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RADIOMETRIC DETERMINATION OF RADIO NUCLEIDES IN VEGETABLE OIL AND CLEANSING WITH MAGNETIC SORBENTS

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ABSTRACT
The article describes the radiometric determination and purification of naturally occurring radionuclides of potassium-40, strontium-90 and cesium-137 in vegetable oils produced by oil extraction plants in Surkhandarya region of the Republic of Uzbekistan with the help of magnetic sorbent. research has been described. Magnetite sorbents have been proven by modern physicochemical methods to be effective sorbents in the purification of vegetable oils from radionuclides.

Introduction. In addition to food products, our country produces a variety of oils. Resolution of the President of the Republic of Uzbekistan dated 16.01.2019 No PP-4118 "On additional measures for further development of the oil industry and the introduction of market mechanisms in the management of the industry" Given the growing demand for it, the need to expand the production of this product was emphasized [1]. In Denau district of Surkhandarya region, the joint-stock company "Denau Oil Extraction Plant" operates with foreign investment. In 2021, the company produced 8,512 tons of high-grade edible oil. Denau Oil Extraction Plant is one of the largest oil refineries in the country. The company employs more than 200 people to produce high-quality natural cottonseed oil for our people [2].

Part of the experiment. The main raw material for oil production is cottonseed. As soon as it is delivered to the plant, it is first tested by the staff of the central laboratory. However, the presence of radionuclides in the raw material is not checked in the laboratory. We know that radionuclides are the main source of cancer in the human body. Therefore, we took samples of raw cotton seeds received at the Denau oil extraction plant and determined the content of potassium-40, strontium-90 and cesium-137 radionuclides with MKGB-01 radiometer. All studies to determine the amount (specific activity) of radionuclides in food products were carried out in the laboratory of Surkhandarya region LLC "Agrochemical Analysis" on the radiometer MKGB-01. The results are shown in

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Table 1

Results of radiometric determination of radionuclides in Bukhara-6 grade cotton seeds

№	Varieties of seeds	Specific activity of radionuclides, bk / kg		
		K-40, NZD 3,0	Sr-90, NZD 2,0	Cs-137, NZD 1,0
1	1-sort (hairy)	5,7	3,1	1,8
2	1st grade (hairless)	3,6	2,4	1,2
3	2-sort (hairy)	6,4	3,7	2,3
4	2nd grade (hairless)	4,3	2,8	1,9

As can be seen from Table 1, the amount of radionuclides in all types of raw cotton used in the production of vegetable oil exceeds the established norm (NZD-radiation damage dose). It should also be noted that radionuclides in hairless seeds contain less radionuclides than in hairy seeds. In our opinion, the amount of radionuclides in the ginning process (using mechanical, chemical and physicochemical methods) in cotton ginning plants is reduced [3].

This means that the process of dehydration of the seed is also one of the ways to reduce the radionuclides in it. However, this method cannot reduce the amount of radionuclides in the seed. Therefore, in order to prevent the radionuclides in the seeds from entering the oil during the extraction of vegetable oil, it is advisable to remove them from the radionuclides during the processing of the seeds. In our previous research, it was described in detail that radionuclides in food cause various oncological diseases in the human body [4,5].

Although the process of obtaining vegetable oil from cottonseed is a complex technological process, it was found that the content of radionuclides in vegetable oil, which passed through these stages and became a finished product, is not significantly reduced (Table 2).

Table 2

Results of radiometric determination of radionuclides in fat products

№	Types of vegetable oils	Specific activity of radionuclides, bk / kg		
		K-40, NZD 3,0	Sr-90, NZD 2,0	Cs-137, NZD 1,0
1	1st grade vegetable oil called Golden Oasis (5 liters)	3,7	2,5	1,1
2	Baraka 1st grade vegetable oil (4 liters)	3,3	2,2	1,0
3	1st grade vegetable oil (5 liters)	4,1	2,7	1,3
4	1st grade vegetable oil called Golden Seed (1 liter)	3,6	2,5	1,0

From the data in Table 2, it can be concluded that the radionuclides in the seeds are significantly reduced due to processing processes (washing, heating, alkali treatment, extraction), but the amount of radionuclides in the finished product remains above the established norm. For this reason, we need to use methods to reduce or eliminate radionuclides in the processing of raw materials [6].

As a result of extensive research conducted by several research groups, magnetite-based materials are gaining great attention in various fields, including biomedicine, catalysis, energy and data storage devices, magnetic resonance imaging, and environmental protection. The use of these materials to combat environmental toxins is constantly increasing due to low cost, ease of modification, biomass and superparamagnetism [7]. We focus on recent advances in the world in the use of magnetite-based adsorbents to remove radionuclides (^{137}Cs, ^{90}Sr, etc.) from a variety of foods [8].

One of the most important studies in recent years has been the use of magnetic nanoparticles to purify food (mainly dairy products) by adsorption of radionuclides [6]. This method has certain advantages over other methods due to its simplicity and efficiency of purification of dissolved radionuclides in low concentration ranges. The main advantage of a magnetic adsorbent is that the entire cleaning process can be systematically adjusted and remotely controlled [9,10]. A reactor filled with a magnetite sorbent can be used to remove radioactive contaminants from the oil stream during seed processing. This does not reduce the rate of extraction of vegetable oil and does not adversely affect the quality of the product. In this case, after refining and filtration of vegetable oil, the magnetite sorbent is passed through a reactor, where the radionuclides of potassium-40, strontium-90 and sex-137 in the product are transferred to the sorbent at a rate of about 0.2 l / s. swallowed. Another advantage of such sorbents is that the magnetite residues left in the product can be completely removed using the property of magnetization (magnetic attraction). Obtaining radionuclides in MNPs can be done using a magnet (or magnetic system) in a relatively short time immediately after the MNPs are collected. Compared with traditional adsorbents, radionuclides adsorbed on magnetic sorbents can be easily tracked, recovered and reused using a magnetic field, which reduces secondary pollution and protects the population, especially preventing the accidental release of radionuclides into the environment. Eventually, the final waste containing concentrated radionuclides will be permanently disposed of in a safe warehouse. The technological scheme of purification of radionuclides from vegetable oil contaminated with radionuclides using magnetite sorbents is shown in Figure 1.

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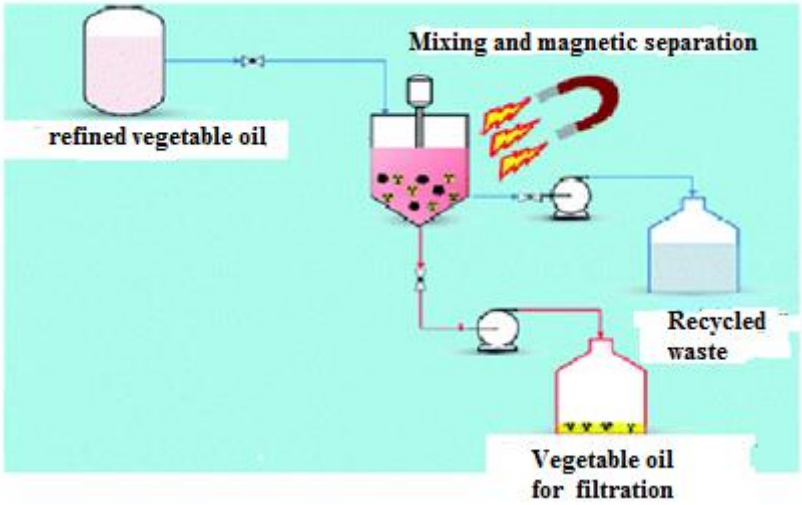

Picture 1. Purification of radionuclides from solutions using magnetite adsorbent.

Adsorbents composed of magnetic metals include Fe, Ni, Co, and their oxides. Among them, magnetite (Fe3O4) nanoparticles, one of the most widely used magnetic materials, attracts great attention due to its strong magnetic susceptibility, cost-effectiveness and biological compatibility. Due to these specific properties, magnetic resonance imaging is widely used in various research sciences such as catalysis, separation and environmental reconstitution.

Conclusion. The results of the research show that in the process of processing cotton seeds contaminated with radionuclides using soil, atmospheric air and natural waters, vegetable oils in an effective magnetite adsorption method that does not interfere with the production line, does not reduce economic efficiency and adversely affects product quality proposed a method of purification from radionuclides containing potassium-40, strontium-90 and cesium-137.

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