Iraqi National Journal of Chemistry

Journal homepage:
http://iqnjc.com/Default.aspx

The determination of Uraniumpercentage in the water and rocks of the city of Mosul using α-ray detector

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Abstract

This research has been included a practical study to detect the radioactive materials in the water and the stones of Nineveh city in Iraq. It is known that Radon gas is the natural product of the Uranium decomposition. Therefore, this study focused on measuring the quantity of Radon element on some chosen mineral waters in this city which indicate of the presence of Uranium on these samples. The presence of Uranium and Radon are studied using the technique of detection the alpha particles paths that emitted from these elements using the nuclear detections methods which depend on the polymeric detectors.

The paths and signs of alpha particles are occurred by the reaction of these particles with the sensitive part of the polymeric detector. The paths of alpha particles are studied using the optical microscope after the chemical scraping (or chemical treatment) of the polymeric detector. The results show circular spots with different diameters on the detector which related to the number of charged particles that emitted from radioactive compounds like the Radon gas.

Introduction.

It has become important to identify the radiation dose that we absorb during our daily duty and activities. So, it is very important to understand and determined the the radiation dose that surrounding the people of the city of Mosul which can be found in the natural, industrial sources and also as a result of many wars that happened in this region.

It is known that Uranium is a very highly reactive metallic element that has the highest atomicmass of the naturally occurring elements [1-4]. The average concentration of Uranium is found about 3 mg/kg in Earth's crust [5]. The formation of uranium in nature is a normal geological process which can be found especially in granites and sedimentary rocks, two widely spread rock types. The uraninite (a complex uranium oxide) is the most common uranium-containing mineral. Other examples of uranium-containing minerals are autunite (a hydrated calcium uranium phosphate). Also, brannerite (a uranium calcium cerium titanium iron oxide) and carnotite (a hydrated potassium uranium vanadate)[4].

Surface waters and especially groundwater play the main role in the migration ofradionuclides in the earth’s crust. Concentrations of uranium in waters are influenced bythe chemical and physical characteristics of the aquifer and by the uranium content ofthe geological

formation involved. [6] It is well-known that in many locations very small amounts of uranium are alsopresent in drinking and mineral waters. Uranium is transferred to plants, foodsupplements and to humans. The average uranium concentration in ocean water, plants,and animal organism is around 10-7 g/g, as a result of the solubility of uraniumcompounds in water [7]. It also noted that mineral phosphate fertilizers can contain uranium and are therefore a possible source of this element [8-9]. In addition,uranium enters the environment as a result of other human activities such as nuclearweapon tests, the use of uranium ammunition, the uranium mining as well as themanufacture and processing of fuel rods [1-2, 10].

There are different methods used to determine the Uranium in the nature. There are several methods for determination of uranium concentration in water. Uranium can be measured in mass units using chemical analytical methods and in activity units using radiochemical analysis [11]. For most frequently applied laboratory methods the following basic steps are included: pre-concentration or vaporization; acidification; co-precipitation; calcification; acid or carbonate separation; extraction and preparation for measuring [12-14].

Uranium in water is commonly measured by fluorimetry with either laser excitation or ultraviolet light following fusion of the sample with a pellet of carbonate and sodium fluoride (detection limit in the range ofμg/L). This method is based on the measurement of the fluorescence intensity of the UV irradiated uranyl ion. Fluorimeter is suitable to determine the concentration of uranium in drinking waters, groundwater, surface waters, as well as wastewater of the uranium industry [15-17].

There is an urgent need to know and understand the way of siting uranium underground. The main reason of this – siting of uranium ores at depths of more than a few meters –is by considering the radon can centration near the surface which is the natural gas output of uranium degradation.[18]

All the previous works suggest that radon the possibility of displacement through ground for long distances up to more than 100m where this method can be achieved by airflow of air or the near-surface water, which is through permeance pored approaching by thermal gradient.It has been found that this method is fully consistent with the notes about the deposition of uranium ores in New Mexico.[19]

The attention has been paid to the use of technical in estimating radon basedon long-term integrated researches of radon and using sold tracks detectors by putting it in shallow scanning to record alpha particles decomposed from radon and present in soil air.[20, 21] The flow psn222 is renewed by average aye(5.5) day. Also, the guidance that should be detected by the active alpha particles in the soil gases that can enter in to the air chamber of the detector mug, and it composed of radon is topes and nascent nuclei. As for polonium, it is ignored in the detection because it takes (22 year) to disappear and an it is a long time. The intention of this research is to detect radon in water and rocks in Nineveh province by using unclear impact detector (R-3q).

Experiment.

The most promment methods in detecting radon by using nuclear impact detectors.The detector R-3q and its composition consists of polymeric material with hydrocarbon composition that is very sensitive to light charged particles (protons, alpha) and is also sensitive to heavy particles.

It is important to mention that these detectors are easy to use and can be widely used places as mountains, sand and water for a very long time without the need for electronic devices or electric current, and it is also used in other large areas.

Different samples of the water and rocks are conducted the study of sensitive low-level nuclear radiation.

1-Sample of AinKibreet water in Mosul

2- sample of Hamam Al Aleel water in Mosul

3- sample of Sinjar stones north west of Mosul

4- semple of surrounding stones in AinKibreet .

5-Deposits of AinKibreet .

The CR-39 detector was used in this research, it was cut in to pieces with an area of ($1cm^2$).This pieces of detector (film) has been put with the sample in closed pot for a month (30 days). Then, the film was extract and then abrasion it using sodium hydroxide (NaOH, 6.25N) at temperature of 7 ºC for 4 hours by using water bath type (memmert).

After finishing the process of abrasion, the detector must be wash several times with distilled water then dried.

The number of exposed impacts on film was measuredusing an optical microscope of the type REICHRT NEOVAR Size 400x.

Result and discussion,

The previous process was applied to all samples used and obtained the following results:

Film	Place	Number of impacts	Activity
Hamam Al Aleel water	Ain Zahra	826	0.21
AinKibreet	Mosul	1035	0.26
Sinjar stones	Sinjar	1011	0.26
AinKibreetstones	Mosul	917	0.23
Deposits of AinKibreet	Mosul	1035	0.26

To measure the film sensitivity, the film was exposed to the am241 sourceof air in a vacuum chamber made by the CastaBira company for (5 minutes) and at distance 2cm.Then the process of abrasion in the same circumstances mentioned earlier in terms of abrasion material, temperature, concentration and time of abrasion.

In order to calculate the efficiency of am241 source, it would consider a non-oil source and thus observe the geometric

This research includes a practical study to detect low-level nuclear radiation in the water and some rocks in the city of Nineveh and we have obtained good results in order to approximate the results among them, indication the existence of the contents of the radioactive material naturally, our results were similar to the results of previous research of rocks and water in another cities of Iraq.

The results that we have are about (0.21 to 0.26)per , this is consistent with natural rate of uranium efficiency in rocks and water globally known (0.2)pei.

On the whole, we have been able to obtain these results based on the measurement of radon in water and rocks because the presence of radon gives an indication of the presence of uranium in these material.

As radon from low-level nuclear radiation, inference is done using alpha a particles path way detection technology, emitted by the detector (cr-39), it has been found that the number of paths in the detector is a function of the number of charged particles emitted from radioactive materials, of which radon is the most important of it.

Conclusion.

In conclusion it is possible to say that the technology of solid state detectors is a successful method for detecting radioactive materials in building materials, different foodstuffs and in different buildings.

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