

## **Biosecurity problems of liberated territories of Azerbaijan and their solutions**

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**The presented work touches upon the importance of ensuring the biological safety of society and nature in modern times, as well as the points taken into account when ensuring it. It becomes clear that biosecurity is a process aimed at preventing the spread of bioterrorism and infectious diseases, which lead to dangerous consequences and is realized thanks to the participation of each individual. Biosecurity is an even more important issue for Azerbaijan in view of more than 70% of water resources forms at the expense of transboundary sources, and the presence of a state in the neighborhood that openly uses all types of terrorism (political, ecological, biological, etc.). This is clearly shown by the pollution of Okhchuchay, which enters Azerbaijan from the territory of the Republic of Armenia, according to its physicochemical and microbiological indicators. At the same time, the presented work shows the local, regional and global problems for biosecurity and touched upon points that are important to pay attention to their solution.**

***Keywords: Biosecurity, bioterrorism, infectious diseases, transboundary waters***

### **INTRODUCTION**

One of the characteristic features of our increasingly globalized world is the development of approaches to the security of the country. From this point of view, the comprehensive guarantee of biological security (BS) of the country is one of those types. Thus, BS is one of the main and most important components of the security system that ensures the stable development of the state. Biologically active materials (living or various metabolites derived from them), which shake the world and are even more terrible than weapons of mass destruction, can sometimes be used as a tool that can destabilize the local, regional and global space, create social tension and cause other negative situations to occur. Although the advancements in world politics and scientific research have had a positive effect on the biosecurity problem, they have not been directed towards solving this issue fundamentally. For this reason, BS today should be characterized as an issue that concerns everyone, from the ordinary

citizen to the person at the highest level of power, and should be considered a realistic approach. If we add to what has been said, the achievements of biotechnology have a "double" character (Belyaletdinov, 2019; Romanovsky, 2021), then no further argument is needed to confirm how great the importance of this matter is.

First of all, it should be noted that in modern times, biosecurity (BS) is not only a concept that includes the fight against bioterrorism (Renault et al., 2021), it also includes the creation of conditions that allow the mass death of people and the emergence of serious problems of social and economic nature due to the purposeful and spontaneous spread of infectious diseases in the world. It is clear from this idea that it is necessary to create new technologies, develop and adopt strictly justified programs in the field of biosecurity within the country, and actively implement international relations to ensure BS.

Naturally, there must first be a legal basis for ensuring biosecurity, and this must be confirmed by the current Constitution of the Republic of

Azerbaijan and the international conventions it has joined as a state, signed agreements, adopted laws and other documents. It is no coincidence that new laws (Romanovsky, 2021; <https://adilet.zan.kz/rus/docs/Z2200000122>; Xue and Shang, 2022) are currently being adopted in this direction in many countries of the world (Russia, China, USA, Kazakhstan, Belarus, etc.). It is only necessary to note that the recent decisions about BS make this issue more comprehensive and significantly differ from the Cartagena Convention, which entered into force on 11.09.2003, and reveals new perspectives on the essence of biohazard.

In general, the based on accepted and planned principles of biosecurity in the world (Shevired, 2020) firstly must be the people's health and protection, as well as the reconciliation of the interests and responsibilities of individuals, the public and the state in the field of biosecurity.

Of course, in order to solve this issue, it is necessary to carry out many tasks, but it would be logical to express in a general form: "Creating technologies that allow identifying, preventing and completely eliminating any biological threats and constantly developing them in accordance with changing requirements". The fulfillment of this task is possible in any country due to the management of society and the use of nature in accordance with the principles of sustainable development. To make this possible, it is necessary to carry out scientific research and modern research.

Although the problem of BS is one of the issues at the center of attention in the Republic of Azerbaijan, the situation cannot be considered satisfactory in the full sense. It would be appropriate to clarify this against the background of the tasks that are performed or are important to solve in terms of providing BS in several countries of the world.

The first is the tasks performed in connection with the timely identification of diseases caused by biological agents, the functionally active substances synthesized by them, and the preparation of events to prevent complications that may occur due to their influence. It should be noted that if we approach the solution of these tasks in Azerbaijan from a scientific point of view, it is clear that this field should be strongly developed. Thus should be prepared a large-scale

research program for the timely identification of diseases and their causative agents, especially infectious diseases, preparation of scientific and practical bases of preventive measures aimed at the treatment of diseases, as well as preparation of methods and approaches that allow identification of metabolites produced by living organisms and causing various pathologies in humans. This program can be realized more successfully as a result of the joint activity of various fields (molecular biology, microbiology, biotechnology, genetic engineering, biochemistry, bioinformatics, toxicology, biophysics, etc.) of exact and natural sciences.

Secondly, tasks related to the use of resources, primarily bioresources, in accordance with the principles of safe and sustainable development. Extensive research is being conducted in this field around the world, and Azerbaijan is no exception in this respect. In the century we live in, the establishment of a scientific research institute under the Food Safety Agency, certain research in this field has been carried out in the institutes of ANAS (currently assigned to the Ministry of Science and Education of the Republic of Azerbaijan), the Ministry of Agriculture and Health of the Republic of Azerbaijan.

As it is known, up to 70% of Azerbaijan's water basin is formed due to transboundary waters (Yolchiyeva et al., 2020), and some of the states (Georgia and Armenia) located in the areas where these waters pass have not joined the relevant convention. On the other side, there are problems related to the security of water resources within the Republic of Azerbaijan itself. So, our territories that were occupied for nearly 30 years were returned to their original owners as a result of the 44-day Patriotic War. However, some issues that have not yet been resolved should be among the issues that should be given serious attention when ensuring the biological safety of waters from these areas to other regions of the country.

Therefore, the aim of the presented article is to clarify the points important for biosecurity and its provision in Azerbaijan.

## **MATERIALS AND METODOS**

Initial biomonitoring was carried out in

Okhchuchay under the leadership of the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan with the participation of the institutes of Microbiology, Zoology, Botany, Physiology, Soil Science and Agrochemistry of ANAS (currently of the Ministry of Science and Education of the Republic of Azerbaijan), as well as other organizations. The samples were taken from the part of Okhchuchay that falls on the territories of Jahangirbeyli (N 39°24321'E 46°44928'), Tagli (N 39°643263' E 46°37446') and Burunlu (N 39°102218' E 46°304140') villages, and the samples from Basitchay, which was selected as the background, were taken from the part of Baharli (N 39°04178' E 46°41239') village. The water samples taken by the Institute of Microbiology were analyzed according to their physicochemical and microbiological indicators, for which standard methods (Aksenov et al., 2014, Alimov et al., 2013; MUK 4.2.1884-04, Primary production of plankton, 1981) and devices such as Polintest-Photometer 7100, MW600 oxygen meter, HM digital pH-200 and others were used.

## RESULTS AND DISCUSSION

The analysis of the samples taken from the

monitoring points showed that there were no significant changes in the physical and chemical properties of the water. However, the amount of oxygen dissolved in the water is low (6.2 mg/l), which is not suitable for mountain rivers (8 mg/l), the amount of iron and molybdenum is 3-70 times higher than the permissible limit, the number of saprotrophic bacteria ( $3.5-6,0 \times 10^3$  CFU/ml) corresponds to the dirty water category ( $N \geq 10^3$  CFU/ml), the amount of biodestruction of organic substances and the amount of primary organic substance formed is corresponding to it, and the amount of conditionally-pathogenic bacteria (mainly fecal coliform bacteria) is more than the permissible limit (PL). All these indicate water pollution and this happens mainly in the territory of Armenia, so when the river flows through the territory of Azerbaijan, pollution decreases (Tables 1 vø 2).

Thus, Okhchuchay moves in the direction of Burunlu, Tagli and Chahangirbeyli in the Azerbaijan territory. The indicators in Basitchay, taken as a background for determining the situation in Azerbaijan, are much lower than those obtained in Okhchuchay. This fact alone allows us to say with certainty that it is one of the most important issues in terms of ensuring the biosecurity of water resources.

**Table 1.** General characteristics of some indicators of the samples taken from Okhchuchay and Basitchay

Hidrobiological indicators	Baharli (Basitchay)	Jahangirbeyli (Okhchuchay)	Tagli (Okhchuchay)	Burunlu (Okhchuchay)	Permissible limit
Dissolved oxygen	7.4	7.3	-	-	6-8
Destruction	0.7	2.6	-	-	
Primary product	0.37	1.05	-	-	
Overall Density	215	320	390	390	50
Mg, mg/L	35	60	80	75	50
NO <sub>2</sub> , mg/L	0.01	0.09	0.83	0.55	3.3
NO <sub>3</sub> , mg/L	1.52	2.70	3.60	4.40	45
NH <sub>4</sub> , mg/L	0.06	0.10	0.19	0.54	0.5
PO <sub>4</sub> , mg/L	0.54	0.33	0.11	0.09	
P, mg/L	0.27	0.09	0.04	0.02	0.001
Fenol, mg/L	0.00	0.06	0.04	0.01	
Fe, mg/L	0.02	0.04	0.04	0.07	0.001
Cu, (Total) mg/L	0.00	0.08	0.42	0.40	1
Cu, mg/L	0.00	0.00	0.04	0.03	1
Zn, mg/L	0.00	0.05	0.08	0.12	1
Al, mg/L	0.01	0.08	0.09	0.12	0.5
MoO <sub>4</sub> , mg/L	0.18	0.25	0.29	0.31	
Mo, mg/L	0.108	0.15	0.174	0.186	0.05

**Table 2.** Microbiological results of samples taken from Okhchuchay and Basitchay

Microbiological indicators	Baharli (Basitchay)	Jahangirbeyli (Okhchuchay)	Tagili (Okhchuchay)	Burunlu (Oxchuchay)
Saprotrof(SB)	2000	5800	6000	6500
Azotobacter	120	100	60	70
Cl. pasterianum	10 <sup>1</sup>	10 <sup>1</sup>	102	10 <sup>3</sup>
E.coli	9	17	19	29
SS (salmonella and shigella)	-	+	+	+
Bloody agar (Streptococcus,Staphylococcus)	-	A lot of	A lot of	A lot of

Note: PL- Clean water – SB ≤100 CFU/ml; Relatively clean water - SB=100-1000 CFU/ml and Dirty water – SB>1000 CFU/ml

In order to achieve BS, based on the above, as well as the realities accepted in the world, the organization of biomonitoring of the environment, the prediction of threats aimed at the state of the biological environment and its safety, and the identification of cases of spontaneous and purposeful use of biological agents in a short period of time and individual and collective means of protection that allow eliminating their negative impact should be prepared as soon as possible. In addition, to ensure BS, it is important to train personnel (individual and institutional) who professionally organize the production of disinfectants, restrictive measures, organization of training, operative management of mobile resources and other issues. It is also necessary to prepare the necessary devices, equipment and reagents for ensuring BS, to prepare normative documents regulating their use, and to implement measures aimed at their improvement from time to time. These tasks can be realized as a result of the cooperation of individuals and institutions both locally, regionally and globally. Because threats to BS occur at these levels.

Local problems that pose a threat to biological security can be attributed to the level of development of each state, the state of well-being of its population, and other circumstances. Thus, the number of the world's population is gradually increasing within a stable area, and accordingly, serious problems are observed in terms of the increase in the demand of people for food, fodder, medical and technical products. It is worth noting only one fact, in 2050 the world population is predicted to be 9.8 billion. Accordingly, it is predicted [Islam and Karim, 2019] that the world's demand for food products, for example, wheat will be 10904 million tons in 2030 and

15970 million tons in 2050, which means that the production from 2030 to 2050 will increase 1.46 times. It does not seem very convincing that this can be solved in each country, as a result, it will be inevitable that there will be problems in providing biosecurity, at least locally in those countries.

The situation in the Caucasus region regarding threats that may occur on a regional scale can be cited as an example. So, each region has people with different traditions and cultures. It is possible that the states of which they are also citizens have a different attitude to the political struggle and the principles of peaceful coexistence. This has been confirmed many times in the example of the Republic of Armenia and the information given about water resources is a clear example of this. On the other side, there is no doubt that a state that considers it possible to use all types of terrorism (political, ecological, biological, etc.) to occupy foreign lands poses a threat to biological threats on a regional scale.

The following can be mentioned in relation to the dangerous situations on a global scale:

- Bio- and agro-terrorism and biological occupation;
- The spread of unknown infectious diseases in the world for a short period of time and the spread of known diseases in a new and aggravated form;
- Increase in the emergence of antibiotic-resistant forms (resistance) among disease-causing microorganisms, observation of characteristics of being able to overcome interspecies barriers in some microorganisms;
- Improper organization of control over the use of the results of biotechnology and

genetically modified organisms and products of this type;

- Development of synthetic biology, the purpose of which is to create artificial organisms that do not exist in nature, etc.

There is no doubt that there is a need to address these threats to BS. However, for this, during the provision of people's freedom, it is necessary to think of a model that does not define responsibilities at all three levels mentioned for its preparation. In short, biosecurity in the modern era is a process that will be realized due to the study and application of the traditions of the population of any country related to a healthy lifestyle for each individual, and its reconciliation with the processes taking place on a regional and global scale.

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**Azərbaycanın işğaldan azad olunmuş ərazilərinin biotəhlükəsizlik problemləri və onların həlli yolları**

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Təqdim olunan işdə müasir dövrdə bioloji təhlükəsizliyin cəmiyyət və təbiətdə təmin edilməsinin əhəmiyyətinə və onun təminatı üçün diqqət yetirilən məqamalara toxunulur. Aydın olur ki, biotəhlükəsizlik hər bir fərdin də iştirakı sayəsində reallaşan, bioterrorizmin və yolxucu xəstəliklərin təhlükəli fəsadlara yol açan yayılmasının baş verməsinin qarşısının alınmasına istiqamətlənmiş bir prosesdir. Su ehtiyatlarının 70%-dən çoxunun transsərhəd mənbələr hesabına formalaşması, qonşuluqda terrorun bütün növlərindən (siyasi, ekoloji, bioloji və s.) açıq şəkildə istifadə edən dövlətin olması biotəhlükəsizliyi Azərbaycan üçün daha da əhəmiyyətli bir məsələyə çevirmişdir. Bunu Ermənistan Respublikasının ərazisindən Azərbaycana daxil olan Oxçuçayın fiziki-kimyəvi və mikrobioloji göstəricilərinə görə çirklənməsi də aydın şəkildə göstərir. Eyni zamanda biotəhlükəsizlik üçün lokal, regional və qlobal səviyyədə olan problemlər göstərilir və onların həlli üçün diqqət yetirilməsi vacib olan məqamlara toxunulur.

***Açar sözlər:** Biotəhlükəsizlik, bioterror, yolxucu xəstəliklər, transsərhəd sular*

**Проблемы биобезопасности освобожденных территорий  
Азербайджана и их решение**

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В представленной работе затронута важность обеспечения биологической безопасности общества и природы в современное время, а также моменты, учитываемые при её обеспечении. Выявлено, что биобезопасность – это процесс, направленный на предотвращение возникновения биотерроризма и распространения опасных последствий инфекционных заболеваний, реализуемый участием каждого индивидуума. Формирование более 70 % водных ресурсов за счет трансграничных источников, наличие по соседству государства, открыто использующего все виды терроризма (политического, экологического, биологического и т.п.), делает вопрос биобезопасности еще более важным для Азербайджана. Это наглядно проявляется в загрязнении Охчучая, поступающего в Азербайджан с территории Республики Армения, по его физико-химическим и микробиологическим показателям. При этом показаны локальные, региональные и глобальные проблемы биобезопасности и затронуты важные моменты, решение которых требует особого внимания.

***Ключевые слова:** Биобезопасность, биотерроризм, инфекционные заболевания, трансграничные воды*