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ENVIRONMENTAL MONITORING IN SOME VILLAGES OF SAATLI AND IMISHLI DISTRICTS

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Institutes of Radiation Problems of ANAS

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Abstract: The data on the content of heavy metals and radionuclides in the water and the bottom sediments of the Araz River in the villages of the Saatli and Imishli regions of Azerbaijan were studied by mass spectroscopy and radio spectrometry. The ecological state of arable and pasture soils has been studied. Some water and soil samples showed high levels of molybdenum, copper, manganese, and other metals. We also studied the photosynthetic activity of some agricultural plants grown in areas along the Araz River.

Key words: Heavy metals, radionuclides, pollution, bottom sediments, arable soils, mass spectrometry - ISP – MS.

1. Introduction

The Araz River is the main water source of the Saatli and Imishli regions of Azerbaijan. According to the Monitoring Department of the Ministry of Ecology and Natural Resources of Azerbaijan, hundreds of thousands of tons of solid acidic water, salts of heavy metals, and other wastes from the mining enterprises of Meghri, Kajaran, Kafan, and Dastakert are thrown into the tributary of the Araz Okchuchay (Ecology and Security UNDP, UNEP, OSCE reports) [1].

It should be noted that the population of coastal villages use the water of the Araz River for entering the soil pass through the ecological links from one chain to another, eventually enter the human body. Soil is the environment with which a person is connected throughout his life. She can to influence his health. When contaminated with toxicants, soil can become a source of various diseases. Anthropogenic pollution, natural disasters can have an impact on the release of pollutants into the environment. There were speeches in the Iranian parliament on the pollution of the Araz River by Armenia. It was noted that the reason for the increase in cancer among the population in the Mugan region of Ardabil province in Armenia. The deputies noted that Armenia causes great damage to ecology by discharging radioactive waste into the river. It should be noted that the territories of Iran along the Araz River are fertile lands. Agriculture is widely developed here. Local farmers get irrigation water from the Araz River. Contamination of river water with toxic substances by Armenia not only reduces productivity but also increases oncological diseases among the population. So, in 2010 floods on the Kura and Araz rivers led to the flooding of many villages in the Saatli district. For several months, many agricultural lands and pastures remained underwater. After the retreat of the water, the flooded areas were under a muddy layer, and as a result, the quality of the Araz River water and its use becomes a matter of special concern. The main goal of the research was not only to study the composition of water and soil along the river but also to identify sources of pollution. The possibility of using the mass spectrometry method with inductively coupled plasma in studying the composition of waters, soils, and bottom sediments has been studied. To assess the health of soil and water, different methods of research are used depending on the goal. Field studies of the chemical composition of the sediments of the Araz rivers were carried out in the period 2015-2017. A sampling of

bottom sediments and soil was carried out from the upper 10-20 cm of sediments. Field studies of the chemical composition of the bottom sediments of the Araz River were carried out in the villages of Hadzhikasimly, Kamally of the Saatli and Bajiravan, and Karalar in the Imishli region.

2. Materials and methods of research

The number of samples was calculated based on the study area of the site at the rate of 1 sample per 1 ha. Samples taken from the upper 10-20 cm layers of deposits were more than 100. The studies were carried out using the mass spectrometer with the inductively coupled plasma of the firm Agilent-Technologies 7700 ICP-MS (USA). In the literature there is a lot of information on various aspects of the use of ICP-MS, a large number of articles have been published [2]. In all the test samples, the BC concentration equal to 25 mg / l was created by adding the required volume of the prepared solution.

The study of the content of heavy metals was carried out in the of the ICP-MC device.

Table 1. The value of the operating parameters in "standard model".

Parameter	Range
Power of RF generator	1400-1500 W
The flow rate of argon through a nebulizer	1,15-1,25 l/min
Depth of sampling	7,5-8,5 mm
Potential on the lens-extractor	2-4 V

The content of radionuclides was measured on a Canberra HPGe radio spectrometer.

3. Results and its discussion

When analyzing the ecological situation, bottom sediments are one of the most informative objects of research. By accumulating pollutants coming in for a long period, bottom sediments are an indicator of the ecological condition of the territory, an integral indicator of the level of pollution. Based on this, in the first of our studies, we paid the greatest attention to the investigation of the Araz river bottom sediments. The standards for the content of heavy metals and radionuclides in soil and water in the countries of the former USSR differ from those of the United States and European countries. The conducted studies of the composition of the bottom sediments of the Araz River in the villages of Bajiravan and Karalar in the Imishli region showed that the content of heavy metals is high. The content of Mn, Mo, Cu, Al in the waters of the Araz River also exceeds the maximum allowable concentration (MPC). The presence of Fe, Mn, and Mo in groundwater and wells turned out to be above the norm. In some wells, the molybdenum content in water is 50-100 times the MPC. Increased molybdenum content can be observed in rivers that are located near the metal enrichment plants. At low concentrations, molybdenum helps the normal development of the organism (both vegetable and animal). Excess of molybdenum in water leads to disruption of normal metabolism. Increased molybdenum content was observed in almost all samples of bottom sediments and in well waters. The participation of molybdenum in biological processes in certain quantities is necessary for the functioning of plants, animals, and humans. Even at low intake levels it is prone to accumulation in biogeocenoses, and its concentration can reach dangerous values. Neutral and slightly alkaline waters are less favorable for the migration of most metals [3,4]. The copper content in samples

of well waters was within the norm. In the samples of arable soils and pastures of Kamally village, the copper content exceeded the MPC by 2 times. Manganese enters rivers mainly in the leaching of minerals and ores that contain manganese. It is known that mining and processing enterprises, metallurgical plants, mines can be sources of pollution of waters with a high content of copper and molybdenum. The increased molybdenum content was also observed in the bottom sediments of the river in the Kamally and Bajiravan villages. Bottom sediments are capable of depositing metals in the form of various compounds. Heavy metals in bottom sediments are in the process of permanent migration, at which their continuous exchange through the geochemical barrier system "water environment - bottom sediments". The content of manganese in some water samples of the Araz River and the waters of the well exceeded the MPC 3-5 times.

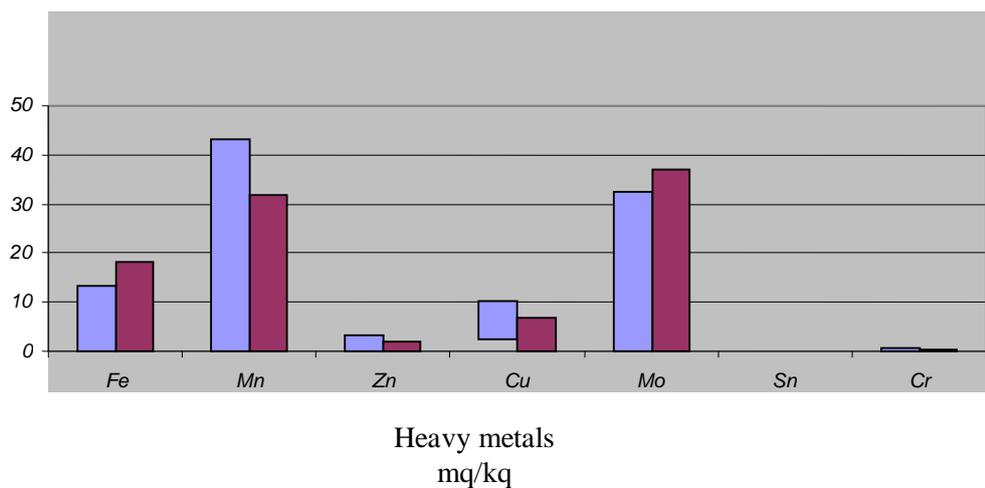


Fig. 1. The content of heavy metals in the bottom sediments of the Araz River and arable soils and pastures (Kamally village, Saatli)

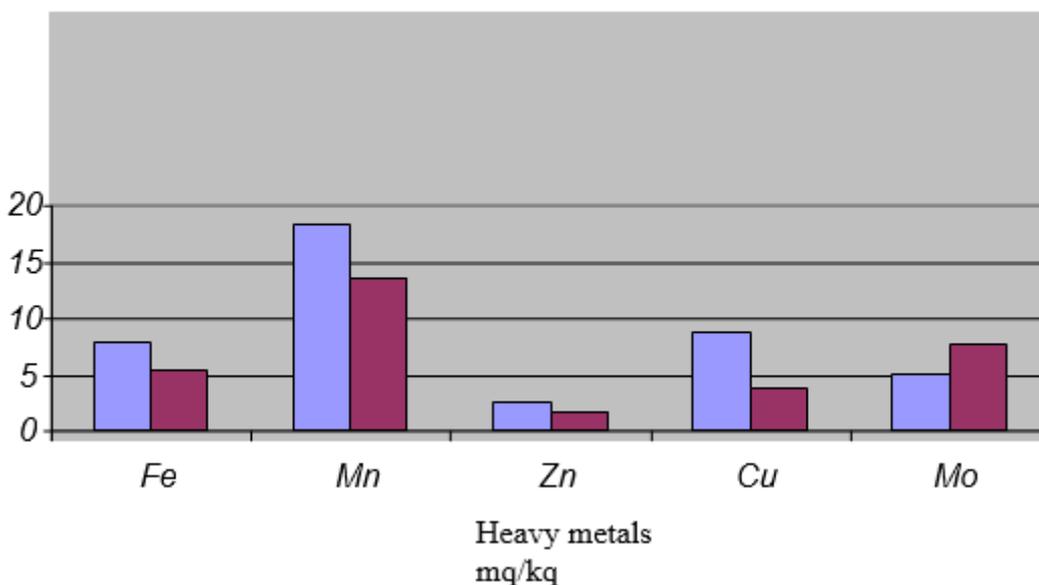


Fig. 2. The content of heavy metals in arable soils and pasture soils (Kamally village, Saatli)

The conducted studies of the composition of bottom sediments of the Araz River in the villages of Bajiravan and Karalar in the Imishli region showed that the content of heavy metals is

high. The content of Mn, Mo, Cu, Al in the waters of the Araz River exceeds the maximum permissible concentration (MPC). The presence of Fe, Mn, and Mo in groundwater and wells turned out to be higher than the norm. In some samples, the content of molybdenum in water was 50 times higher than the MPC level [5]. The high content of molybdenum was observed in almost all samples of bottom sediments and in well waters. The copper content in water samples from wells was within the normal range. In samples of arable soils and pastures from the village of Badjiravan, the copper content exceeded the MPC by 4 times. The content of manganese in some water samples from the Araz River and well waters exceeded the MPC by 3-5 times (Fig 1-2-3).

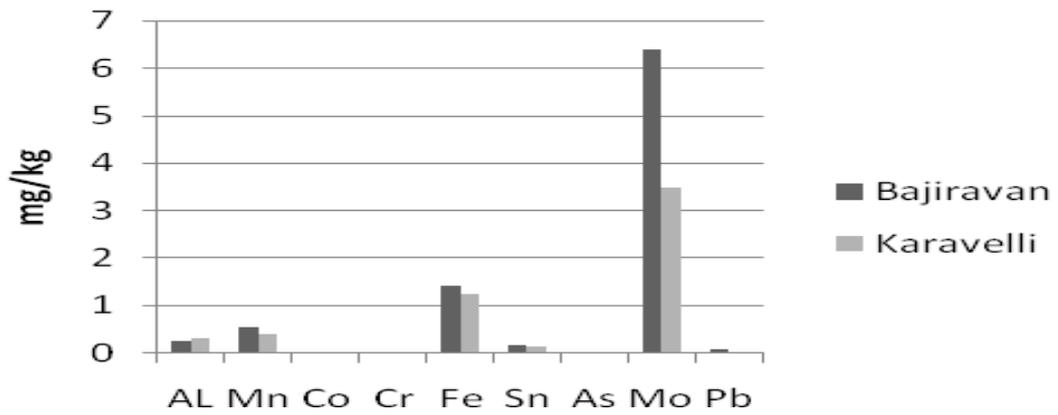


Fig. 3. The presence of heavy metals in well waters in the villages of Karavelli and Bajiravan

A study of the heavy metals content of As, Pb, Cr, Zn, Co, Ni, Sn in the waters and bottom sediments of the Araz River in the sections of the villages of Kamally, Hadzhikasymlly (Saatli) showed that the content of these metals does not exceed the MPC. The concentration of radionuclides in these samples was within the limits of MPC. In all samples of bottom sediments, the presence of U-238 and Th-232 was observed (Fig. 4-5).

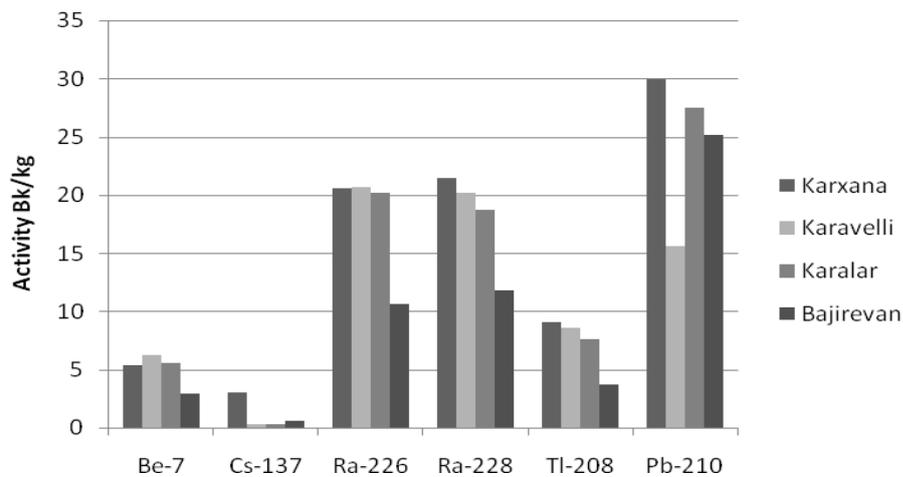


Fig. 4. Radionuclide content in bottom sediments of the Araz river

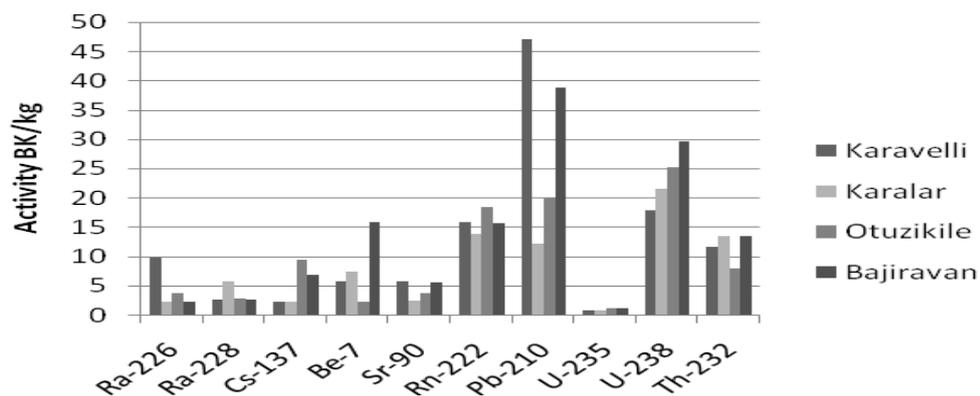


Fig. 5. Radionuclide content in pasture soils

Also, were studied the morphological and physiological characteristics of plants grown on agricultural lands of these villages using wheat as an example.

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МОНИТОРИНГ ОКРУЖАЮЩЕЙ СРЕДЫ В НЕКОТОРЫХ ДЕРЕВНЯХ СААТЛИНКОГО И ИМИШЛИНСКОГО РАЙОНОВ

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Резюме: Исследовано содержание тяжелых металлов и радионуклидов в водах реки Араз в селах Саатлинского и Имишлинского районов Азербайджана. Исследовано также степень загрязнения почв на посевных площадях и пастбищах, используемых в сельскохозяйственных целях в прибрежных селах. Изучены морфологические и физиологические показатели у сельскохозяйственных растений. Установлено, что содержание Mo, Cu, Al, Mn в пробах почвы, в донных отложениях, в водах, взятых из реки Араз в несколько раз превышает норму. В частности, было обнаружено, что количество молибдена намного превышает нормы (ПДК). Результаты исследования показывают, что интенсивное загрязнение реки Араз на территории Армении может

в конечном итоге серьезно повлиять на здоровье населения прибрежных населенных пунктов в Азербайджане.

Ключевые слова: тяжелые металлы, радионуклиды, загрязнение, донные отложения, пахотные почвы, масс-спектрометрия

SAATLI VƏ İMİŞLİ RAYONLARININ BƏZİ KƏNDLƏRİNDƏ ƏTRAF MÜHİTİN MONİTORİNQİ

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Xülasə: Azərbaycanın İmişli və Saatlı rayonlarının sahiyanı kəndlərində Araz çayının suyunda ağır metalların və radionuklidlərin tərkibi araşdırılmışdır. Bununla yanaşı əkin sahələrində və otlarlarda torpağın çirklənmə dərəcəsi araşdırılmışdır. Burada əkilən bitkilərin morfoloji və fizioloji parametrləri öyrənilmişdir. Bu ərazilərdə torpaq nümunələrində, dib çöküntülərində, Araz çayından götürülmüş sulara Mo, Cu, Al, Mn-in miqdarının normadan bir neçə dəfə çox olduğu aşkar edilmişdir. Xüsusilə, molibdenin miqdarının daha çox olduğu müəyyən olunmuşdur. Tədqiqatların nəticələri onu deməyə əsas verir ki, Ermənistan ərazisində Araz çayının davamlı çirklənməsi son nəticədə sahiyanı yaşayış məntəqələrində yaşayan əhalinin sağlamlığına ciddi təsir göstərə bilər.

Açar sözlər: ağır metallar, radionuklidlər, çirklənmə, dib çöküntüləri, əkin torpaqları, kütlə spektrometriyası - ISP – MS.