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Thoron Concentrations in Some Samples Solid of Medical Drugs in Iraq

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Abstract

In the present work, Thoron (^{220}Rn) concentrations was determined for (44) samples of medical drugs derived from medicinal plants in Iraqi pharmacies. Solid state nuclear detectors (SSNTDs) CR-39 detectors were used in the present study. The results show that the Thoron concentrations in the samples under study ranged from 1.82 Bq/m^3 to 66.48Bq/m^3, with an average 32.91±3.36 Bq/m^3. All results of radon concentrations for all samples were much less than the acceptable lower limits of the action level, by International Commission on Radiological Protection (ICRP). So, the intake of the studied samples of medical drugs in Iraq does due to ^{220}Rn not lead to substantial changes in the internal effective dose. It is conclude that the thoron concentrations in the samples under study were not significant from a health hazard point of view.

Keywords: Medical drugs; Medicinal plants; ^{220}Rn concentrations; C-39; Annual internal dose.

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Introduction

The basic component of our life support system is considered to be in the soil, water, plants and air. These environmental components contain measurable amount of radioactivity. The specific metabolic character of the plant species may lead to accumulation of radio -nuclides in their organs, which may further depend upon the physic- chemical characteristics of the soil [1]. Therefore, there may be increased risk to human population via food chain. The primary sources of elements from the environment to plants are: air, water and the soil [2]. The radionuclides present in the environment are transferred to plants by two ways first indirect method uptake from soil through roots. When food crops are grown in the contaminated soil, the activity is shifted from the soil to the roots and then in shoots. At the end, activity is transferred to the human diet [3]. These radio-nuclides can get transferred into plants along with the nutrients during mineral uptake and accumulate in various parts and even reach edible portions [4]. Second, it is direct method absorption through aerial parts of the plants. Presence of radioactivity in plant organs has been reviewed by various workers [2]. There are two pathways leading from Uranium and thorium to parents in plant: through the air and through the roots [4]. The plants roots are naturally related to microorganisms, and these associations can have direct or indirect impacts on the mobility, availability and acquisition of elements by plants [3]. The radiological effect of the uses of fertilizers in soil is due to the internal irradiation of the respiratory organ by the alpha particles, short lived radon-thoron progeny and the external irradiation of the body by gamma rays emitted from the radionuclides. Radon is carcinogenic to humans and responsible for main natural radiation exposure to human being [5,6]. Thorium (chemical symbol Th) is naturally-occurring radioactive metal found at very low levels in soil, rocks, and water, and therefore is found in plants and animals as well. The most common form of thorium is ^{232}Th, found naturally. Almost all thorium is natural, but, thorium isotopes can be artificially produced. Since thorium is naturally present in the environment, people are exposed to tiny amounts in air, food and water [7]. The thorium series may be also considered in three subseries: ^{232}Th itself, ^{228}Ra, and ^{220}Rn. The subseries headed by ^{228}Ra yields ^{228}Ac, ^{228}Th, and ^{224}Ra, are generally in radioactive equilibrium. The third subseries is headed by ^{220}Rn (thorium emanation, or thoron) which has a (54.5) s half-life and which quickly forms transformation products down to stable ^{208}Pb [8]. ^{220}Rn is not able to travel far i.e. decays before reaching the earth's surface due to its-short half-life and can often be eliminated from the monitoring system by introducing filter or other delaying techniques. Radionuclides in water or air may enter the food chain. For example, plants are capable of absorbing radionuclides from water in the same way as other minerals are absorbed. Anything that people eat can contain radionuclides. The drugs derived from medicinal plants that people eat can also contain radionuclides. The common radionuclides are ^{238}U and ^{232}Th as well as the associated progeny. Some radionuclides are internationally ingested as part of a medical drugs. Some of the radionuclides people ingest can remain in the body for long periods of time while others are quickly eliminated, often within hours [7]. The aim of present study is to determine the thoron activity

concentrations in solid samples of drugs derived from medicinal plants and collected from local pharmacies in Iraq using CR-39 detector.

Methods

Sample Collection

Forty four samples of different types of medical drugs derived from medicinal plants such as solid were collected from local pharmacies in Iraq from the period that starts from 1/10/2017 to 1/12/2017 in order to measure the ^{220}Rn levels. The types samples are listed in the table, where the table of medical drugs samples were designated according to sample code and sample name (Table 1).

Preparation of Samples

In this study, after collecting the medical drugs samples from various local pharmacies in Iraq, they packed in labeled polyethylene bags and then sent to the radiation detection and measurement laboratory in the physics department, faculty of science, University of Kufa. The purpose of preparation of the solid samples is to conduct the required analysis by drying and keeping them moisture-free by placing them for 8 hours in an oven at 70℃. In order to reach an appropriate homogeneity, the samples are mechanically grounded, by using the electric mill. Also , the samples were sieved through of 0.8 mm pore size diameter. The oral solution, liquid and ointment samples were measured directly without any preparation. The respective net weights are measured and recorded with a high sensitive digital weighing balance with a percent of ±0.01%. Next, the samples were placed in plastic cups with diameter (3.5 cm), length (7 cm) and volume (130 ml) cm^2. All samples were stored for about one month before they were counted, to allow secular equilibrium to be obtained between 222 Rn and its parent 226 Ra in uranium chain [9].

Measurement of Samples

It used the integrated passive dosimeter to measure thoron concentration in medical drugs samples in this study from various local pharmacies of Iraq, which included solid stated detectors CR-39 with dimensions of (1×1) cm^2. CR-39 detector with a thickness of (100 μm) (made in USA, charleswater.co.un, vermason.co.un, IEC61340-5-1) was put directly on samples of containers (Figure 1). Then, they were sealed at room temperature for 62 days exposure time. When end exposure time ended, CR-39 detectors where etched of sodium hydroxide (NaOH) solution at 60℃ temperature for five hours using water path, solution of 6.25 normality respectively [10,11]. Next, they were washed using distilled water. The track density on CR-39 (Tr/cm^2) was counted through the use of an optical microscope of magnification 10×40. To evaluate the background correction, the background was subtracted from registered alpha track density.

Table 1: Names and codes of medical drugs samples.

Sample name	Sample code	Sample name	Sample code
Eucarbon	S1	Gentaplex	S23
Trilac	S2	Acaiberry	S24
Urologica probiakut	S3	Speman	S25
Aspin	S4	Prostamed	S26
Senade	S5	Ab slim extra	S27
Vitalacticb	S6	Fat burner	S28
Swiss microlactin	S7	Digestives	S29
Uriclar	S8	Ginseng	S30
Allohol	S9	Pilex	S31
Magne sium dragees	S10	Colon cleanse	S32
Dizyme blend	S11	liv.52	S33
Asmasam	S12	brewer,s yeast	S34
Kellagon	S13	Agiolax	S35
Glucose powder	S14	Green tea	S36

^{220}Rn concentration in the airspace of the tube (C_{Rn}^{a}) was calculated from the formula [12]:

$$C_{Rn}^{a}\left(\frac{Bq}{m^3}\right)=\frac{\rho}{Kt} \quad (1)$$

where ρ is the track density on the exposed detector (Tr/cm^2), **t** is the exposure time of the sample (62 d), and *K* is the diffusion constant (calibration factor or sensitivity factor). The fluctuation of calibration factors ranges from (0.0049 - 0.0198) Tr mm^{2}K Bq/h m^3 for thoron [13,14].

Results and Discussion

The results of thoron (^{220}Rn) concentrations in solid samples using CR-39 detectors in unit (Bq/m^3) as present in the table (Table 2). It is

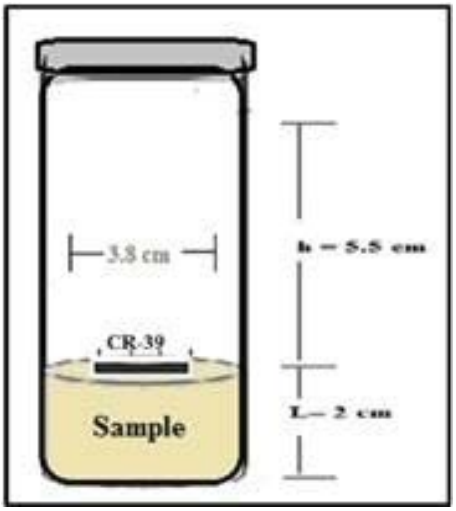

Figure 1: Diagram of container that used CR-39.

Table 2: ^{220}Rn concentrations in solid samples using CR-39 detectors.

Sample code	^{220}Rn Concentrations	Sample code	^{220}Rn Concentrations
S1	30.96	**S23**	34
S2	21.86	**S24**	29.14
S3	14.57	**S25**	25.5
S4	43.71	**S26**	2.73
S5	4.55	**S27**	18.21
S6	12.75	**S28**	25.5
S7	25.5	**S29**	60.1
S8	42.5	**S30**	3.64
S9	23.68	**S31**	1.82
S10	12.75	**S32**	5.46
S11	25.5	**S33**	47.35
S12	34.6	**S34**	21.86
S13	18.21	**S35**	5.46
S14	1.82	**S36**	19.12
S15	30.35	**S37**	32.78
S16	21.86	**S38**	7.29
S17	66.48	**S39**	10.02
S18	12.75	**S40**	10.93
S19	30.96	**S41**	25.5
S20	27.93	**S42**	38.25
S21	7.29	**S43**	7.29
S22	18.21	**S44**	40.07

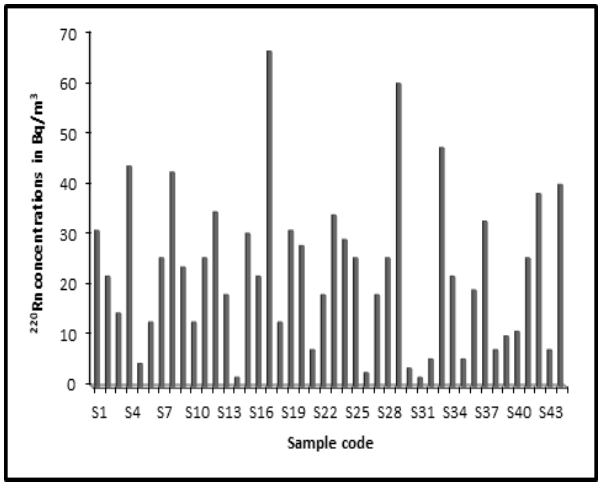

Figure 2: ^{220}Rn concentrations in present study samples.

found that ^{220}Rn concentrations ranged between 1.82 Bq/m^3 to 66.48Bq/m^3, with an average 32.91±3.36 Bq/m^3. The data obtained revealed that sample S17 recorded the highest level of ^{220}Rn, whereas S14 contained the lowest level of ^{220}Rn (Table 2) (Figure 2). The variation in the radon concentrations can be attributed to the numerous components of these pharmaceuticals because they were of plant origin. The pollution that occurred by radiation can be also directly caused by the absorption of radionuclides from the atmosphere. The uptake of radionuclides by plant varies relying on the soil crust, the plant itself and the fertilizer. Consequently, the radiation pollution of the plant is highly anticipated. The result show that the thoron concentrations in solid pharmaceuticals samples were still less than the lower limit recommended by ICRP 2009) [15]. Therefore, the results of the study samples are safe when compared with the permissible values globally.

Conclusion

The Thoron concentrations in solid samples of medical drugs are much lower than the regulatory standard recommended according to ICRP reported. As a result ^{220}Rn concentrations, the intake of the current medical drugs derived from medicinal plants in Iraqi pharmacies for all samples in present study does not result in significant changes in the internal radiation dose and do not constitute a health hazard to those who use this drugs.

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