

## Сельскохозяйственные науки

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**A.I. Erzhanova**, Master of Biological Sciences  
Innovative University of Eurasia (Pavlodar, Republic of Kazakhstan)

E-mail: aleksandra.erhanova@mail.ru

**L.S. Komardina**, Candidate of Biological sciences  
Innovative University of Eurasia (Pavlodar, Republic of Kazakhstan)

E-mail: komardina57@mail.ru

### Monitoring of drinking water in the water supply system of Ekibastuz city

**Annotation.** *On the basis of research on bacteriological indicators of the water supply system in the Ekibastuz region for the period 2016-2018 the 310 cases of detection of pathogenic microflora were identified. The chemical indicators are given the results of research to determine the content of toxic elements and heavy metals in the source and purified water, as well as in the distribution network of Ekibastuz.*

*The largest number of pathogenic microflora cases and a high concentration of chemical elements are noted during the flood season. Sporadic pathogenic microflora and chemical elements are also recorded in the winter and summer periods.*

**Key words:** *source water, drinking water, monitoring, pathogenic microflora, analytical control, plumbing system, heavy metals.*

One of the urgent problems associated with the impact of environmental factors on public health is the problem of water pollution. Water is a social, political, medical, geographical, as well as engineering and economic problem.

In recent decades, as a result of intensive anthropogenic impact, the chemical composition of not only surface, but also groundwater has changed markedly. Despite the relatively high degree of protection from pollution, they already detect lead, chromium, mercury, copper, zinc, etc. Naturally, the concentration of heavy metals in groundwater is increasing in the area of cities and industrial centers.

At present, possibly due to the use of mineral fertilizers (superphosphates) containing significant fluorine impurities, the concentration of fluoride ions has increased not only in surface but also in groundwater.

Oil and petroleum products are often found in well water, which enter the water during drilling and as a result of the penetration of shallow aquifers into gasoline and diesel fuel from gas stations or industrial waste into the ground.

One of the main problems of industrial and domestic use of water is microbiological contamination of surface sources of centralized water supply infected with pathogenic microorganisms that cause bacterial and viral infections [1].

In urban distribution networks, characterized by physical deterioration and frequent accidents eliminated untimely there is an intense secondary microbial contamination of drinking water, which is a serious epidemic danger to human health. In this regard, the further improvement of sanitary and microbiological monitoring of water objects and drinking water, which is one of the areas of the system of social and hygienic monitoring, is of particular relevance.

In Kazakhstan, the main regulatory document for water supply systems is "Sanitary and epidemiological requirements for water sources, water abstraction sites for household and drinking purposes, household water supply and places for cultural and community water use and safety of water bodies", which set MPCs for 44 physical and chemical indicators water quality, subject to mandatory control, as well as 6 biological and 715 additional indicators, most of which are various organic substances [2].

Based on research conducted in the laboratory on the territory of the state enterprise «Gorvodokanal» in the city of Ekibastuz for the period from 2016 to 2018, there are 310 cases of pathogenic microflora in the water supply system in the Ekibastuz region - such as the determination of microbial number, the determination of coliform bacteria. According to chemical indicators, special research conducted to determine the content of toxic elements and heavy metals in the source and purified water, as well as in the breeding network of Ekibastuz.

According to bacteriological indicators, from 2016 to 2018, the initial water was 167 cases. In 2016, there were 55 positive samples, in 2017 - 49 positive samples, in 2018 - 63 positive samples (Table 1). The positive results were mainly in the flood period (April, May, June).

Table 1 – The results of the research of the source water indicator LPC

№	Year	I quarter			II quarter			III quarter			IV quarter		
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2016	0	0	0	10	18	12	5	3	3	4	0	0
2	2017	0	0	2	8	20	13	3	3	0	0	0	0
3	2018	0	0	3	10	18	22	6	3	1	0	0	0

At the stage of purification of the technological process in this period, 87 positive samples were registered, of which TMN - 53 samples and TCB, CCB - 34 samples (Table 2).

Table 2 – Results of the research of water at the stage of technological purification

Year	TMN	TCB	CCB
2016	23	14	14
2017	20	10	10
2018	10	10	10

The positive results of drinking water from the water supply network (CHS, WPS, standpipe) amounted to 56 samples, of which - TMN 21 and TCB, CCB - 35, which is connected with the wear of the urban water supply network and untimely repair work conducted during accidents, causing the loss of water from the system and secondary contamination (Table 3).

Table 3 – The results of the research of drinking water

№	Year	CHS			WPS			Standpipe		
		TMN	TCB	CCB	TMN	TCB	CCB	TMN	TCB	CCB
1	2016	1	2	2	1	1	1	7	5	5
2	2017	1	2	1	1	1	1	5	3	4
3	2018	0	1	1	0	0	0	5	2	3

In the water supply network of the city, according to the chemical composition in purified water compared with the source water, the content of aluminum increases by 1.7-32.3 times, iron -1.2-5.5 times, zinc -1.3-116.3 times, bromine -1.7-5.0 times, strontium -1.1-1.4 times, cadmium – from zero concentrations to 0.0004-0.0865 mg/l.

In some samples of drinking water the content of aluminum exceeds MPC (1,01-9,8 MPC), iron - in all samples (2,1-10,0 MPC), zinc - in one sample (service station «Horseshoe» -1,3 MPC), cadmium - in one sample (on Auezov street - 86,5 MPC).

In addition, there was an increased content of iodine in water samples taken in the building of the city SES and CHS -311 (31 microdistricts).

High content of aluminium was found in water samples taken from the hotel «Squirrel» (of 9.8 MPC), the city department of The Public Health (2,5 MPC), the district No. 31 in (3.5 MPC), the district № 22 (1,7 MPC) district No. 23 (1,3 MPC), district No. 15 (1,2 MPC), the district No. 8 (1,3 MPC) district No. 5 (1,4 MPC), district № 4 (1,5 Mac), the district No. 6 (5,9 MPC) district No. 32 (the 1.6 MPC), the service station «Horseshoe» (district No. 29; 1,6 MPC) district No. 28 (1,3 MPC) district No. 10 (1,2 MPC), to KSC at the Privokzalnaya, 15 (4,4 MPC).

Thus, in drinking water supplied to the consumer, there is an accumulation of a large number of metals (aluminum, iron, zinc, bromine, strontium, cadmium). In most districts of the city drinking water content of iron and aluminum does not match the requirements of GOST 2874-82 [3].

Completed assessment current state of water quality in the canal named after K. Satpayev and drinking water in the water supply network of Ekibastuz allows to make a number of practical conclusions:

1. At the existing water treatment facilities of the source water (mixers, filters, chlorination), the recommended technological modes of operation of the equipment are not always observed, the rules of sanitary maintenance of water distribution networks and water intake columns are violated, which causes insufficient purification of the source water and deterioration of water quality in the water supply network.

2. The water supply network of the city due to significant deterioration is in a critical condition and requires major repairs.

3. Due to untimely repair, accidents systematically occur on the network, leading to water loss from the system and its secondary pollution.

4. The quality of drinking water during its transportation from treatment facilities to consumers is significantly deteriorating. There is an increase in microbiological parameters, as well as an increase in the

concentration of aluminum, iron, zinc, bromine, strontium, cadmium. In most districts of the city drinking water content of iron and aluminum does not correspond the requirements of GOST 2874-82 «Drinking water».

In order to provide the population of Ekibastuz with good-quality drinking water, it is necessary to:

1. Organize systematic monitoring of the content of microbiological and chemical indicators in the source and drinking water.
2. To introduce a multi-stage technology of disinfection of drinking water using modern technologies.
3. Timely carry out repair work and eliminate accidents on the networks.
4. To solve the issue of financing the replacement of obsolete and unusable carrier networks.

## REFERENCES

- 1 Scientific journal «AKSA», analytical review of water supply. – Astana, 2012. – P. 28-30
- 2 «Sanitary and epidemiological requirements to water sources, places of water intake for economic and drinking purposes, economic and drinking water supply and places of cultural and domestic water use and safety of water bodies», approved by the order of the Minister of national economy of Kazakhstan № 209 dated 16.03.2015.
- 3 GOST 2874-82 «Drinking water. Hygienic requirements and quality control».

## ТҮЙІН

*А.И. Ержанова, жаратылыстану магистрі  
Инновациялық Еуразия университеті (Павлодар қ., Қазақстан Республикасы)  
Л.С. Комардина, биология ғылымдарының кандидаты  
Инновациялық Еуразия университеті (Павлодар қ., Қазақстан Республикасы)*

### *Екібастұз қ. сумен жабдықтау жүйесіндегі ауыз суға мониторинг жүргізу*

*Мақалада 2016-2018 жж. Екібастұз өңіріндегі зерттеулер негізінде сумен жабдықтау жүйесінің бактериологиялық көрсеткіштері қарастыралды. Нәтижесінде 310 патогендік микрофлора оқиғасы анықталды. Екібастұздың тарату желісінде ұлтты элементтер мен химиялық көрсеткіштер тазартылған судың құрамында, ауыр металдардың құрамын анықтау бойынша зерттеу нәтижелерін көрсетеді.*

*Су тасқынының маусымы кезінде химиялық элементтердің жоғары концентрациясы және патогендік микрофлораның ең көп саны байқалды. Қысқы және жаз мезгілдерінде су тасқыны кезінде патогендік микрофлора және химиялық элементтер табылды.*

*Түйін сөздер:* бастапқы су, ауыз су, мониторинг, патогенді микрофлора, аналитикалық бақылау, су беру жүйесі, ауыр металдар.

## РЕЗЮМЕ

*А.И. Ержанова, магистр естествознания  
Инновационный Евразийский университет (г. Павлодар, Республика Казахстан)  
Л.С. Комардина, кандидат биологических наук  
Инновационный Евразийский университет (г. Павлодар, Республика Казахстан)*

### *Мониторинг питьевой воды в системе водоснабжения г. Экибастуза*

*На основании исследований по бактериологическим показателям системы водоснабжения по Экибастузскому региону за период 2016-2018гг. установлено 310 случаев обнаружения патогенной микрофлоры.*

*Наибольшее количество случаев патогенной микрофлоры и высокая концентрация химических элементов отмечается весной, в период паводкового сезона. Спорадические случаи патогенной микрофлоры и химических элементов регистрируются также в зимний и летний периоды.*

*Ключевые слова:* исходная вода, питьевая вода, мониторинг, патогенная микрофлора, аналитический контроль, водопроводная система, тяжелые металлы.