

Natural Occurring Radioactive Materials in Some Types of Coffee Available in Baghdad Markets

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المواد المشعة الطبيعية الموجودة في بعض أنواع القهوة المتوفرة في أسواق بغداد

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تم في هذه الدراسة قياس نسبة وجود العناصر المشعة وهي: U-238 بمتوسط تركيز ١٣٤ بيكريل / كغم ، Th-232 بتركيز ١١٣ بيكريل / كغم ، K-40 كان ٢٥٤ بيكريل / كغم و Cs-137 كان ٦٠٠ بيكريل / كغم في العينة. وقد تم التوصل الى ان اعلى تركيز للإجراء النوعي ل K-40 هو ٦٠٠ بيكريل / كغم ، حيث استهدف أقل نسبة مئوية ، كان للعنصر Cs-137 في ذلك المنتج ، حيث بلغ ١١٢ بيكريل / كغم في عينة القهوة وأعلى متوسط K-40 كان ٥٢٤.٤ من مجموع التركيزات. أما بالنسبة للكمية السنوية (معدل الاخذ السنوي) ، فكان أعلى مدخول في النويدات المشعة Th-232 حيث بلغ ١٠.٤٧٠٣٩ ملي سيفرت / سنة وأقل مدخول كان في النويدات المشعة K-40 وبلغ ٠.٠٢٠٠٩ ملي سيفرت / سنة ، وكانت جميع التركيزات المحسوبة ضمن الحدود المسموح بها والمقبولة دوليا.

Abstract:

This study, proportion of the presence of radioactive elements was measured, which are: U-238 with average concentration of 134 Bq/kg, Th-232 at a concentration of 113 Bq/kg, K-40 was 254 Bq/kg and Cs-137 was 600 Bq/kg in sample.

The highest concentration of specific action for K-40 is 600 Bq/kg , as aimed at the lowest percentage, it was for the element Cs-137 that in product, as it reached 112 Bq/kg in coffee sample highest average of K-40 was 524.4 of the total concentrations.

As for the annual intake (AED), the highest intake was in radionuclides Th-232, where it reached 10.47039 $\frac{mSv}{y}$ and the lowest intake was in radionuclides K-40, reaching 0.02009 $\frac{mSv}{y}$ all calculated concentrations were within the permissible and internationally accepted limits.

Keys words: Specific activity, detector, Annual dose effective, radionuclides and radiation.

Introduction

The dangers ionizing radiation poses to human health are well understood. Roanoke gas, the relatively nearby earth's surface where radon is generated can either diffuse through the soil or be propelled by pressure gradients [1 and 2].

Is out and away the foremost essential Arial of radiation amid people who are of natural origin, radon may be a argon on formed from radium for this most significant issue now daily is that the indoor air quality and food because maximum folks spend 90% [3 and 4].

Once radon gas is gulped, solidly ionizing alpha(α) particles produced by put short-lived deterioration products of gab (Po-218 and Po-214) can interrelate with organic, the total radiation dose received because of radon Exposure [5]

Radon is that the ground's only rationally bent radioactive gas and emanates from the breakdown of uranium in loam, pillar, and liquor. Radioactivity internal, air, water and fodder [1, 3 and 4].

Exposure to radon gas, whether from the air or closed places and through food, is one of the main reasons of lung tumor in a high proportion of people, for example [6, 7 and 8]. In recent years there have been many studies showing the relationship between exposure to a number of gases from the air or inside food and drinks and the incidence of a number of cancers [9].

Over several decades, scientists have gained a better understanding of radon sources and transport mechanisms. High levels of radon were discovered in domestic and drinking water from drilled wells in the 1950s [1]. In addition to checking drinks (stimulants) it necessary checking water, she is most important sources of life. As a result, its accessibility, purity, and control are timely and critical issues. As a result, rules governing the level of radioactivity in drinking water are required

In addition uranium is a naturally stirring part found everywhere in stalwarts, muds and silts. Then, owing to geological courses, uranium pollution of groundwater is gradually becoming a widespread problem in many countries. WHO; guidelines have now been amended some eras to ensure the safety of drinking water WHO.

We can reduce the impact of natural radioactivity on human and animal life by improving water sources and forests and increasing agricultural land. Radiation enters the body via a variety of pathways, inhalation , as well as the interior dose produced by ingestion, are concentrated within the body [10, 11 and 12].

In this study, concentration of nuclides was measured (Ai and AED) in different samples of drink Al-Dhiafa, Al-ameed,, Goulette coffe, matt coffe, Mahmood coffe, Joker and Gold Nescafe using a type of counter Na I (TI) manufactured by a German company, to ensure the rate and percentages of the presence of radionuclides because knowing this percentage is important to maintain health and reduce the negative

effects of industrial products and give the correct procedures in case the concentrations are high and outside the established limits.

Materials and Experimental

Specific activity S. P becomes calculated in keeping with equation [12, 13and 14].

$$S. p = \frac{A}{M} \dots \dots \dots (1)$$

A: Activities decided at once from the device display screen.

M: Mass of samples

Samples: Al Amide, Ridha Alwan, Coffee Mate, Gold Nescafe, Joker Classic, Café Pele and Nescafe Classic for Baghdad marketplace, are Prepared organized at 1 kg for every pattern (one pattern in keeping with powder type).

Gamma spectroscopy (NaI (TI)) (3" x 3") device calibrated for 3600 seconds and absolutely separated with the aid of using a lead display screen, had been worn to decide NORM concentrations in powdered coffee samples.

The unique hobby of radioactive collection of uranium - 238 and thorium - 232 account has been in directed through figuring out the radioactivity for his or her daughters, became decided on radionuclides daughter to decide the attention of radioactivity for collection of U-238 and Th- 232 he radioactivity for a sequence of ²³⁸U, that have been decided via radioactive isotope Pb -214, in addition to decide a sequence of Th- 232 via a radioactive isotope Pb- 212. K-40 may be detected definitely and without delay through the detector [12 – 14].

1 kg of the sample in the gaging cylinder is sited inside measurement scheme that is previously standardized for 3600 seconds [12 - 14].

Dimension system has been insulated by the buffer from principal to reduce background radiation. Activity was heroic straight from the scheme [14 - 16].

Annual effective dose

AED open to the public $\frac{Sv}{y}$ According to ICRP [13 - 15], can take by:

$$AED \left(\frac{mSv}{y} \right) = C \left(\frac{Bq}{Kg} \right) \times Ai \left(\frac{Bq}{y} \right) \dots \dots \dots (2)$$

Whereas:

C = The constant of amount renovation for absorption (Sv·Bq⁻¹) [13,14and 15].

The take annual can take by equation:

$$Ai \left(\frac{Bq}{Kg} \right) = S. A \left(\frac{Bq}{Kg} \right) \times 365 \times \text{consuption of the matter} \dots \dots \dots (3)$$

The coefficient of dose conversion for Th-232, U-238 and K-40 is (4.6*10⁻⁶ ,4.9*10⁻⁸and 6.2*10⁻⁶ Sv·Bq⁻¹) [14 - 16].

Results and Discussion:

activity of the nuclides shown in Table1 , where it was found that the highest activity is in K-40, which was 600 Bq/kg all samples, and average was found 0.022535 Sv/y for Annual effective dose (AED) as Table.2 , with annual taking (Ai) average was highest 9566650 Bq/y for nuclide K-40 in Table .2

Table 1: Specific activity of the four radionuclides in the different samples of powders coffee.					
	Sample	U-238 Bq/kg	Th-232 Bq/kg	K-40 Bq/kg	Cs-137 Bq/kg
1	Al Dhiafa	134	113	600	254
2	Al ameed	129	124	590	260
3	Ridha Alwan	143	156	460	246
4	Coffee Mate	154	112	435	270
5	Gold Nescafe	128	167	612	251

6	Joker Classic	161	125	453	269
7	Café Pele	143	155	588	276
8	Nescafe Classic	174	114	484	249
9	Goulette Coffee	132	159	598	267
10	Mahmood Coffee	154	141	422	296
	Average	145.2	136.6	524.2	263.8

Lowest dosage was 112. Bq/kg in Th-232, and highest average was found 11.88075 Sv/y for Annual active active dose (AED) in Table.2, with annual taking (A_i) average was lowest 2492950 Bq/y for nuclide Th-232 in Table .2

The most cost became discovered in al-Dhiafa and the minimal cost became discovered Coffee Mate correspondingly, The sharing of specific activity for U-238, Th – 232 , K-40 and Cs-137 in n powdered changed into illustrated in Figures, Figure .3 shows the high concentration of K-40 nuclide and Figure .4 shows the low concentration of nuclide Cs-137

Table 2: A_i (Bq/y) and ADE (Sv/y) four radionuclides in different samples of powders coffee.

Sampls	A_i	A_i	A_i	A_i	AED	AED	AED	AED
	$Bq^{-1} . y$	$Bq^{-1} . y$	$Bq^{-1} . y$	$Bq^{-1} . y$	mSv/y	mSv/y	mSv/y	mSv/y
	U-238	Th-234	K-40	Cs-134	U-238	Th-234	k-40	Cs-134
Al Dhiafa	2445500	2062250	10950000	4635500	1.198295	8.66145	0.022995	0.02225
Al ameed	2354250	2263000	10767500	4745000	1.153583	9.5046	0.022612	0.022776
Ridha Alwan	2609750	2847000	8395000	4489500	1.278778	11.9574	0.01763	0.02155
Coffee Mate	2810500	2044000	7938750	4927500	1.377145	8.5848	0.016671	0.023652
Gold Nescafe	2336000	3047750	11169000	4580750	1.14464	12.80055	0.023455	0.021988
Joker Classic	2938250	2281250	8267250	4909250	1.439743	9.58125	0.017361	0.023564
Café Pele	2609750	2828750	10731000	5037000	1.278778	11.88075	0.022535	0.024178
Nescafe Classic	3175500	2080500	8833000	4544250	1.555995	8.7381	0.018549	0.021812
Goulette Coffee	2409000	2901750	10913500	4872750	1.18041	12.18735	0.022918	0.023389
Mahmood Coffee	2810500	2573250	7701500	5402000	1.377145	10.80765	0.016173	0.02593
Average	2649900	2492950	9566650	4814350	1.298451	10.47039	0.02009	0.023109

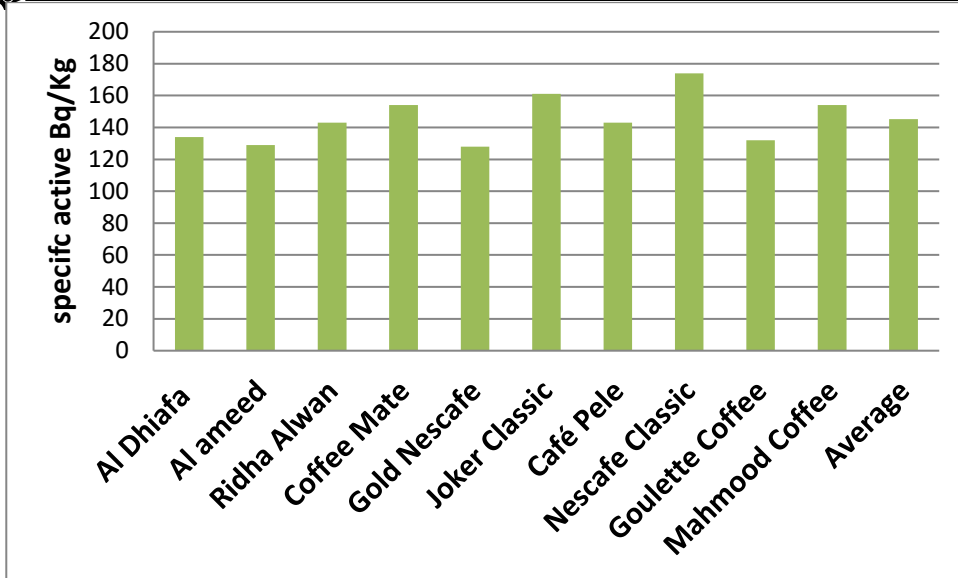


Fig.1: U- 238 Specific activities in all coffee powder.

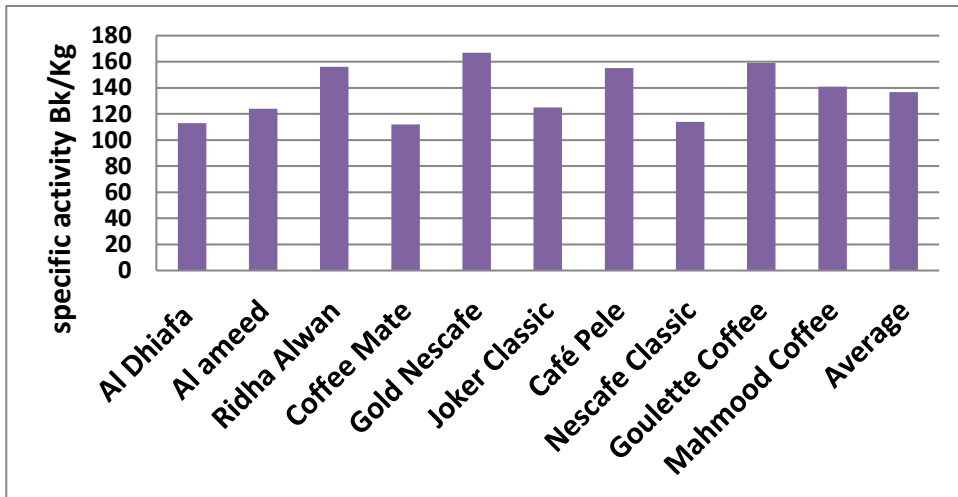


Fig. 2. : Th- 232 Specific activity in coffee powder

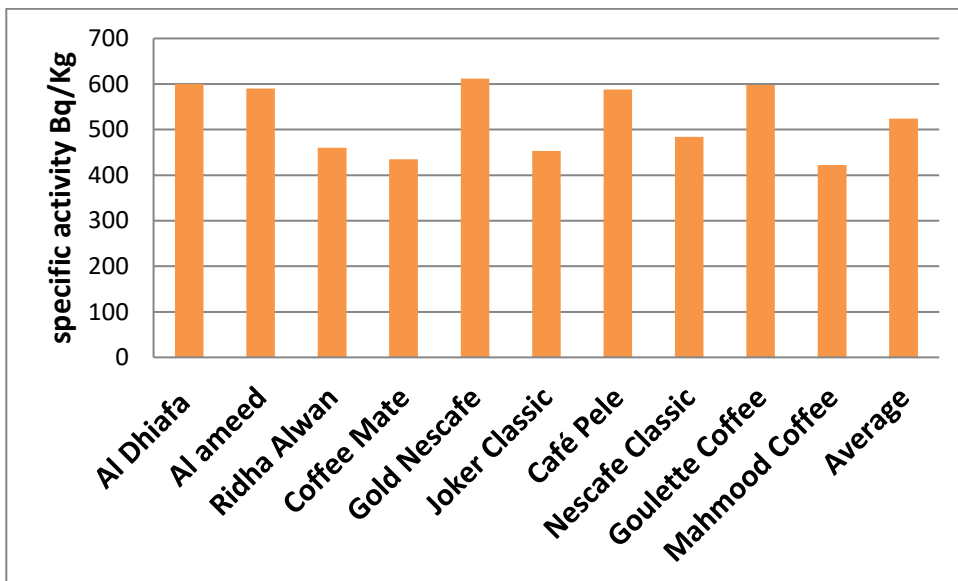


Fig.3: K-40 Specific activity in coffee powder.

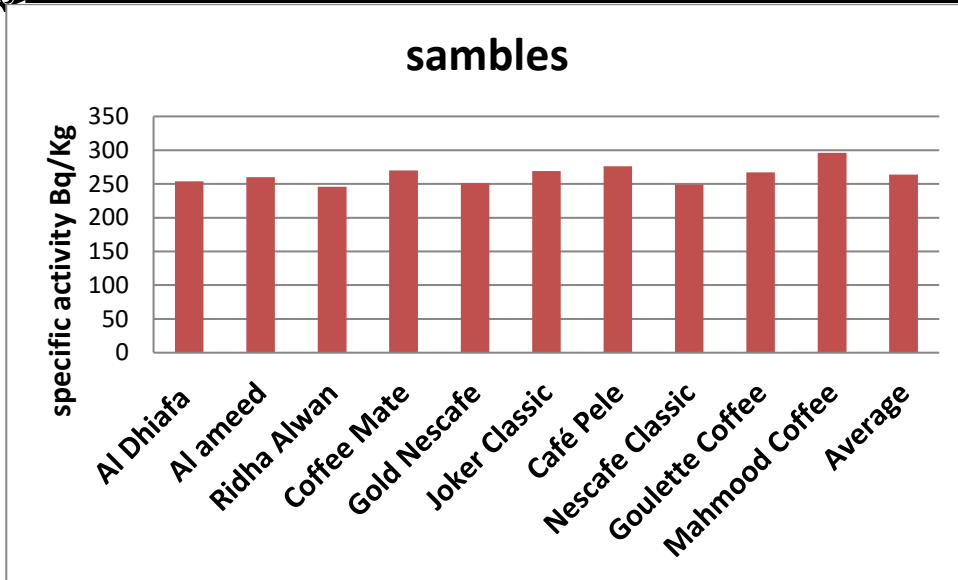


Fig.4: Cs -137 Specific activity in coffee powder.

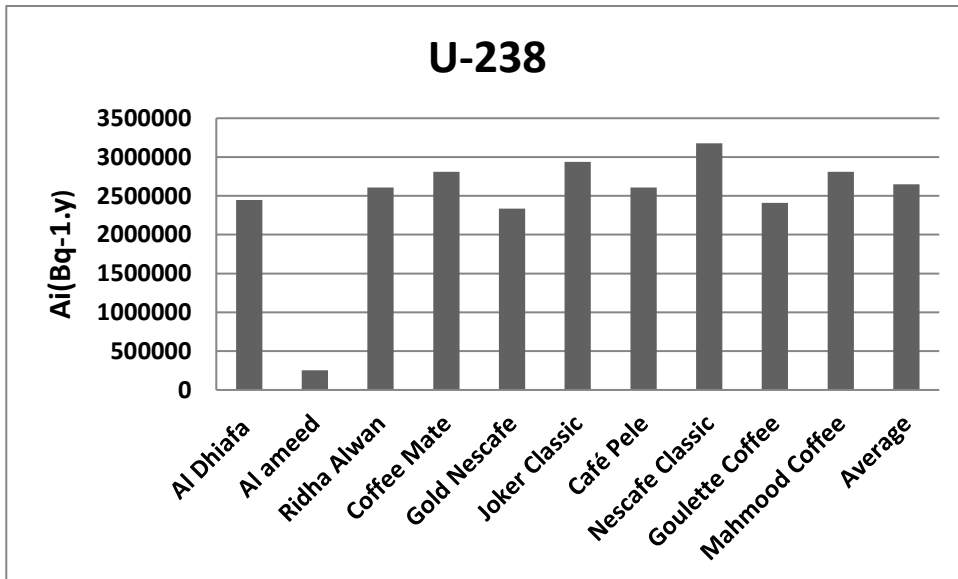


fig .5: Ai (Bq-1.y) for U-138 in samples

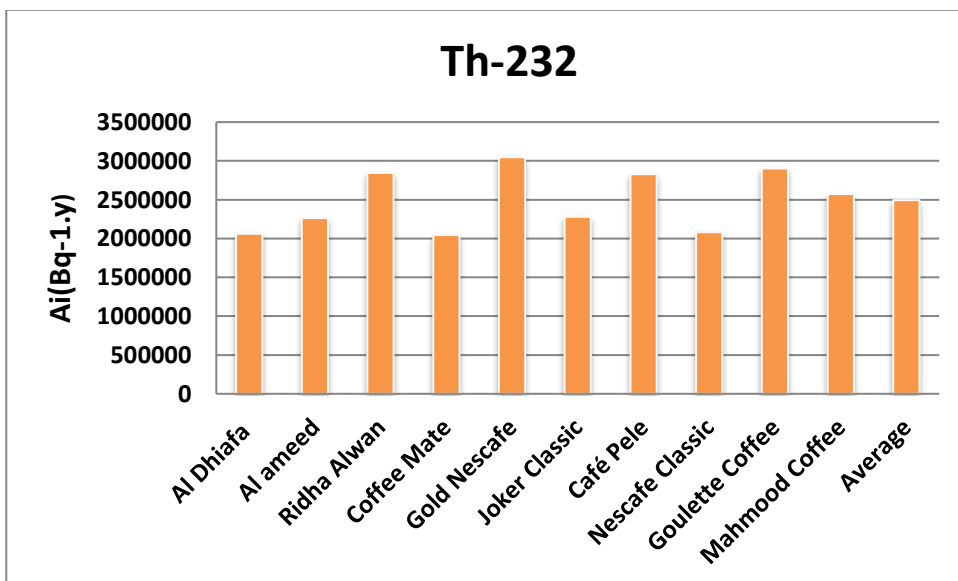


fig.6: Ai (B q-1.y) for Th-232 in samples

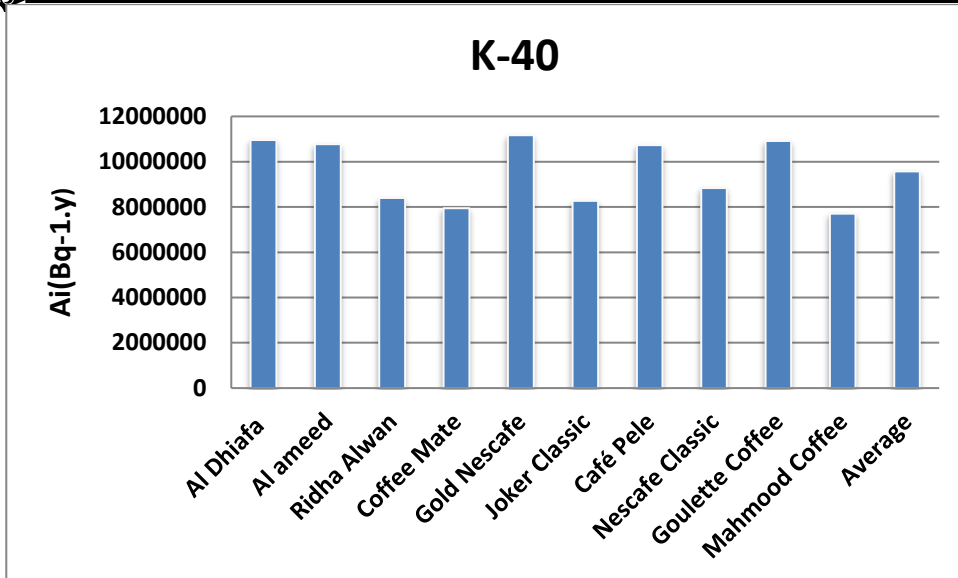


fig.7: Ai (Bq-1.y) for K-40 in samples

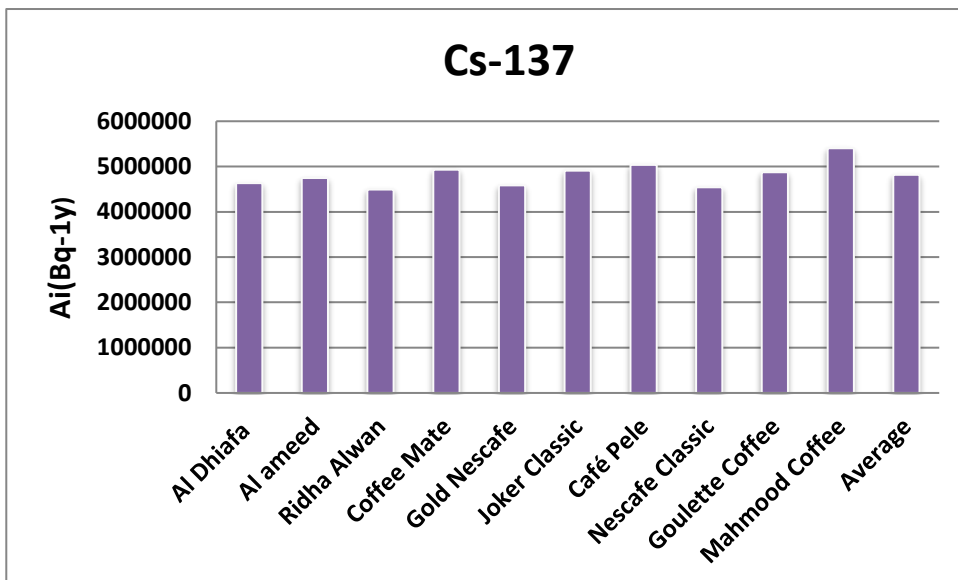


fig.8: Ai (Bq-1.y) for Cs-137 in samples

Conclusion:

The specific activity of U-238, Th-232, K-40 and Cs-137 in different Coffee samples was measured with a NaI (TI) detector.

The specific activity of the K-40 radionuclide was great in all samples. All specific activity tenets for all radioactive isotopes in totally coffee samples were within the scale of globally permitted values. Estimated annual effective dose to a personal from uptake of radionuclides into the physique organ in these samples

References:

- 1- WHO (World Health Organization), 2009. Handbook on indoor radon: a public health perspective.
- 2- Ali A. Radon Concentrations Measurement for Drinking Water in Kufa City / Iraq Using Active Detecting Method. Advances in Physics Theories and Applications.2013; 26: 2225-0638.
- 3- Basim K, Haitham T .Wassan R, Farah F and Ahmed A. Measurement the concentrations of radon and thoron and their progeny in the air samples of al-haswaa city in Babylon province. Journal of Physics: Conf. Series 1178 .2019; 012001.
- 4- Komal B, Rohit M and Sonkawadeb R G. Measurement of radon concentration in ground water using RAD7 and assessment of average annual dose in the environs of NITJ, Punjab, India. Indian Journal of Pure & Applied Physics. 2010; 48(4):508-511.

- 5- Basim K, Gofraan Th. Radon gas concentration measurement in air of al-haswaa city in province of Baghdad". Iraqi Journal of Science.2017; 58 (2): 663-668.
- 6- WHO Air Quality Guidelines for Europe. Geneva 1987.
- 7- Truta- Popa L.A, Hofmann W, and Cosma C. Radiation protection Dosimetry. 2011; 146 (1-3) : 34-37.
- 8- Ali H, Abdul. R. H. and Ahmed R. Measurement of Radon Concentration in Soil Gas using RAD7 in the Environs of Al-Najaf Al-Ashraf City-Iraq. Advances in Applied Science Research.2011; 2 (5):273-278
- 9- Ruwiadah T. M. "Measurement of Indoor Radon Gas Concentration in same Region of Baghdad Governorate Using CR-39 Nuclear Track Detector". Baghdad Journal for Science.2017; 14 (4): 688 – 691.
- 10- Khaled S.D, Khaled A.M., Shaban R.H and Baset A. Abdel. Measurement of ²²²Rn concentration levels in drinking water samples from Qena city (Egypt) and evaluation of the annual effective doses. Int. J. Radiat. Res.2020; 18(2): 227-233.
- 11- Minghao M,Ruixia W, Lining Xu . Emerging health risks and underlying toxicological mechanisms of uranium contamination: Lessons from the past two decades. Environment International. 2020;145(2020):106107
- 12- Gaso, M. I.; Segovia, N.; Cervantes, M. L.; Herrera, T. and Perez-Silva, E. 2000. Internal Radiation Dose from ¹³⁷Cs Due to the Consumption of Mushrooms from the Mexican Temperate Mixed Forest. Radiat. Prot. Dosimetry.2000; 87: 213-216.
- 13- Lederer, C. M. Shirley, Browne V. Dairiki S. E, Doebler R. E." Table of Isotopes", 7th Edition, Inc. John Wiley. 1978.
- 14- Basim R. Natural Occurring Radioactive Materials (NORM) and Technologically Enhanced NORM (TENORM) Measurements on Oil Field in North Region of Iraq. PhD. Thesis, Baghdad University. 2015.
- 15- Basim R. Specific Activities of Natural Radionuclides and Annual Effective Dose Due to the Intake of Some Types of Children Powdered Milk Available in Baghdad Markets. Baghdad Science Journal. 2017; 14 (3):623
- 16- International Basic Safety Standard for Protection against Ionizing Radiation and for the Safety of Radiation Sources. 2011. Safety Series No. 115.