Print ISSN: 0976-2876 Online ISSN: 2250-0138

Available online at: http://www.ijsr.in

INDIAN JOURNAL OF SCIENTIFIC RESEARCH

DOI:10.32606/IJSR.V14.I2.00011

Received: 13-09-2023 Accepted: 12-12-2023 Publication: 31-01-2024

Indian J.Sci.Res. 14 (2): 47-51, 2024 Original Research Article

MEASUREMENT OF ACTIVITY CONCENTRATION OF RADON IN WHEAT AND BARLEY SAMPLES IN THI QAR PROVINCE IRAQ USING DIFFUSION CHAMBER DETECTION TECHNIQUE

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ABSTRACT

The present work denotes a measurement of Activity construction of radon gas for 23 wheat and barley samples in various localities of Thi Qar province using the diffusion chamber detection technique, the measurement is done for (24-48 h) for only three sample of wheat and results are (11.84 Bq/m^3) for 48 h and (2.96-4.81Bq/m^3) for 24h . Radon gas Activity have been measured for all of the samples, but for a period of 7 days or 168 hours per sample, results for a wheat show that maximum value of radon gas constriction found in Al-Rifai sample (68.92Bq/m^3) and minimum one in Qalat sukar (32.92Bq/m^3), but for barley the maximum was in Al-Rifai (68.77Bq/m^3) and minimum value in Al Nasser (1.76Bq/m^3), variation in radon gas values due to differences in geological formation soil of this sample. All radon gas values for wheat and barley samples under study are below the permissible value of recommended by ICRP thus its safe for human consumption.

KEYWORDS: Wheat, Barley, Radon, Construction, Activity

Radioactive isotopes of element (i.e. the radionuclides) are of course tangible in the firmaments, and stray add up our bodies and foodstuff and water. The objective is uncovering to windowpane (i.e. background supportable) movable, those radionuclides on daily basis. Radiation's source is the space (i.e. the cosmic rays) in addition to the radionuclides establish on soil, air and water. It is possible to detect the radioactivity in the foods and water, and radionuclides' concentration differs based on a number of the factors like the inborn geology climate and farming practices (IAEA, 1990).

The radionuclides amount in the nutrition are different and reliant on numerous operators, including the nature of food and environmental area where food had been made. Popular radionuclides in the foods are radium -226, uranium 238 and potassium -40 and their daughters (RIFE-22, 2021).

The methods of nuclear and spectroscopy of modern technologies in the study of various scientific aspects, including environmental studies and geological studies, and these methods have proved effective in obtaining good results and important in these trends and in many countries of the world because of the scientific advantages of the ability to sense concentrations with a large number of elements as well as their specificity in the analysis and study of radioisotopes and their radiological products (Ukla, 2004).

The natural occurring radionuclides are also introduced into environment by fossil fuel burning and uncontrolled operations of mining (Banzi *et al.*, 2000). Naturally-occurring radioactive isotopes could be transferred from soil to the plants (Al-Hamarneh *et al.*, 2016; Mc Laughlin, 2015).

As it is expected, those radio nuclides that are accumulated in the arable soil are metabolically incorporated into the plants and find their way ultimately into bodies of animals (humans as well) in case of consuming contaminated foods. In addition to that, to root uptake, the direct deposition could happen on the foliar surfaces, and as soon as that happens, contaminants could be metabolically absorbed as well by plants or could also be transferred on to the animals consuming contaminated foliage. It's famous that once radionuclides eaten or indrawn square measure distributed amongst the organs of the body (based on metabolism of the part concerned and also the organs) usually exhibit varied radio sensitivity levels (Yadav *et al.*, 2018).

Radium is one of the major sources of radioactivity found in food and water (Yücel *et al.*, 2009). 226R is a decay product of the uranium in naturally occurring series of the uranium, 226Ra is one of the most radiotoxic radionuclide with very long half-life (1600 years). As a result of its radiological effects and long half-life, it has been considered as a very significant isotopes to determine among naturally occurring nuclides

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in the environmental samples (Singh *et al.*, 2010; Zhang *et al.*, 2015).

Radon can be described as naturally occurring radioactive tasteless, odorless, and colorless gas continuously emitted by a natural source, like the geological formations in the construction materials and soil. Radon and its daughters are created throughout uranium and thorium's radioactive decays, in the crust of the earth, thus the soil is rich in radon where it is The concentration of uranium is high in areas where granite rocks are abundant, 222Rn's half-life is 3.824d (Vogiannis and Nikolopoulos, 2015).

The danger of health cannot be in the radon itself, but in the result of the radon after the analysis of the radon after the arrival of open air gradually decomposes into solid atoms join the grains of dust in the air and reach the human lung through breathing and stop the dust particles accompanied by these radioactive atoms in the lungs, these atoms have a short half-life, they decompose and release as alpha particles that affect the cells and their genes are released. This causes cancer, even after a while. Radon is a danger to human health. (Fatima, 2015; Makedonska *et al.*, 2018; Sheen *et al.*, 2016).

It was estimated that large portion, a minimum of 1/8 of average annual effective dosage as a result of the natural sources due to food intake. Concentration measurements of the radionuclides that are present in the foodstuffs provides the ability to assess dosage that results from food product intake. (Patra *et al.*, 2014; Priharti and Samat, 2016; Syarbaini *et al.*, 2014).

There are various techniques for radioactivity analysis in foodstuffs with the ability to determine qualitatively and quantitatively alpha and beta emitting radio nuclides. However, Gamma Ray Spectrometry (GRS) provides a multi elemental, fast, and non-destructive radioactivity measurement approach. Both qualitative and quantitative analysis of samples can be easily achieved by gamma-ray spectrometry systems. (Alhiall and Alsalihi, 2019; Naskar *et al.*, 2016; Lecomte *et al.*, 2014).

Sample Collection and Preparation

In this study, 23 samples of wheat and barley were collected in farms within an area covered(Thi Qar province) which lies in south of Iraq and this province shown in (Fig. 1) to measure radon activity concentrations using diffusion chamber detector technique. The samples were weighed to be (1000 g) per sample.

Samples have been dried then placed in a plastic container and after that coded as shown in Table (1) and Table (2) show the areas from which the samples were taken and their codes.

Figure 1: Thi Qar province

Table 1: Show the areas from which the wheat samples were taken

S.No.	Region	Symbol
1	Syd dkhyl	L1
2	Nasiriya center	L2
3	Ghraf	L3
4	Qalat Sukar	L4
5	Al Neser / Atab village	L5
6	Al Neser / Al bo khalaf village	L6
7	Dewayah	L7
8	Rifai/ Al dofar village	L8
9	Rifai/ Nadhum no.4	L9
10	Al Fager / Maysaloon village	L10

Table 2: Show the areas from which the barley samples were taken

S.No.	Region	Symbol
1	Syd dkhyl	R1
2	Nasiriya	R2
3	Ghraf	R3
4	Qalat Sukar	R4
5	Al Neser / Atab village	R5
6	Al Neser / Al bo khalaf village	R6
7	Dewayah	R7
8	Rifai/ Al dofar village	R8
9	Rifai/ Al bo jrad village	R9
10	Rifai/ Nadhum no.4	R10
11	Al Shatra / bin ziad village	R11
12	Al Fager / Maysaloon village	R12
13	Al Fager	R13

Diffusion Chamber Detector Technique

In this research, a new centrifugal detector (canary pro) of the Norwegian company Airthings was produced in August 2016. It is one of the most advanced and accurate portable reagents in the sensing, measurement and analysis of radon irradiation, compared to other similar radon detectors, which are based on the same principle The detector is considered to be one of the most important reagents, as shown in (Fig. 2) for its sensitivity and high stability. This detector is also linked to a computer program for data analysis that allows the user to make maximum use of all variables using this device.

Figure 2: Diffusion chamber detector model BQM

The detector is small in size and has a long battery life of three years. The device has been calibrated for three years. If the measured concentration is less than 0.35 pci, in case of continuous operation, there will be no need to re-calibration during the first 10 years. The measurement process is carried out by inserting the batteries into the device and operating after three minutes starting automatically. The device is generally placed in an area where radon concentrations are to be measured. Where the device will record the concentration of radon after an hour and continue to update every hour for a period specified by the user and preferably the minimum measurement period is 48 hr to give you a concentration rate of radon in which the accuracy of almost high. The measured values of Bq / m 3 are shown on the monitor. It is important to observe that the device is not directly exposed to sunlight or to high electromagnetic radiation. It should also be laid down. The system operates with two short-term testing systems from one day to ninety days and a long-term testing system with a range of 90 days to a full year (https://store.airthings.com/eu/products/ corentium –home-bqm-radon –detector.html).

In the current research, the short-term method is used to measure radon activity concentration in wheat and barley samples for different areas in Thi Qar province.

RESULTS AND DISCUSSION

The radon is a cumulative gas, samples and diffuse motion detectors were placed in a closed chamber. In the present paper, radon is measured for two samples of wheat. The measurement period was 24 hour, one day, and another sample of wheat. Radon gas was 48 hours. Table (3) shows the samples measured for one or two days, Measure all samples with the same technique and in the same way, but for 30 days (1month) for each sample.

Three models of wheat were taken and radon were measured. The radon activity concentration of the two samples (L8, L10) measured at no quite 24 hours with radon concentration (L10 = 2.96 Bq / m3) and the activity concentration of radon in third sample L8 = 4.81 Bq / m3 The sample for which radon activity concentration was measured for 48 hours was the concentration (L7 = 11.84 Bq / m3) as shown in Table (3)

Table 3: wheat samples which calculate for 24, 48 hour

S.No.	Region	Symbol	Period (h)
1	Dewayah	L7	48
2	Rifai/ Al dofar village	L8	24
3	Al Fager / Maysaloon village	L10	24

Radon concentrations were measured for all samples, but for a period of 30 days per sample. The highest radon concentration in wheat has been found in (L9). The concentration was 68.92 Bq / m3 and therefore the lowest value was in (L4) Concentration (32.94 Bq / m3).

Samples of barley were the highest values of radon concentration at (R8) and (68.77 Bq / m3) and the lowest values in (R6) and (31.76 Bq / m 3) as shown in Tables 4 & 5 and Figure 3.

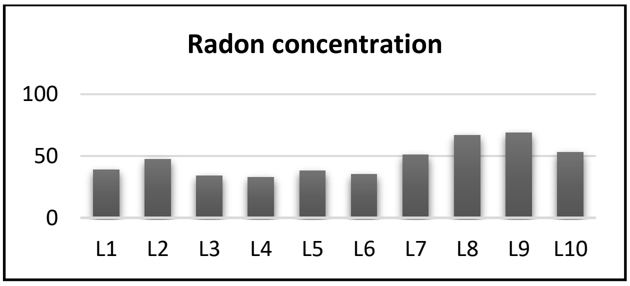

Figure 3: Radon concentration in wheat samples

Table 4: Activity concentration of radon in the samples of barley from different regions of Thi qar

S.No.	Region	Symbol	222Rn $\frac{Bq}{m^3}$
1	Syd dkhyl	R1	80.52
2	Nasiriya	R2	95.62
3	Ghraf	R3	38.42
4	Qalat Sukar	R4	37.08
5	Al Neser / Atab village	R5	38.11
6	Al Neser / Al bo khalaf village	R6	31.76
7	Dewayah	R7	52.86
8	Rifai/ Al dofar village	R8	68.77
9	Rifai/ Al bo jrad village	R9	62.20
10	Rifai/ Nadhum no.4	R10	58.86
11	Al Shatra / bin ziad village	R11	51.12
12	Al Fager / Maysaloon village	R12	56.47
13	Al Fager	R13	34.91

Table 5: Radon Activity concentration in wheat samples from different region of Thi qar

S.No.	**Region**	**symbol**	**222Rn** $\frac{Bq}{m^3}$
1	Syd dkhyl	L1	38.77
2	Nasiriya center	L2	47.53
3	Ghraf	L3	34.15
4	Qalat Sukar	L4	32.94
5	Al Neser / Atab village	L5	37.97
6	Al Neser / Al bo khalaf village	L6	35.33
7	Dewayah	L7	51.14
8	Rifai/ Al dofar village	L8	66.93
9	Rifai/ Nadhum no.4	L9	68.92
10	Al Fager / Maysaloon village	L10	53.18

CONCLUSION

Analysis of activity concentrations of Radon-222 for in wheat and barley which are part of the household food samples are highly significant for the realization of the comparative contributions of certain substances to entire content set of the radon within human body.

This paper shows nature of the radioactivity as the alpha particle produced from radium decaying to the radon, which is why, this paper describes radon in 23 wheat and barley samples.

The most important notes from this work that the concentrations of radon 222Rn in wheat and barley samples in different areas of Thi Qar (current study) at intervals the boundaries allowed by International Commission on Radiation Protection (ICRP). This is often safe for human consumption and does not pose a radiation hazard to humans when used.

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