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Detector to Measure Radon Gas in CR-39 Use a Solid State Nuclear in Samples of Spices Consumed in the City of Hilla –Iraq as a Model of Green Sustainability

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Abstract

The study of determining the concentrations of uranium in the spices used in cooking is the first of its kind in Iraq as a model of green sustainability, where seven samples were selected from the spices consumed in the city of Hilla, the center of the province of Babel (Darsin spices, Cummins spices, Turmeric spices, al-Barriani spices, curry spices, Kebabs spices, impregnation spices). The concentrations of radon and uranium in the selected samples were measured by recording the fission effects in the CR-39. The concentrations were determined by the calculations based on comparison with the standard samples. In the results obtained, the uranium concentrations in the samples are among the internationally permitted values according to the international organization Atomic Energy Agency IAEA.

Keywords: Spices, CR-39, Turmeric, Cumin, Radioactivity

1 Introduction

The high SSNTDs response to the charged particles as well as their high effectiveness in the detection, pricing, and ease of use of a wide range of energies have made it highly significant for studying their properties and means for developing them for use in a variety of the applications. This

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research has the aim of using one of the types of this detector (CR-39) in the measurement and study levels of radiation activity and environmental pollution in different samples of spices consumed in the city of Hilla, the center of the province of Babylon because of its direct impact on human health as it is the daily meal of lunch, Radiation, and radon and compare it to the level of global radiation activity [1].

Spices are fragrant plant-based sources that grow and thrive in tropical regions such as India, Indonesia, and Southwest Asia. It also grows in the regions of Mexico, Peru, and the Antilles. Spices have been known since ancient times, and are indispensable in cooking.

Spices are an essential ingredient that contributes greatly to giving food a special flavor and taste [2].

Spices usually include leaves, roots, seeds, flowers, and long-term use of herbs and spices. Significant benefits have been found, including medical benefits such as providing protection against cardiovascular disease, neurological nerves, cardiovascular disease, cancer, and type 2 diabetes [3].

2 Experiment Part

Determining the alpha particle concentrations which have been obtained from the radon gas in the samples of the cement have been carried out with the use of a nuclear tracking detector (CR39) of thickness 500μm and area of approximately (1x1 cm2). The concentration of the radon gas in the samples of the cement has been obtained with the use of sealed-cup approach as can be seen from Fig1.

After the time of irradiation (i.e. six weeks), CR39 track detectors have been etched in 6.25N (with the solution of the NaOH) as can be seen from Figure2 at a 60oC temperature for 5h, and the density of the tracks has been recorded with the use of an optical microscope (ALTAY type BIO-1007). The density of the tracks (ρ) in samples have been computed based on the equations below:

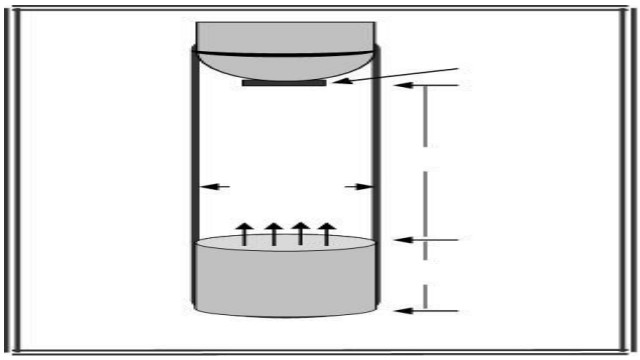

Figure 1 A Sealed-Cup Method Diagram

The concentrations of the radon in the air include seal cup from equation 1 [4]

$$Ca = C°t°\rho / \ t\ \rho° \ldots\ldots\ldots\ldots\ldots (1)$$

where (Co) represents radon concentration, (ρo) is track density per mm2 on the calibrated dosimeter, (Ca) is the radon concentration in the air within the seal cup. (ρ) represents track density for each mm2 for the detector with samples, (t) represents the time of exposure, and (to) represents the calibration exposure time.

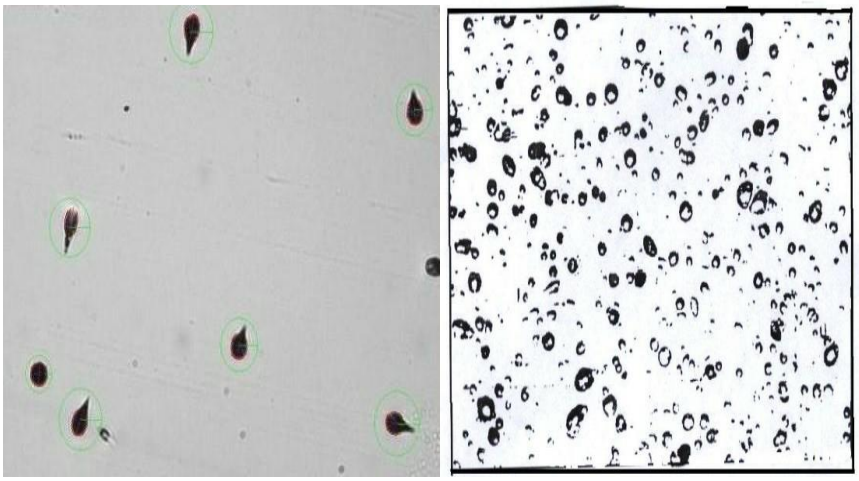

Figure 2 Showing Some Effects That Were Magnified By Light Microscopy after the Process of Chemical Skimming

Through the concentration of the Radon in the air, radon concentration can be calculated in every one of the samples from the equation 2 below [5]

$$CW = Ca\ \lambda Rn\ \text{h}t \ \ldots\ldots\ldots\ldots\ (2)$$

where (Ca) represents radon concentration in air space which is represented in Bq/m3, and (λ Rn) represents the decay constant of the radon and equals (0.1814 Daily), (h) distance between the surface of the sample within the seal cap and the detector surface equals (8.8cm), and (L) represents the sample thickness. Radon activity in samples (ARn) in the (Bq) unit may be specified according to the equation 3 [6].

$$\text{ARn} = \text{CWV} \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

where V= πr2h; (V) the samples' volume which has been measured in (cm3) and the seal cup radius equals (r =3cm).

The concentration of the uranium can be determined by the number of the radon atoms:[7]

$$ARa = \lambda Rn\ NRn \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Utilizing the radiative equilibrium equation for the determination of the number of the uranium atoms in samples from equation 5:[8]

$$NU\ \lambda U = NRn\ \lambda Rn \text{……..} (5)$$

Where λu represents the uranium decay constant (3. 4 × 10-18sec-1), After the calculation of the number of the atoms of uranium in every one of the samples, uranium mass (Wu (g)) can be calculated in every one of the samples from the equation 6 below:

$$WU=NU\ AUNav \text{ ..... } (6)$$

Where AU represents the uranium U238 mass number, Nav represents Avogadro number (6.02 × 1034 mol-1). Finally, uranium mass has been calculated in the unit (ppm) from the equation 7 below:[7]

$$CU(ppm)=WUWS \text{……} (7)$$

Where (WS) mass of the sample.

3 Result and Discussion

Table 1 Radon Gas Concentration for Spices Samples from Different Province

No	Type of species	Ca (Bq/m3)	Cw (Bq/m3)	A(Rn)Bq x 10^{-3}	N(Rn) x 10^{3} Atom	N(u) atom x 10^{16}
1	Cummins	14.7	521.5	0.029	0.16	6.12
2	Turmeric	8.82	312.8	0.017	0.09	3.67
3	curry	22.05	782.2	0.044	0.24	9.18
4	Kebabs	15.3	542.3	0.031	0.17	6.37
5	impregnation	10.7	380.6	0.021	0.12	4.47
6	Barriani	29.4	1042.9	0.059	0.32	1.22
7	Darsin	23.52	834.3	0.047	0.26	9.79

In the present work, we studied the concentration of the radon gas in 7 different sample spices in Iraq (Darsin spices, Cummins spices, Turmeric spices, al-Barriani spices, curry spices, Kebabs spices, impregnation spices) with the use of the alpha-emitters registration that has been emitted from the radon gas in the CR39 detector of the nuclear track.

From Table1 we can be noticed that the activity of the radon is dependent upon radon consternation in the materials .222Rn concentration in the spices samples, differs between 29.4Bq/m3 and 8.82Bq/m3, where the maximum average concentration of the radon gas in the spices samples has been found in Barriani spices sample, which has been (29.4 Bq/m3), whereas

the minimum average concentration of the radon has been discovered in the Turmeric spices sample, which has been (8.82Bq/m3)

The concentration of uranium depends on the ratio between the weight of uranium 238 and the weight of the model studied, which depends in turn on the uranium atoms 238 number and the mass of the nucleus, it is worth noting that uranium concentrations have increased particularly in the samples 7,3,4,1, And the calculated values in all samples ranged between (9.79-1.22)*1016. Figure 3. shows the percentage of radon within sample Cw of the samples .

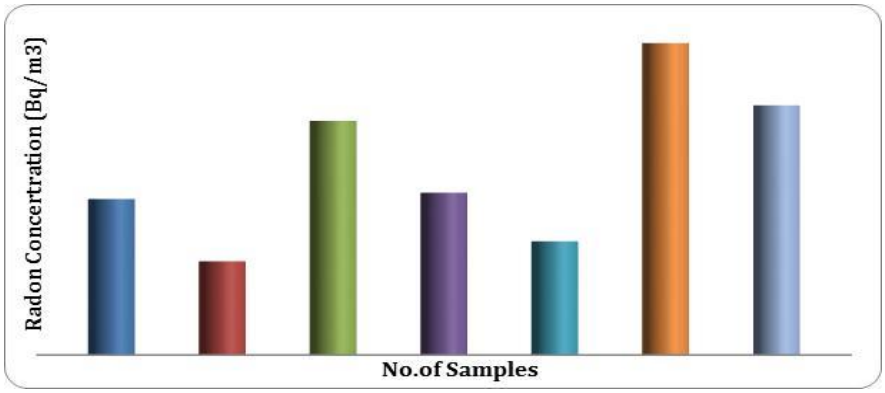

Figure 3 Relation of Activity of the Concentration of the Radon Gas Samples

The results of this study illustrate that the concentration of the radon gas in all of the spices samples have been lower than the permitted limit from the agency of the ICRP (International Commission of Radiation Protection) that is (200-800Bq/m3) in the sample of the food [9]. Values have been discovered minimum for the samples of the spices, which is why. This work has been modeled for studying the level of the radon, the activity of the radium, and the annual effective dosage from the building materials. Additional researches are required for the determination of the level of the radon as well as the natural radio-activity in the soil, water, vegetation, and food samples as well as their risk factors that have to be researched.

4 Conclusions

In this study, the concentration of the effectiveness of the radioactive elements was measured in different samples of the berry and from different creations which focused on the most prominent types of spices consumed by the citizens in Hilla. Using the nuclear impact detector, we found that the results of this study are consistent with other international and local studies. We need such studies periodically to follow the example of other developed countries in order to preserve the integrity of our environment.

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