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Issue Article

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EXAMINATION OF THE CHEMICAL COMPOSITION OF WATER FROM THE WELL OF RUFOTI CILLAGE, TERJOLA MUNICIPALITY

***Abstract**: for the first time, the investigation of the chemical composition of the waters of the Rufoti well of the Terjola municipality was carried out. Magnesium and calcium ions, bicarbonate ions, chloride ions, sulfate ions, dry balance, permanganate oxidizability, dissolved oxygen and carbon dioxide content are determined. Relatively simple and fast chemical and physico-chemical methods with good reproducibility were selected for determination. Biogenic substances were determined by the photometric method. The content of the above-mentioned ions in the waters of the well of the village of Rufoti, Terjola district, is within the norm, and its use for drinking and from an agricultural point of view is appropriate.*

***Key words**: ions, ndicatori, Spring waters, titrant, biogenic elements.*
***Language**: English*
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Introduction

Aim. We aimed to study the hydrochemical composition of some spring waters of Rufoti village of Terjoli municipality. The aim of our research was the content of Ca_2+, Mg_2+, HCO_3-, SO_42- and Cl- ions, CO_2, oxygen, dry balance, permanganate oxidizability and biogenic elements [8] in the spring waters of Rufoti village, Terjoli district. 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 highly sensitive methods were chosen.

Introduction. The history of the well dates back to 7000 years. The time when a human dug the first well, it can be considered as the beginning of the civilization, but the well itself is its symbol. Humans, who managed to find water they were respected. All over the world, the well was widely used. Every new house started with the construction of a well. The water of the well was considered to have curing effect. The one who had to dig water, first went to the church to pure the mind and not to transfer his thoughts to the well. It was believed that all sins were forgiven to the builder of the well. The lake, the lake and the river are clean. Every village should have its own holy beginning. A well, like a stream, a lake and a river, was considered sacred. Almost all the villagers had their own holy origin.

It is a myth that well water is always clean and safe. In fact, well water that is in contact with ground rocks can be contaminated with bacteria and heavy metals. First of all, to determine the quality of drinking water, an accurate analysis is always necessary - even if there are no visible signs. Water analysis provides complete information about the nature of water. In addition to smell, sediment, turbidity and color, the electrical conductivity of water, pH level, acidity, hardness, content of minerals, manganese, iron, sulfates are also checked [4].

Water is the most common substance in nature, it is found in liquid, solid and gaseous state, water is mainly found in the form of oceans, seas, rivers and lakes, which occupy almost ¾ of the earth's surface. In a gaseous state, water is mixed in the air of the atmosphere, where its amount varies according to meteorological conditions and reaches up to 4%, in a solid state (in the form of ice and snow) water is in high snow peaks and in the polar zone[2;3].

A water molecule consists of one oxygen atom and two hydrogen atoms. The arrangement of which forms an isosceles triangle. The electron clouds of the water molecule are arranged in the form of a tetrahedron, in the center of which is the nucleus of the oxygen atom, and the hydrogen nuclei are at the vertices, the distance between the oxygen and hydrogen nuclei is about 0.1 nm, and between the hydrogen nuclei - about 0.15 nm. In the water molecule, eight electrons are paired with each other, which form a filled electronic layer in the oxygen atom. Two of these electron pairs form two covalent bonds, and the other two pairs are unshared. The electronic configuration of a free hydrogen atom is 1S1, and that of a free oxygen atom is 1S2 2S2 2P4. When an oxygen atom joins a hydrogen atom, electrons are hybridized in it. 3 P and 1 S orbitals participate in hybridization, SP3 hybridization takes place, four hybrid orbitals are obtained. The hybrid orbitals are stretched towards the vertices of the tetrahedron. Two of the four hybrid electron clouds are overlapped by hydrogen electron clouds, the valence angle in the water molecule is 104.50, which is close to tetrahedral (109, 28$^{/}$). This small deviation is explained by the fact that the electron clouds around the oxygen nucleus are not equivalent: two of them form O-H bonds, and two belong only to oxygen.

The association of water molecules is due to the presence of hydrogen bonds. In a water molecule, the hydrogen atom has a partial positive charge, and the oxygen has a partial negative charge. Because of this, the hydrogen atom of one water molecule joins the oxygen atom of the other molecule with a weak bond. The oxygen atom of each molecule participates in the formation of two covalent and two hydrogen bonds[1].

Terjola is located on the Imereti plain, on the right bank of the Chkhari river. Terjola region has a humid subtropical sea climate, moderately cold winters and relatively dry hot summers. The relief of the plain is flat and divided by the valleys of the tributaries of the Kvirila River. It is built with quaternary pebbles, sand and clay and modern river sediments. There is non-carbonate alluvial soil along the rivers in the plain area of Terjola. In the elevated part of the plain and on the Simoneti plain, subtropical soil occupies a large place. Here and there there are also small patches of yellow soil. Humus-carbonate soil is developed on the southern slope of the Okriba-Argveti ridge. In the high places of the same ridge, there are forest soils. The rivers of Terjola are fed by rain, snow and underground water. Floods are in spring, low water is in summer and early autumn [9].

Judging the experiment. Thus, the content of Ca_2+, Mg_2+, HCO_3-, $SO_4$2- and Cl- ions, CO_2, oxygen, dry balance, permanganate oxidizable elements in the waters of Rufoti village of Terjoli municipality was determined for the first time. The results of the analysis are given in Table #1.

In the waters of the well of Rufoti village, Terjoli district, the pH changes from 7.12 to 8.31.

The source of the Samkharadze Sulkhani well contains the largest amount of magnesium ion, 4.78 mg/l. Its content in Todidze Temur well water is the lowest at 1.08 mg/l. The average content of magnesium ions in Diakonidze Temur well water is 2.14 mg/l.

The Ca^{2+} ion content is also variable. A relatively large amount of it was recorded in the water of Gognadze Temur at 7.56 mg/l, while its content was low at 1.86 mg/l in the water of the Todidze Tengo well. The average content of calcium ions is 3.51 mg/l in the spring of the Megrelishvili Tsezari well.

The HCO_3^- ion content is the highest in the water of the Gognadze Temur well, 8.78 mg/l, the content of hydrocarbonate ions is the smallest in the water of the Nikoladze Ivane well, 3.58 mg/l. Its average content is 4.86 mg/l in the Kupatadze Mikheili well water.

A high concentration of ion SO_4^{2-} is recorded in the water of the Megrelishvili Tsezari well at 0.247 mg/l. Diakonidze Tengiz well water contains a small amount of sulfate ions in mg/l. The average amount of sulfate ions in the water of the Samkharadze Sulkhani well is 0.173 mg/l.

The water of the Megrelishvili Shota well contains relatively large amounts of chloride ions, 5.02 mg/l. And its mass content is small in Todidze Temur well water at 1.82 mg/l. The average content of chloride ions in the water of Megrelishvili Gulgezi well is equal to 3.12 mg/l.

The content of carbonic acid gas is the highest in the water of the Samkharadze Sukhani well, mg/l. A small amount of carbonic acid gas is contained in the water of Megrelishvili Tsezari's well, 0.85 mg/l. Megrelishvili Gulgezi well water contains an average amount of carbon black gas in the amount of 1.62 mg/l.

Permanganate oxidizability is relatively high in Todidze Mzia well water, 3.46 mg/l, its small amount is recorded in Diakonidze Tengizi well water, 0.42 mg/l. The average value of permanganate oxidizability characterizes the water of the Todidze Temur well at 1.76-2.36 mg/l.

The content of dissolved oxygen in the water of the Samkharadze Sulkhani well is high, 24.96 mg/l. A relatively low concentration of oxygen is recorded in the source of Diakonidze Tengiz, 3.51 mg/l. Its average value is fixed in the water of Todidze Mzia well at 16.64 mg/l.

The dry balance is the highest in Diakonidze Tengiz well water, 2.15 mg/l. Its content is the smallest in the water of the Megrelishvili Shota well, 0.75 mg/l. The water of Samkharadze Sulkhani well contains 1.48 mg/l of dry residue in average amount.

The content of biogenic elements NO_2^-, NO_3^-, NH_3, PO_4^3–ის is lower than the detection limit and their content is not recorded in the investigated well waters of Rufoti village of Terjola municipality.

Experimental part. Methodology for determination of chemical elements in water

The analyzes were carried out in the Yason Moseshvili Hydrochemistry Laboratory of Akaki Tsereteli State University of Kutaisi. Methods tested in hydrochemical practice were used for the analysis [5, 6].

The acidity rate was measured by the potentiometric method (potentiometer pH 673-M)

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

Hydrocarbons were determined by the acidimetric method (titrant 0.1-0.01 N indicator HCl methyl orange.

The content of calcium and magnesium, as well as the total hardness of the water under investigation, was determined by the complexonometric method (titrant 0.01N complexon III. To determine the magnesium ion content, we used eriochrome as an indicator, we created the recommended area with an ammonia buffer, and to determine the calcium ion, Merexide was used as an indicator. We created an alkaline area with 2N sodium alkali).

Sulfate ions were determined by the classical gravimetric method, $BaSO_4$ represent a precipitated form.

Carbonic acid gas was determined by the alkalimetric method. Titrant 0.1-0.01N $NaOH$ Indicator Phenophthalein.

Oxidability was determined by the permanganatometric method (oxidizing agent 0.01 N $KMnO_4$, in acidic area. Titrant 0.01 N $H_2C_2O_4$) ([7].

The oxygen content was 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 passes into a tetravalent manganese compound, I_2 is formed by acidifying the solution KI in excess).

The dry balance was determined by the classical gravimetric method.

Biogenic substances were determined by photometric method: with NO_2^- shell reagent, NO_3^- with sodium salicylate, NH_4^+ -with Nessler's reagent, PO_4^{3-} - with ammonium phosphorolybdate.

NO_2^- - photometric determination using Gries's reagent in the acid zone is based on the reaction of formation of a reddish-brick-colored azo dye as a result of the interaction of sulfanilic acid, nitrite ion and alpha-naphthylamine.

NO_3^- - was determined by the photocolorimetric method using sodium salicylate. The method is based on the interaction between nitrate ions and sodium salicylate ions, in the presence of sulfuric acid, during which the resulting yellow coloration is directly proportional to the nitrate ion concentration.

The determination of NH_4^+ is based on the interaction between the ammonium ion and Nessler's reagent (mercury tetra iodide) in the alkaline zone, during which the resulting yellow coloration is directly proportional to the concentration of the ammonium ion.

PO_4^{3-} was determined by the photocolorimetric method, which is based on the interaction of orthophosphoric acid and ammonium molybdate in the acid zone, during which the resulting blue coloration is directly proportional to the phosphate concentration.

Table N 1. The results of the hydrochemical analysis of the waters of the well of Rufoti village of Terjola municipality

N	Name of well waters	*pH*	MG/L								
			SO_4^{2-}	Ca^{2+}	Mg^{2+}	HCO_3^-	Cl^-	Dissolved oxygen	Permanganate oxidizabili	CO_2	Dry balance
1	Megrelishvili Shota	8,31	0,054	4,74	1,42	5,74	5,02	14,42	3,44	1,69	0,75
2	Kupatadze Mikheili	7,62	0,099	4,78	2,18	4,86	4,82	20,48	2,94	1,04	1,15
3	Todidze Mzia	7,71	0,029	2,64	1,34	3,92	2,10	16,64	3,46	1,08	2,04
4	Megrelishvili Gulgezi	7,12	0,058	7,12	1,62	7,70	3.12	14,04	0,56	1,62	1,13
5	Nikoladze Ivane	7,64	0,025	4,41	1,98	3,58	4,81	15,36	2,64	1,11	1,01
6	Samkharadze Sulkhan	7,56	0,173	3,32	4,78	9,82	3,32	24,96	1,68	2,44	1,48
7	Todidze Temuri	7,64	0,087	1,82	1,08	4,98	1,82	6,40	1,76	1,12	1,15
8	Megrelishvili Tsezari	7.58	0,247	3,51	1,46	4,22	2,60	21,12	1,09	0,85	0,94
9	Diakonidze Tengizi	7,55	0,045	8,12	2,14	7,91	4,71	3,51	0,42	1,60	2,15
10	Gognadze Temur	7,28	0,046	7,56	2,16	8,78	2,48	15.74	1,44	1,34	1.20

Conclusion: The content of Ca_2+, Mg_2+, HCO_3-, $SO_4$2- and Cl- ions, CO_2, oxygen, dry balance, permanganate oxidizability in the studied well waters of Rufoti village of Terjola municipality is within the norm and its use for drinking and from the agricultural point of view is appropriate.

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