Measurement of Radon-222 exhalation rate in different kinds tablet medicine samples byDetectors CR-39

قياس نسبة انبعاث غاز الرادون-222 في عينات طبية مختلفة باستخدام كاشف الاثر النووي CR-39

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الخلاصة :

ان تركيز غاز الرادون يعد موشراً لوجود اليورانيوم , حيث ان وجود اليورانيوم في الجسم قد يلحق الضرر بكلى الانسان لانه يحول دون التخلص من اليوريا والنواتج غير المرغوب فيها. وفي بحثنا هذا تم حساب تركيز الرادون في 20 نوع من النماذج الطبية على هيئة اقراص مختلفة المنشأ(العراق- بغداد و العراق – صفا والعراق – نينوى و العراق –سامراء) وباستخدام كاشف الاثر النووي للحالة الصلبة CR-39 . حيث استخدمت قطع الكاشف بمساحة $1cm^2$ ولفترة تشعيع بلغت (60 days). لقد اشارت النتائج الى ان مستويات الرادون في العينات المدروسة تراوحت بين Bq/gm (0.0077-2.1)

Abstract:-

Radon-222 concentration is indicated to the uranium in medicines and the amount of uranium in medicines can damage human's kidneys by preventing normal elimination of urea and other waste products. We measured the radon gas concentration in twenty types of medicine samples as a tablet different in origin{ (*IRAQI - BAGHDAD*) , *(IRAQI – SAFA*) ,(*IRAQI-NINAWA),* and (*IRAQI - SAMARA*) } by using alpha-emitters registrations which are emitted from radon gas in (CR-39) nuclear track detector. A number of the detectors were used with dimensions of 1x1 cm^2 and with exposure time of 60 days. The detectors collected and chemically treated . we found that the radon levels in medicine samples range from (0.0077-2.1) *Bq/*mg.

Keywords: solid medicine; Radon , nuclear track

Introduction

Radon is a radioactive gas that occurs naturally from decay of uranium (^{238}U) to lead-206 (^{206}Pb). Uranium decays through a number of steps to radium-226 (^{226}Ra),

Radium will then decay into another radioactive element called radon gas. As a radon gas is colorless, odorless, and tasteless. The main source of radon is Uranium which is may enter into the drinking water, food and medicine samples from natural processes or as a result of human activity (Cothern and Lappenbusch,1983). The manufacture of the medicines containing uranium may also contribute uranium in its composition.

The main health risk associated with long-term, elevated exposure to radon is increases the risk of developing lung cancer by the release of radioactive energy from the radon daughters. When in the lungs the radon daughters are within one thousandth of an inch to the most cancer-sensitive cells in the human body. The radon daughter in the decaying process emits an alpha particle which regrettably is one hundred times more efficient than beta and gamma particles at inducing cancer. The reason alpha particles will create substantial damage to the molecules in which they come in contact (Abdallah et al 2008).

It is necessary to measure the radon concentration of food, medicine and water samples to assess potential radiation doses and, if necessary, to take action to avoid the exposure of consumers to

radiation. Solid-state nuclear track detection technique is widely used as an erective tool to measure α-tracks activity(M. Akram et al., 2008).

As the plants form a major part of the food stuffs for human beings and uranium is a toxic element, therefore, high intake of uranium and its decay products through plants and food stuffs may lead to harmful effects in the human being. The uptake of uranium in plants is also found to depend upon the nature and age of the plants (Singh et al., 2001).

There are some papers studied uranium and radon in water, food and medicine samples, the one of three food categories, fish and shellfish, cereals (excluding rice) and vegetables are found to be the main contributors to the daily intakes of ^{238}U and ^{232}Th (Fisenne et al., 1987,Shiraishi et al., 2000; and Kuwahara et al., 1997) using neutron activation analysis and radiochemical separation ^{238}U and ^{232}Th concentrations have been measured in some biological reference materials(Dang et al., 1992).some researchers used sensitive LR-115 type II plastic track detectors to determine the alpha radioactivity in tobacco leaves , the medicine samples and building materials samples . (Mahabir Nain et al., 2008,M. Akram et al., 2008, Oktay Baykara et al., 2010 and Nabil M. Hassan et al., 2011).

The objective of this study is to evaluate the radon gas concentration in twenty types of medicine samples as a tablet by using solid-state nuclear track detection technique.

2. Experimental methods:

2.1. Sample preparation

Different types of medicine samples originating in Iraq were collected from several commercial companies , Twenty types of medicine samples as a tablet only in amounts weighing from 1.02 - 7.98 gm as shown in table . 1, the samples crushed to be powder were placed at the bottom of the plastic can. The mouth of the can was sealed with a cover fixed with used CR-39 Lantrack® polycarbonate detector ,detectors (1 cm x1 cm) were used to measure the number of tracks per cm^2 , as shown in Fig. 1.

Table 1 : Trade Name , Scientific Name ,tablet or capsule dosage forms and source of the drugs .

Sr.No	Trade Name	Scientific Name	Weight (mg)	Sources
A1	Paracetol	Paracetamol	500	**IRAQI - NINAWA**
A2	Paracetol	Paracetamol	500	**IRAQI – SAFA**
B	REMOPAIN	Mefenamic acid	250	**IRAQI**
C	NAPROSAM	Naproxen	250	**IRAQI**
D	Neoprofen	Ibuprofen	200	**IRAQI**
E1	Butadin	Salbutamol as Sulphate	2	**IRAQI – SAFA**
E2	Butadin	Salbutamol as Sulphate	2	**IRAQI - NINAWA**
F	LIBRAXAM	Chlordiazepoxide Clidinium bromide	5 2.5	**IRAQI**
G	SPASMOSAM	Hyoscine –N-Butyl Bromide	10	**IRAQI**
I	ACID FOLIC - 5	Folic acid	5	**IRAQI**
K1	VOLTADIN	Diclofenac Sodium	25	**IRAQI - SAMRA**
K2	VOLTANIN	Diclofenac Sodium	25	**IRAQI -**

				NINAWA
L1	METHYLDOPA	Methyldopa (as anhydrous)	250	**IRAQ I - SAFA**
L2	ALDOSAM	Methyldopa	250	**IRAQI - SAMRA**
N	BECARDIN – 10	Propranolol HCL	10	**IRAQI**
M	FLu – out	Paracetamol ,Vitamin C Chlorpheniramine Maleate	350 100 2	**IRAQI**
P1	PREDNISOLONE	Prednisolone	5	**IRAQI - SAFA**
P2	PREDNISOLONE	Prednisolone	5	**IRAQI - BAGHDAD**
V1	SAMAVIT B6	Pyridoxine HCL	40	**IRAQI – NINAWA**
V2	SAMAVIT B6	Pyridoxine HCL	40	**IRAQI – SAFA**

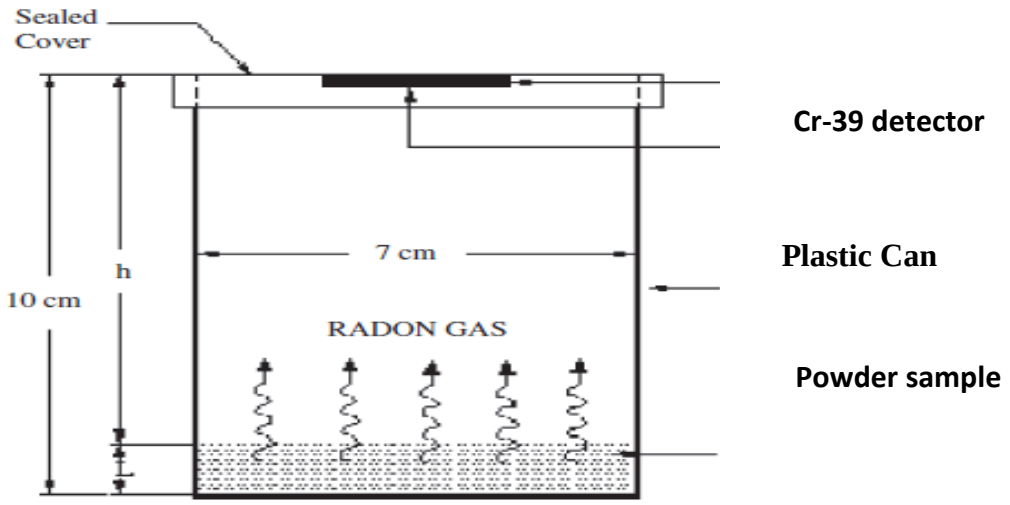

Fig. 1. The components of the experiment for measure of radon content in drug samples.

2.1. Experimental procedure:

After the exposure time was about 2 months. The CR-39 films separated from the sample cups. The detectors were chemically etched, using a 6 M NaOH solution at 70 °C for 18 hours . An optical microscope with a magnification of 40x and web cam connected with computer to count the number of tracks per mm^2 in each detector**[**A. F. Magen et al**],** Fig 3 shows the Cr-39 after chemical treatment.

3. Results and discussion:

Fig 1. demonstrate values of distance between the detector and top of the powder samples(cm) and mass of the solid sample (gm)for to compute the consideration of the radon which emitted from samples by using the relation

$$Q = \left(\frac{\sigma - \sigma p}{\delta \tau}\right)\left(\frac{hA}{m}\right)$$

Q is the effective radon content of the sample.

σ is the total number of tracks/mm^2 in the Cr-39 detector after measurement.

σp is the total number of tracks/mm^2 in the Cr-39 detector before measurement.

τ is the exposure time.

δ is the detection efficiency. The value of δ for a can of radius 3.5 cm and height 10 cm is (1/30) tracks cm^{-2} d^{-1} *(*Bqm^{-3}*)*$^{-1}$ with an uncertainty of 15% (Somogyi, 1986).

M is the mass of the solid sample in kg.

A is the area of cross-section of the can in m^2;

h is the distance between the detector and top of the medicine sample in m.

Table 2 :Serial no. , weight , hight of air in cup and mass of the solid sample

Sr.No	Weight(gm)	Hight (cm)	Average of track/mm^2	Radon concentration Bq/gm
A1	6.73	5	804	**0.75**
A2	6.85	5.2	357	**0.24**
B	6.76	5.1	311	**0.19**
C	4.32	5.4	229	**0.15**
D	4.74	5.3	557	**0.77**
E1	1.58	5.6	440	**0.58**
E2	1.02	5.5	495	**0.68**
F	2.31	5.4	154	**0.008**
G	1.97	5.6	795	**1.295**
I	1.17	6	1025	**1.883**
K1	2.21	5.6	454	**0.61**
K2	1.46	5.5	281	**0.26**
L1	4.03	5.2	350	**0.373**
L2	3.33	5.3	304	**0.29**
N	2.22	5.5	168	**0.035**
M	7.98	4.6	1089	**1.55**
P1	1.83	5.7	376	**0.46**
P2	1.67	5.6	1198	**2.1**
V1	1.67	5.6	592	**0.89**
V2	1.83	5.5	368	**0.43**

The results for the determination of concentration of radon in a variety of medicines (20 samples) obtained by solid-state nuclear track detection technique have been presented in Table 2 and shown in Fig.2. The nrado concentration in the investigated medicine samples is in the range of (2.1) Bq/mg–(0.0077) *Bq*/mg. Maximum radon concentration were observed in the medicine (**PREDNISOLONE P2**) *(*2.1*) Bq*/mg, manufactured by (*IRAQI - BAGHDAD*), while minimum radon were observed in the medicine **(LIBRAXAM F**) *(*0.008*) Bq*/mg, manufactured by *(IRAQI).* From Table 2 it can be seen that the concentration of radon in medicine sample (**PREDNISOLONE P1**) ,(2.1) Bq/mg manufactured by (*IRAQI- SAFA*) is 4 times higher than the concentration in the medicine samples(**PREDNISOLONE P2**) ,(0.46) Bq/mg manufactured by

(*IRAQI- BAGHDAD*). Average radon concentration in the medicine samples (**PARACETOL,A1**),manufactured by(*IRAQI -NINAWA*). is 3 times higher than the concentration in the medicine samples (**PARACETOL ,A2**), manufactured by(*IRAQI–SAFA*). Similarly Average radon concentration in the medicine samples(**VOLTADIN K1**), manufactured by(*IRAQI - SAMRA*). is 2 times higher than the concentration in the medicine samples (**VOLTADIN K2**), manufactured by (*IRAQ -NINAWA*).The source of the presence of higher uranium in some homeopathic medicine samples as compared to the other from the local market of IRAQ appears to be from the high uranium concentration in their parent ingredients while radon concentration in medicine samples (**BUTADIN E1**) manufactured by*(IRAQI–SAFA*).is almost equal to the concentration in the medicine sample (**BUTADIN E2**) manufactured by (*IRAQI-NINAWA*). Similarly, radon concentration in medicine samples(**METHYLDOPA L1** and **ALDOSAM L2**). The results indicates that the small difference between Radon concentrations in samples (**REMOPAIN B, NAPROSAM C)** (0.19 and 0.15)Bq/mg respectively .

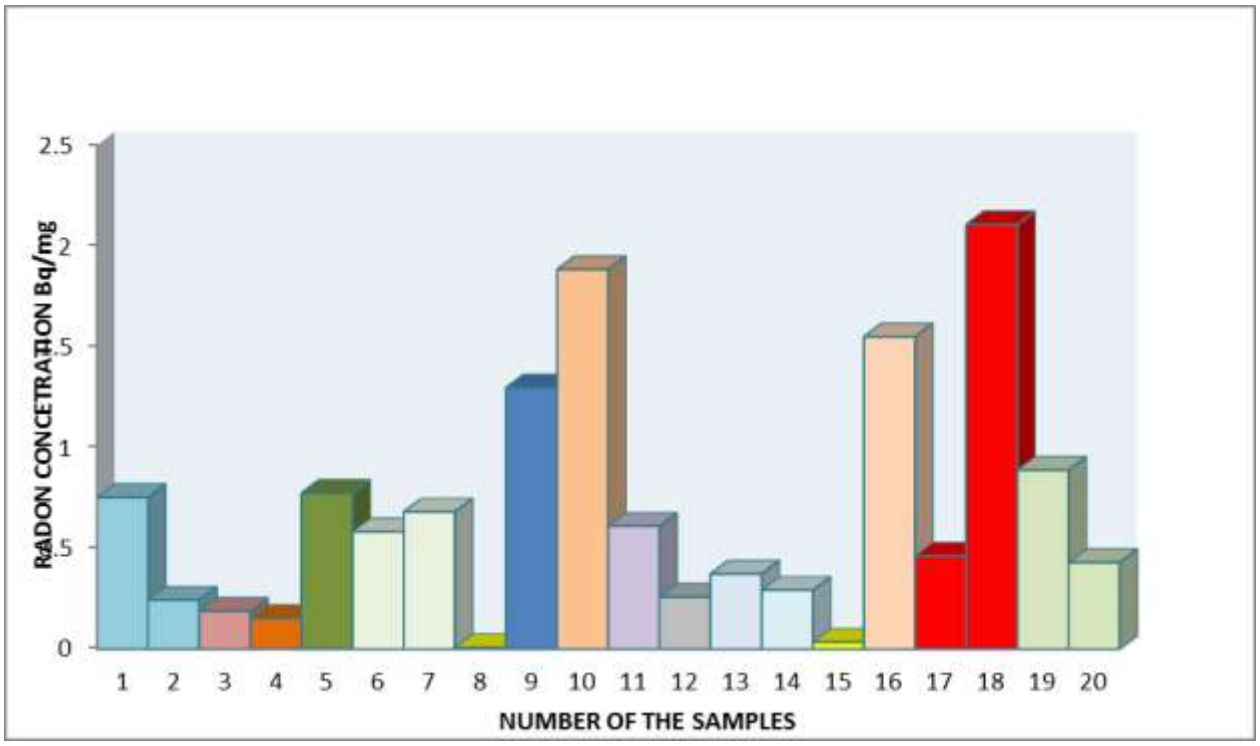

Fig. 2. Radon concentrations in twenty drugs samples from Iraq companies.

This small variation in Radon values inside samples due mainly to the difference in the natural uranium consists of a mixture of three radioactive isotopes in these medicines samples and when uranium decays, it changes into different elements that are also radioactive, including radon, a gas that is known to cause lung cancer.

this results also shows that 6.7 gm of samples (**REMOPAIN B)** emitted one (α-particle) per second and 5.3 gm of samples **(NAPROSAM C)** to emit same value of α-particle , the sample (**NEOPROFEN D)** have high radon concentration as compared to samples (**REMOPAIN B and NAPROSAM C)** the source of the presence of higher uranium in medicine samples as compared to the other , The radon concentration in the medicine samples **(SPASMOSAM G , ACID FOLIC – 5 I)** were found very high **(** 1.295 and 1.883) Bq/mg compared to the other samples where (0.77 and 0.53) gm resp. decays to give (1 α-particle) per second, the sample (**ACID FOLIC – 5 I)** is very important for pregnant women which need 400 to 800 micrograms of folic acid every day.

The radon concentration in (**BECARDIN – 10), (**0.035) Bq/mg is **s**mall compare to other samples where we need 28.6 gm to emit (1 α-particle) per second, the sample **(FLU – OUT M), (**1.55) Bq/mg having high radon concentration as compared to other samples, where 0.645 gm to get (1 α-particle/sec) and this concentration may be danger because of this medicine sample(flu-out) is over the counter which was used as an analgesic for home medication for over 30 years and is accepted as a very effective treatment for the relief of pain , fever , cough and cold in adults and children. The quantitative determination of uranium in medicine is important because of its chemical and radiotoxic effects. Most (>95%) uranium entering the body is not absorbed, but is eliminated via the faeces. Of the uranium that is absorbed into the blood, approximately 67% will be filtered by the kidney and excreted in the urine in 24 hours. It is also present in drinking water and food. On average, approximately 90 μg (micrograms) of uranium exist in the human body from normal intakes of water, food and air; approximately 66% is found in the skeleton, 16% in the liver, 8% in the kidneys and 10% in other tissues. If increasing the amount of uranium in the human body above to 90 μg because of damage human's kidneys may become carcinogenic(Somogyi et al 1986).

4. Conclusions:

1-The radon concentrations depend on the uranium concentrations in samples only because of using filter to eliminate the (α-particle) which is emitting from thorium .
2-The radon concentrations in medicines samples different from samples to other related to the manufacturing company and to the constituents of the drug.
(3) Many drugs may cause damage in the kidneys and may become carcinogenic related to the presence of other toxic and trace elements and, therefore,may have a great impact on human health.

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