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Complex Hygienic Chacteristics of Water in Aktobe City of Kazakhstan

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Abstract: Aktobe region as many other regions of the Republic of Kazakhstan due to the ecological situation is an adverse area according to sanitary and hygienic standards. Potable water, also water for other household needs of the population in the residential areas of the city is one of the most important city-forming factors. Comprehensive assessment of the quality of drinking water and hygienic characteristics of all major industrial and municipal water reservoirs of the city for the period of 2009-2015 were carried out. Drinking water quality was evaluated by the 26 indicators in accordance with thesanitary requirements. Integrated indicators and total pollution levels were calculated on the basis of the results obtained. Despite on the fact that the drinking water of city generally fit to the sanitary requirements, relative trouble was marked for a number of indicators.

Key words: Drinking water, complex indicators, total pollution levels, sanitary, quality

INTRODUCTION

Now a days the bulk of the population of the Republic of Kazakhstan lives in a crisis ecological environment. Aktobe region is also an adverse area according to sanitary and hygienic standards (Kiyek *et al*., 2002). Potable water, also water for other household needs of the population in the residential areas of the city is one of the most important city-forming factors. It is known that a person cannot live without water. Therefore, water conservation, improving the quality of drinking water reservoirs is the global problems for today. Now a days there remain some diseases transmitted through contaminated water. Therefore, a strict control over the quality of drinking water is needed (Krasovsky *et al*., 2006; Belonog *et al*., 2003). Over the years, the role of man-made pollutants of the environment, including water objects cause general alarm, because it is impossible to accurately determine the actual biological activity of the aqueous medium. This assessment conducted on the basis of real risk of environmental object and not on the basis of laboratory data (Selyatitskaya *et al*., 1996; Levich and Terekhin, 1997; Amroseva and Votyakov, 2002; Borschuk *et al*., 2013). The purpose of this research is to give a comprehensive sanitary conditions description of the water supply.

MATERIALS AND METHODS

Comprehensive analysis of hygienic characteristics of the water supply for the period of 2009-2015 were carried out.

To assess the quality of drinking water the analysis of the results of research of water of all major industrial and municipal water intakes of the city was carried out as well as samples from the water network of 7 observation areas, selected in accordance with the requirements of Sanitary Regulations and Standards on drinking water acting in Kazakhstan (hereinafter SanPiN) named "Sanitary-epidemiological requirements for water sources, water intake places for drinking purposes, drinking water supply and places of cultural and household water use and safety water objects" with additions and changes. Drinking water quality was evaluated according to 26 indicators, for compliance with the requirements of SanPiN, application No. 1 "indicators of drinking water quality". The 312 water samples were analyzed, taking into account the total exposure rates, depending on the limiting feature of harmfulness.

RESULTS AND DISCUSSION

Water supply of Aktobe city represented by 6 water intakes (Ilek left and right bank, Tamdy, Sazdy, Upper Kargaly, Kundaktyr) of control "Vodokanal" with the former number of wells-70 with pro ductivity of 110

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Table 1: Drinking water quality of Aktobe (average for the period of observation)

Ingredient	Indicator	SaNPiN (sanitary regulations and standards) No. 3 02002.04 (normative)
Transparency (cm)	30±0.01	30
Chromaticity (degree)	5±0.08	20
Smell (score)	2±0.02	2
Taste (score)	2±0.01	2
pH	7.6±0.07	6.0-9.0
Sulphates (mg L^{-1})	311.17± 0.09	500
Chlorides (mg L^{-1})	360.42± 0.03	350
Iron (mg L^{-1})	0.5±0.05	0.3
Hardness, total (mg L^{-1})	8.0±0.4	7.0
Nitrogen nitrates (mg L^{-1})	17.7±0.09	45.0
Nitrogen nitrates (mg L^{-1})	OTc	OTc
Fluorine (mg L^{-1})	0.35±0.08	0.7-1.5
Dry residue (mg L^{-1})	1401.28±0.02	1000.0
Chromium (mg L^{-1})	0	0.05
Boron (mg L^{-1})	0.5±0.01	0.5

thousand m^3/day and the next intake enterprises and centralized water supply. About 100 m^3/day of water, including for the domestic needs of about 60 thousand m^3/day from municipal plumbing enters the distribution and diluting network of the city, i.e., per capita accounts for around 150-200 L of water per day and for residents with sewer and plumbing-approximately, 230 L, i.e., compared with the construction norms and regulations "water supply, external networks and facilities" it is marked a clear deficit in providing the population with water. With taking into account the current situation, the city should be provided with water according to the increase of capacities annually within 60-80 m^3/day. In fact, since 1983, after the commissioning of the Upper Kargaly water intake, the city does not have increase in capacity.

The concentration of boron in the Lower Kargaly intake increased by 2, 3 times. On many departmental water intakes in the industrial area the high salinity, chemical contamination by nitrates, hexavalent chromium were marked that was the reason for their closure. Analyzing the current situation in Aktobe with drinking water to its chemical composition, quality in closed water intakes, it can be noted that the formation of ecological province in boron, hexavalent chromium and nitrate nitrogen were observed.

Drinking water quality in the territory of Aktobe is due to looped water system when the water coming from different intakes, mixed and then supplied to the consumer. The results of drinking water investigation are presented in Table 1. As can be seen from Table 1, the water meets the hygiene standards. However, it should be noted that every year the presence of various discrepancies percent of drinking water samples for microbiological and chemical indicators is marked (Table 2).

Table 2: Percentage of the non-compliance of drinking water samples according to microbiological and sanitary-chemical indicators

Indicators	Microbiol	Sanitary-chem
2009	3.4	33.9
2010	3.0	8.4
2011	2.3	8.1
2012	3.4	9.4
2013	2.5	3.0
2014	2.9	3.0
2015	2.7	2.9

In which connection in dynamic, these indicators tend to decrease, remaining, however, according to the criteria of danger in the group as "harmless". If we consider that the physiological deficiency of fluoride in drinking water and an increased amount of iron, the "K" factor is not equal to 1 but it equals to 2, i.e., water quality deteriorates significantly and to bring the aquatic environment to normally harmless condition the fluoridation and iron removal are required.

Previous investigations on the quantitative composition of fluoride in drinking water of Aktobe showed that the amount of the trace element in water varies widely. This is due to the variety of natural and climatic and hydro geological conditions of the area. Studies have shown that the low levels of fluoride in drinking water are one of the causes of dental caries among children of city and region.

CONCLUSION

As a result of studies, it was found that the iodine content in drinking water of Aktobe is very low and counts to 0.03-0.12 mg L^{-1} with norm for potable water 1.6 mg L^{-1} (Table 3). In addition, increased boron content is found in drinking water and in hot water supply (Table 3).

As can be seen from Table 4, the content of boron in drinking water and the water of hot water supply is in the range of 0.2-1.0 mg L^{-1} which is slightly higher than the established hygienic standards.

Thus, despite the fact that drinking water of Aktobe generally meets the sanitary and hygienic requirements, number of indicators show a relatively adversity. In connection with this, the situation of drinking water supply to the city's population can be characterized as "relatively satisfactory."

Ethical considerations: Ethical issues (including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.,) have been completely observed by the researchers.

Table 3: The content of iodine in drinking water of Aktobe (mg L^{-1}) (once)

Sampling point	Micro areas 1-7	Autumn	Winter	Spring	Summer
Campus 2 of WKSMU	3	0.03	0.08	0.05	0.05
TB hospital t2	2	0.03	0.07	0.03	0.04
District "Moscow" t3	5	0.04	0.05	0.05	0.02
Clinic of family medicine t4	6-7	0.03	0.08	0.05	0.09
LLP "Assem" t5	4	0.03	0.07	0.03	0.04
Residential town	1	0.09	0.11	0.08	0.01

Table 4: Content of boron in water of Aktobe (mg L^{-1}) (single time)

Sampling point/type of water	Minimum	Maximum	Average
Cold	0.2	0.4	0.3±0.05
Cold	0.5	0.6	0.6±0.03
Cold	0.4	1.0	0.7±0.09
Cold	0.2	0.6	0.4±0.04
Hot	0.4	1.0	0.7±0.80
Hot	0.6	0.6	0.6±0.01

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