) initial syllables of several words, such as Interpol = International +police. It is basically a variant of the acronym.

Syllabic abbreviations are not widely used in English or French. The United States Navy, however, often uses syllabic abbreviations. When you start living in an English speaking country or you are just learning about the language you realize that abbreviations are very common, at the beginning it seems a bit weird as in other languages they are not that common, but then you see their potential, because they save a fairly amount of time.

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THE SPECIES THE SALUTATION

Ibrahimova Nigar Farman gizi
senior lecturer,
Ganja State University

MÜRACİƏTİN NÖVLƏRİ

İbrahimova Nigar Fərman qızı
baş müəllim
Gəncə Dövlət Universiteti

Abstract

As the author notes, the salutation, which is an important means of speech contact, is one of the elements of speech that indicate the communicative competence of the speaker. The salutation can be an indicator of the nature of social and personal relations between communicators. This is one of the most important functional properties of the address.

As the author shows, we are not interested in the place of speech acts in a communicative speech situation, but in the place of the salutation in each of these types of speech acts. As we see, none of the linguists (except D. Wunderlich) has distinguished the salutation as a special type of speech act. In the classification of these linguists, the salutation is present in all types of speech acts, i.e. it is a component of directive types, declarative types, commissure types, etc. According to the author, in pragmatics, intention is perceived as communicative speech intention. This term refers to the speaker's attempt to exert a significant influence on the recipient of his speech by his actions. Thus, the main feature of a speech act is its purposeful and final stage. The purposeful phase refers to the initial situation in which the addressee is. In addition, the salutation has unlimited communicative and functional capabilities. The salutation can be an indicator of the nature of social and personal relations between communicants.

This is one of the important functional features of the address finally, according to the author; the communicative-functional approach primarily involves the study of the functional capabilities of linguistic units within the text, the statistics of all possible connections created by a specific communicative situation. The communicative situation plays a large role in the appearance of the greeting

Xülasə

Müəllifin qeyd etdiyi kimi, nitq təmaslarının mühüm vasitəsi olan müraciət, nitqin dil daşıyıcısının kommunikativ sərişləsinə dəlalət edən elementlərindən biridir. Müraciət ünsiyyətçilər arasında sosial və şəxsi münasibətlərin xarakterini göstərən göstərici ola bilər. Bu, müraciətin ən mühüm funksional xüsusiyyətlərindən biridir.

Müəllifin göstərdiyi kimi, bizi kommunikativ nitq situasiyasında nitq aktlarının yeri deyil, bu tip nitq aktlarının hər birində xitab yeri maraqlandırır. Gördüyümüz kimi, dilçilərin heç biri (D. Vunderlixdən başqa) xitabı nitq aktının xüsusi növünə ayırmamışdır. Bu dilçilərin təsnifatında ünvan hər növ nitq aktında mövcuddur, yəni. direktiv tiplərin tərkib hissəsidir, deklarativ tiplər, komissar tiplər və s.p

Müəllifin fikrincə, praqmatikada niyyət kommunikativ nitq niyyəti kimi qəbul edilir. Bu termin natiqin öz hərəkətləri ilə onun nitqini qəbuledənə böyük təsir göstərmək cəhdinə aiddir. Deməli, nitq aktının əsas xüsusiyyəti onun məqsədli və yekun mərhələsidir. Məqsədli faza ünvanın olduğu ilkin vəziyyətə aiddir.

Bundan başqa Müraciətin qeyri-məhdud kommunikativ və funksional imkanları var. Müraciət ünsiyyətçilər arasında sosial və şəxsi münasibətlərin xarakterini göstərən göstərici ola bilər. Bu, müraciətin mühüm funksional xüsusiyyətlərindən biridir

Sonda müəllifin fikrincə, kommunikativ-funksional yanaşma ilk növbədə mətn daxilində linqvistik vahidlərin funksional imkanlarının, konkret kommunikativ situasiyanın yaratdığı bütün mümkün əlaqələrin statistikasının öyrənilməsini nəzərdə tutur. Kommunikativ vəziyyət salamlaşmanın görünüşündə böyük rol oynayır

Keywords: address, language carrier, speech acts, communicative speech, functional feature, declarative type group

Açar sözlər: müraciət, dil daşıyıcısı, nitq aktları, kommunikativ nitq, funksional xüsusiyyət, deklarativ növ qrupu

Barkowski və Esserin qeyd etdiyi kimi, tədris və öyrənmə prosesləri biliklərin ötürülməsi prosesləri (sosial strukturların və onların fərdlərinin sağ qalmasını təmin etmək marağındadır) və iki cəhətdən mədənidir. Barkowski və Esserə görə, mədəni imprintingin effektivliyinə dair empirik sübutlar uğurlu olarsa, nəticələr müvafiq xarici dil tədrisinin metodologiyasının və didaktikasının əsas məzmununa təsir göstərəcəkdir. Çünki öyrətmə və öyrənmə mədəniyyətlərin təkrar istehsalı və sonrakı inkişafı prosesləridir və onlar mədəniyyətdə inkişaf etdirilən tədris və təlim üslubları ilə formalaşır.

Xarici dilin öyrədilməsi və öyrənilməsi bir sıra mədəni xüsusiyyətlərə malikdir. Əslində, xarici dil öyrənmə yeri ən azı iki dilin mürəkkəb mədəniyyətlərində bir-biri ilə görüşdüyü və müxtəlif mədəniyyətlərdən olan tələbələrin də sinifdə iştirak edə biləcəyi mədəniyyətlərarası görüş yeridir. Beckmann ümumilikdə xarici dillərin tədrisində mədəniyyətlərarası münasibətin üç ölçüsü haqqında danışır, yəni mədəniyyətlərarası öyrənmə, öyrənmə prosesində mədəniyyətlərarası münasibət gücləndirildikdə, mədəniyyətlərarası səriştə, buna uyğun olaraq mədəniyyətlərarası ünsiyyət öyrənmə məqsədidir və son nəticədə mədəniyyətlərarası ünsiyyət vəziyyəti və ya öyrənmə fonu. və öyrənmə prosesləri**.[7]**

Sonuncu, məsələn, alman müəllimi Vyetnam dilini öyrətdikdə tətbiq edilir. Müəllim öz metodik və didaktik hazırlığından bildiyi metodları, iş formalarını və məşqləri, tədris materiallarını, medianı, hətta ev tapşırıqlarını seçməklə öz mədəni keçmişini və təcrübəsini dərsə gətirir. Sinifdə o, şüurlu və ya şüursuz olaraq tələbənin müəyyən bir rolunu və nəticədə müəyyən bir davranışı gözləyir. Müvafiq gözlənilən davranışa üstünlük verəcək və əcnəbi tələbənin davranışındakı sapmaları rədd edəcəkdir. Şagirdlər həmçinin öz mədəni öyrənmə təcrübələrini sinifə gətirirlər. Onlar həmçinin müəllimlərindən, eləcə də dərsin gedişindən, tədris materiallarından, alət və iş formalarından və imtahanlardan müəyyən rol davranışları gözləyirlər. Bundan əlavə, uzun illər məktəb sosiallaşmasından akademik uğur və təhsil sənədləri baxımından müəyyən təcrübəyə malikdirlər. Tomasın fikrincə, insan "sosiallaşma prosesində mədəniyyətə çevrilir, öz qrupunda sosial əhəmiyyətli davranışları öyrənir və onunla təcrübə qazanır. Fərdi davranış müəyyən mədəniyyətin nümayəndəsi kimi onun üçün mövcud olan variantlardan istifadə edən şəxsin hərəkətinin nəticəsidir. Bir qayda olaraq, o, müvafiq mədəniyyət tərəfindən müəyyən edilmiş fəaliyyət hüdudlarına (normalar, əmrlər, adət-ənənələr, vərdişlər) riayət edəcək və mədəniyyətdə qəbul edilmiş oriyentasiya sisteminə uyğun olaraq öz hərəkətlərini tənzimləyəcəkdir ". Bu iki mədəniyyətin üst-üstə düşməsi anlaşılmazlıqlara, uyğunsuz gözləntilərə və uyğunsuzluqlara səbəb ola bilər, lakin etməməlidir. Bununla belə, öyrətmə və öyrənmə davranışında oxşarlıqlar və paralellər də ola bilər ki, bu da öyrətmə və öyrənməni hər iki tərəf üçün daha effektiv və zövqlü edir**.[2]**

Kommunikativ vəziyyətin əsas komponentləri bunlardır:

1) danışmaq üçün stimul, yəni. h. kommunikativ niyyət. (Kommunikativ niyyətin mahiyyəti ondan ibarətdir ki, o, ünvanı alan şəxsin diqqətini cəlb edir.)

2) müraciət aktının baş verdiyi reallıq şəraiti. (Bunlar ilk növbədə müraciət sahələridir: inzibati-hüquqi sahə, peşə sahəsi, sosial-məişət sahəsi, sosial-mədəni sfera və ailə sahəsi.)

3) kommunikantlar arasındakı münasibətlər, burada onların hər birinin öz sosial rolları dəyəri var. Ünvan fərqləri təcrübəsinə diqqət, beləliklə, xüsusi bir ifadə növü xarici dilçilikdə və ilk növbədə C.Ostin və C.Searlenin əsərlərində, D.Vunderlix və H.Habermasın konsepsiyalarında böyük köhnə ənənələrə malikdir. Nitq hərəkəti anlayışının işlənib hazırlanmasında C.Ostin və C.Searlin ümumi nitq hərəkəti nəzəriyyəsi böyük rol oynayır.

Bu nəzəriyyənin əsas mahiyyətini belə formalaşdırmaq olar: insan hər hansı obyekt üzərində müəyyən məqsədlə və müəyyən şəraitdə hərəkət edir və bununla da bu obyektdə müxtəlif dəyişikliklərə səbəb olur. Struktur-morfoloji hərəkətlər üç komponentdən ibarətdir:

1) hərəkət, yəni. h. niyyəti çatdıran vasitələr;

2) niyyətin özü;

3) ardıcıllıq **[3]**

Praqmatikada niyyət kommunikativ nitq niyyəti kimi qəbul edilir. Bu termin natiqin öz hərəkətləri ilə alıcıya böyük təsir göstərmək cəhdinə aiddir. Buna görə də kommunikativ niyyət nitq aktının dil mərhələsidir. Amma niyyətin həyata keçməsi artıq nitq aktının nəticəsidir. Deməli, nitq aktının əsas xüsusiyyəti onun məqsəd və yekun mərhələsidir. Məqsədli faza müraciəti olduğu ilkin vəziyyətə aiddir. Son mərhələ müraciətin görünüşü ilə yaranan dəyişiklik vəziyyətinə aiddir.

Adətən bu mərhələ üst-üstə düşmür. Nitq hərəkətinin əsas məfhumu "müxtəlif dilçilər tərəfindən təfsirindən məhəllə hərəkətinin, tələffüz hərəkətinin və təfsir hərəkətinin sərhədlənməsidir" [1]. Loktiv əlaqə ifadəsidir; qeyri-müəyyən əlaqə danışanın alıcı ilə əlaqə yaratmaq niyyətini ifadə edən hərəkətdir; perlocutive əlaqə, ünvan sahibinin sonrakı reaksiyası ilə göstərilən əlaqəyə münasibət və ya dəstəkdir. Deməli, demək olar ki, natiq eyni vaxtda üç yarımkəsmədə iştirak edir: lokutiv – illokutiv və perlokutiv hərəkət. Burada onu da vurğulamaq lazımdır ki, bütün bu hərəkətlər eyni vaxtda baş verir. J.Searle-in konsepsiyasına görə, nitq aktının

strukturu ifadənin illokasiya və təklif məzmununun məcmusudur. D.Vunderlixin konsepsiyasına görə, bu kontekstdə bəyanatın modallığının tərkib hissəsi kimi münasibətdən də danışmaq olar.

J.Searle-in konsepsiyasına görə, nitq aktının strukturu ifadənin illokasiya və təklif məzmununun məcmusudur. D.Vunderlixin konsepsiyasına görə, bu kontekstdə bəyanatın modallığının tərkib hissəsi kimi münasibətdən də danışmaq olar. C.Searl elmi əsərlərində intonasiya, durğu işarələri, vurğu və s. vasitəsilə ifadənin illoksion qüvvəsini nəzərdən keçirir:

1) indiki fəaliyyət növünün məqsədi;
2) əks etdirmə istiqaməti;
3) psixoloji vəziyyətlər (burada: inanc, arzu...)
4) illokasiya məqsədini xarakterizə edən qüvvə;
5) rabitəçilər arasında əlaqələr;
6) söhbətin qalan hissəsi ilə əlaqələr;
7) təklif məzmunu.

Sonuncudan başqa bütün bu prinsiplər fəaliyyətin ilkin əsasını təşkil edir. İlk üç prinsip, J.Searle-in fikrincə, ən mühümdür və onun təsnifatına əsaslanır, burada illoksion hərəkətin beş əsas kateqoriyası mövcuddur: [5]

Bu praqmatik tip danışanın məzmuna münasibətində inandırıcılığının ifadəsi ilə səciyyələnir. Bu qrupa təsvir, ünsiyyət, təsdiq və s. nitq əməlləri daxildir.C.Serailin təsnifatı bizə göstərir ki, daimi, təmsil, ifadəli tiplər əslində onlardan birinin adıdır. Biz bunu C.Ostin, D.Vunderlixin konsepsiyalarında da tapırıq. Bu dissertasiyanın mövzusu bəyanat – müraciət xüsusi kommunikativ-intensial tip kimi, müxtəlif dil ünsiyyət aktlarının mühüm hissəsi kimi özünəməxsus konstruktiv, semantik və kommunikativ-funksional xüsusiyyətlərə malik olan və digər dil elementləri ilə birlikdə diskursa aid olan və ya müstəqil kommunikativ vahid kimi çıxış edir.[2] Hazırda nitqin konstruktiv xüsusiyyətləri fransız və ingilis dillərinin qrammatikasına dair əsərlərdə kifayət qədər tam tədqiq edilmişdir. Müəyyən edilmişdir ki, müraciət forması dil təmaslarının qurulması və dəstəklənməsinin əsas vasitəsidir və yalnız hər iki kommunikant arasında mövcud olan münasibətləri əks etdirir. Ünvan kommunikativ hərəkət başlayanda yaranır, yəni qeyri-müəyyən bir akt (şəxsi münasibətlərin qurulması) həyata keçirilir. Qeyri-adi hərəkət həyata keçirildikdə, danışanın psixoloji vəziyyəti ifadə edilir (məsələn, arzu, niyyət ...) və salamlama ilə cümlələr yalnız alıcının deyil, həm də danışanın mənafeyinə uyğun olaraq istifadə edilə bilər. **[6]** J.Searle görə, direktiv dil aktları alıcını bir şey etməyə başlamağa təşviq etmək məqsədi daşıyır. Bu nitq aktları arzunun psixoloji vəziyyətini ifadə edir. Beləliklə, B.Frasierin təsnifatında tələb və təkliflərin nitq aktları müxtəlif illokasiya tiplərinə aid edilir və yalnız məqsədlərinə görə üst-üstə düşür. C.Ostenin təsnifatında əmr, nəsihət və xəbərdarlıq nitq hərəkətləri də qrup halındadır. Bu nitq aktlarını həyata keçirmək üçün natiq davranış normaları və qaydaları ilə xarakterizə olunan müəyyən sosial statusa malik olmalıdır. Buna görə də dildə əmr, nəsihət və xəbərdarlıq aktları praqmatik tipdə birləşir. C.Searlenin təsnifatında növbəti praqmatik tip komissardır. Bu növ gələcək fəaliyyətə münasibətdə müəyyən öhdəliklər kimi başa düşülür.

Bu tip dilçilərin demək olar ki, bütün anlayışlarında mövcuddur. Bu reaksiya həm müsbət, həm də mənfi ola bilər. Bu kontekstdə bu praqmatik tip iki alt qrupa bölünür:

1) danışanın müsbət reaksiyasını ifadə edən ifadələr (məsələn, minnətdarlıq, təbriklər və s.)
2) danışanın hərəkətə mənfi reaksiyasını ifadə edən ifadələr (məsələn, məzəmmət, təəssüf və s.)

İcazə və qadağaların linqvistik aktları bu və ya digər növə mənsubiyyətləri qeyri-müəyyənliyinə görə böyük diqqəti cəlb edir. D. Wunderlich, məsələn, onları birləşdirir. B. məhdudlaşdırıcı tipdə, lakin L. Hofmann – xüsusi icazə tipində. [8] C.Searlenin təsnifatında nitq aktlarının sonuncu qrupu deklarativ tiplər qrupudur. Dilçilərin bu növləri çox fərqli təsnif etsələr də, tərif növlərinin funksiyalarını ümumiləşdirsək, belə bir nəticəyə gəlmək olar: Bəyanat növünün nitq aktının funksiyası ifadəni əşyaların real vəziyyətinə uyğunlaşdırmaqdan ibarətdir. Komissarların və direktiv növlərin nitq aktının funksiyası yalnız gələcəkdə və indiki zamanda deyilənləri əlaqələndirməkdir. Ekspressiv ifadələr, onları dəyişdirmədən və ya təsvir etmədən dillərin əsas vəziyyətinə reaksiyanı ifadə edir. Deklarativ bəyanatlar yalnız reallığa təsir edir, başqa heç nə yoxdur. Komissarların gətirdiyi dəyişikliklər və direktiv bəyanatlar öz-özlüyündə təhrifedici təsir göstərir. Əksinə, deklarativ bəyanatın gətirdiyi dəyişikliklər öz-özlüyündə qeyri-müəyyən effekt verir. Beləliklə, demək olar ki, nitq aktları nəzəriyyəsini müzakirə edən C.Osten və C.Searle üçün nitq aktı və ya nitq hərəkəti ünsiyyətin elementar vahididir, yəni. h. məlumatı yalnız bir istiqamətdə ötürən. Nitq aktı praqmatik dilçiliyin diqqət mərkəzində olan insan ünsiyyətinin ikitərəfli xarakterini əks etdirmir. Bu elm insan sayəsində müəyyən kommunikativ şəraitdə və müəyyən məqsədlərlə, xüsusi dil vasitələrindən istifadə etməklə həyata keçirilən ünsiyyət fəaliyyətini dəqiq öyrənir. [**4]**

Təsadüfi deyil ki, Ton van Denk kommunikativ fəaliyyətin daha geniş konsepsiyasını təklif etmişdir. Bu kommunikativ akt aşağıdakılardan ibarətdir:

1) danışanın hərəkəti, yəni, nitq aktı;

2) alıcının hərəkəti, yəni, eşitmə hərəkəti;

3) kommunikativ vəziyyət, yəni, natiq və qəbuledicinin xüsusiyyətləri Nitq aktı, T.van Denkə görə, danışan, onun (natiqin) dediyi bəyanat və bütün bunların baş verdiyi zaman arasındakı əlaqədir. Bununla belə, eşitmə nitqi aktı qəbul edən, onun (qəbuledicinin) qəbul etdiyi ifadə və bütün bunların (yəni ifadənin qavranılması) baş verdiyi zaman arasındakı əlaqədir. Bəyanatın deyildiyi vaxt və məkan üst-üstə düşə bilməz. T.van Denk öz təsnifatında aşağıdakıları fərqləndirir:

1) çıxış edənin və qəbul edənin ifadəsi;

2) nitq aktı;

3) eşitmə yekun hərəkəti;

4) nitq aktının vaxtı və eşitmə aktının vaxtı;

5) nitq aktının və eşitmə hərəkətinin yeri.

T.van Denkin kommunikativ nitq aktı konsepsiyasının həm müsbət, həm də mənfi tərəfləri var. Bütövlükdə dilçilər dil hərəkətinin mahiyyətini düzgün başa düşmüşlər. Lakin onlar nitq aktları nəzəriyyəsində yerləşmənin konkret yeri, illokasiya və perlokasiya haqqında mübahisələr aparmışlar. Məhz bu mübahisə C.Ostin, C.Searle, D.Hofmann kimi dilçilərin konsepsiyalarında öz əksini tapmışdır.[**3]** Lakin bizi kommunikativ nitq situasiyasında nitq aktlarının yeri deyil, bu tip nitq aktlarının hər birində xitab yeri maraqlandırır. Gördüyümüz kimi, dilçilərin heç biri (D. Vunderlixdən başqa) xitabı nitq aktının xüsusi növünə ayırmamışdır. Bu dilçilərin təsnifatında nitq aktının hər bir növündə xitab vardır. Yalnız D.Vunderlixin konsepsiyasında müraciət forması "vokativ" termini altında vahid nitq aktı növünə ayrılmışdır. D. Vunderlich nitq aktını "hərəkət hərəkəti" adlandırır. D. Vunderlix əsas dil aktlarını fərqləndirir. Bunlar: təsdiq, tələb, icazə...

Onun fikrincə, dil aktlarının əsas sinifləri mütləq semantika ilə səciyyələndirilməlidir. Bu növə təkcə nitq və ya çağırış hərəkətləri deyil, həm də onlara uyğun gələn ifadələr daxildir. Salamlama məntiqi semantikada xüsusi ad rolunu oynayır. Mütləq xüsusi adı ehtiva etməyən vokativdən istifadə edərkən, salam alıcını birləşdirməyə xidmət edir. Amma bu ondan irəli gəlir ki, D.Vunderlix nitq aktlarının bəzi növlərini, o cümlədən vokativi semantik səviyyədə fərqləndirir. "Nitq nəzəriyyəsi semantikanın tərkib hissəsi kimi çıxış edir." **[5)** Vokativ ifadələr, D.Vunderlixin konsepsiyasında deyildiyi kimi, bu birliyin müstəqil elementi kimi bilavasitə və ya kommunikativ-intensial funksiyalı ifadə vasitəsilə dialoq vəhdətinə daxil ola bilər. D. Vunderlich buna görə də dil aktlarını müxtəlif növlərə görə təsnif etmişdir. Onun təsnifatında vokativlər həmişə təşəbbüskardır, çünki onların semantik strukturunun elementi stimullaşdırma mənasıdır. Bu tip sadə və mürəkkəb cavablardan ibarətdir.

Lakin D.Vunderlix ünvanı müəyyən illokasiya tipinə ayırsa da, o, C.Osten, J.Searle, D.Hofmann kimi bu fikirdədir ki, müraciət (vokativ) diskursun yalnız köməkçi elementidir və özünəməxsus linqvistik statusa malik deyil, nitq aktı ola bilməz. [7]

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ON THE MAIN LINGUISTIC FEATURES OF FILM DIALOGUE AS A TEXT OF A NEW FORMAT

M.G. Tsertsvadze
Doctor of philology, associate professor,
A. Tsereteli Kutaisi State University, Georgia. Kutaisi
E.S. Akopova
Senior lecturer,
Sh. Esenov Caspian State University of Engineering and Technology. Kazakhstan. Aktau.

ОБ ОСНОВНЫХ ЛИНГВИСТИЧЕСКИХ ОСОБЕННОСТЯХ КИНОДИАЛОГА КАК ТЕКСТА НОВОГО ФОРМАТА

М.Г. Церцвадзе,
доктор филологии. асоцированный профессор,
Кутаисский государственный университет имени А. Церетели, Грузия. Кутаиси
Е.С. Акопова
стпрщий преподавателъ
Каспийский государственный университет инжиниринга и технологии имени Ш. Есенова. Казахстан. Актау

Abstract

This article deals with the issue of defining the concept of ‘film dialogue’. The interrelation of verbal and visual aspects of film dialogue is considered. The structural and content features of the film dialogue are described. The study of film dialogue is similar to the study of oral speech under certain communicative conditions.

Аннотация

В данной статье рассматривается вопрос определения понятия «кинодиалог». Рассматривается взаимосвязь вербального и визуального аспектов кинодиалога.Описываются структурные и содержательные особенности кинодиалога. Изучение кинодиалога сходно с изучением устной речи при определенных коммуникативных условиях.

Key words: film dialogue, film dialogue structure, verbal and non-verbal elements, non-verbal means of communication, semiotic systems of cinema, spoken text.

Ключевые слова: кинодиалог, структура кинодиалога, вербальные и невербальные элементы, невербальные средства коммуникации, семиотические системы кино, разговорный текст.

Введение

В последние десятилетия сфера интересов лингвистов расширяется за счет новых объектов, из которых особое место занимает анализ кинопроизведений, поскольку кино как искусство не только оказывает значительное влияние на язык и культуру людей, но и становится инструментом формирования мировоззрения отдельного человека и общества в целом. **Кино** утвердилось как массовый вид искусства в жизни современного человека, предоставляя доступ к различным видам информации, как развлекательной, так и познавательной, а в некоторых случаях даже и той и другой вместе.

В каждом фильме заложена идея, которую режиссер пытается донести до зрителя разными способами. Передача смысла и основной идеи осуществляется как вербальными, так и невербальными средствами. Использование разговорной лексики, художественной выразительности и других средств в кино вызвало интерес к анализу лингвистической стороны кинодиалога.

Актуальность исследования кинодиалога определяется, прежде всего, недостаточной изученностью этого типа текста как языкового элемента поликодового текста - фильма, а также интересом лингвистов к содержательной стороне фильма(текста).. При изучении кинодиалога как текста нового типа становится актуальным определение в нем специфических особенностей общетекстовых категорий в сфере интересов лингвистики, поскольку кинематографический диалог является одной из новых форм языковой жизни.

Цель данной статьи-описание лингвистических особенностей кинодиалога.

В работе применялись следующие методы и приёмы исследования:

Диалог в кино - это не только общение, но и развитие сюжета и конфликта. Благодаря диалогу и герой фильма, и зритель могут узнать новую информацию.

Теоретический обзор

Кино - многозначный и многоаспектный предмет изучения, который анализируется различными дисциплинами, такими как лингвистика, переводоведение, литературоведение и т.д.

Изначально, в эпоху немого кино, существовало литературное либретто, или предисловие.

Либретто - это предисловие к фильму, в котором описывались наиболее важные события и кратко и емко излагался сюжет.

С развитием технологий в области кинематографа возросло и значение слова и его вербальной составляющей. Слово в кино продолжает развиваться и сегодня с расширением технологических возможностей, но предметом теоретического изучения эта форма языкового существования стала только в последнее десятилетие.

Кинодиалог как текстовое явление впервые был упомянут в работе Л.В. Ильичева при анализе немецкой кинопрозы и ввела его в научную дискуссию. Исследовательница определяет кинодиалог как «отрезок речи персонажа» [1]. Несмотря на перспективность изучения этого явления, российские лингвисты не уделяют ему должного внимания.

За последние двадцать лет изучение этого явления привело к следующим результатам.

Значительный вклад внесен В. Е. Горшковой: создание теоретических основ процессного подхода к переводу кинодиалогов; две монографии, посвященные специфике кинодиалога как особого типа текста, используемого в кинопереводе, а также ряд статей, посвященных данной проблеме [2; 3; 4]. В. Е. Горшкова понимает кинодиалог как «вербальный компонент художественного фильма, смысловая завершенность которого обеспечивается аудиовизуальным (звуковым и изобразительным) рядом в общем дискурсе фильма» [2]. В этом определении не случайно на первое место выходит вербальный, а не невербальный компонент, хотя последний функционирует как смыслоопределяющий.

Существен вклад и других исследователей. Так, И. П. Муха выделил четыре типа информационного содержания кинодиалога: полное, двойственное, интегративное и комплементарное [5].

И. П Федотова определяет кинодиалог как сочетание устно-речевого и письменно-речевого компонентов. К вербальному компоненту относятся речь персонажей, речь дикторов телевидения и радио в кадре, различные виды звукозаписей в кадре, все виды закадрового повествования, песни, исполняемые или слышимые персонажами, все виды письменных текстов в кадре и за кадром [6].

По мнению Е.А. Колодина, кинодиалог - это «вербальная составляющая фильма, ее смысловое дополнение аудиовизуальным (звуковым и изобразительным) рядом.

в общем дискурсе фильма» [7]. Е. А. Колодина изучила взаимодействие семиотических систем в формировании смысла кинодиалога и дополнила теоретическую образно-смысловую модель кинодиалога, предложенную В. Е. Горшковой, которая объясняет композиционное взаимодействие различных семиотических систем фильма в пространстве кинодискурса.

Как видно из приведенных выше определений, кино диалог не похож на разговорный текст в традиционном понимании.

Диалог в кино отличается от спонтанной разговорной речи. В повествовательных фильмах диалог может изо всех сил стараться имитировать естественный разговор, но это всегда имитация, потому что кинодиалог пишется, редактируется, подвергается цензуре, дорабатывается, репетируется и исполняется . Ошибочно полагать, что диалог в кино должен напоминать диалог из повседневной жизни .

Термин «кинодиалог» обозначает доминирование диалогической речи персонажей как основной естественной формы общения. Монологическая речь также присутствует в кинодиалоге, но не занимает доминирующего положения. Доминирование диалога в кино связано с тем, что кинематограф делает акцент на зрелищность, при которой мотивы поступков персонажей не нуждаются в объяснении, а проясняются видеорядом

Поэтому диалогический материал фильма, предназначенный для воспроизведения на экране, лаконичен и приобретает смысл только в зависимости от изображения, при этом кинодиалог может передавать не только фактико-логическое содержание, но и различные виды эмоционально-экспрессивной и оценочной информации.

По мнению С. Козлова, диалог в кино (которое по своей природе является прежде всего визуальным массовым искусством) более лаконичен, чем диалог в театре, поскольку в кино он дополняет действие, а не заменяет его [8].

Отличие диалогической речи от монологической состоит в том, что говорящий может отказаться от собственного мотива высказывания, поскольку мотив содержится в вопросе вопрошающего. Еще одним отличием диалога от монолога является знание собеседниками общей темы или даже общего

содержания разговора, а также умение говорящего включать в разговор языковые и экстралингвистические элементы: мимику, жесты, интонационные и просодические средства, паузы. Иными словами, имплицитные характеристики кинодиалога отражают как опыт говорящего, так и различные каналы коммуникации: вербально-интонационный, мимический и жестовый, а также ситуативный.

Как язык, звучащий с экрана, кинодиалог характеризуется естественностью, идиоматичностью, выраженной синтаксической спецификой, использованием элизии и прагматических связок, характерных для повседневного языка [9]

Как текстовый феномен кинодиалог относительно самостоятелен и представляет собой целостное и отдельное структурное образование. Кинодиалог отличается от классического письменного текста по ряду структурных параметров. Кинодиалог предстает как непрерывный текст, не разделенный на главы и абзацы; он содержит минимум отдельных элементов, способствующих восприятию текста в целом и обеспечивающих связность и слитность его частей

М.С. .Снеткова выделяет следующие особенности диалога в кино: (1) ограниченное время; (2) мгновенное восприятие и обратная связь; (3) видеоряд определяет выбор возможных вариантов перевода (при устном переводе необходимо учитывать специфику аудио- и видеоряда). [10].

. Кинодиалог характеризуется как общими текстовыми категориями (информативность, связность, целостность, смысловое разделение, проспекция и ретроспекция), так и частными текстовыми категориями, среди которых доминирующей является тональность, понимаемая как «концептуальная и содержательная категория кинодиалога, отражающая культурный аспект фильма и его выражение в «передаче реалий и языковых особенностей персонажей» [11].

Что касается структуры кинодиалогов, то они структурно представлены репликами – фрагментами речи, определяемыми намерениями субъектов общения. Каждый ответ подразумевает речевой акт. Реплики связаны тематически и логически.

В кинодиалоге обычно участвуют два или более собеседника.

Способ адресации сообщения определяет изменение направления коммуникации [11].

Некоторые элементы диалога в фильме непоследовательны. Может случиться, что в кинодиалоге изменится одна или несколько целей, изменится количество собеседников, не будет сохранено единство темы или диалоги окажутся логически незавершенными.

В кинодиалоге субъекты общения реализуют явные или неявные коммуникативные цели и намерения (запрос информации, оценка, вопрос, рекомендация, просьба, совет и т. п.), установки (прагматика высказывания: коннотативные утверждения, аллюзии и т. п.), обязательным признаком которого является ссылка. (соответствие языка выражения, относящиеся к реальным объектам).

Для достижения своих целей коммуникаторы прибегают к различным тактикам и речевым стратегиям.

Они основаны на прагматических предположениях. Прагматические допущения предполагают взаимную оценку уровня различных личных качеств (знаний, образованности, черт характера и т. д.) коммуникантами, а также оценку информативности высказываний (иронии, страха, двусмысленности и т. д.). и оценка приоритетов в диалоге (упорядочивание вопросов диалога в соответствии с тем, что является наиболее важным).

Заключяение.

Таким образом, кинодиалог – разговорный текст, подвергшийся определѐнной стилизации в соответствии с интенциями кинорежиссера,обладающий постоянными и переменными характеристиками. Специфика кинодиалога как кинолингвистической системы учитывает как вербальный, так и невербальный жлементы для целостного толкоани смысла

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Political sciences

EUROPEAN INTEGRATION IN THE SYSTEM OF INTERNATIONAL RELATIONS

Gulumjanli Aziza Ayaz
The Institute of Oriental Studies named after academician Z. M. Bunyadov of the Azerbaijan National Academy of Sciences

Abstract

The characteristic feature of the modern stage of international relations is undoubtedly the formation of new approaches that determine the nature of relations between states and state blocs. These approaches are not only reshaping how countries interact but also laying the foundations for the establishment of a new world order following the collapse of the bipolar system. The fall of this system marked the end of the Cold War and created new challenges for the international community. From this historical perspective, it becomes clear that the development of integration has been a natural consequence of the evolution of productive forces, necessitating closer and more reliable connections among states and entities. This shift towards greater cooperation stems from the need to eliminate many of the barriers that once hindered cross-border collaboration. In particular, integration has become a critical component in the restructuring of the international relations system. Over time, various forms of integration have emerged, and the European integration process serves as one of the most prominent examples. The integration of European states has evolved from a simple economic cooperation model into a broader political and institutional framework, thus making Europe one of the most integrated regions in the world. In this context, the role of integration goes beyond merely fostering economic ties; it also involves creating political cohesion and ensuring security within a region that was once divided along ideological lines. In examining the European integration process, it is essential to consider the conceptual underpinnings of integration itself. Integration, in its most basic form, involves the blending of different elements into a unified whole, often through cooperative mechanisms that enhance mutual benefits. This concept is not only relevant in the context of Europe but can also be applied to other parts of the world where states are seeking to strengthen their ties in the face of shared challenges. Integration, thus, plays a crucial role in shaping the global order of the modern world. As we analyze the European integration process within this conceptual framework, we observe that the dynamics of cooperation have transformed over time. What began as a practical economic collaboration has expanded into a complex web of political, social, and cultural interdependence. The results of this integration are clear: it has led to increased stability, prosperity, and cooperation among European nations, providing valuable lessons for other regions seeking to foster similar ties. In conclusion, the process of integration remains a cornerstone of contemporary international relations. By systematically analyzing the evolution of European integration, we gain valuable insights into how states and regions can navigate the complexities of globalization while strengthening their connections with one another. This understanding is crucial as the world continues to adjust to the changing contours of international relations in the post-bipolar era.

1. The Conceptual Essence of Integration Processes

The term "integration" has undergone evolution over the years before attaining its current universally accepted form, even bearing different meanings in earlier times. Initially, it is essential to note that the Latin word "integratio" means "full restoration" or "renewal" [6, p. 11]. Thus, in general terms, the concept refers to the state of interconnection between differentiated parts and functions of a system or organism, as well as the process leading to such a state. Analyzing the term itself, we may infer that, according to "Britannica," the national encyclopedia of the United Kingdom, "integration" refers to the transformation of relations among independent or autonomous socio-political entities (tribes, kinship groups, cities, countries, trade unions, political parties) in a way that reduces their independence or autonomy [5, p. 411].

Another definition of "integration" is provided by Kaplan. According to M. Kaplan, the founder of system analysis in international relations, integration signifies the unification of two or more parts into a single whole or "the absorption of others by a system"

It is important to note that the term "integration" cannot be considered separately from the concept of "system." The existence of multiple interpretations of the system concept demonstrates the impossibility of defining it in isolation from the general theory of systems. In this context, the definition provided by L. Bertalanffy, who describes a system as a "complex of interacting components," is more appropriate. American scholars R. E. Fagin and A. D. Hall define a system as "a set of elements that are interconnected and form a

single whole." They also view a system as "a structure comprising objects and the relationships between those objects and their attributes" [1, p. 40].

Historically, the development of integration issues has been a natural consequence of the growth of productive forces, which, in turn, required the establishment of more reliable relations and connections between subjects, as well as the elimination of numerous barriers to cooperation. However, contrary to common belief, this process has not been solely based on mutually beneficial economic, military, and cultural cooperation but has also been shaped within the framework of interstate integration unions founded on political agreements.

Political integration is observed in the nature of relations among modern political entities, such as states. According to Alan V. Deardorff, during the integration process, these entities voluntarily accept a form of central authority. This process requires at least four fundamental elements: (a) participating political entities must permit the creation of central institutions responsible for shaping and implementing integration policies; (b) the functions of this central body must be significant and specific; (c) the functions or tasks performed by the central institutions must be inherently expansive; (d) political units must remain committed to the common enterprise [3].

Alan V. Deardorff further notes that in the system of international relations, integration implies the acceptance of the policies of individual countries as a unified political entity. The degree of political integration is often assessed by examining whether interest rates, stock prices, or commodity prices are aligned across various national markets [3, p. 23]. In general, integration is frequently viewed in an economic sense, particularly as the gradual unification of national markets within a group of states into a single economic complex that may eventually evolve into a political and economic union.

2. The Role of European Integration in the International Relations System

The goal of any country's accession to a particular union is to ensure long-term high growth rates and mitigate negative external influences (financial, raw material factors, and other forces). In other words, integration is a unique political and economic process. Therefore, it should not be equated with concepts such as neighborhood or friendship. Successful integration cannot be reduced to harmonious neighborhood relations, friendship, or cooperation. Integration involves conditions that extend far beyond the diplomatic, military, and economic experience of the 20th century.

Expanding on this point, examining Western Europe's integration practices reveals the following:

1. European integration emerged at the beginning of the Cold War amid the weakening of political and economic institutions following World War II and the United States' efforts to expand its influence through the Marshall Plan.
2. European integration became possible by resolving the long-standing Franco-German rivalry, with these two major powers laying the foundation for the process. Other participants gradually joined them.
3. Integration was not only dependent on the long-term evolution of nation-states and the high cultural level of political elites but also required a high degree of economic, political, and legal culture across society as a whole. Achieving this was no simple task, as countries coordinated all their internal resources for development.
4. Integration does not commence merely through political declarations or the signing of high-profile agreements. For example, European integration began at the level of enterprises and industries, resolving numerous pricing and customs-related issues.
5. European integration demonstrated that participating countries had different levels of development, interests, and priorities, which influenced their goals and objectives. Special programs were developed, particularly funded by Germany, to support lagging countries.
6. Integration is effective only if it helps resolve specific problems and yields tangible benefits for each citizen. However, this process requires a transitional period, as seen with the introduction of the euro, which initially caused economic discomfort.
7. Integration is not a universal solution to all problems. The experiences of the Czech Republic, Poland, Slovakia, Hungary, and the Baltic states indicate that each country must exert its maximum effort and should not rely solely on external support. Furthermore, mobilizing the interests of six countries is considerably easier than coordinating the interests of nine, twelve, fifteen, or twenty nations.

Additionally, the development of European integration has been significantly influenced by the identification of patterns within integration processes, as well as the determination of their directions and prospects.

Conclusion

This paper has explored the concept of integration, its terminological aspects, and various theoretical-conceptual approaches related to integration as an element of the international relations system. Additionally,

it has critically examined the views of certain researchers and analyzed their perspectives on integration processes. Based on this analysis, it can be concluded that the most fundamental definitions of integration have been provided by the "Britannica" encyclopedia and researcher Kaplan.

Furthermore, it is evident that European integration is a lengthy and complex process that entails both positive and negative developments. Integration requires the emergence of a particular historical context, favorable international relations, and the readiness of a country in political, social, and legal dimensions. Since any country's existence presupposes interactions with others, integration plays a crucial role in modern international relations.

A critical observation in reviewing the academic literature on integration in the international relations system is that many studies analyze integration without considering the specific characteristics of the regions or groups involved. Instead, they primarily rely on the principles and characteristics of European integration, particularly the historical experience of the European Union.

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Technical sciences

A COMPARATIVE ANALYSIS OF SOLVING THE THERMAL CONDUCTION EQUATION USING DUAL NUMBERS AND AUTOMATIC DIFFERENTIATION

Spartak Sirakanyan
Applied Mathematics and Physics,
National Polytechnic University of Armenia, Teryan 105, Yerevan, 0009, Armenia.

Abstract

This paper presents a comparative analysis of the methods for solving the thermal conduction equation. The differential equation was solved using dual numbers and automatic differentiation. The thermal conduction equation is one of the fundamental equations of physics, describing the temperature distribution in a given region over time. The paper compares the accuracy, efficiency, and computational cost of these two methods for solving the thermal conduction equation. Experimental results show that the automatic differentiation method is more effective for more complex problems, and the dual number method for simpler problems. Although this still requires further development and analysis, the unique characteristics of dual numbers open up new possibilities for solving differential equations.

Keywords: Thermal Conduction Equation, Differential Equations, Automatic Differentiation, Dual Numbers, Comparative Analysis

Introduction

Differential equations and equations of mathematical physics play an important role in mathematics, physics, and modeling of various natural and technical processes. These equations appeared in the 17th-18th centuries, when Isaac Newton and Gottfried Leibniz began to formulate the laws of nature, such as the motion of bodies and temperature changes, using mathematical models. Differential equations allow us to predict the behavior of systems that undergo changes in time or space. They are widely used in such fields as physics, mathematics, biology, economics, engineering, and medicine. Solving differential equations helps develop effective methods for analyzing and optimizing systems in real applications. The papers [1] and [2] investigate the use of dual numbers in computational problems: in [1] they are used for algorithmic differentiation and extension of classical numerical methods, and in [2] a method for calculating the Jacobian matrix in robot kinematics is proposed, demonstrating a 12% acceleration of calculations when using the KUKA KR 500 robot. Automatic differentiation (AD) is a powerful tool for calculating high-level derivatives such as Jacobian and Hessian matrices, as well as function tensors. One of the key applications is the use of AD in optimization algorithms, where efficient calculation of derivatives plays an important role [3]. In [4], an approach is proposed that integrates automatic differentiation with the finite element method, which allows transforming standard programs for deterministic analysis into stochastic versions suitable for the analysis of engineering structures subject to random influences. The original Holley method, also known as the tangential hyperbola method, which is a classical third-order method for solving optimization problems, is considered in [5]. However, calculating the derivatives in solving the Holley equation becomes a key issue to reduce the computational cost. In this paper, an improved version of the method is proposed using the automatic differentiation technique and the conjugate gradient method with preconditioning.

Thermal Conduction Equation

Let us consider a rod whose lateral surface is thermally insulated and which is sufficiently thin, i.e. we can assume that the points of the cross section have the same temperature. Let us assume that the coordinate line Ox passes through along the axis of the rod. Let $v(x,t)$ denote the temperature of the section x at time t. Heat can be absorbed or generated within the rod. The function $F(x,t)$ represents the density of the heat source at the intersection point x at time t. The process of temperature distribution in the rod is described by the relation:

$$c\rho\frac{\partial v}{\partial t}-\frac{\partial}{\partial x}\left(k\frac{\partial v}{\partial x}\right)=F(x,t)$$

where k is the coefficient of thermal conductivity, c is the specific heat capacity, and ρ is the density [6] . Let's call it the thermal conduction equation.

Dual Numbers and Automatic Differentiation

Dual numbers are generalizations of complex numbers. There are three types of generalized complex numbers:

1. Complex Numbers (ordinary, $i^2 = -1$)
2. Doubles Numbers (hyperbolic, $i^2 = 1$, but $i \neq 1$)
3. Dual Numbers (parabolic, $i^2 = 0$,but $i \neq 0$) [7]

Dual numbers were introduced in 1871 by William Clifford . A dual number or (hyper)complex number of parabolic type "according to Clifford" is a complex number of the form:

$x = a + b\eta$, where $\eta^2 = 0$

Let's calculate the function depending on the dual number using the Taylor series. If we replace $a + b\eta$ with x, we get:

$$f(a + b\eta) = \sum_{k=0}^{\infty} \frac{f^{k}(a)}{k!}(a + b\eta - a)^{k} = \sum_{k=0}^{\infty} \frac{f^{k}(a)\, b^{k}\, \eta^{k}}{k!} = f(a) + bf'(a)\eta + \\ + \eta^2 \sum_{k=2}^{\infty} \frac{f^{k}(a)\, b^{k}\, \eta^{k-2}}{k!} = f(a) + bf'(a)\eta$$

This equation shows that, using dual numbers, we can simply substitute the dual number into a function without calculating the derivative of the function, and get the value of the function at that point, as well as the value of the derivative of the function at that point.

Automatic differentiation (AD) is a method of calculating derivative functions based on the application of the chain rule to successive operations. Unlike numerical differentiation, AD allows you to accurately calculate derivatives without approximations, using direct and reverse passes through a program or algorithm. This method is especially useful for optimization and solving complex problems related to higher derivatives, such as partial differential equations, machine learning problems, and deep learning applications. In machine learning, AD is used to efficiently calculate gradients when training models, which allows you to optimize loss functions using methods based on gradient descent. It is especially useful for neural networks where gradients are propagated back through the layers, allowing fine-tuning of weights and biases to minimize prediction errors. AD eliminates the need to manually calculate derivatives, which makes it a powerful tool for training complex models and solving problems based on big data.

Comparative Analysis of Solutions

In this work, the differential equation of thermal conductivity was solved by two methods using the Python programming language. With the same coefficients I got the following results: (Table 1) (The time measurements may vary due to system performance and runtime factors).

Table 1.

Comparison of methods by speed

Methods	Time to solve the problem
Dual Numbers	0.000108 seconds
Automatic Differentiation	0.001519 seconds

In (Table 2) I have presented the advantages and disadvantages of the two methods.

Table 2.

Comparison of Solutions

Criteria	Dual numbers	Automatic Differentiation
Accuracy	Very high accuracy, since calculations are performed using dual number algebra, which eliminates rounding errors	Also high accuracy, since exact differentiation is used, but errors can appear when using calculations in large networks or complex expressions
Complexity of implementation	It is necessary to manually implement the work with dual numbers, which can be complex and time-consuming, especially for complex functions	Ease of use, as for most tasks it is enough to connect a library (for example, autograd or TensorFlow). Minimal configuration is required
Versatility	Suitable for simple functions and problems where derivatives can be calculated manually	Very versatile and suitable for solving problems in the field of machine learning, deep neural networks and other complex calculations where the functions can be quite complex
Use in Machine Learning	Rarely used as most machine learning tasks require working with large amounts of data and complex models	Most applicable to machine learning tasks, especially neural networks and optimization. Used in libraries such as TensorFlow, PyTorch, JAX
Flexibility	Limited flexibility, must manually customize code for each function and task	High flexibility, the library automatically handles calculations for any functions and operands
Errors and mistakes	Very low rounding errors, but requires fine tuning to work with various functions	An error may occur if there are too many calculations or if the setup is poor (for example, using an inappropriate step in optimization)

Conclusion

In this paper, we conducted a comparative study of two methods for calculating derivatives: the dual number method and the automatic differentiation method. Both approaches have high accuracy, but differ in the complexity of implementation, versatility, and scope of application. The dual number method, due to its high accuracy and minimal rounding errors, is ideal for analytical problems with simple functions that require full control over the calculation process. However, its use in complex or multidimensional problems is limited, as it requires significant efforts for implementation and data manipulation. On the other hand, the automatic differentiation method has greater flexibility and performance, which makes it preferable for solving problems in the field of machine learning, neural networks, and other complex calculations. The use of ready-made libraries can significantly speed up the development and optimization process, which is especially important when working with large amounts of data. Comparison of the methods by speed (Table 1) shows that the dual number method solves the problem faster (0.000108 seconds), while the automatic differentiation method takes more time (0.001519 seconds). This confirms that for problems that require fast data processing, the dual number method may be preferable, especially for simple calculations. Thus, the choice between the methods depends on the specific problem: for analytical calculations and problems with simple functions, the dual number method is better suited, while for complex multidimensional problems and optimization of large models, the automatic differentiation method is more efficient. In the future, I plan to create libraries that will allow me to solve more complex differential equations.

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SOLVING THE PROBLEM OF STICKING OF ANNEALED ANODE BLOCKS DUE TO HIGH PITCH CONTENT IN GREEN ANODES

N.Zh. Yerezhep[1]
S.R. Massakbayeva[2]
Master of chemical technology of inorganic substances[1]*, candidate of chemical science*[2]
Toraighyrov University, Republic of Kazakhstan, Pavlodar

Abstract

This article examines the issues related to the production of baked anodes for the aluminum industry, with a particular focus on the sticking of anode blocks due to the high pitch content in green anodes. The primary reasons for this issue include the deposition of resinous by-products and incomplete pitch carbonization under suboptimal thermal conditions. A detailed analysis of pitch characteristics, anode composition, and baking regimes was conducted to assess their influence on the probability of sticking. The study identifies critical parameters such as pitch content, heating rates, and furnace atmosphere that affect adhesion between anode blocks. Experimental findings suggest that reducing pitch content to 10-14% and implementing controlled heating profiles minimize block adhesion. Proposed solutions include optimizing pitch composition, adjusting thermal treatment conditions, and incorporating separation materials like coke interlayers. These modifications not only improve anode quality and operational efficiency but also contribute to lower production costs and reduced environmental impact. The study's recommendations hold significant industrial value, offering a practical approach to mitigating anode sticking in large-scale production.

Keywords: anode sticking, high pitch content, baking regime optimization, thermogravimetric pitch analysis, anode separation materials, carbonization of binder, aluminum electrolysis efficiency, industrial process improvement.

In the production of carbon anodes for aluminum electrolysis, ensuring the quality and uniformity of baked anode blocks is critically important. However, a high pitch content in green anodes can lead to block sticking during the baking process, causing operational problems and product defects.

In most furnaces, calcined petroleum coke with a particle size of 0.1 to 6 mm is used as a covering material. When determining the thickness of the covering layer on the top and sides, the following factors must be considered:

If the top layer is too thick, more time is required for material removal. Notably, the removal of covering material is one of the most time-consuming operations in the baking furnace.

The amount of covering material: The utilization coefficient of the cassette (i.e., the ratio of the anode volume to the cassette volume) is approximately 60%. As a result, the remaining 40% of the cassette volume must be filled with covering material.

In some cases, when causes are difficult to determine, as well as in cases of high pitch content where cracking issues arise, covering material (coke) adhesion to anodes occurs.

Main Causes of Anode Block Sticking

Role of Pitch in Green Anodes Pitch serves as a binder, ensuring the structural strength of anodes before the baking stage. However, at temperatures of 350–500 °C, it decomposes, releasing volatile substances that contribute to the formation of a sticky layer on the anode surfaces.

Baking Process Parameters

- Temperature: When heated above the softening point of pitch (approximately 200–250 °C), the risk of sticking increases.
- Pressure**:** High load between blocks enhances adhesion.

Contact Conditions

- Incorrect stacking of anodes in the furnace.
- Lack of separation materials, such as coke interlayers.

Sticking mainly occurs due to two mechanisms:

- Deposition of resinous by-products on block surfaces at elevated temperatures.
- Formation of a sticky layer due to incomplete pitch carbonization, especially under suboptimal thermal gradients.

Raw Materials and Baking Conditions:

- Green anodes**:** Composition, pitch content (10-14% by mass), and particle size distribution.

- Pitch characteristics**:** Softening temperature, coke yield, and viscosity measurement.

Baking conditions:

- Heating regimes: Standard temperature rise rates (10-15 °C/h) up to peak values (1100-1250°C).
- Atmospheric conditions: Nitrogen-enriched environment to minimize oxidation.

Influence of Pitch on Anode Quality

The literature contains numerous studies on the relationship between pitch properties and anode quality (Alsher et al., 1990; Rhedey, 1990). Of all pitch properties, the most significant influence on anode quality is exerted by the coking value.

Laboratory tests using standard compositions and technological parameters have demonstrated the effect of the coking value on the apparent density of the anode. As shown in Figure 1, the apparent density of pressed baked anodes increases by 0.01 kg/dm3 with a 20°C increase in the pitch softening temperature according to the Mettler method. This finding is consistent with the conclusions of Wagner et al. (1988, 1986), who reported changes in the apparent density of baked anodes by 0.021 kg/dm3 with a 20°C change in the Mettler softening temperature.

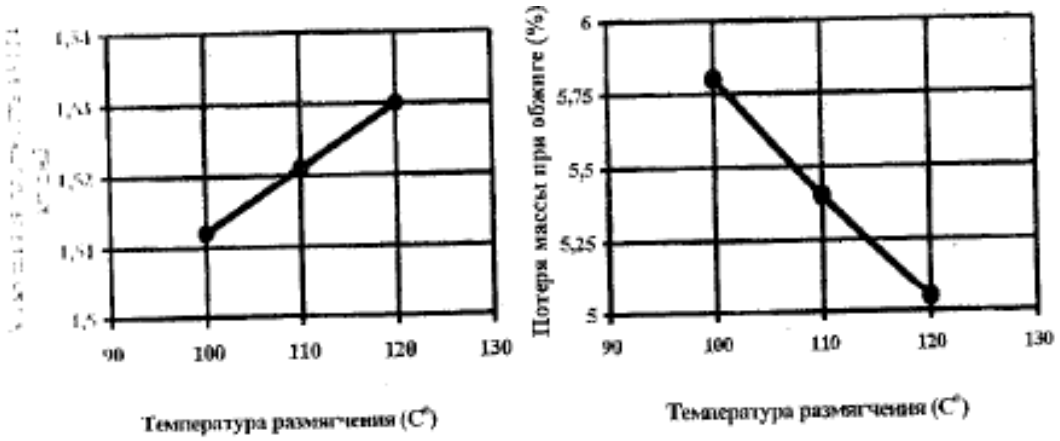

Figure 1 – Influence of Pitch Softening Temperature on Anode Density and Mass Loss During Baking.

Pitch acts as a binding component, ensuring the structural integrity of green anode blocks. During baking, pitch undergoes pyrolysis, releasing volatile organic compounds (VOCs) and leaving a carbon residue. Excessive pitch content increases VOC emissions, leading to their deposition on adjacent blocks and subsequent sticking. High pitch content also increases the amount of liquid phase during heating, promoting pitch residue spread between anodes, which creates a "glue" effect and results in sticking. Furthermore, high pitch content can mix with coke filler, creating deposits between anodes, especially in interblock spaces, and affecting anode structure after baking due to the formation of a denser carbon layer.

To prevent this issue, pitch content in green anodes is optimized, considering factors such as:

- Ratio of coke to pitch in the mixture.
- Viscosity and thermal properties of pitch.
- Heating rate and temperature in multi-chamber ring furnaces.

Conclusion

Analysis has shown that optimizing the composition of green anodes and improving baking processes play a key role in enhancing anode quality and operational performance.

Sticking of baked anode blocks due to high pitch content in green anodes is a complex problem. This study highlights the importance of raw material control and baking parameter optimization. The proposed solutions, including pitch optimization and temperature regime adjustment, provide a practical approach to eliminating this issue and improving anode production efficiency.

Modifying baking processes, including slower heating rates in critical temperature ranges (300-600 °C) and atmosphere control using inert gases for effective removal of volatile organic compounds, minimizes internal anode defects and enhances their uniformity.

Implementing these approaches helps reduce production costs, improve environmental performance, and enhance aluminum electrolysis efficiency, making these solutions relevant and promising for industrial applications.

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Veterinary sciences

CASE ANALYSIS OF A CHICKENS DEATH FROM EXHAUSTMENT IN AN INDIVIDUAL FARM

Papchenko I.
candidate of veterinary sciences, associate professor,
associate professor of the department of veterinary and sanitary examination
and laboratory of diagnostics of the Institute of Postgraduate Studies
managers and specialists of veterinary medicine
Belotserk National Agrarian University,
Bila Tserkva, 8/1 Cathedral Square, Ukraine, 09100
ORCID: 0000-0003-2476-8770
Antipov A.
candidate of veterinary sciences, associate professor
associate Professor of the Department of Parasitology and Pharmacology
Bilotserk National Agrarian University,
Bila Tserkva, 8/1 Cathedral Square, Ukraine, 09100
ORCID: 0000-0003-3955-3377
Goncharenko V.
candidate of veterinary sciences, associate professor
associate Professor of the Department of Parasitology and Pharmacology
Bilotserk National Agrarian University,
Bila Tserkva, 8/1 Cathedral Square, Ukraine, 09100
ORCID: 0000-0003-3955-3377
Selykh I.
teacher of special disciplines
VSP "Technological and economic professional college of
Belotserkiv National Agrarian University,
Bila Tserkva, st. 21/2 Yaroslav the Wise, 09100
Yerokhina O.
teacher of veterinary disciplines, specialist of the highest category
VSP "Technological and economic professional college of
Belotserkiv National Agrarian niversity
Bila Tserkva, st. 21/2 Yaroslav the Wise, 09100
Peresunko E.
teacher of veterinary disciplines, specialist of the first category, master
VSP "Technological and economic professional college of
Belotserkiv National Agrarian University,
Bila Tserkva, st. 21/2 Yaroslav the Wise, 09100
Chovgun A.
teacher of veterinary disciplines, specialist of the highest category, master
VSP "Technological and economic professional college of
Belotserkiv National Agrarian University,
Bila Tserkva, st. 21/2 Yaroslav the Wise, 09100

АНАЛІЗ ВИПАДКУ ЗАГИБЕЛІ КУРКИ ВІД ВИСНАЖЕННЯ В ІНДИВІДУАЛЬНОМУ ГОСПОДАРСТВІ

Папченко І.
кандидат ветеринарних наук, доцент,
доцент кафедри ветеринарно-санітарної експертизи та лабораторної діагностики
Інституту післядипломного навчання керівників та спеціалістів ветеринарної медицини
Білоцерківський національний аграрний університет,
м. Біла Церква, Соборна площа 8/1, Україна, 09100
ORCID: 0000-0003-2476-8770

Антіпов А.
кандидат ветеринарних наук, доцент
доцент кафедри паразитології та фармакології
Білоцерківський національний аграрний університет,
м. Біла Церква, Соборна площа 8/1, Україна, 09100
ORCID: 0000-0003-3955-3377
Гончаренко В.
кандидат ветеринарних наук, доцент
доцент кафедри паразитології та фармакології
Білоцерківський національний аграрний університет,
м. Біла Церква, Соборна площа 8/1, Україна, 09100
ORCID: 0000-0003-3955-3377
Селих І.
викладач спеціальних дисциплін
ВСП „Технолого-економічний фаховий коледж
Білоцерківського національного аграрного університету"
м. Біла Церква, вул. Ярослава Мудрого 21/2, Україна 09100
Єрохіна О.
викладач ветеринарних дисциплін, спеціаліст вищої категорії
ВСП „Технолого-економічний фаховий коледж
Білоцерківського національного аграрного університету"
м. Біла Церква, вул. Ярослава Мудрого 21/2, Україна 09100
Пересунько О.
викладач ветеринарних дисциплін, спеціаліст першої категорії, магістр
ВСП „Технолого-економічний фаховий коледж
Білоцерківського національного аграрного університету"
м. Біла Церква, вул. Ярослава Мудрого 21/2, Україна 09100
Човгун А.
викладач ветеринарних дисциплін, спеціаліст вищої категорії, магістр
ВСП „Технолого-економічний фаховий коледж
Білоцерківського національного аграрного університету
м. Біла Церква, вул. Ярослава Мудрого 21/2, Україна 09100

Abstract

The presented work analyzes the reasons for the single death of mo-speeches in the private economy. For this purpose, a pathological-anatomical opening of the chicken was performed, where during the study the metabolism was detected in the course of insufficient feeding of a given animal. We have the question why among the games of animals that are kept under the same conditions and consume the same feed, there are cases of exhaustion in individual animals? A detailed analysis of the conditions of maintenance showed that chickens of all ages (up to one year and older than 2 years) are held in one room and among them is a manifestation of an age-old hierarchy, that is, older chickens often drive away from the feeders of the young people as long as they do not saturate themselves. And among young chickens there are isolated frightening specimens that do not consume feed enough and gradually deplete against the background of impaired metabolism for a shortage of feed consumed. To prevent this owner of chickens, such young should be detected and feeding them separately.

Анотація

В представлений роботі проведено аналіз причин поодинокої загибелі молодих курей в приватному господарстві. Для цього було проведено патолого-анатомічний розтин курки, де в процесі дослідження було виявлено порушення обміну речовин обумовленого недостатньою годівлею даної тварини. Перед нами постало питання, чому серед групи тварин, які утримуються в однакових умовах і споживають однакові корми, виникають випадки виснаження у окремих тварин? Детальний аналіз умов утримання показав, що кури різного віку (віком до року і старші 2 років) утримуються в одному приміщенні і серед них відбувається прояв вікової ієрархії, тобто старші кури часто відганяють від годівниці молодших доки самі не наситяться. А серед молодих курей є поодинокі лякливі екземпляри, які недостатньо споживають корму і поступово виснажуються на фоні порушення обміну речовин за дефіциту спожитого корму. Щоб запобігти цьому власнику курей слід виявляти такий молодняк і проводити їх годівлю окремо.

Keywords: chickens, cuts, inflammation, dystrophy, exhaustion, eggs, ascaria, eimerium oocycles.
Ключові слова: кури, розтин, запалення, дистрофії, виснаження, яйця, аскаридії, ооцисти еймерій.

Актуальність теми. Вирішальним фактором у збільшенні виробництва сільськогосподарської продукції та продуктів харчування для населення і сировини для промисловості є інтенсифікація виробництва [1, 2]. В Україні птахівнича галузь традиційна достатньо розвинена. Одним із головних завдань галузі птахівництва України було і залишається забезпечення населення екологічно безпечними та високоякісними продуктами харчування. Тому основою розвитку цієї галузі є створення здорових стад птиці [3–5]. Птиця різного напрямку продуктивності утримується як в великих птахопідприємствах промислового типу так і в приватних індивідуальних господарствах. Це дає можливість постійно забезпечувати внутрішній ринок країни м'ясною та яєчною продукцією і в значній кількості експортувати її в країни Західної Європи і Близького Сходу [6–9].

Мета роботи. Вивчити причину захворювання курей у приватному господарстві.

Матеріал і методи роботи. Дослідження проводились в двох кафедрах Білоцерківського НАУ. Розтин трупа курки віком до року, що належала підсобному господарству, розташованому у Васильківському районі Київської області проводили в секційній залі кафедри ветеринарно-санітарної експертизи, гігієни продуктів тваринництва та патологічної анатомії імені Й.С. Загаєвського [10–12], а паразитологічні дослідження проводились на кафедрі паразитології та фармакології. З цією метою ми дослідили 15 проб помету від курей різних вікових гру. Проби досліджували методом гельмінтоовоскопії з використанням лічильної камери для овоскопічних досліджень [13].

Власні дослідження. Розтин трупа курки віком до року, що належала підсобному господарству, розташованому у Васильківському районі Київської області. Маса трупа становила менше 1 кг. Пірйовий покрив чорного кольору, тусклий, злегка скуйовджений. Пір'їни добре утримуються в пірйових фолікулах. Вік курки становив до року, про що свідчать рогові лусочки в ділянці цівки, які щільно прилягають до епідермісу (рис.1). Гребінь і борідки світло-сірого кольору, анемічні (рис. 2).

Рис. 1. Рогові лусочки щільно прилягають до дерми

Рис. 2. Анемічність гребеня і борідок

Слизова оболонка ротової порожнини і кон'юнктива сірого кольору, помірно волога, очні яблука позападали в орбіти, рогівка помутніла. В підшкірній клітковині жирова тканина відсутня. Кровоносні судини підшкірної клітковини містять незначну кількість крові, що нагадує собою червону водянисту рідину.

Кіль викривлений і значно виступає над тілом грудної кістки. Грудні м'язи в незначній кількості розташовані на тілі грудної кістки, зів'ялої консистенції, сірого кольору з червонуватим відтінком, вологі, малюнок не виражений (рис. 3).

Рис. 3. Викривлення кіля і атрофія грудних м'язів

Слизова оболонка ротової порожнини, глотки і стравоходу світло-сірого кольору помірно вкрита слизом. На слизовій оболонці стравоходу виділяється дрібна зернистість як наслідок зроговіння епітелію навколо вивідних залоз за відсутності в раціоні (дефіциту) вітаміну А. Слизова оболонка вола сірого кольору і в ньому містилось біля 2 мл білої пінистої рідини.

Рис. 4. Рогова дистрофія слизової оболонки стравоходу

Слизова оболонка гортані і трахеї сірого кольору, помірно вкрита слизом, міжкільцеві кровоносні судини не проглядаються.

Легені сірого кольору з червонуватим відтінком, еластичні, на розрізі сіро-червоні, при натискуванні на них із бронхів виділяється повітря, а із судин червона водяниста рідина (рис 5). Стінка повітроносних мішків прозора, сторонній вміст в них відсутній.

Серце злегка збільшене за рахунок розширення правої половини, зів'ялої консистенції і не однотонно забарвлене сіро-червоний та сірий колір. Епікард гладенький, блискучий. Підепікардіальний жир відсутній. В порожнинах серця містилась невелика кількість крові, що нагадує собою червону водянисту рідину. Ендокард гладенький, блискучий, сірого кольору.

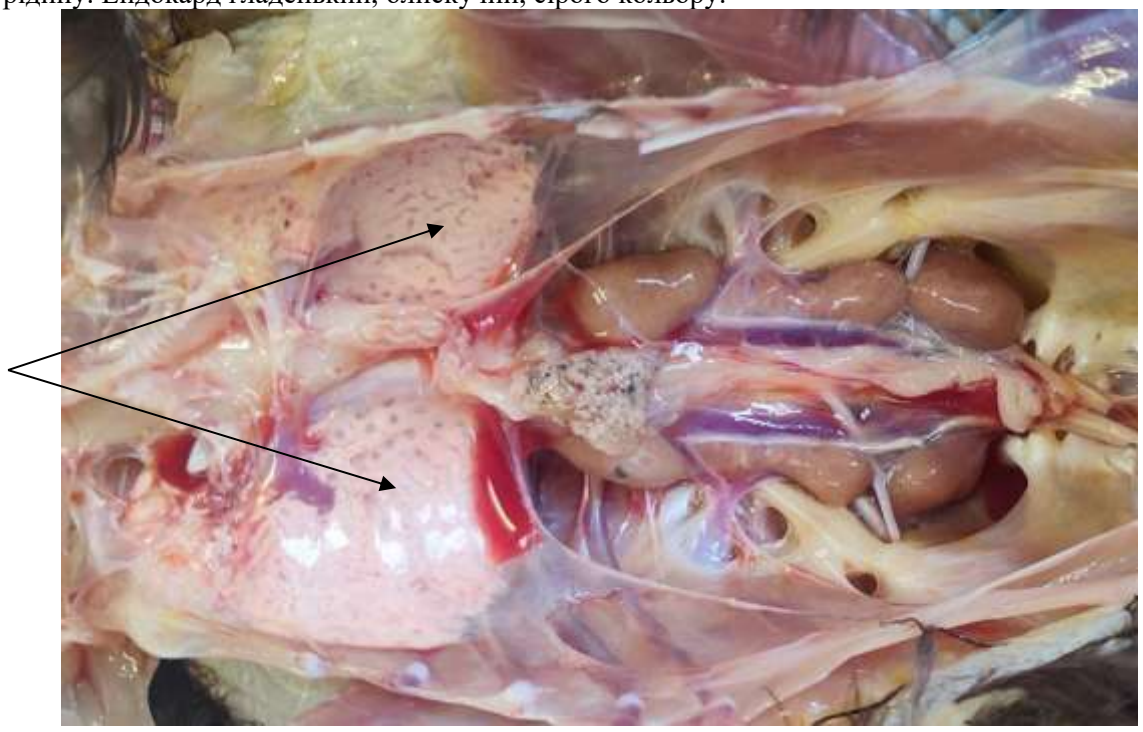

Рис. 5. Зовнішній вигляд легеней

Печінка не збільшена, злегка зів'ялої консистенції, не однотонно забарвлена в червоно-коричневий, а невеличкими ділянками в світло-коричневий колір. На розрізі вона мало кровна, забарвлена так як і ззовні, малюнок дещо стертий (рис. 6)

Рис. 6. Зовнішній вигляд: а – серця, б – печінки

Селезінка не збільшена, злегка зів'ялої консистенції, на розрізі темно-червона, помірно волога, малюнок не виражений, паренхіма не розм'якшена.

Нирки дещо зів'ялої консистенції, однотонно забарвлені в світло-коричневий колір, на розрізі такого ж кольору як ззовні, помірно вологі, малюнок не виражений Репродуктивні органи знаходяться на стадії формування (рис. 7).

Рис. 7. Зовнішній вигляд: а – нирок та б –репродуктивних органів

В залозистій частині шлунку містилась значна кількість гравію і сліди корму (очевидно, наслідок антиперистальтичних скорочень). Слизова оболонка його сірого кольору і вкрита значною кількістю слизу. В м'язовій частині шлунку містилась помірна кількість гравію із слідами корму. Слизова оболо-

нка м’язової частини шлунку сірого кольору. Під кутикулою, в слизовій оболонці, виявлено три невеликі ділянки ерозій розміром 3-5 мм в діаметрі (рис. 8). М’язи шлунку темно-червоного кольору, пружної консистенції, помірно розвинені.

Рис. 8. Ерозії слизової оболонки м’язової частини шлунку

В тонкому кишечнику містилось незначна кількість хімусу сіро-жовтуватого забарвлення. Слизова оболонка забарвлена переважно в сірий колір, а невеликими ділянками в сіро-червонуватий, злегка набрякла і вкрита слизом. В передній частині тонкого кишечнику виявлено дві зрілі аскаридії довжиною 6-8 см (рис. 9).

Рис. 9. Слизова оболонка 12-ти палої кишки з наявністю поодиноких аскаридій

В товстому кишечнику (сліпих кишках) містилось незначна кількість фекалій сіро-жовтуватого кольору, слизова оболонка сірого кольору помірно вкрита слизом. Просвіт клоаки містив значну кількість білої рідини густої консистенції Слизова оболонка клоаки мала сіре забарвлення.

Патолого-анатомічний діагноз:

1. Виснаження з інтенсивною атрофією скелетних м'язів.
2. Інтенсивно виражена загальна анемія.
3. Відсутність корму у волі (наявність невеликої кількості слизистої маси), залозистій і м'язовій частині шлунку (за наявності значної частини гравію), незначна кількість хімусу в тонкому кишечнику та фекалій в товстому.
4. Дві зрілі аскаридії в тонкому кишечнику.
5. Слабо виражений вогнищевий катаральний ентерит.
6. Слабо виражена зерниста дистрофія в міокарді, печінці та нирках.
7. Три невеличкі ерозії в слизовій оболонці м'язової частини шлунку (під кутикулою).
8. Виражена рогова дистрофія слизової оболонки стравоходу.

Проведений аналіз умов утримання і годівлі курей в даному господарстві показав, що все поголів'я курей в кількості 135 голів утримується в просторому приміщенні на підлозі з використання підстилки із соломи. Різновікові кури утримуються разом. Годують курей власними комбікормами з додаванням білково-вітамінних добавок. Фронт годівлі забезпечує всім куркам водночас приймати корм, але вікова ієрархія проявляється тим, що кури 2-3- річного віку відганяють молодих курей від годівниці, поки самі не задовольняться кормом. Тому серед молодняку появляються окремі лякливі тварини, які не регулярно одержують належну кількість корму, вони ослабляються внаслідок порушення обміну речовин (про що засвідчує рогова дистрофія слизової оболонки стравоходу), у них знижується апетит, вони відокремлюються від остальних курей, поступово виснажуються і гинуть. Щоб запобігти розвитку такого явища, слід відділяти таких окремих тварин із загального стада і утримуються окремо.

Паралельно з цим нами вивчалась ситуація з наявності і поширення в стаді гельмінтів. Для цього було досліджено 15 проб фекалій від курей різних вікових груп. У результаті копроскопічних досліджень були знайдені яйця аскаридій, гетеракисів та ооцисти еймерій. Зараженість курей аскаридіями, гетеракисами та еймеріями була слабкою (рис. 10).

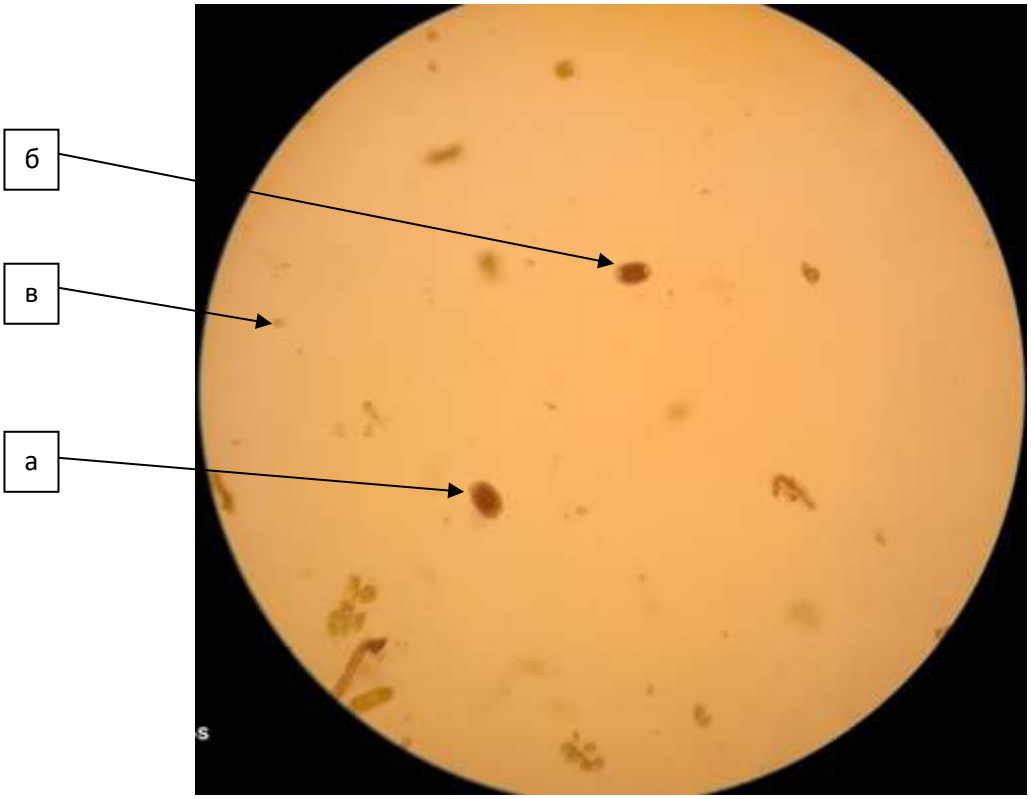

Рис. 10. Зовнішній вигляд яєць а – аскаридій, б – гетеракисів та в – ооцист еймерій

З метою лікування і профілактики аскаридозу, гетеракозу та еймеріозу курей ми рекомендували власнику господарства при можливості організувати утримувати птицю у пташниках на незмінюваній підстилці. Перед розміщенням кожної нової партії птиці проводити механічне очищення, дезінфекцію

і дезінвазію приміщень і замінювати підстилку. При вході до пташника обладнати дезкилимки. Приміщення для сховища фуражу та кормокухні захищати від залітання диких птахів. Періодично 1 раз на місяць проводити профілактичну дегельмінтизацію.

Висновки. На підставі результатів розтину прийшли до висновку, що дана тварина загинула від аліментарної дистрофії (виснаження). Але постало питання, що могло спричинити виснаження однієї курки, яка утримувалась в однакових умовах з іншим поголів'ям. Тому вирішено було провести детальний аналіз годівлі і поведінки курей різних вікових груп в період годівлі. Спостереження показали, що кури різного віку (віком до року і старші 2 років) утримуються в одному приміщенні і серед них відбувається прояв вікової ієрархії, тобто старші кури часто відганяють від годівниці молодших доки самі не наситяться. А серед молодих курей є поодинокі лякливі екземпляри, які недостатньо споживають корму і поступово виснажуються на фоні порушення обміну речовин за дефіциту спожитого корму. Щоб запобігти цьому власнику курей слід виявляти такий молодняк і проводити їх годівлю окремо.

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