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CONCENTRATION AND ANALYSIS OF IODINE CONTAINED IN GROUND SALINE WATERS ON THE BASE OF HEXAMETHYLENETETRAMINE.

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Abstract. Groundwater and ocean salt water contain high concentrations of various salts, and iodine ions present in it are mainly in the form of potassium iodide. They are first oxidized under the influence of special oxidizers. The released iodine was precipitated on the basis of hexamethylenetetramine, and its composition was observed using the X-ray fluorescence method. According to the analysis of the results of this analysis, it was suggested that a complex compound with iodide was formed through the amino group in the compound.

Key words: Ground saline waters, iodine, potassium iodide, radioactive isotope of iodine, hexamethylenetetramine, X-ray fluorescence.

Introduction. Currently, the problem of iodine deficiency is being observed all over the world, it is important to use its available reserves and extract them from natural waters based on economically and ecologically productive methods.

Groundwater is widespread in nature, and the concentration of iodine in a multicomponent solution of salts is slightly higher than in the normal composition. The annual production of iodine in the world is 30 thousand tons. Production figures for the United States were weak, but accounted for about 5% of global production. Of the world iodine production, Chile (66%) and Japan (32%) are the largest producers [1]. Bound waters are promising for iodine production if the iodine content is at least 10-18 mg/l. In the development of iodine extraction technology based on iodized groundwater containing iodine compounds, it is necessary to justify a number of scientific solutions in the following directions: - determination of the optimal technological parameters of the kinetics of iodine ions and the oxidation mechanism during drilling. -water in an acidic environment; selection of oxidizing agents and determination of optimal process conditions for precipitation of iodine from iodine concentrates, as well as development of molecular crystalline iodine separation technology [2, 3]. In the territory of our republic, a number of industrial iodine groundwaters located mainly in the Fergana, Bukhara-Karshi and Surkhondarya basins and on the Ustyurt plateau were found. They are characterized by increased concentrations of iodine, cesium, rubidium, strontium and bromine. Calcium iodate, potassium iodate and potassium iodide refer to iodine-containing compounds that are added to animal feed and salt to prevent medical diseases due to the lack of iodine and iodide ions in the body [4]. In the Surkhandarya artesian basin, 3 deposits of strong hydrogen sulfide, iodine waters were identified and studied, their formation is also related to oil fields and oil rocks: Uchkizil, Khaudag, Kakayti and Ortabulok - objects containing iodine and bromine. The amount of iodine in the waters of the Surkhandarya basin is 17.4-24.34 mg/l, bromine 313.2-426.4 mg/l, pH 5.1-6.7, temperature 39-76°C, and mineralization 142.9-283.0 g/l depending on the deposit. Khaudak mine Kattakum-2 well, Uchkizil underground salt water deposits, Kakayti and Ortabulok underground salt water deposits according to the type of anion: bicarbonate, sulfate, chloride and according to the cation: calcium-magnesium - the concentration of sodium cations is high. According to the content of iodine and bromine, these waters are industrial waters [5].

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The fact that the concentration of iodine in nature changes depending on the conditions shows that it is one of the important things to pay attention to its isolation even in the case of complex compounds. For example, a sample of the pyrroloperylene-iodine complex was subjected to a dry nitrogen purge at TGA below 25 mL/min. The ramp rate was 10 °C/min to 650 °C. A weight loss corresponding to the volatilization of iodine is seen, followed by complete sublimation of the organic part [6]. Iodine complex compounds in the form of biocides are used in medicine for a wide range of procedures [7]. As a result of the conducted research, the complex precipitation of iodine in the content of underground saline waters with the participation of starch was isolated. When analyzing the composition and amount of the iodine precipitate extracted by the synthesis method using scanning electron microscopy and elemental analysis methods, it can be seen that almost half of the iodine contained in the original Khaudak salt water has been absorbed [8].

At first, 0.3 g of urotropin was dissolved in 19.7 g of water, then 350 g of iodine solution with a concentration of 40 mg/l was taken and the reaction was carried out at room temperature until the precipitate was completely separated. The obtained precipitation infrared spectrum is presented below (Fig. 1).

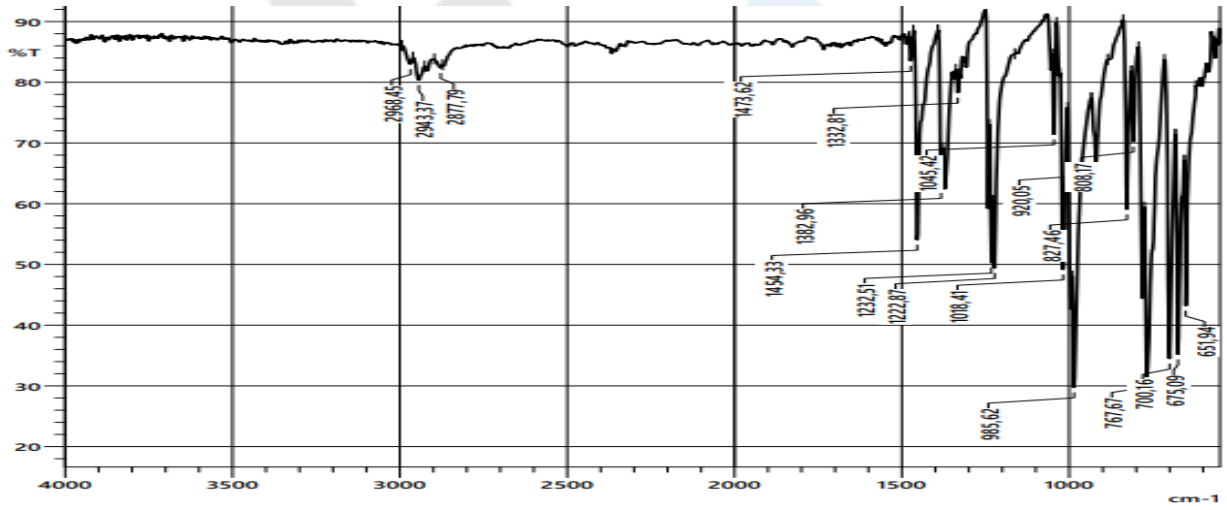

Figure 1. IR spectrum of urotropin (hexamethylenetetramine) iodine compound.

In this case, a slightly different situation was noted from the first obtained spectra. The light refraction indicators shifted slightly to the left and showed the presence of iodine ion in the region of 785-730 cm^{-1}. This allows the iodine ion to be separated from the existing compounds first through the chlorine compound and then through the urotropin solution, without iodine precipitation. 10 ml of 0.02 N solution of KI was taken. Oxidation was carried out by adding 1 ml of 0.2 N solution of FeCl3 to this solution at room temperature. As a result, a reddish solution of iodine was formed. An equivalent amount of aqueous solution of hexamethylenetetramine was added to the liberated iodine. As a result of the reaction, a reddish-brown cloud was formed and settled. The composition of the precipitate obtained was examined using the infrared spectroscopy method (Fig. 2) [8].

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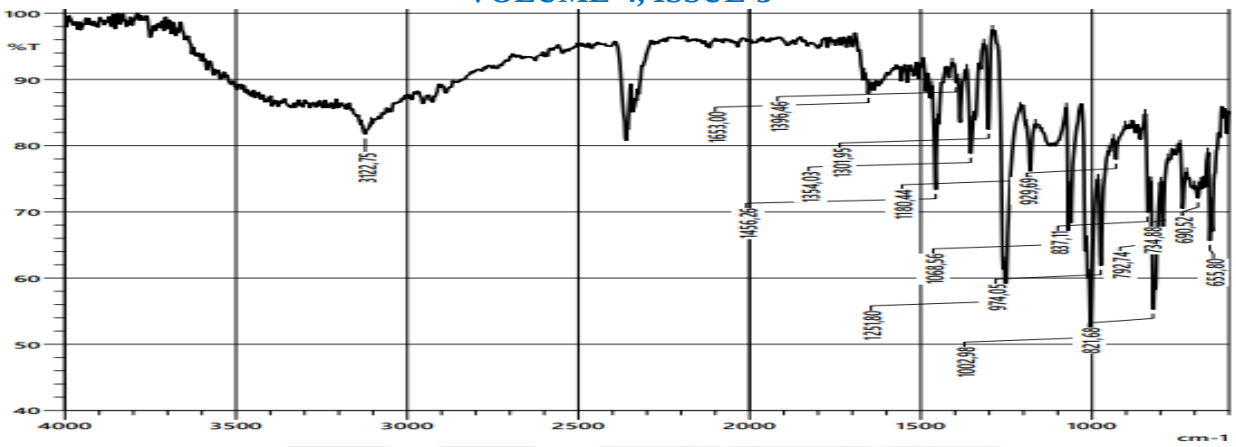

Figure 2. IR spectrum of urotropin precipitate of oxidized KI solution

The same experiment was carried out in Uchkyzil underground salt water, i.e. instead of KJ solution, salt water was used, and the IR spectrum of the resulting precipitate was obtained (Fig. 3).

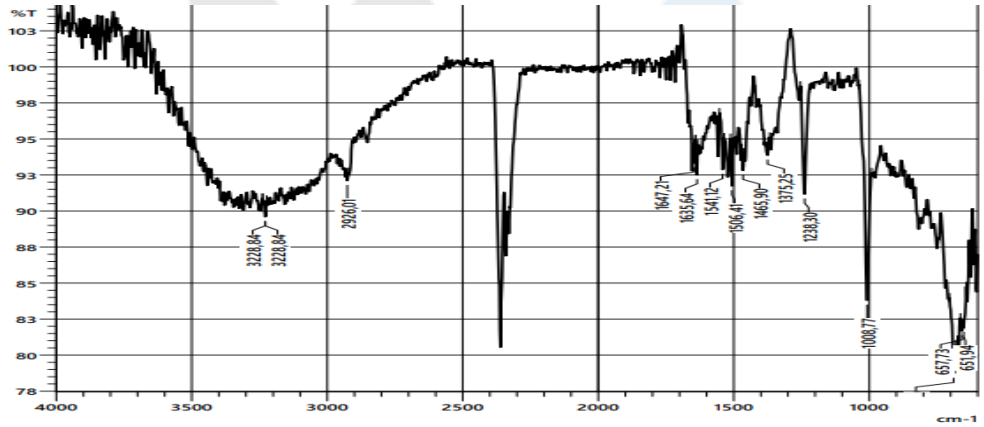

Figure 3. IR spectrum of urotropin precipitate formed by oxidizing KI contained in the trident water

In this figure, bands of symmetric valence vibration of the groups in almost the same area as the spectra of the figures 1 and 2 obtained above, as well as the vibration of iodine anion groups, were observed [8].

Experimental part

As we know, Uchkizil and petroleum waters contain high concentrations of various salts, and iodine ions are present in the form of potassium iodide. During the work, 0.5 liters of Uchkizil groundwater in Surkhandarya region (Uzbekistan) was taken. In order to oxidize the iodine ions in this water, 8 ml of a 3 percent solution of H_2O_2 was added and stirred for 5 minutes. After the solution turned yellow, 8 ml of a 0.5 molar solution of hexamethylenetetramine (urotropin) in water was added. It was waited for 2 hours until a complex compound was formed and settled. The reaction was carried out under normal conditions at 20-25 °C. As a result, 0.733 g of dry sediment was separated.

Results and their discussion

The composition of the complex sediment isolated in the research work was analyzed in an X-ray fluorescence analyzer (Fig. 4).

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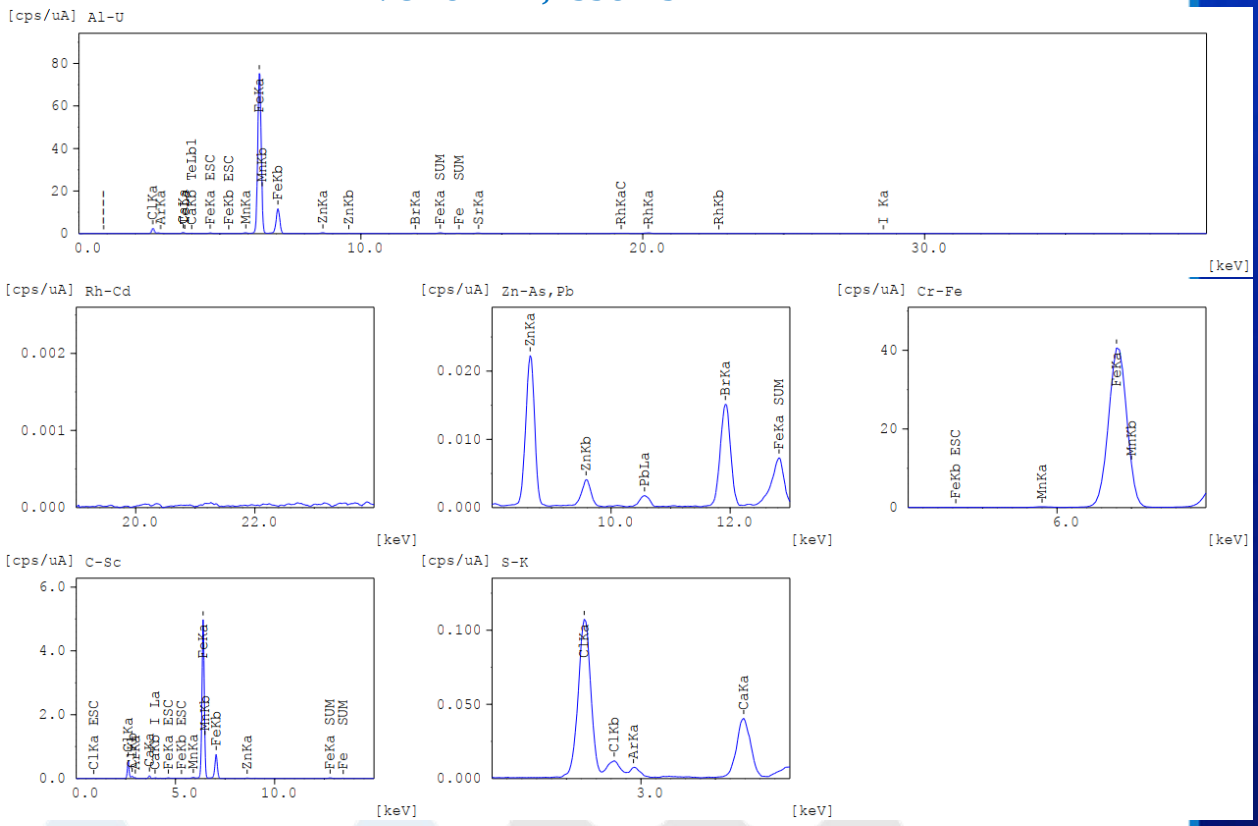

Figure 4. The spectrum of the iodine-urotropin compound in a Centgen fluorescence analyzer.

As can be seen from the picture, vibration bands were formed in the composition of the complex sediment based on the phenomenon of luminescence of several elements. In addition, the elemental analysis of the complex precipitate separated from the complex mixture was presented based on the X-ray fluorescence analyzer (Table 1).

Table 1

The obtained elemental composition of the complex sediment based on the X-ray fluorescence analyzer

Analyte	***Result***	***[3-sigma]***	***Proc.-Calc.***	***Line***	***Int.(cps/uA)***
Fe	73.043 %	[0.186]	Quan-FP	Fe Ka	297.1188
Cl	23.202 %	[0.405]	Quan-FP	Cl Ka	1.0992
Ca	1.864 %	[0.069]	Quan-FP	CaKa	0.9684
I	0.633 %	[0.051]	Quan-FP	I Ka	0.9347
Zn	0.581 %	[0.023]	Quan-FP	ZnKa	0.1918
Mn	0.379 %	[0.014]	Quan-FP	MnKa	1.1356
Sr	0.176 %	[0.010]	Quan-FP	SrKa	2.6117
Br	0.121 %	[0.005]	Quan-FP	BrKa	0.1502

According to the analysis of the amount of iodine in the initial salt water, 733 mg of dry complex was separated from 500 ml of salt water in the sample (Trial underground salt water),

and it was determined that 0.633% of it consists of iodine. The amount of iodine in the initial sample was 20.7 mg/l and 4.64 mg, i.e. 44.83% was separated by complex precipitation.

Conclusion. As a result of the conducted research, iodine contained in underground saline waters was separated in the form of a complex compound by precipitation in the presence of hekmethylenetetramine. The composition, structure, and quantity of iodine extracted by the synthesis method were analyzed using analytical methods.

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