ISSN:0975-1459
Journal of Pharmaceutical Sciences and Research
www.jpsr.pharmainfo.in

Monitoring Studies of the Ecological State of Springs in the Aktobe Region in Western Kazakhstan

Guldana Zeinullaevna Idrissova,
Saratov State Agrarian University named after N.I. Vavilov.
410012, Russia, Saratov, Teatralnaya square, 1

Kazhmurat Maksutovich Akhmedenov,
West Kazakhstan Agrarian-Technical University named Zhangir khan.
090009, Kazakhstan, Uralsk, Zhangir Khan street, 51

Irina Vyacheslavovna Sergeeva,
Saratov State Agrarian University named after N.I. Vavilov.
410012, Russia, Saratov, Teatralnaya square, 1

Albina Leonidovna Ponomareva,
Saratov State Agrarian University named after N.I. Vavilov.
410012, Russia, Saratov, Teatralnaya square, 1

Evgenia Sergeevna Sergeeva,
Saratov State Medical University in honor of V.I. Razumovsky.
410710, Russia, Saratov, B. Kazachia, 112

Abstract

The paper provides the monitoring researches of hydrochemical and toxicological indicators of 16 springs in the Aktobe region located within the boundaries of Western Kazakhstan. The characteristic of the content of cations and anions, heavy metals, oil products and phenols in hydrogeochemical samples of spring water is presented.

A comparative analysis of hydrochemical and toxicological indicators with sanitary norms and hygienic requirements for water quality was carried out. The water of the 6 springs was distinguished by considerable hardness and strong mineralization. The increased content of manganese was noted in the Karauylkeldy spring, iron - in the Islambulak, Bulak ayili, Akshat, Karawilkeldy springs, and chromium - in the (upper) Marjanbulak, Sargansay springs. The water of the (lower) Marzhanbulak, Akshat, Kosestek, Rodnikovka of the Aktobe region contained high concentration of petroleum products.

The content of lead and copper was not found, the level of zinc in the springs investigated did not exceed the established standards. The Suik bulak-2, Moldirbulak, Zhosa-2 springs were recognized as the most suitable for drinking use.

Keywords: spring; drinking water; monitoring; hydrochemical and toxicological indicators; sanitary condition of springs.

INTRODUCTION.

One of the priority tasks of the state policy aimed at preserving the health of citizens is providing the population with quality drinking water. Hygienic rationing of drinking water quality, including a wide range of indicators (hydrochemical, organoleptic, toxicological, radiation, etc.), is important, since extensive data on the effect of the chemical composition of drinking water on human health (organoleptic, non-carcinogenic, carcinogenic effects leading to the possible development of cancer, diseases of the circulatory system, digestion, endocrine system, urinary tract) are now available.

The study of the condition of water sources, both terrestrial and underground, is an actual trend in monitoring the environment of the territories of Russia and Kazakhstan [1-8]. The relevance of the study is related both to the high degree of anthropogenic pressure on the environment and the rational use of natural resources, to providing the population with quality drinking water, and to the problem of formation of ecological thinking and way of life in the context of sustainable development [3, 8-13].

Monitoring studies of the condition of springs in Western Kazakhstan are of particular interest. Currently there are more than 100 natural water manifestations in the territory of the Western Kazakhstan [7].

In the economic and drinking water supply of the Aktobe region, the proportion of groundwater is predominant - 70%, and surface water is used insignificantly - up to 30% [4]. The underground waters used for drinking water supply are traditionally considered to be the most reliable source of benign drinking water protected from surface contamination, and thus permanent monitoring of groundwater condition is of relevance for the local population.

METHODS.

Global studies of the ecological state of springs within the boundaries of the Aktobe region of Western Kazakhstan were conducted with the involvement of different research methods [1, 3, 6, 7]. During 2016, we investigated 16 springs in the following areas: determining the coordinates of the springs using a GarmineTrex 12-channel GPS receiver; studying the water sources arrangement; water sampling; flow rate and pH;

determination of the dissolved oxygen content, hydrochemical and toxicological indicators of water; drawing up of passports of springs; registration of facilities.

Water sampling was carried out in accordance with the requirements of GOST 17.1.5.04-81 "Conservation of nature. Hydrosphere. Devices and equipment for the selection, primary processing and storage of natural water samples. General technical conditions".

Hydrochemical and toxicological indicators of water quality were determined by chemical and physicochemical methods in accordance with the following regulatory documents: GOST 3351-74 "Drinking water. Methods for determining taste, odor, color and turbidity"; GOST 26449.1-85 "Distillation desalination stationary plants. Methods of chemical analysis of salt water"; GOST 18164-72 "Drinking water. Method for determination of the dry residue content"; GOST 31957-2012 "Water. Methods for determination of alkalinity and mass concentration of carbonates and hydrocarbons"; ST RK GOST R 51309-2003 "Drinking water. Determination of the content of elements by atomic spectrometry"; GOST 4192-82 "Drinking water. Methods for determination of mineral nitrogen-containing substances"; "GOST 4245-72" Drinking water. Method for determination of chloride content"; GOST 23268.4-78 "Mineral drinking medicinal waters, medical-dining rooms and natural dining rooms. Method for determination of sulfate ions"; GOST 23268.4-78 "Mineral drinking medicinal waters, medical-dining rooms and natural dining rooms. Method for determination of permanganate oxidizability".

The I-160MI laboratory ionometer (NPO "Izmeritelnaya Technika IT", Moscow), the SPECTR AA 140 atomic absorption spectrophotometer (VARIAN, Australia), the Cary-50 spectrophotometer (VARIAN, Australia), and the laboratory electronic balance RV- 214 (OHAUS, Germany) were used in the work.

Analysis and assessment of hydrochemical and toxicological parameters of spring water samples were carried out on the basis of the ecological laboratory of the West Kazakhstan Agricultural and Technical University named after Zhangir Khan and the laboratory of the Department of Botany, Chemistry and Ecology of the Saratov State Agrarian University named after N.I. Vavilov.

The condition of the springs was assessed in accordance with the Sanitary Regulations and Rules approved by the order of the Minister of National Economy of the Republic of Kazakhstan No. 209 dated March 16, 2015 "Sanitary and epidemiological requirements for water sources, water intake points for household and drinking purposes, domestic and drinking water supply and places of cultural and domestic water use and safety of facilities".

RESULTS.

Based on GPS positioning and field research, coordinates were established, and capture of springs was studied. It was defined that 16 springs were located within the boundaries of five districts of the Aktobe region (Kobdinsky - Suyk bulak, Suyk bulak-2, Bulak ayuly; Alginsky - Asylsu, upper Marzhanbulak, lower Marzhanbulak, Katpar; Kargalynskiy – Kosestek; Martuk - Sarzhansay, Zhosa, Zhosa-2, Rodnikovka; Baiganinsky - Moldirbulak, Karawilkeldy) and the city of Aktobe (Akshat, Islam bulak) of Western Kazakhstan (Table 1). The hydrochemical state of springs have been studied, and classes of springs of the Aktobe region have been established (Table 2). Our monitoring studies program included the study of hydrochemical indicators of the spring water quality (Tables 3, 4). The results of the toxicological analysis are presented in Table 5.

Table 1. The results of field research of the Aktobe region's springs in Western Kazakhstan

No.	Sampling point	Capture	t,^oC	O_2,%	pH	Coordinates	D – debit (l/s)	Location, Aktobe region districts
1	2	3	4	5	6	7	8	9
1.	Suyk bulak	No	18.0	40.9	7.26	N 50°09′29.2″ E 054°46′43.1″	0.007	Kobdinskiy district
2.	Suyk bulak-2	No	22.5	148.6	7.66	N 50°11′29.2″ E 054°53′45.1″	-	Kobdinskiy district
3.	Bulak auyly	No	27.9	134	7.55	N 50°05′54.0″ E 056°07′47.5″	0.20	Kobdinskiy district
4.	Asylsu	available	14.1	109.2	7.34	N 50°15′17.6″ E 056°47′20.7″	0.09	Alginskiy district
5.	Upper Marzhanbulak	available	14.0	127	7.65	N 50°15′23.2″ E 056°50′23.4″	0.14	Alginskiy district
6.	Lower Marzhanbulak	available	14.3	163.9	7.27	N 50°15′16.6″ E 056°50′20.1″	0.08	Alginskiy district
7.	Kaptar	available	9.7	111.7	7.92	N 50°05′59.0″ E 057°27′08.0″	0.33	Alginskiy district
8.	Akshat	No	28.4	143.5	8.16	N 50°23′27.5″ E 057°17′17.3″	0.09	City Administration Aktobe
9.	Islam bulak	available	9	76.8	6.90	N 50°24′00.4″ E 057°18′43.4″	0.12	City Administration Aktobe

No.	Sampling point	Capture	t,°C	O_2,%	pH	Coordinates	D – debit (l/s)	Location, Aktobe region districts
10.	Kosestek	available	9.8	128.7	7.21	N 50°46′17.2″ E 057°55′20.1″	0.12	Kargalınskiy district
11.	Sarzhansay	available	9.5	134.0	7.99	N 50°36′52.0″ E 056°44′44.0″	0.14	Martukdistrict
12.	Zhosa	No	8.3	97.4	7.27	N 50°49′06.4″ E 056°57′51.2″	0.09	Martuk district
13.	Zhosa-2	available	11	76.6	7.24	N 50°47′24.7″ E 056°56′11.7″	0.07	Martuk district
14.	Rodnikovka	No	11	118.1	7.84	N 50°37′41.5″ E 057°10′32.5″	0.03	Martuk district
15.	Moldirbulak	available	13.5	102.9	5.61	N 48°40′46.83″ E 055°52′48.46″	0.14	Baiganinsky district
16.	Karawilkeldy (Eskī awrwkhana)	No	14.3	50.6	8.22	The coordinates were not determined - the northern margin Karawilkeldy township	0.08	Baiganinsky district

Table 2. Distribution of hydrochemical classes of the Aktobe region springs in Western Kazakhstan

No.	Name	Class by anions	Class by cations
1	2	3	4
1.	Suyk bulak	Cl^-	Na^+
2.	Suyk bulak-2	HCO_3^- Cl^- SO_4^{2-}	$Mg^{2+}Ca^{2+}$
3.	Bulak auyly	HCO_3^- SO_4^-	$Na^+Mg^{2+}Ca^{2+}$
4.	Asylsu	HCO_3^- Cl^- SO_4^{2-}	$Na^+K^+Ca^{2+}$
5.	Upper Marzhanbulak	Cl^- SO_4^{2-}	Mg^{2+} Ca^{2+}
6.	Lower Marzhanbulak	SO_4^{2-} Cl^-	$Ca^{2+}Mg^{2+}$
7.	Kaptar	HCO_3^-	Na^+Ca^{2+}
8.	Akshat	$HCO_3^-SO_4^{2-}$ Cl^-	Na^+Ca^{2+}
9.	Islam bulak	Cl^- SO_4^{2-} HCO_3^-	Na^+K^+ Mg^{2+}
10.	Kosestek	SO_4^{2-}	Ca^{2+}
11.	Sarzhansay	Cl^- SO_4^{2-}	Ca^{2+}
12.	Zhosa	SO_4^{2-}	Na^+Mg^{2+}
13.	Zhosa-2	$HCO_3^-SO_4^2$	Na^+
14.	Rodnikovka	HCO_3^- Cl^- SO_4^2	Na^+ Ca^{2+} Mg^{2+}
15.	Moldirbulak	HCO_3^- SO_4^{2-}	Na^+K^+
16.	Karawilkeldy (Eskī awrwkhana)	SO_4^{2-} HCO_3^- Cl^-	$Mg^{2+}Na^+$ Ca^{2+}

Table 3. Hydrochemical composition of the spring waters of Aktobe region in Western Kazakhstan (content of cations and anions in hydrogeochemical samples of spring water)

No.	Sampling point	NH_4^+ mg/l	NO_2^- mg/l	NO_3^- mg/l	Turbidity mg/l	SO_3^{2-} mg/l	HCO_3^- mg/l	Cl^- mg/l	SO_4^{2-} mg/l	Ca^{2+} mg/l	Mg^{2+} mg/l
	2	3	4	5	6	7	8	9	10	11	12
1.	Moldirbulak	1.8	0.01	0.00	0.00	9.0	140.0	25.0	170.0	28.0	26.0
2.	Asyl su	0.1	0.00	0.10	0.00	0.00	104.0	12.0	52.0	50.0	7.0
3.	(Upper) Marzhanbulak	0.0	0.00	0.20	0.00	0.00	113.0	23.0	126.0	46.0	9.0
4.	(Lower)Marzhanbulak	0.3	0.00	0.10	0.12	0.00	82.0	7.0	37.0	30.0	6.0
5.	Islam bulak	0.0	0.00	0.00	0.00	30.0	397.0	87.0	145.0	70.0	27.0
6.	Suyk bulak	0.1	0.023	0.10	0.06	0.00	302.0	4283.0	247.0	100.0	36.0
7.	Suyk bulak-2	0.2	0.041	0.10	1.1	15.0	214.0	13.0	18.0	92.0	101.0
8.	Bulak auyly	0.6	0.002	0.00	1.22	6.0	256.0	6.0	32.0	30.0	22.0
9.	Kaptar	0.0	0.00	0.10	0.75	0.00	70.0	10.0	30.0	17.0	8.0
10.	Akshat	0.3	0.00	0.00	2.03	18.0	348.0	84.0	221.0	590.0	5.0
11.	Kosestek	0.0	0.00	0.00	0.00	0.00	61.0	29.0	128.0	55.0	10.0
12.	Sarzhansay	0.0	0.00	0.00	0.23	0.00	183.0	10.0	23.0	57.0	8.0
13.	Zhosa	0.0	0.00	0.20	0.58	0.00	88.0	20.0	203.0	7.0	25.0
14.	Zhosa-2	0.0	0.00	0.00	0.00	0.00	76.0	2.0	56.0	7.0	3.0
15.	Rodnikovka	0.3	0.00	0.00	0.29	6.0	101.0	42.0	43.0	27.0	10.0
16.	Karawilkeldy (Eskī awrwkhana)	0.3	0.034	0.00	0.00	18.0	156.0	55.0	265.0	55.0	54.0
	MPC SanPiN No. 209	2.0	3.3	45	1.5	non norm	non norm	350	500	non norm	non norm

Table 4. Hydrochemical composition of spring waters of Aktobe region in Western Kazakhstan

No.	Sampling point	Total hardness, Mg-eq/l	Permanganate oxidability, mg/l	Dry residue mg/l	Boron, mg/l	Polyphosphates, mg/l	Sodium + potassium, mg/l	Total mineralization, mg/l
1	2	3	4	5	6	7	8	9
17.	Moldirbulak	3.10	0.2	47	0.00	0.00	87.0	410
18.	Asyl su	3.05	5.4	342	0.00	0.00	1.0	174
19.	(Upper) Marzhanbulak	3.03	3.2	418	0.00	0.00	48.0	309
20.	(Lower) Marzhanbulak	2.00	1.0	238.0	0.00	0.00	7.0	128
21.	Islam bulak	5.75	3.4	802	0.00	0.00	166.0	724
22.	Suyk bulak	8.00	0.7	1832	0.00	0.00	2823.0	7640
23.	Suyk bulak-2	13.00	4.1	1012	0.00	0.00	190.0	156
24.	Bulak auyly	3.30	7.9	332	0.00	0.00	44.0	268
25.	Kaptar	1.53	2.0	222	0.00	0.00	12.0	112
26.	Akshat	1.75	4.2	778	0.00	0.00	266.0	794
27.	Kosestek	3.55	2.3	432	0.00	0.00	21.0	274
28.	Sarzhansay	3.50	1.9	312	0.00	0.00	6.0	196
29.	Zhosa	2.40	3.0	298	0.00	0.00	87.0	386
30.	Zhosa-2	0.60	4.9	136	0.00	0.00	43.0	149
31.	Rodnikovka	2.15	1.3	228	0.00	0.00	40.0	219
32.	Karawilkeldy (Eskï awrwkhana)	7.25	1.2	66.4	0.00	0.00	68.0	593
	MPC SanPiN No. 209	7.0	5	1000	0.5	3.5	non norm	non norm

Table 5. Toxicological indicators of spring waters of the Aktobe region in Western Kazakhstan

No.	Sampling point	Cu, mg/l	Zn, mg/l	Pb, mg/l	Cd, mg/l	Fe, mg/l	Cr, mg/l	Mn, mg/l	Oil products, mg/l	Phenols, mg/l
1	2	3	4	5	6	7	8	9	10	11
1.	Moldirbulak	0.00	0.044	0.00	0.00	0.08	0.24	0.00	0.064	0.000
2.	Asyl su	0.00	0.02	0.00	0.00	0.02	0.04	0.07	0.02	0.004
3.	(Upper) Marzhanbulak	0.00	0.00	0.00	0.00	0.1	0.59	0.00	0.01	0.004
4.	(Lower) Marzhanbulak	0.00	0.026	0.00	0.00	0.026	0.00	0.00	0.15	0.014
5.	Islam bulak	0.00	0.017	0.00	0.003	0.97	0.4	0.01	0.00	0.009
6.	Suyk bulak	0.00	0.059	0.00	0.00	0.059	0.00	0.00	0.00	0.000
7.	Suyk bulak-2	0.00	0.014	0.00	0.00	0.014	0.00	0.00	0.00	0.000
8.	Bulak auyly	0.00	0.034	0.00	0.005	1.17	0.17	0.02	0.02	0.002
9.	Kaptar	0.00	0.074	0.00	0.00	0.00	0.0	0.04	0.05	0.010
10.	Akshat	0.00	0.01	0.00	0.005	1.29	0.4	0.04	0.20	0.000
11.	Kosestek	0.00	0.019	0.00	0.00	0.39	0.00	0.01	0.11	0.003
12.	Sarzhansay	0.00	0.017	0.00	0.00	0.16	0.68	0.00	0.04	0.004
13.	Zhosa	0.00	0.026	0.00	0.00	0.22	0.00	0.04	0.02	0.007
14.	Zhosa-2	0.00	0.015	0.00	0.00	0.2	0.00	0.06	0.02	0.000
15.	Rodnikovka	0.00	0.024	0.00	0.00	0.024	0.00	0.02	0.30	0.012
16.	Karawilkeldy (Eskï awrwkhana)	0.00	0.013	0.00	0.00	0.58	0.45	0.45	0.0527	0.000
	MPC SanPiN No. 209	1.00	5.0	0.03	0.001	0.3	0.5	0.1	0.1	0.001

DISCUSSION.

Based on the data obtained (Table 2), the following hydrochemical classes of springs have been established in the Aktobe region: Sodium chloride, bicarbonate-sulphate sodium-potassium, bicarbonate-chloride-sulfate sodium-potassium-calcium, chloride-sulfate magnesium-calcium, sulfate-chloride calcium-magnesium, hydrocarbonate-chloride-sulfate magnesium-calcium, bicarbonate-sulphate sodium-magnesium-calcium, bicarbonate sodium-calcium, bicarbonate-sulphate-chloride sodium-calcium, chloride-sulfate-hydrocarbonate sodium-potassium-magnesium, chloride-sulphate calcium, sulfate sodium-magnesium, bicarbonate-chloride-sulfate sodium-calcium-magnesium, sulfate-hydrocarbonate-chloride magnesium-sodium-calcium, sulfate-hydrocarbonate-sodium, sulfate-calcium.

An increase in the content of ammonia and nitrates serves as the indicator of the entry of organic contaminants into the water (Table 3). In many cases, the presence of ammonia in the water may be regarded as an indicator of the epidemically dangerous fresh water contamination with organic substances of animal origin. Sometimes, especially in deep underground waters, the presence of ammonia formed due to the reduction of nitrates in the absence of oxygen is possible. In this case, ammonia does not indicate poor quality of water. Nitrous acid salts (nitrites) are the products of ammonia oxidation under the influence of microorganisms in the process of nitrification. The presence of nitrites also indicates a possible contamination of water with organic nitrogen-containing substances; however nitrites indicate a certain prescription of contamination. Nitric acid salts (nitrates) are the final products of mineralization of organic nitrogen-containing substances. The presence of nitrates in the water without ammonia and nitrous acid salts indicates the completion of the mineralization process. Simultaneous content of ammonia, nitrites and nitrates in the water indicates the incompleteness of this process and the continuing, epidemically dangerous water pollution. The increased content of nitrates in the water can also have a mineral origin due to dissolution of soil salts, mineral fertilizers, for example, nitrate.

The values of ammonium concentrations (NH^+_4) varied from 0.0 to 1.8 mg/l, which was significantly lower than the established standard - 2.0 mg/l.

The content of nitrites (NO_2^-) in the spring water of the Aktobe region varied from 0.0 to 0.041 mg/l, which did not exceed the established standard - 3.3 mg/l. Analysis of the content of nitrates (NO_3^-) in the water showed that in all samples there was no deviation from the established standard of 45 mg/l.

The turbidity of water is determined by the presence of undissolved and colloidal substances in the water (it may have inorganic and organic origin). Oils, silicic acid, iron and aluminum hydroxides, organic colloids, microorganisms and plankton are responsible for turbidity of surface waters. Turbidity in groundwater is caused by undissolved mineral substances, and by organic substances which penetrate into the ground of sewage. This indicator in all water samples was much lower than those stipulated by SanPin standard No. 209 (1.5 mg/l), except for the samples of water from the Akshat spring - 2.03 mg/l (Table 3).

The content of carbonates and hydrocarbons in the water is not standardized by SanPin No. 209 (Table 3). The concentration of carbonates (CO_3^{2-}) in the investigated water of the Aktobe region springs ranged from 0.0 to 30.0 mg/l, the content of hydrocarbonates (HCO_3^-) varied from 61.0 to 397.0 mg/l.

The chloride content in the water of surface uncontaminated water sources usually does not exceed 20 - 30 mg/l. In places with solonchak soil in groundwater, chloride salts of salt origin are often present in higher concentrations, and in this case they do not indicate water pollution. By analyzing the concentration of chloride ions (Cl^-) in the spring water, it could be concluded that in the majority of the studied sources the indicator was below the standard one, but in the Suyk bulak spring the MPC value (350 mg/l) was exceeded by 12.2 times (Table 3).

Sulfates (SO_4^{2-}) enter the water as a result of leaching of sedimentary rocks, leaching of the soil and sometimes due to oxidation of sulfides and sulfur, which are products of protein breakdown from sewage. The concentrations of sulfate ions in the water of the Aktobe region springs varied from 18.0 to 265.0 mg/l (Table 3).

The content of Ca^{2+} and Mg^{2+} is not standardized. The highest value of Ca^{2+} was noted in the Akshat spring – 590 mg/l, that of Mg^{2+} - in the Suyk bulak spring - 2,101.0 mg/l (Table 3).

The total rigidity is due to the presence of calcium (Ca^{2+}) and magnesium (Mg^{2+}), salts dissolved in the water, as well as iron, aluminum, manganese (Mn^{2+}) cations and heavy metals (strontium Sr^{2+}, barium Ba^{2+}). In most analyzed samples of the water springs, this indicator did not exceed the established standard - 7 meq/l. However, in some springs, water samples significantly exceeded the standard value: Suyk bulak – by 1.1 times, Suyk bulak-2 – by 1.8 times (Table 4).

Oxidability characterizes the content of organic and mineral substances in the water oxidized by a strong oxidizer. In the course of the research it was established that this indicator was higher than the MPC value (5 mg/l) in the water of the Bulak ayly spring – by 1.6 times (Table 4).

The analysis of the dry residue revealed deviation from the standard value (1,000 mg/l) in the waters of the Suyk bulak spring – by 1.8 times, and the Suyk bulak-2 – by 1.01 times (Table 4).

During the monitoring studies the boron and polyphosphates compounds were not detected (Table 4).

According to SanPin No. 209, the indicator of total mineralization is not subject to standardization. At the same time, the highest values of this indicator were obtained in the study of the water of the Suyk bulak (7,640 mg/l) (Table 4).

The flow of heavy metals into groundwater (Table 5) is closely related to physicogeographical and geological-hydrological factors. Copper (Cu) compounds were not detected in the water of the Aktobe region springs. Zinc (Zn) was detected, the concentrations of which varied from 0.0 (the (upper) Marzhanbulak spring) to 0.074 mg/l (the Katpar spring); however its content was significantly lower than the established standard value (5.0 mg/l). Lead (Pb) was not detected in the spring water.

In most sources of the spring water, cadmium (Cd) was not observed. There were only three springs identified, in the water of which an increased content of cadmium was found: Islambulak – by 3 times, Bulak ayly and Akshat – by 5 times.

Analysis of the iron (Fe) content showed that deviations from the standard value (MPC 0.3 mg/l) were observed in some springs: Islam bulak – by 3.2 times, Bulak ayuly – by 3.9 times, Akshat - 4.3, Karawilkeldy – by 1.9 times.

The standard indicator of chromium content (Cr) (MPC 0.5 mg/l) was exceeded in the springs of (upper) Marzhanbulak by 1.2 times, and in the water of Sarzhansay – by 1.4 times.

In the water of the Karawilkeldy spring, the concentration of manganese (Mn) exceeded the established standard by 4.5 times.

The water from the springs of Marzhanbulak (lower), Akshat, Kosestek, Rodnikovka of the Aktyubinsk region contained an increased content of petroleum products (by 1.5, 2.0, 1.1 and 3.0 times, respectively) and did not meet the requirements of SanPiN No. 209.

Increased concentrations of phenols were found in the Bulak ayuly springs, where the MPC value was exceeded by 2 times, Kosestek – by 3 times, Asyl su, (upper) Marzhanbulak, Sargansay – by 4 times, Zhosa – by 7 times, Islam bulak – by 9 times, Katpar – by 10 times, Rodnikovka – by 12 times, and (lower) Marzhanbulak – by 14 times.

CONCLUSION.

Seven springs (44.0%) lack capturing and fencing, so they represent favorable environment for biological and bacterial contamination. The waters of the springs are distinguished by wide variety of chemical composition, some of them have significant hardness (Suyk bulak-2, Suyk bulak, Karawilkeldy) and strong mineralization (Islam bulak, Akshat, Suyk bulak).

In all 16 springs, the lead and copper were not detected, and the level of zinc in the investigated springs did not exceed the established standard.

The increased content of manganese was noted in the Karawilkeldy spring, iron - in the Islam bulak, Bulak auyly, Akshat, Karawilkeldy springs, and chromium - in the (upper) Marjanbulak, Sarzhansay springs. The water of the (lower) Marzhanbulak, Akshat, Kosestek, Rodnikovka of the Aktobe region contained high concentration of petroleum products.

The Suyk bulak-2, Moldirbulak, Zhosa-2 springs were recognized as the most suitable for drinking use.

ACKNOWLEDGMENTS.

The authors express their deep gratitude to the Committee of Science of the Ministry of Education and Science of the Republic of Kazakhstan for supporting the research and targeted financing of the work "Catalog of Water Resources and Monitoring System for Sustainable Water Resources Management in Western Kazakhstan" (2015 - 2017) as part of the program "Water Security of the Republic Kazakhstan - Sustainable Water Supply Strategy".

REFERENCES

1. Akhmedenov K.M., Boshkova E.S. and Kairgaliyeva G.Z. Rodniki Aktyubinskoy oblasti i problemy ikh okhrany [The springs of the Aktobe region and the problems of their protection]. Hydrology and innovative technologies in the water sector, October 22-23, 2015. Astana: ENU named after L.N. Gumilev, 2015, pp. 91 – 93.
2. Akhmedenov K.M. Rodnikovyye landshafty Zapadnogo Kazakhstana: Monografiya [Spring landscapes of Western Kazakhstan: monograph. Uralsk: LLP "NIDS", 2015, pp. 131
3. Akhmedenov K.M. and Kairgaliyeva G.Z. Otsenka ekologicheskogo sostoyaniya rodnikov Aktyubinskoy oblasti. Kachestvennoye yestestvennonauchnoye obrazovaniye – osnova progressa i ustoychivogo razvitiya Rossiii [Assessment of the ecological condition of the Aktobe region's springs. Qualitative natural science education is the basis for progress and sustainable development in Russia]: Collection of articles of the international symposium of March 2-3, 2016, Saratov: "Amirit", 2016, pp. 56 – 58.
4. Zhakashov N.Zh., Aybasova Zh.A. and Suyungarayev K.A. Gigiyenicheskaya otsenka vodosnabzheniya naseleniya Aktyubinskoy oblasti [Hygienic assessment of water supply to the population of the Aktobe region]. KAZMNU Bulletin. Scientific and practical journal, 2011, 1: 55 – 57.
5. Kairgaliyeva G.Z., Sergeeva I.V. and Orlov A.A. Otsenka kachestva vody rodnikov Aktyubinskoy oblasti Zapadnogo Kazakhstana na osnove gidrokhimicheskikh i toksikologicheskikh pokazateley. [Estimation of water quality of springs in the Aktobe region of Western Kazakhstan on the basis of hydrochemical and toxicological indicators. Agrarian Scientific Journal, 2016, 7: 11 – 15.
6. Klimentov P.P. Metodika gidrogeologicheskikh issledovaniy. [The method of hydrogeological research.]. Moscow: Gosgeoltekhizdat, 1961, pp. 161 – 220.
7. Lange O.K. Osnovy gidrogeologii. [Fundamentals of hydrogeology.]. Moscow: Moscow University Publishing House, 1950, pp. 148, 160 – 163.
8. Sergeeva I.V. and Sergeeva E.S. Sovremennyy podkhod k otsenke rek s uchetom regional'nykh osobennostey. [A modern approach to the assessment of rivers taking into account regional features]. Agrarian Scientific Journal, 2010, 11: 30 – 34.
9. Sergeeva I.V., Mokhon'ko YU.M., Sergeeva E.S. and Ponomareva A.L. Testovyye zadaniya po ekologii cheloveka. [Test tasks on human ecology.] Tutorial. Saratov: Bukva, 2014, pp. 104
10. Sergeeva I.V., Mokhon'ko YU.M., Sergeeva E.S. and Ponomareva A.L. Osnovopolagayushchaya informatsiya po ekologii cheloveka. [Fundamental information on human ecology.] Tutorial. Saratov: Bukva, 2015, pp. 80
11. Ratushnyak, A.A., Borisovich, M.G., Valeev, V.S., Ivanov, D.V., Andreeva, M.G., Trushin, M.V. (2006a). The hydrochemical and hydrobiological analysis of the condition of the Kuibyshev reservoir littorals (Republic of Tatarstan, Russia). Ekoloji, 16(61): 22-28.
12. Ratushnyak, A.A., Borisovich, M.G., Valeev, V.S., Ivanov, D.V., Andreeva, M.G.,Trushin, M.V. (2006b). Diagnostics of the water quality of the Kuibyshev reservoir littorals with various anthropogenic load: Hydrobiological and multifractal analysis. Fresenius Environmental Bulletin 15(7): 626-632.
13. Ratushnyak, A.A., Andreeva, M.G., Trushin, M.V. (2005) Influence of the pyrethroid insecticides in ultralow doses on the freshwater invertebrates (Daphnia magna). Fresenius Environmental Bulletin 14, (9), 832-834.