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MEASUREMENT THE CONCENTRATION OF RADON GAS EMITTED FROM SAMPLE OF HENNA CONSUMED IN IRAQ USING NUCLEAR TRACK DETECTOR CR-39

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Abstract

In this work, investigated of radioactive content in some Henna consumed by Women and recognize the limits allowed by using CR-39 detector technology, the number of selected species under study reported 9 kind of various henna, these tests were conducted in the laboratories of the Faculty of Education for Pure Sciences / Physics Department, University of Babylon, where the duration of preparation for the samples was 60 days and the readings were somewhat different. after examination of the models are compared with indicators of radiation protection (ICRP), which was within the allowable limits of(200-800) Bq/m^3.

Key words : Radon concentration, CR-39 detector, henna.

Introduction

Measurements of radioactivity in environment and in foodstuffs are extremely important for controlling radiation levels to which mankind is direct or indirectly exposed. Besides natural radionuclides, due to several nuclear weapon tests and numerous nuclear reactor accidents, various artificial radioactive elements were introduced in the biosphere (Yahia and Ayya, 2010). Another important fact is that, importation of contaminated food from any region that suffered a nuclear accident, can be indirectly affect people health around the world (Ghayb, 2002). Radionuclide elements coming from the fallout incorporates in biosphere. These elements present in atmosphere contaminate plants, soil and water and by different ways contaminate the environment. The radioactive elements transport in environment involves transference among three primary components: vegetation, soil and water (Yahia and Ayya, 2010). CR-39 used as the detector in the determination of the radioactive contaminants. This detector has a high sensitivity. The CR-39 detectors used for long-term measurement of radon exhalation rate (Abbas, 2013). Radon concentration is determined by measuring the emitted alpha particles that causes damage to the detector surface. Radon levels show important spatial variations on a regional or local scale. The track density exposure time and calibration factor are necessary for calculating the radon concentration (Ghayb, 2002).

The purpose of this work is to measure and study the levels of radiation activity or environmental pollution represented by the radon in a sample of henna and the purpose of the selection of this article in particular, for reasons, including: the great popularity and widespread use of henna by humans, especially women, where considered from the social and inherited customs since ancient times and the wide turnout in the Arab and Islamic peoples as used in cosmetics and decorating hands, feet and hair have known henna since ancient times, used by the pharaohs for various purposes, they took perfume of flowers and made From the powder of their leaves paste for hands and hair dye and wound treatment, and found many of the mummy Pharaonic Henna, as they dig the graves under their death. It is used in leather tanning and wool. As well as in the modern era involved in many industries of cosmetics and adorn them (Abbas, 2013).

Materials and Methods

In this research, 9 samples of henna models were prepared and prepared in the same manner to achieve

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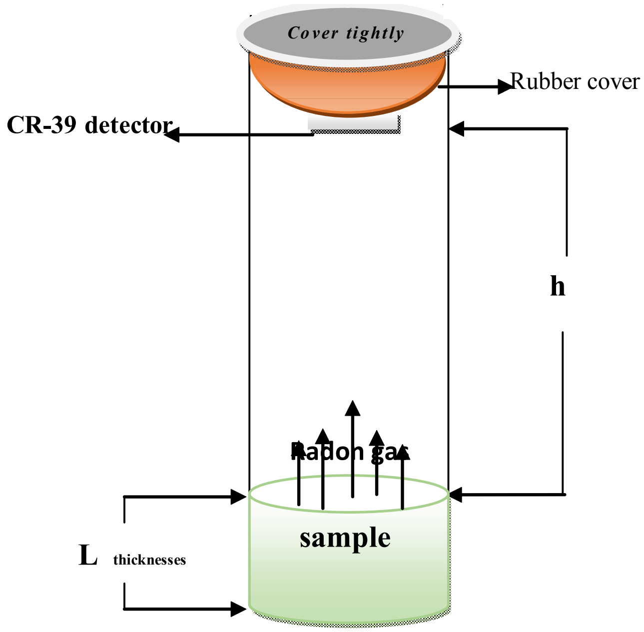

Fig. 1 : A schematic diagram of the sealed-cup technique.

accuracy in radiometric measurements. These models were placed in the reaction chamber tubes with equal diameters (1.02 cm). The distance between the detector and the surface of the sample was 5cm. For the purpose of reaching the radiative balance in the Radon decomposed series, the samples were placed in the reaction chamber tubes for 60 days before the detector was placed and at room temperature. Fig. 1 shows the chamber of the reaction chamber used to calculate radioactive radon concentrations (Abojassim, 2018).

After the irradiation time, CR-39 detector was etched in 6.25 N of NaOH solution at temperature of (60±1°C) by thermostat water bath (WATER BATH HH-2) for 5 hour. After the process, the detector rinsed with distilled water and dried in air. The impact of alpha particles have been calculated by optical microscope (type ALTABIO-1007) with magnification of (400×) connected with camera 14 mp (Abojassim, 2018).

Results and Discussion

Table 1 presents alpha particle density for henna samples under study. The density of alpha particles were calculated by using the following relationship (Abojassim, 2018):

$$\text{Track density}\ (\rho) = \frac{\text{Average number of total pits (tracks)}}{\text{Area of field view}} \quad (1)$$

Calculating the concentration of the radon in the air include the seal cup from the equation [5].

$$C_a = C^0 t^0 \rho / t\rho^0 \quad (2)$$

Where, (C^o) is the concentration of radon, (ρ^o) is the track density per mm^2 on the calibrated dosimeter, (C_a) is the concentration of radon in the air inside the seal cup. (ρ) is the track density per mm^2 for detector with the samples, (t) exposure time and to exposure time for calibration.

Through the Radon concentration in air we can calculated the radon concentration in each sample from the following equation [6].

$$C_W = C_a\ \lambda_{Rn} < t\ L \quad (3)$$

Where, (C_a) is the concentration of radon in the air space given in Bq.m^{-3} and (λ_{Rn}) radon decay constant and equal to (0.1814 / Day), (h) distance from the sample surface inside the seal cup to the surface of detector is equal to (8.8 cm), and (L) is the thickness of the sample.

The activity of Radon in the samples (A_{Rn}) in (Bq) unit could be determined through the relation [5].

$$A_{Rn} = C_W V \quad (4)$$

Where, $V = \pi r^2 h$; (V) the volume of samples given in (cm^3) and the radius of the seal cup equal to (r =3 cm).

For uranium, concentration, we can determined through the number of atoms of radon:

$$N_U \lambda_U = N_{Rn} \lambda_{Rn} \quad (5)$$

Where, λ_U is decay constant of uranium (3.4×10^{-18} sec^{-1}).

After calculating the number of uranium, atoms in each sample we can calculated the mass of uranium (W_u (g)) in each sample from the following equation:

$$W_U = N_U\ A_U N_{av} \quad (6)$$

Where, A_U: mass number of uranium U238, Nav: Avogadro number (6.02 × 1034 mol^{-1}). Finally, we can calculated the mass of uranium in unit (ppm) from the following equation [7]:

$$C_U(\text{ppm}) = W_U W_S \quad (7)$$

Where, (WS) mass of the sample.

Radon concentrations were also calculated in the air C_a after stabilizing the aerodynamic space in the cylindrical reaction chamber and stabilizing the detector 7 cm from the samples, each of which was 12 gm. Radon concentrations within sample C_s and radioactivity of radon ^{222}Rn and radium ^{226}Ra were also calculated in Bq units, number of radon atoms N_{Rn} and Uranium Nu, and as indicated in Table 1.

Table 1 shows that the highest intensity of the effects was in sample 2 (Brite Henna) was (10.66) track / cm^2, while the lowest value of the effects of the sample in sample 6 (Afrin Henna) where it was (4.33 track / cm^2),

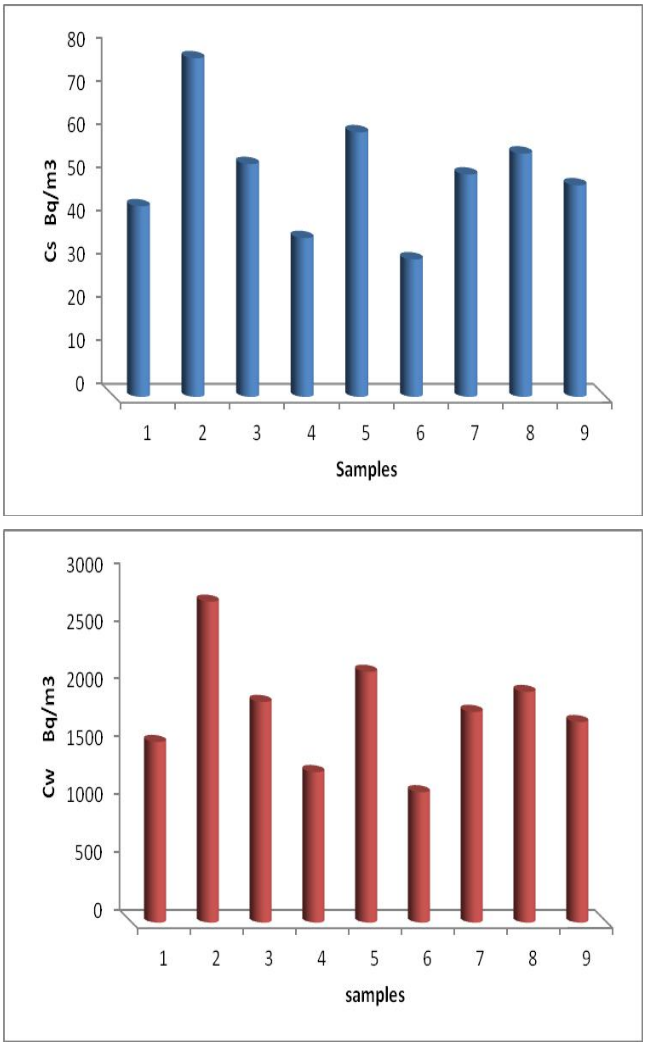

Fig. 2 : Radon concentration airspace Ca and inside samples Cs as function of the number of samples.

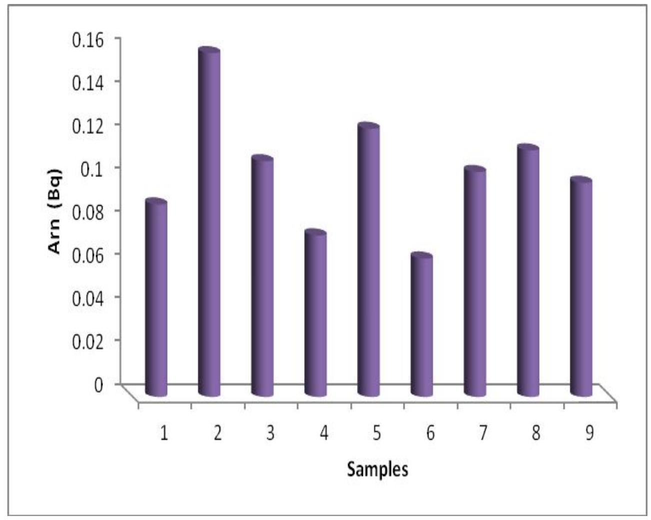

Fig. 3 : Radioactivity of radon compared to radionuclide radiation effectiveness.

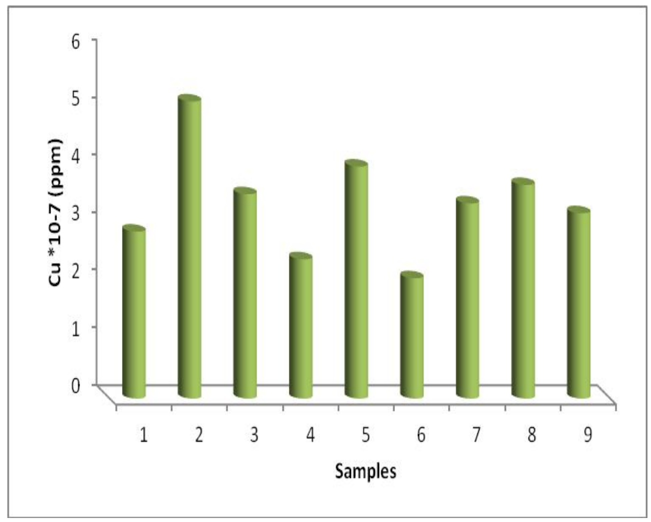

Fig. 4 : Uranium concentrations of the samples under study.

while the rest of the samples ranged between (5-10.66) track / cm^2. The radon concentration was calculated for the studied samples. The highest concentration of radon in sample 2 (78.35 Bq.m^{-3}) and the lowest concentration of radon in sample 6 (31.82 Bq.m^{-3}) and the rest of the samples ranged between radon (36.75 - 78.38 Bq.m^{-3}). By comparing the results of this study with the permissible values documented by the relevant international organizations to determine exposure values for radon, ICRP issued warnings about limits of exposure to radon through the permissible limits of 200 - 800 Bq.m^{-3}, which was confirmed by the International Agency and the World Health Organization. He therefore found that the models studied are among the values allowed globally.

Radon radiation activity within the sample depends mainly on the size and concentration of the sample where the values were limited between (0.064 – 0.159) Bq for the same samples. Fig. 3 illustrates the radiological efficacy of radon and the radiation effectiveness of the radium analog.

The uranium was also calculated and concentrated in ppm units and the radiation efficiency of ^{218}Po on the face of the reagent used and the walls of the reaction chamber cylinder resulting from the dissolution of ^{222}Rn. 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 number of uranium atoms 238 and the mass of the nucleus. Fig. 4 shows the uranium-equivalent concentrations in ppm units of the samples under study.

For the purpose of identifying the permissible limits of the results under study, they were compared to the permissible exposure limits for radon and published by the International Radiation Protection Organization (ICRP) of (200-800) (Bq.m^{-3}). ICRP (1994) of solid-liquid

Table 1 : Radon concentration in samples, air space, radiation efficiency of radon, radium, and number of uranium and radon atoms.

No.	Name Henna	Mean	Ca $Bq.m^{-3}$	C_w $Bq.m^{-3}$	A_R Bq	N_{Rn}(atom)	N_U(atom) $*10^{16}$	C_{Rn} (atom) $*10^{-7}$
1	Trichup	6	44.1	1564.39	0.089	0.49	1.84	2.9
2	Brite	10.66	78.35	2779.4	0.159	0.87	3.26	5.16
3	Bin Ali	7.33	53.87	1911.16	0.109	0.60	2.24	3.5
4	Zeba	5	36.75	1303.65	0.0747	0.41	1.53	2.42
5	Vatika	8.33	61.22	2171.89	0.124	0.68	2.55	4.03
6	Afrin	4.33	31.82	1128.96	0.064	0.35	1.33	2.09
7	Mallika	7	51.45	1825.12	0.104	0.57	2.14	3.39
8	Shama Herbal Bukhur Henna	7.66	56,3	1997.25	0.114	0.63	2.34	3.71
9	Supreme	6.66	48.95	1736.47	0.099	0.54	2/04	3/22

samples are all within permissible limits.

Conclusion

In this study, the concentration of the effectiveness of the radioactive elements was measured in different samples of the Henna, which consumed by the women in Hilla. Using the nuclear track 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.

References

Abbas, J. Al-Saadi (2013). Determination of Radon Concentration and the Annual Effective Dose in Karbala University Campus, Karbala, Iraq. *Karbala J. Med.*, **6(1)** : June, 2013

Abojassim, A. (2018). Alpha Particles Concentrations from Soil Samples of Al-Najaf/Iraq. *Polish Journal of Soil Science*, **50(2)** : 249.

Ali, Abid Abojassim and Dhuha Jalil Lawi (2018). Alpha particles emissions in some samples of medical drugs (capsule) drived from medical plants in Iraq. *Plant Archives*, **18(1)** : 1137-7.

Ghayb, D. H. (2002). Measurement of Alpha Emitters concentration in Tigris river water in Baghdad city using CR-39 plastic track detector. *M.Sc. Thesis*, Al-Nahrain University, College of Science, 2002.

Hanaa N. Azeez (2018). Radon Concentration Measurement in Ainkawa Region Using Solid State Nuclear Track Detector. *Iraqi Journal of Science*, **59(1C)** : 482-488.

ICRP (International Commission on Radiological Protection) Human respiratory tract model for radiological protection (1994). ICRP Publication 66. *Annals of the ICRP*, **24(1-4)** : Pergamon Press.

Nasha Rahim, Al-Atabi (2008). Using Nuclear Impact Detectors for the Solid State in Measuring Radon Concentrations in Soil in Al-Tawitha Region, Volume **3**, December 11, 2008. Yahia Bin Khalaf and (2010). Ayya Muslim, Cultivation of medicinal plants under rain conditions, National Center for Agricultural Research and Extension, Syria 2010.