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	JIF = **1.500**	**SJIF** (Morocco) = **6.004**	**OAJI** (USA) = **0.350**

SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2026 **Issue:** 05 **Volume:** 157

Received: 25.05.2026
Accepted/Published: 30.05.2026 https://T-Science.org

Issue **Article**

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RESULTS OF THE ANALYSIS OF SPRING WATERS OF THE VILLAGE UKHESHI OF AMBROLAURI MUNICIPALITY

Abstract: *We set a goal to study the chemical composition of the spring waters of the village Ukheshi of Ambrolauri municipality. For this purpose, we studied in the investigated springs: pH, water hardness, Mg^{2+}, Ca^{2+}, HCO_3^-, Br^-, total arsenic and Cl^- ions, permanganate oxidizability, dissolved oxygen, BOD_5, and free carbon dioxide content. Total iron and Cu^{2+}. The relevance of the issue lies in the fact that the content of the above-mentioned ions was determined for the first time in the given waters, for which high-sensitivity methods were selected. The analyses were conducted in the Iason Moseshvili Hydrochemistry Laboratory of the Department of Chemistry of the Faculty of Exact and Natural Sciences of Akaki Tsereteli State University.*

Key words: *Ambrolauri, Ukheshi, spring water, ion.*
Language: *English*
Citation: Chikovani, M.I., Tabeshadze, E., Kakhidze, N., Kupatashvili, N.N., & Julakidze, N.J. (2026). Results of the analysis of spring waters of the village Ukheshi of Ambrolauri municipality. *ISJ Theoretical & Applied Science, 05 (157),* 468-472.
Soi: https://s-o-i.org/1.1/TAS-05-157-44 ***Doi***: https://dx.doi.org/10.15863/TAS.2026.05.157.44
Scopus ASCC: *1600.*

Introduction

Pure water does not exist in nature; water is a good solvent and dissolves substances it touches on its path of circulation. Gases mainly transfer into it from the air, and solid substances from rocks and minerals. Many substances that are insoluble in water mix with it mechanically and follow it in a suspended or colloidal state. When reaching deep layers of the earth, water undergoes the influence of high temperature and pressure, which facilitates the dissolution of substances [1].

Climate plays a major role in the formation of soil water composition, which conditions the entry of atmospheric precipitation into the water. The surface cover of the water layer, on which the penetration of atmospheric precipitation depends, is of great importance. The sanitary condition of its upper horizon influences the composition of soil waters. Many substances mix with water through industrial runoff and enrich its composition [2].

Microorganisms play a major role in the formation of the chemical composition of water, which use organic substances existing in the water, mainly organic, as food and transform them into other substances. Free oxygen, which enters it from the air and participates in oxidation processes both directly and through the vital activity of microorganisms, plays a large role in the transformations occurring in water. Different waters touch different substances, therefore they differ in chemical composition [3].

Ambrolauri is a city in Georgia, in the Racha-Lechkhumi and Kvemo Svaneti region, and is built at the confluence of the Rioni and Krikhula, at an altitude of 550 m above sea level. Its south-eastern border runs along the Racha ridge, to the north lies the Lechkhumi ridge. Ambrolauri is bordered by Oni municipality from the north-east, Lentekhi and Tsageri municipalities from the north-west, Tskaltubo municipality from the south-west, Tkibuli municipality from the south, and Chiatura and Sachkhere municipalities from the south-east.

The climate of Ambrolauri municipality is transitional between temperate and humid subtropical. In the low mountains of the district, a type of climate with moderately cold winters and relatively hot summers prevails, while a humid mountain climate with heavy snow is characteristic of the high mountain zone. The Rioni and its tributaries flow through the territory of the municipality: Krikhula, Znakura, Shareula, Lukhuni, Ritseula, Askistskali. The main mineral wealth is arsenic, gypsum.

Snow and rain water, when falling on the soil, wash away sand and clay particles. These particles are difficult to dissolve in water and therefore remain in a suspended state. This happens according to the river bed and reaches its maximum in plain rivers during the spring flood period. The maximum content of suspended substances in mountain rivers is noted after torrents [4]. The presence of suspended substances in water prevents its use for drinking and household tasks.

The allowable concentration of suspended substances for drinking water is 1.5 mg/dm^3. The determination of suspended substances in water is done by the gravimetric method, which consists of filtering a certain volume of water through pre-dried filter paper. Then the filter with residue is dried in a cabinet at 105°C, cooled to room temperature, and weighed. The weight difference is recalculated per 1 dm3 of water, which expresses the concentration of suspended substances in it (mg/dm^3) [5].

Picture 1.

Judgment of the Experiment.

In the spring waters of the village Ukheshi of Ambrolauri municipality, the following were determined: pH, water hardness, Mg^{2+}, Ca^{2+}, HCO_3^-, Br^-, total arsenic and Cl^- ions, permanganate oxidizability, dissolved oxygen, BOD_5, total iron, Cu^{2+} ions and free carbon dioxide content by chemical and spectrophotochemical methods. The analysis results are given in Table #1.

Table N 1. Results of hydrochemical analysis of spring waters of the village Ukheshi of Ambrolauri municipality

N	Spring Water Name	pH	Hardness mg-eq./L	Mg_2^+, mg/L	Ca_2^+, mg/L	Total Iron mg/L	Cu_2+mg/L	Cl-mg/L	Br-mg/L	HCO_3 mg/L	Free CO_2 mg/L	Dissolved O_2 mg/L	BOD_5 mg/L	Permanganate.Oxidizability mg/L	Total Arsenicmg/L	SO_4 2- (mg/L)
1	Kodi	6.7	3.32	4.78	58.40	0.115	-	17.75	0.015	3.56	0.40	2.40	23.36	1.04	0.015	0.0090
2	Sholiko	7.4	3.96	5.08	71.20	0.034	-	15.52	0.020	5.00	0.30	2.72	21.25	0.72	0.030	0.0065
3	Soso	7.7	3.84	14.15	53.60	0.029	0.001	5.54	0.017	4.72	0.24	2.59	20.48	0.88	0.026	0.0402
4	Agara	7.5	3.20	0.98	62.40	0.035	-	14.06	0.018	3.82	0.32	2.82	21.18	0.88	0.034	0.0069
5	Jorbenauri	7.6	2.60	5.17	44.00	0.033	0.003	12.78	0.026	2.88	0.16	1.76	20.22	0.34	0.036	0.0023

6	Chenchkhia	7.8	4.12	8.30	68.80	0.040	0.002	7.24	0.027	5.06	0.66	1.70	22.34	0.82	0.027	0.0016
7	Momtsemlidzes	7.6	3.40	5.27	60.00	0.100	0.003	12.35	0.021	3.66	0.26	1.92	22.98	1.17	0.021	0.0527

In the studied spring waters, pH varies from 6.7 to 7.8.

Water hardness is relatively higher in the Chenchkhia spring at 4.12 mg/L. Water hardness is low in the Jobenauri spring - 2.60 mg/L.

Soso spring contains the highest amount of magnesium ion at 14.15 mg/L. Its content is lowest in the Agara spring in 0,98mg/L.

The Ca^{2+} ion content is also variable. Its relatively large amount was recorded in the Shaliko spring at 71.20 mg/L, while the content is low in the Jobenauri spring at 44.00 mg/L.

The content of total iron is higher in the Kodi spring at 0.115 mg/L, while its content is low in the water of the Soso spring at 0.029 mg/L.

The Cu^{2+} ion was not recorded in the spring waters of Kodi, Sholiko and Agara. In these springs, the copper ion content is below analytical sensitivity. In Jorbenauri and Momtsemlidzes springs it is 0.003 mg/L, in Chenchkhia spring it is 0.002 mg/L, while it is relatively lower in the Soso spring at 0.001 mg/L.

Kodi spring contains a relatively larger amount of chloride ions at 17.75mg/L, while its mass content is low in the Soso spring at 5.54 mg/L.

Chenchkhia spring contains a larger amount of bromide ions at 0.027 mg/L, while its content is low in the Kodi spring at 0.015 mg/L.

The HCO_3^- ion content is highest in the Shaliko spring at 5.00 mg/L, the content of hydrocarbonate ions is low in the Jobenauri spring at 2.88 mg/L.

The content of free carbon dioxide is highest in the Chenchkhia spring at 0.66 mg/L. Jobenauri spring contains a small amount of free carbon dioxide at 0.16 mg/L.4

The dissolved oxygen content is higher in the Agara spring at 2.82 mg/L. A relatively low concentration of dissolved oxygen is recorded in the Chenchkia spring at 1.70 mg/L.

BOD_5 is highest in the Kodi spring at 23.36 mg/L, and relatively low in the Jobenauri spring at 20.22 mg/L.

Permanganate oxidizability is relatively high in the Momtsemlidzes spring at 1.17 mg/L, its small amount is recorded in the Jobenauri spring at 0.34 mg/L.

A high concentration of total arsenic is recorded in the Jorbenauri spring at 0.036 mg/L. Kodi spring contains a small amount of total arsenic at 0.015 mg/L.

A high concentration of SO_4^{2-} ion is recorded in the Momtsemlidzes spring at 0.0527 mg/L. Chenchkhia spring contains a small amount of sulfate ions at 0.0016 mg/L.

Experimental Part

Methodology for Determining Chemical Elements in Water

The analyses were conducted in the analytical chemistry laboratory of Kutaisi Ak. Tsereteli State University. Methods approved in hydrochemical practice were used for the analysis [6,7,8].

The acidity indicator was measured by the potentiometric method (potentiometer PH 673-M).

The content of calcium and magnesium, as well as the total hardness of the water in the studied waters, is determined by the complexometric method (titrant 0.01N complexone III). We used eriochrome black as an indicator for determining the magnesium ion content, created the recommended environment with ammonia buffer, and murexide was used as an indicator for the determination of the calcium ion. We created the alkaline environment with 2N sodium alkali.

We determined total iron and Cu^{2+} in the studied waters by the spectrophotometric method. Iron after preliminary oxidation in an alkaline environment (photometric reagent sulfosalicylic acid) (UN-5100B UV/VIS SPECTROPHOTOMETER). Cu^{2+} - in an alkaline environment (with ammonia) (photometric reagent sodium N,N diethyl dithiocarbamate) (UN-5100B UV/VIS SPECTROPHOTOMETER).

We determined hydrocarbonates by the acidimetric method (titrant 0.1-0.01 N HCl indicator methyl orange).

The mercurimetric method was used to determine chlorides (titrant 0.01 $Hg(NO_3)_2$, indicator (diphenyl carbazone).

Total arsenic was determined by the iodimetric method, titrant 0.05 N iodine solution, indicator starch.

Free carbon dioxide was determined by the alkalimetric method (titrant 0.1-0.01N NaOH). We added a small amount of Rochelle salt and the indicator phenolphthalein to the water to be titrated.

Oxidizability was determined by the permanganate method (oxidant 0.01 N $KMnO_4$ in an acidic environment, titrant 0.01 N $H_2C_2O_4$).

Oxygen content and BOD_5 were determined by the iodometric method (titrant 0.01 N $Na_2S_2O_3$). In an alkaline environment, $Mn(OH)_2$ is oxidized by oxygen dissolved in water and converts into a tetravalent manganese compound, which, upon

acidification of the solution in the presence of excess KI, forms I_2.

We determined bromide ions by the iodometric method. (To the analysis water, we added sodium hydrogen phosphate, sodium hypochlorite, and sodium formate; we heated the analysis mixture, then cooled it. We added potassium iodide, sulfuric acid, and ammonium molybdate. Titrant 0.01N $Na_2S_2O_3$, indicator starch). Bromide ions are oxidized by sodium hypochlorite to bromate ions[9].

SO_4^{2-} ions were determined by the classical gravimetric method; $BaSO_4$ represents the precipitated form.

Conclusion

In the studied spring waters of the village Ukheshi of Ambrolauri municipality: pH, water hardness, calcium, magnesium, total iron, chloride, bromide, hydrocarbonate, permanganate oxidizability, total arsenic, dissolved oxygen, BOD_5 and carbon dioxide content are in compliance with the Technical Regulation of Drinking Water of Georgia with some exceptions, and its use for drinking and household purposes is advisable. The total arsenic content in the spring waters of Agara 0.034 mg/L and Jobenauri 0.036 mg/L is slightly more compared to the norm.

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