Khazar Journal of Science and Technology `Volume 9 №1 2025, 21-26
 DOI: 10.5782/2520-6133.2025.9.1.21

Investigation of Some Chemical Indicators in Okhchuchay River

Aiten Samadova
Ecological Chemistry Departament, Baku State University, Baku, Azerbaijan
Corresponding author: aytan.samad@gmail.com

Abstract
Assessing the environment in the liberated territories is crucial and relevant. In this context, rivers originating from neighboring areas in these regions are of particular importance. To organize the eco-chemical assessment of the Okhchuchay River, the dynamics of concentration changes along the water flow were studied in March. It was determined that during March, the levels of hardness, ammonium, and manganese ions in the Okhchuchay River were significantly above the permissible limits.
Keywords: anion, cation, metals, physicochemical parameters, Okhchuchay

Introduction

Monitoring of the liberated territories is extremely important. Since living organisms in these areas rely on river waters, continuous research is necessary (Hajiyeva, et al., 2019; Mammadov, et al., 2005). An excessive amount of any parameter in water can disrupt the ecosystem. Additionally, metals and various chemical parameters must be constantly monitored due to their impact on living organisms (Medvedev, et al., 2017; Moore, 1987; Mudry, 1997; Skalny, 1999). One of the key factors affecting the biosenosis is the pH interval. Therefore, this indicator is primarily analyzed during research, followed by an examination of its physicochemical properties (Teplaya, 2013; Avtsyn, 1991).

Materials and Methods

An Etrex 10 device was used to determine the sampling coordinates. Subsequently, the physicochemical parameters of the water samples were analyzed. The parameters examined included pH, dissolved oxygen, electrical conductivity, hardness, Cl^-, SO_4^{2-}, NH_4^+, NO_2^-, NO_3^-, Cu, Fe, Mn, Mo, Pb, Zn, Co, and Ni (GOST 24481-80, 1986). The elemental composition

was determined using an atomic absorption spectrometer, while anions were analyzed using a spectrometer (Lurye, 1979; Korostilev, 1981).

Result

Considering that a river is a self-purifying system, we collected samples from the upper, middle, and lower reaches of the river. The sampling coordinates are provided in Table 1.

Table 1. Sampling Coordinates for Okchuchay

№	Name of area	Coordinates
1	Burunlu	$39^0$10'23.5" $46^0$30'39.8"
2	Shayifli	$39^0$07'19.1" $46^0$34'19.7"
3	Jahangirbayli	$39^0$02'43.1" $46^0$44'09.0"

The analyses were conducted throughout March, with samples taken in each ten-day period. The results are presented in Tables 2, 3, and 4.

Table 2. Analysis results of the water sample taken from Okchucay on 06.03.2024.

№	Name of component	Unit of measure-ment	Amount of components			MPC
			Okchuchay-Zangilan district			
			Burunlu village	Sayifli village	Jahangirbe yli village	
1	pH	–	7.9	8.0	7.8	6.5-8.5
2	Dissolved oxygen	mgO_2/l %	8.3 85.0	8.2 84.0	8.3 85.0	≥4.0
3	Electrical conductivity	µS/cm	1493	1448	1532	–
4	Hardness	mg-ekv/l	12.08	12.0	13.3	7.0
5	Cl^-	mg/l	16.3	15.9	18.4	350
6	SO_4^{2-}	mg/l	441.8	447.7	456.3	500
7	NH_4^+	mg/l	1.1	0.9	0.1	0.5
8	NO_2^-	mg/l	0.6	0.95	0.93	3.3
9	NO_3^-	mg/l	4.3	4.21	4.09	45.0
10	Cu	mkg/l	20.7	11.0	6.94	1000
11	Fe	mkg/l	28.0	69.1	61.7	300
12	Mn	mkg/l	348	323	313	100
13	Pb	mkg/l	0.401	0.158	0.150	30
14	Zn	mkg/l	37.1	38.8	40.0	1000

15	Co	mkg/l	4.15	5.55	4.97	100
16	Ni	mkg/l	2.29	<LOD	<LOD	100
17	Mo	mkg/l	242	247	209	250

As seen in Table 2, the analysis of water samples indicates that hardness levels in Okchuchay exceed the Maximum Allowable Concentration (MAC) by 1.7 times in Burunlu and Sayifli villages and by 1.9 times in Jahangirbayli village. The ammonium ion concentration is 2.2 times higher than the MAC in Burunlu, 1.8 times higher in Sayifli, and manganese levels exceed the MAC by 3.5 times in Burunlu, 3.2 times in Sayifli, and 3.1 times in Jahangirbayli. It is important to note that the Maximum Allowable Concentrations (MAC) for surface waters were established by the State Committee for Ecology and Nature Use Control of the Republic of Azerbaijan under Order No. 01 dated January 4, 1994, as part of the "Regulations on the Protection of Surface Waters from Pollution by Wastewater."

Table 3. The results of the analysis of the water sample taken from Oxçuçay on 13.03.2024.

№	Name of component	Unit of measure-ment	Amount of components			Permissible viscosity limits
			Okchuchay-Zangilan district			
			Burunlu village	Sayifli village	Jahangirbeyli village	
1	pH	—	6.9	7.3	7.2	6.5-8.5
2	Dissolved oxygen	mgO_2/l %	9.7 98.0	9.7 99.0	9.5 97.0	≥4.0
3	Electrical conductivity	µS/cm	1131	1632	1628	—
4	Hardness	mg-ekv/l	9.4	14.0	14.3	7.0
5	Cl^-	mg/l	18.1	18.1	17.4	350
6	SO_4^{2-}	mg/l	340.2	430.5	412.3	500
7	NH_4^+	mg/l	0.62	0	0	0.5
8	NO_2^-	mg/l	0.7	0.72	0.8	3.3
9	NO_3^-	mg/l	4.65	4.91	5.13	45.0
10	Cu	mkg/l	13.0	9.76	11.4	1000
11	Fe	mkg/l	88.6	77.9	84.4	300
12	Mn	mkg/l	180.0	111.0	109.0	100
13	Pb	mkg/l	0.131	0.870	0.608	30
14	Zn	mkg/l	36.4	31.1	38.5	1000
15	Co	mkg/l	3.67	4.34	3.47	100
16	Ni	mkg/l	0.0269	<LOD	<LOD	100
17	Mo	mkg/l	104.0	177.0	173.0	250

On 13.03.2024, the hardness level in the water exceeded the permissible concentration limit by 1.3 times in Burunlu, 2 times in Shayifli, and 2.04 times in Jahangirbayli. The ammonium parameter exceeded the permissible concentration limit by 1.24 times in Burunlu. Manganese exceeded the permissible concentration limit by 1.8 times in Burunlu, 1.11 times in Sayifli, and 10.9 times in Jahangirbayli.
Considering the flow of the river, the third sample was taken again on the 28th of the month. The results are presented in Table 4.

Table 4. Results of the analysis of the water sample taken from Okchuchay on 28.03.2024.

№	Name of components	Unit of measurement	Amount of components			MPC
			Okchuchay-Zangilan district			
			Burunlu village	Shayifli village	Jahangirbayli village	
1	pH	—	7.5	7.3	7.1	6.5-8.5
2	Dissolved oxygen	mgO_2/l %	9.2 94.0	9.0 93.0	9.1 92.0	≥4.0
3	Electrical conductivity	µS/cm	609	614	615	—
4	Hardness	mg-ekv/l	5.32	5.4	5.41	7.0
5	Cl^-	mg/l	9.4	10.9	11.0	350
6	SO_4^{2-}	mg/l	150.87	152.44	153.1	500
7	NH_4^+	mg/l	**0.63**	**0.52**	**0.52**	0.5
8	NO_2^-	mg/l	0.04	0.21	0.23	3.3
9	NO_3^-	mg/l	4.13	4.61	4.63	45.0
10	Cu	mkg/l	16.1	23.0	22.2	1000
11	Fe	mkg/l	**368**	**357.0**	**350.0**	300
12	Mn	mkg/l	33.8	31.3	32.4	100
13	Pb	mkg/l	0.981	0.312	0.306	30
14	Zn	mkg/l	10.3	8.70	10.1	1000
15	Co	mkg/l	<LOD	<LOD	<LOD	100
16	Ni	mkg/l	71.8	82.1	80.1	250

As shown in Table 4, according to the analyses of the water samples, ammonium ions in Okchuchay were 1.3 times higher in Burunlu village, 1.02 times higher in Sayifli and Jahangirbayli villages, and iron in Okchuchay was 1.2 times higher than the permissible limits in Burunlu, Sayifli, and Jahangirbayli villages.
In the beginning of March, the hardness level in the Burunlu village area was 12.08 mg-equiv/l. In the second ten-day period of the month, it decreased to

9.4 mg-equiv/l, and by the end of the month, it further dropped to 5.32 mg-equiv/l. The norm for hardness is 7 mg-equiv/l. Considering the river's self-regulating property, the hardness was 1.73 and 1.34 times above the norm in the first and second periods, respectively. At the same time, the ammonium ion exceeded the norm on all three dates. Specifically, on March 6th, it was 1.1 mg/l; on March 13th, it was 0.62 mg/l; and on March 28th, it was 0.63 mg/l, which means it exceeded the norm by up to 2.2 times. The manganese ion, which was 348 μg/l at the beginning of the month, dropped to 180 μg/l in the second ten-day period. However, despite this decrease, its levels were still 3.48 times and 1.8 times above the norm, which is considered a significant amount. Given that the river is 82 km long within Azerbaijan, if the concentration limit were somewhat lower over such a distance, the river could potentially be self-cleaning. However, the high levels of such critical parameters affect the integrity of the ecosystem (Vorobyov, 2007; Israel, 979; Onishchenko, 2002). Water with high hardness, when consumed over a long period, can lead to the precipitation of calcium and magnesium protein compounds on the walls of the stomach and esophagus, which complicates peristalsis and disrupts the function of enzymes (Mudry, 2008). Additionally, frequent consumption of hard water can lead to dysbacteriosis. High levels of ammonium in the blood can lead to severe pathology. Consuming water with high ammonium ion levels can result in serious lung diseases and genetic enzyme disorders. Cases of consciousness impairment are also reported. The excess of manganese disrupts plant development and affects metabolic processes in animals (Shachneva, 2012; Filov, 2004; Davidova, 1991). It also makes the central nervous system highly sensitive. When the permissible amount is exceeded, manganese-induced Parkinson's syndrome damage is observed in the nervous system. It affects the reproductive processes of living organisms. Additionally, consuming water with high manganese levels causes intoxication in humans, leading to memory impairment and disruptions in the lymphatic system (Hajiyeva *et al.*, 2021; Hajiyeva, *et al.*, 2019).

References

Avtsyn, A.P. (1991) Human microelementoses. A.P. Avtsyn, A.A. Zhavoronkov, M.A. Rish, L.S.Strochkova. M.: Medicine. P.496.

Davidova, S.L. (1991). About the toxicity of metal ions. Series "Chemistry" №3, 243.

Filov, V.A. (2004) Chemical pollutants of the environmental, toxicology and information issues. Ros.chem. journal. t. 48. № 2, p.4-8.

GOST 24481-80. (1986) Drinking water. Taken of sample: M.: State Committee of the USSR on standards, p.4.

Hajiyeva, S.R., et al. (2019). Fundamentals of ecotoxicology., p.123-136

Hajiyeva, S.R., et al. (2019). Practicum of ecologycal monitoring., 140.

Hajiyeva, S.R., et al. (2021). Chemical ecotoxicology, 288.

Israel, Yu. A. (1979). "Ecology and control of the state of the natural environment", 1979

Korostilev, P.P. (1981) Preparation of solutions for chemical and analytical works. -M.: Nauka. p.202.

Lurye, Yu.Yu. (1979) Handbook of analytical chemistry. M.: Chemistry. p.480. (in Russian)

Mammadov G., et al. (2005). Ecology and environmental protection, p.880.

Medvedev, I.F., et al. (2017) Heavy metals in ecosystem. Saratov. Rakursc, p.178.

Moore, JW, et al. (1987). Heavy metals in natural waters. M.:Mir, p.297

Mudry, I.V. (1997) Heavy metals in the soil-plant-human system. Hygiene and sanitation. – Moscow, № 1, p.14-16.

Mudry, I.V. (2008) The impact of chemical contamination of soil on public health. Hygiene and Sanitation, №4, p.32-37.

Onishchenko, G.G. (2002) Fundamentals of assessing the risk to public health when exposed to chemicals polluting the environment. M.: Research Institute of ECh and GOS, Bibliography: p.305-324.

Shachneva, E.U. (2012). Impact of heavy toxic metals on the environment. Scientific potential of regions for the service of modernization. 2(3), 127-134.

Skalny, A.V. (1999). Microlementoses in humans (diagnosis and treatment): Practical manual for doctors and students of medical universities.M.: Printhouse, Nauchniy mir, p95. (Series "School of Biotic Medicine"). Bibliography: p. 92-93.

Teplaya, G.A. (2013) Heavy metals as a factor in environmental pollution. Astrakhan Bulletin of Environmental Education. №1(23) p. 182-192.

Vorobyov, D.V. (2007) Biogenic migration of metals in soils, water and plants of the Lower Volga. Vorobyov D.V., Andrianov V.A., Osipov B.E. Collection of articles (Authors: V.P. Pilipenko and A.V. Fedotova). Astrakhan. Publishing House of Astrakhan State University, part II.2007. 16-22.