Radioecological monitoring of radionuclides in the natural waters of the Sherabad River, Surkhandarya region

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ABSTRACT

The article presents studies on the radiometric determination of the beta-radiation activity of radionuclides of potassium-40 and thorium-232 isotopes in the waters of the Sherabad River in the Surkhandarya region. Six samples were taken from the water of the Sherabad River and measured with a radiometer-spectrometer MKGB01. The concentration of potassium-40 and thorium-232 isotopes in a sample taken from a river flowing near the village of Kallamozor was higher than at other points.

Keywords: radioactivity, radionuclide, beta radiation, radiometer, activity, detection unit, UV - level of interventions, MPC (maximum permissible concentration)

The Sherabad River originates from Boysun mountain ranges and is fed by snow water, and it is the main source of water for irrigating agricultural crops in Boysun, Sherabad, Kyzyriq, Muzrabot and Angor districts of Surkhandarya region. Near the village of Kallamozor, the salty Shorab river joins this river, and Sherabad increases the concentration of metal salts in the river water, making it unfit for consumption. As we know, radionuclides, which are the main damage to agricultural crops, mainly pass through the soil, atmosphere and natural waters. In the Surkhandarya region, the harmful effects of radionuclides in the soil and atmospheric air on agricultural crops and food products have been studied to a certain extent [1], but no research has been conducted on the determination of radionuclides in natural waters. It is known from the literature that radioactivity is one of the main factors that cause various oncological diseases in living organisms. is considered

Natural waters play an important role in the distribution of radionuclides in the environment, because precipitations that bring radionuclides from the atmosphere and the radioactivity of underground water interact with the soil. It is natural waters that play the main role in the migration of radionuclides over long distances and their redistribution in different parts of the earth. Although there are very large amounts of naturally occurring radionuclides in natural waters, nuclear waste, accidents, and underground mining contribute significantly to the increase of this amount. The rate of diffusion of radionuclides in water depends on both the isotope and the water body. Some radionuclides dissolve well in water, others remain in the form of a mixture, some sink almost completely to the bottom of the water. The speed of water displacement varies greatly in different types of water. The entire volume of surface water in the ocean changes in about 2,000 years, and underground water changes in 8,000 years. As the depth of the water body increases, the movement slows down. Therefore, nuclear waste must be buried deep in the ocean. And since the mountain river waters have a strong speed, the exchange is also fast. Therefore, since the river waters in the mountains are fast, water-soluble and insoluble radionuclides mix quickly in them, and soluble and insoluble radionuclides pass through the digestive system and have a negative effect on living organisms [2].

In foreign countries, radiometric methods of determining radon, radium, thorium, uranium, plutonium, cesium, strontium and other radionuclides in natural water, soil, atmospheric air and food products are widely used. But radiometric methods are little studied in our republic. Therefore, the use of new methods for quick, highly sensitive and effective determination of beta-radiation activity of radionuclides in natural waters is of great scientific and practical importance. Radiometers are divided into portable, stationary and hand-held types. Among them, stationary radiometers are distinguished by their sensitivity and high detection limit.

Potassium ranks after uranium, thorium and radon among radionuclides. The isotope potassium-40 is produced by beta-decay of the stable isotope potassium-39 and is the main element in limestone ores [3].

Therefore, the determination of radionuclides in natural waters is of great practical importance. The Sherabad River is a continuation of the Darband River and is saturated with snow and spring water flowing from the mountain slopes through the villages of Kallamazor, Khojaulkan, Pashkhurt, Zarabog and is the main source of water for drinking and irrigation of agricultural crops of the residents of Sherabad, Kyziriq, Muzrabod and Angor districts of Surkhandarya region. does. As we know, radionuclides, which are the main damage to agricultural crops, mainly pass through the soil, atmosphere and natural waters. Therefore, when agricultural products are consumed, the radionuclides contained in them enter the human body, even if the amount is small, they have their effect for years, as a result, they serve as the main source of causing various oncological diseases in the human body. In order to carry out the identification works, the sample points of the Sherabod River, i.e., the confluence of the river passing near the village of Kallamazor with the Darband River, the point of the river passing through the territory of the village of Chilanzor, the confluence of the tributary of the snow and spring waters flowing from the village of Khojaulkan, and flowing from the villages of Pashkhurt and Zarabog near Sherabad district The connection point of the incoming, snow and spring waters of the river tributary, the exit point from the city of Sherabad, and the connection points to the Zang canal of Angor district were selected and determined. According to the determined experimental results, the following values were recorded. Natural waters play an important role in the distribution of radionuclides in the environment, because the precipitation that brings radionuclides from the atmosphere and the radioactivity of underground water interact with the soil. It is natural waters that play the main role in the migration of radionuclides over long distances and their redistribution in different parts of the earth. Although there are very large amounts of naturally occurring radionuclides in natural waters, nuclear waste, accidents, and underground mining contribute significantly to the increase in this amount. Some radionuclides dissolve well in water, others remain in the form of a mixture, some sink almost completely to the bottom of the water. The speed of water displacement varies greatly in different types of water. The entire volume of surface water in the ocean changes in about 2,000 years, and underground water changes in 8,000 years. As the depth of the water body increases, the movement slows down. Therefore, nuclear waste must be buried deep in the ocean. And since the mountain river waters have a strong speed, the exchange is also fast. Therefore, since the river waters in the mountains are fast, water-soluble and insoluble radionuclides mix quickly in them, and soluble and insoluble radionuclides pass through the digestive system and have a negative effect on living organisms [4].

Potassium ranks after uranium, thorium and radon among radionuclides. The isotope potassium-40 is produced by beta decay of the stable isotope potassium-39 and is the main element in limestone ores.

Radiometric determination of the amount of radionuclides of potassium-40 and thorium-232 isotopes in the waters of the Sherabad River of Surkhandarya region was carried out using the MKGB-01 radiometer. The waters taken from 6 sampling points of the natural waters of the Sherabad River were taken on the basis of the normative document of UzDSt ISO/IEC 17025:2017 standard PSK:04-2018 "Sampling procedure of natural and wastewater". The obtained samples were placed in 200 ml flat-bottom flasks with a polished bottom, placed in a Marinelli container to determine the presence of potassium-40 and thorium-232 radionuclides, and the beta-radiation activity was measured in the MKGB-01 radiometer-spectrometer device, which was compared with standard measuring devices. Initially, the results of radiometric measurement (by quarters) based on the results of the comparative activity average annual values of potassium-40 and then thorium-232 isotopes by seasons are given in tables 1 and 2 below [5].

Table 1
The results of radiometric measurement of beta-radiation activity of potassium-40 radionuclide and gamma-radiation activity of thorium-232 radionuclide in the atersof Sherabod River
(t_{mea}=40 min, E_{max}=624 keV, ν =0.64 imp/s.) [1,4].

№	**Bar code of samples**	**Location of sampling**	**The average value of radiation activity**	
			K-40 β - radiation Bk/kg (ZD=10	**^{232}Th γ - radiation Bk/kg (ZD=1.0)**
1	Sh-1-20	A point of the river passing through Chilonzor village	0,23	0,22
2	Sh -2-20	The confluence of the Darband river, which passes near the village of Kallamozor	0.24	0.18
3	Sh -3-20	The confluence of snow and spring water flowing from Khojaulkan village.	1.11	1.13
4	Sh -4-20	The confluence of snow and spring waters of the river tributary flowing from the villages of Pashkhurt and Zarabog near Sherabad District	1.15	1.12
5	Sh -5-20	Exit from Sherabad city	0.96	0.81
6	Sh -6-20	Angor district confluence with Zang canal	0.80	0.73

Table 2
Results of radiometric measurement of potassium-40 radionuclide, beta-radiation activity and thorium-232 radionuclide, gamma-radiation activity in the waters of Sherabod River
(t_{mea}=40 min, E_{max}=624 keV, ν =0.64 imp/s.) [5].

	Bar code of samples	**Relative activities of β-radiation of K-40, γ -radiation of Th-232, Bk/kg(ZD=10), Bk/kg(ZD=1.0)**	**Exceeding the establish ed norm**

№		I-quarter (December, January, February)		II quarter (March, April, May)		III quarter (June, July, August) Th-232		IV quarter (September, October, November)			
		K-40	Th - 232	K-40	Th - 232	K-40	Th - 232	K-40	Th - 232	K-40	Th - 232
1	Sh-1-20	0.14	0.12	0,63	0,36	0.11	0.15	0.11	0.12	-	-
2	Sh -2-20	0.19	0.17	0,48	0,40	0.15	0.18	0.13	0.14	-	-
3	Sh -3-20	0.31	0.31	1,62	1,82	2.10	2.15	0.42	0.24	-	+
4	Sh -4-20	0.43	0.43	3,26	3,38	0.83	0.33	0.32	0.35	-	-
5	Sh -5-20	0.52	0.32	2,03	1,64	1.03	1.13	0.27	0.16	-	+
6	Sh -6-20	0.72	1.61	1,84	0,78	0.53	0.43	0.14	0.13	-	-

Average annual values of experimentally determined results of potassium-40 and Thorium-232 isotopes are presented in table 1 below, and results of radiometric measurements based on the results of average annual values of comparative activity by seasons (by quarters) are presented in table 2 below.

The table shows that the concentration of radionuclides of potassium-40 and thorium-232 isotopes is high at point 3. Because it is at this point that the Sherabad River joins the Shorab River. The Shorob River passes through the site of the ore mining of the Granite Plant, which is operating today, and the potassium-40 and thorium-232 isotopes contained in the ore enter the river waters. Of course, this indicator is much lower than the level of damage, but when it passes to agricultural crops, it is concentrated and has a harmful effect.

According to the Ardn-Schults law, although radioactivity is at a lower level, it has a negative effect on living organisms for years and causes various oncological diseases in the body[6].

Therefore, it is advisable to continuously monitor radionuclides in natural waters at least every quarter.

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