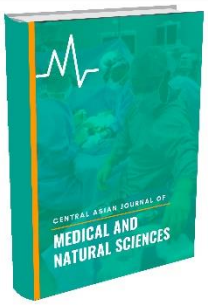
CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES



Volume: 03 Issue: 03 | May-Jun 2022 ISSN: 2660-4159

http:// cajmns.centralasianstudies.org/index.php

DRINKING WATER COMPOSITION OF INDUCTION CONNECTED MASS-SPECTROMETRY STUDY

Fazliyeva N.T.[1], Bakhranova M.A.[1], Muhamadiyev N.Q.[1]

EMAIL:
baxranovamohidil@gmail.com

Received 20th April 2022,
Accepted 18th May 2022,
Online 28th May 2022

[1]Samarkand State University. Samarkand, Uzbekistan

ABSTRACT: The article examines the composition of drinking water in the city of Samarkand and Samarkand region using induction-coupled plasma mass spectrometry and micro-X-ray analysis. The tested drinking water contained IA (alkali metals), AEM (alkaline earth metals), IIIA (np1 elements), VA (np5) group elements, 3d-elements and 4f-elements, i.e. almost all elements except the metals listed in the periodic table noted. The quantitative results can be used to assess the mineral content of water and its drinkability as well as to obtain information about the mineral resources, geological and hydro-chemical processes.

KEYWORDS: drinking water, analysis, element, induction-coupled plasma mass spectrometry, micro X-ray analysis.

INTRODUCTION

About 97.2% of the water on Earth is salt water from the oceans and seas [1,2]. Only 2.8% of the water is drinking water and is distributed as follows: 2.15% of the water is in mountain glaciers, ice sheets and icebergs in Antarctica; 0.001% of water reserves are stored in the atmosphere; 0.65% of water is stored in rivers and lakes [1]. Mankind uses them for their own needs. Over the last 40 years, per capita drinking water has decreased by 60%. Agriculture sector accounts for the largest consumption clean water. Today, 85% of the clean water used by mankind is used by this sector of the economy [1,2].

Therefore, despite the fact that 2/3 of the earth's crust is covered with water, providing the population with clean drinking water is one of the most pressing issues in the world [2]. Because pure drinking water must meet certain requirements in terms of its chemical composition [3-6]. Modern physical, physicochemical and chemical methods for studying the composition of water have been developed [7-22]. At the same time, there are strict requirements for the chemical composition of drinking water. Therefore, the requirements for methods and techniques for studying the chemical composition of water have been growing from year to year, and the solution remains one of the most pressing issues facing experts.

THE PURPOSE OF THE WORK

Study of the composition of drinking water in the city of Samarkand and Samarkand region using induction-coupled plasma mass spectrometry.

RESEARCH OBJECTS AND METHODS.

Drinking water samples were taken from Samarkand city and Samarkand region (Jambay, Pastdargom, Akdarya) and Zarafshan river. The analyses were performed on an inductively coupled plasma mass spectrometer (model iCAP Q) at the High Technology Center (Figure 1). Qualitative composition of the elements was carried out using mass-spectral characteristics, and quantitative analysis was carried out using grading lines based on standard solutions of metal salts. The results of qualitative and quantitative composition of the elements were calculated using a special program. With 5-time repetations in the analysis of samples. The results were statistically processed in Excel's Data Analysis application.

Figure 1-View of iCAP Q mass spectrometer

The elemental composition of some of the studied metals and their quantities (mg / l and μg / l) are shown in the form of histograms in Figures 2-7.

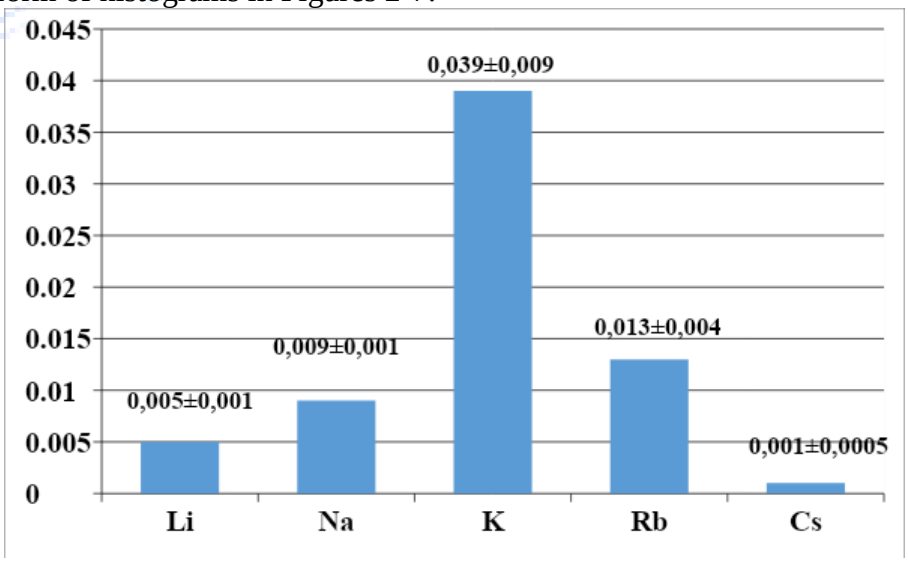


Figure 2. The composition of Samarkand drinking water identified in IA group elements (mg/l)

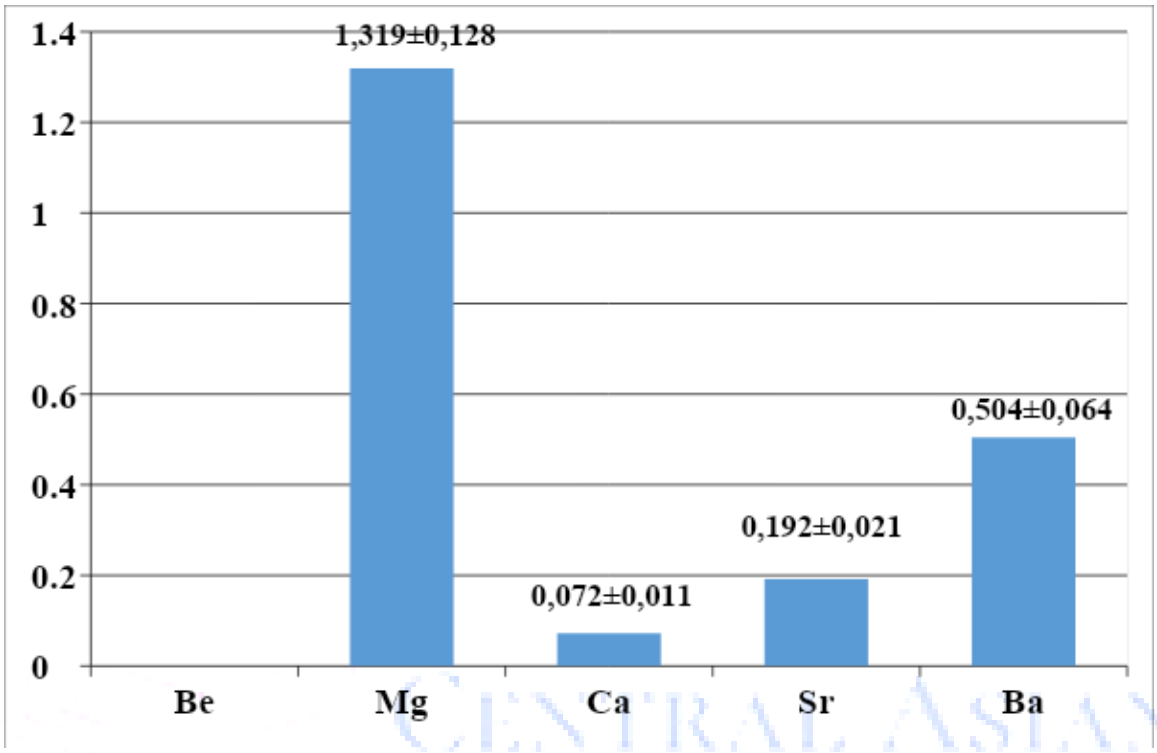


Figure 3. The composition of Samarkand drinking water of IIA group elements (mg/l)

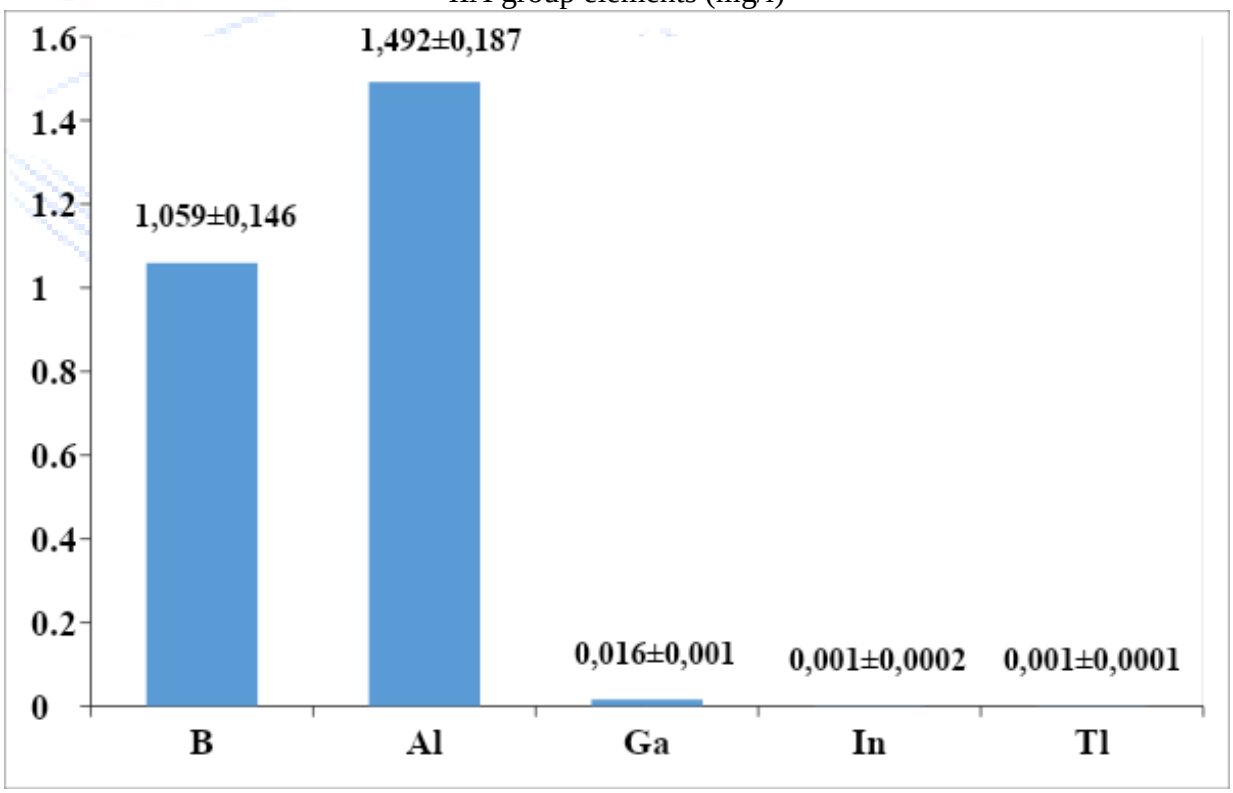


Figure 4. The composition of Samarkand drinking water identified in group IIIA elements (mg/l)

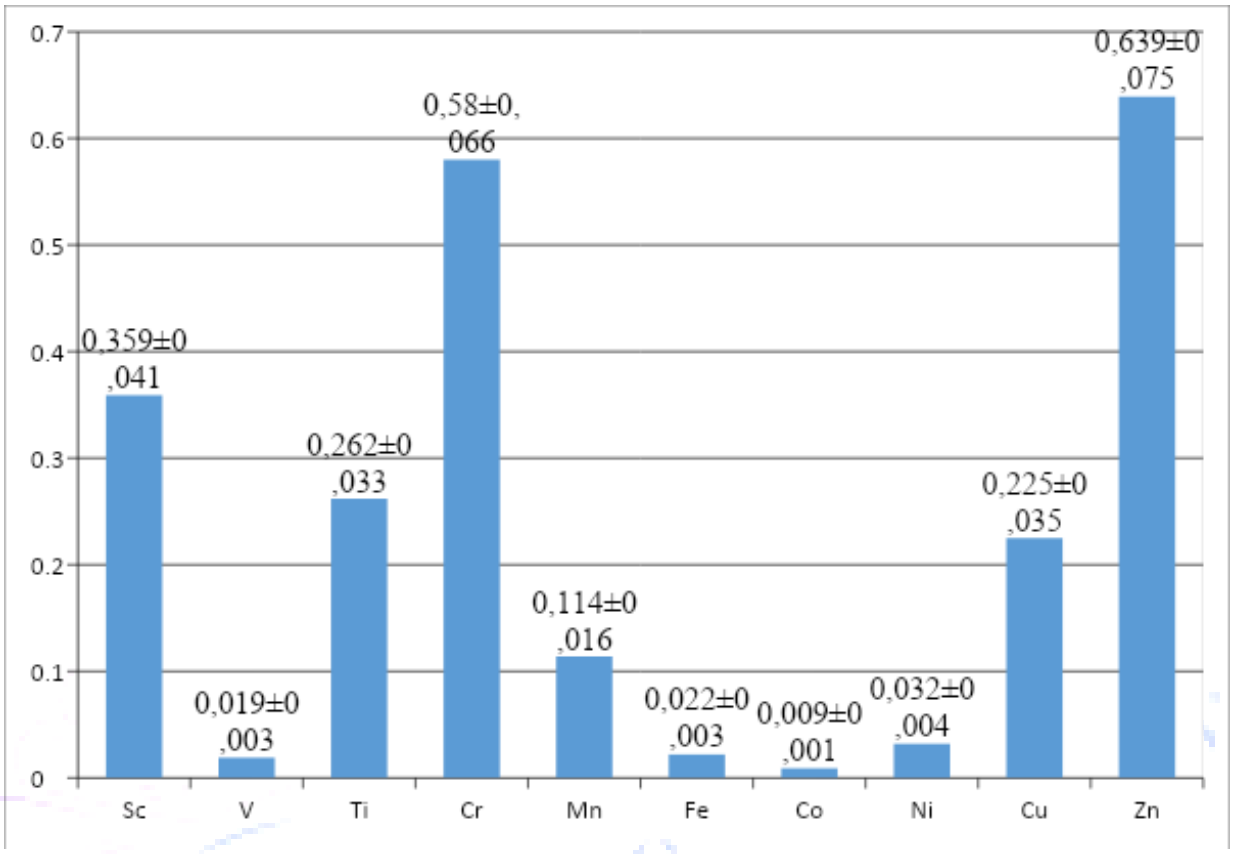


Figure 5. The composition of Samarkand drinking water detected in 3d elements (mg/l)

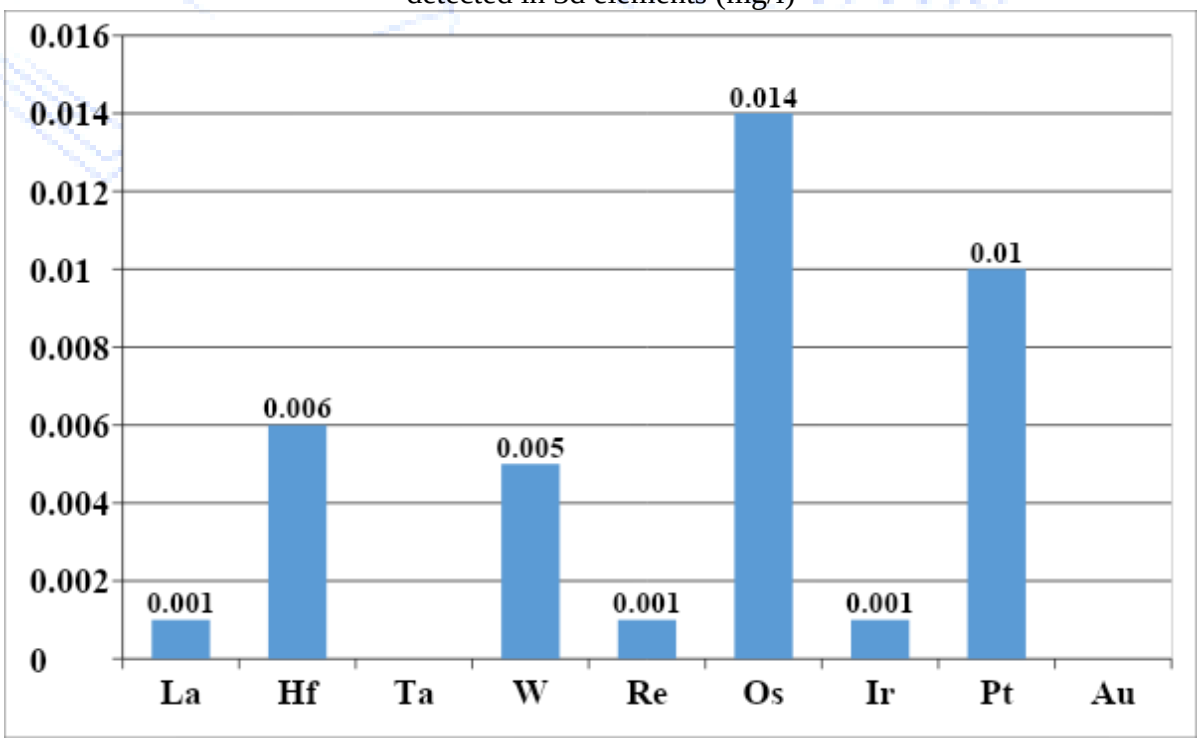


Figure 6. 4f-elements detected in Samarkand drinking water (mkg/l)

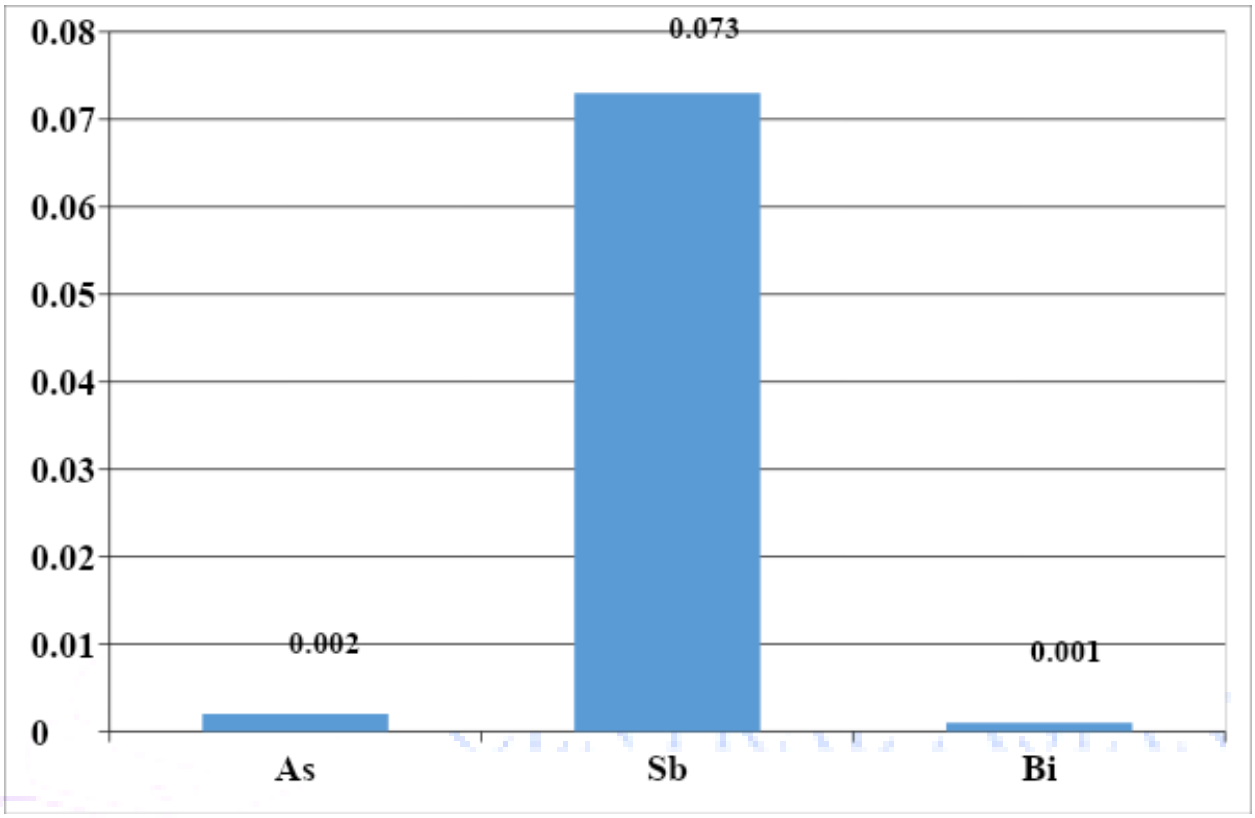


Figure 7. The composition of Samarkand drinking water identified VAgroup elements (mkg/l)

The figures show that the water contains IA (alkali metals), IIA (alkaline earth metals), IIIA (np1 elements), VA (np5) group elements, 3d-elements and 4f-elements, i.e., almost all elements except the metals listed in the periodic table have been identified. Transuran elements are excluded. The obtained quantitative results can be used to assess the mineral content of water and its drinkability, as well as to obtain information about the mineral resources, geological and hydro-chemical processes.

In addition to the above, solid residues from the evaporation of water samples were analyzed using a micro X-ray element analysis [23]. The results obtained are presented in Table 1.

Table 1. The content of drinking water from different regions of Samarkand region (%)

Element	Jomboy	Zarafshon	Dahbet	Pastdarg'om	Suzangaron	Yangiqo'rg'on
C	9,83	11,51	10,35	11,84	11,61	11,59
O	46,15	45,92	43,77	45,36	45,11	45,85
Mg	3,00	0,11	0,09	0,06		1,22
Al	0,32					0,08
Si	2,72	0,20	0,20	0,20	0,20	0,20
Cl	0,06					
K	0,21					
Ca	37,26	42,15	45,50	42,48	43,08	39,98
Fe	0,44					
S		0,11	0,09	0,05		0,06
Sr						0,72
Cu						0,30

Na						0,20

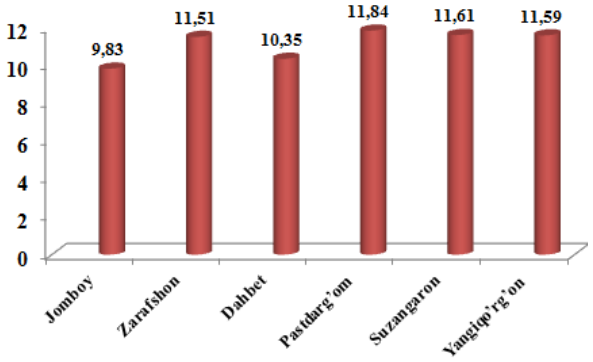


Figure 1. The amount of element C (%)

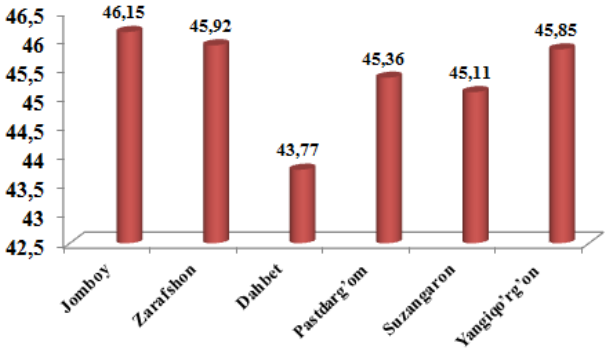


Figure 2. The amount of element O (%)

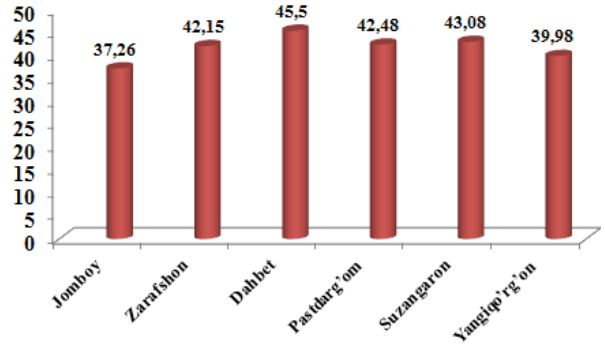


Figure 3. The amount of Ca element (%)

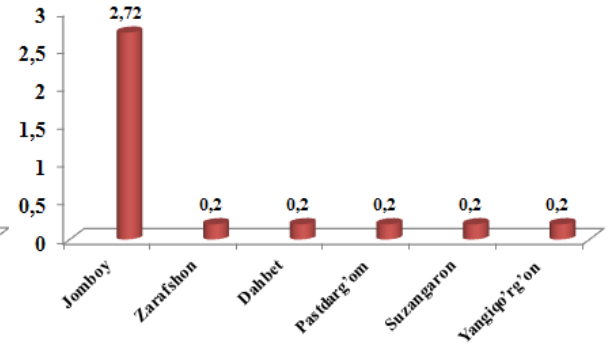


Figure 4. Amount of Si element (%)

The table shows that water samples from Jambay and Yangikurgan were high in magnesium, aluminum.

Iron and silicon were found in water samples from Jambay, Zarafshan, Dahbet, Pastdargom and Yangikurgan.

Sulfur was found in the water samples obtained. In addition, the elements of potassium, iron and chlorine, as well as the elements in Jambay. Sodium, strontium and copper were found in water samples taken from Yangikurgan. The results serve as preliminary data for assessing the chemical composition of water.

CONCLUSIONS

1. For the first time, qualitative and quantitative analysis of the chemical composition of drinking water in the city of Samarkand and some districts of Samarkand region was carried out using the method of IBP MS, which has a high sensitivity.
2. The chemical composition of post-boiling residues of drinking water in Samarkand city and some districts of Samarkand region was determined by micro-X-ray method.
3. The composition of drinking water of Samarkand city and some districts of Samarkand region includes elements of groups IA (alkali metals), IIA (alkaline earth metals), IIIA (elements np1), VA (np5), 3d-elements and 4f-elements, that is It was noted that almost all elements were identified, except for the metals listed in the periodic table.

4. The obtained quantitative results can be used to assess the mineral content of water and its drinkability, as well as to obtain information about the mineral resources, geological and hydro-chemical processes.

REFERENCES:

[1]. Kukharenko A. A., Orekhova V. I. World fresh water reserves // Scientific support of the agro-industrial complex. - 2018. - S. 263-265.

[2]. Smirnova E. E. World reserves of fresh water // Bulletin of Science. - 2020. - Vol. 1. - No. 2. - S. 80-84.

[3]. GOST 18165 - 89. Drinking water.

[4]. GOST 31870-2012 Drinking water. Determination of the content of elements by methods of atomic spectrometry.

[5]. Method for measuring the mass concentration of cesium, potassium, sodium, lithium, magnesium, calcium, strontium and barium cations in samples of natural, drinking and waste water and ammonium cations in waste water samples using the Kapel capillary electrophoresis system M 01-31 -99. SPb., 1999. 34 p.

[6]. Method for measuring the mass concentrations of chloride ions, nitritions, sulfate ions, nitrate ions, fluoride ions and phosphate ions in samples of natural, drinking and waste water using the Kapel capillary electrophoresis system PND F 14.1: 2: 4.157-99. M., 1999. 34 p.

[7]. Muravyov A.G. Guidelines for the determination of water quality indicators by field methods. – St. Petersburg, 2009. 220 p. Catsimpoolas N.-In: Electrophoresis ’79./Ed. Radola B.J. Berlin, De Gruyter, 1980. p.503

[8]. Novikov, Yu. V. Methods for studying the quality of water in reservoirs / Yu. V. Novikov, K. O. Lastochkina, Z. N. Boldina. Moscow: Medicine, 1990. 400 p.

[9]. Sergeev G.M., Shlyapunova E.V. Pozdnyakova M.A. Selective extraction-photometric redox determination of low concentrations of sulfur(IV), selenium(IV), tellurium(IV), and arsenic(III), Zh. analyte chemistry. - 2007. - T. 62, No. 5. - S. 465-472.

[10]. Sergeev G.M., Shlyapunova E.V. Extraction redox photometry using antimony(V) hexachloride complex // Analytics and control. - 2006. - T. 10, No. 3-4. - S. 327 - 335.

[11]. System of capillary electrophoresis "Capel" (Fundamentals of the method. Equipment. Examples of the use of capillary electrophoresis systems "Capel-103, -104, -105"). SPb. : Lumeks, 2001. 55 p.

[12]. Shlyapunova E.V., Sergeev G.M. Analysis of mineral waters by anion chromatography // Sorption and chromatographic processes. -2007. - Vol. 7, Issue. 3. - S. 527-533.

[13]. Shlyapunova E.V., Sergeev G.M. Anion chromatography and redox photometry in drinking water analysis, Zh. applied chemistry. -2008. - T. 81, Issue. 5. - S. 730-735

[14]. Shlyapunova E.V., Sergeev G.M. Ion chromatographic control of the content of cations of alkaline and alkaline earth elements in some natural drinking waters // Bulletin of the UNN. - 2008. - No. 4.

- S. 65-70.
[15]. Shlyapunova E.V., Sergeev G.M. Some patterns of anion retention in two-column ion chromatography // Analytics and control. - 2008. - V. 12, no. 3-4. - S. 138-142.
[16]. Shlyapunova E.V., Sergeev G.M. Application of anionite “ANIEKS-N” for ionochromatographic analysis of mineral waters. Izv. universities. Chemistry and chem. technology. - 2008. - V. 51, No. 1. - S. 27-29.
[17]. Shlyapunova E.V., Sergeeva V.P., Sergeev G.M. The use of sorbents "Elsikat" for the separation and determination of cations of alkaline and alkaline earth elements by ion chromatography // Bulletin of the UNN. - 2008. - No. 5. - S.39-44.
[18]. Gorbachev A. L. Influence of the chemical composition of drinking water on the health of the population of Magadan //Microelements in medicine. - 2021. - T. 22. - No. 2. - S. 17-24.
[19]. Shirokova V. A. Miraculous waters: a historical review // Bulletin of the Academy of Sciences of the Chechen Republic. – 2017. – no. 2. - S. 114-120
[20]. Ashikhmina T. Ya., Kutyavina T. I., Domnina E. A. Studying the processes of eutrophication of natural and artificially created reservoirs (literature review) // Theoretical and applied ecology. – 2014. – no. 3. - S. 6-13.
[21]. Azamatuly E. M. et al. Study of the composition of salts of heavy metals in drinking water // Science and Technology of Kazakhstan. – 2019. – no. 2. - S. 114-125.
[22]. Bahranova MA, Pirmamatova G., Egamberdiyeva M., Ergasheva D. Study of the composition of natural water "Karasuv" by ion chromatography // Proceedings of the 75th International Scientific and Practical Conference of Medical Students and Young Scientists “Modern Medicine and Pharmacy: new approaches and current research” (Samarkand, May 18, 2021). - Samarkand, 2021. - S. 150-151.
[23]. Fazliyeva N.T., Baxranova M.A. Chemical composition of drinking water in some areas of Samarkand region // Collection of materials of the Republican scientific and practical conference “Innovative technologies for processing mineral and technogenic raw materials of the chemical, metallurgical, petrochemical industries and the production of building materials” (Tashkent, May 12-14, 2022). - Tashkent, 2022. - S. 30-32.(translation from Russian to English)