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Uranium Concentration in Some Medical Herbs

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Abstract

Uranium concentration and the annual committed effective dose in some selected medicinal plants commonly used in Iraq have been determined using fission tracks technique etch in twelve medical plants samples using CR-39 track detector. The results show that the uranium concentration ranged from 0.044±0.012 ppm in Thyme sample to 0.2±0.03 ppm in Black Pepper and Cardamom samples with an average value of 0.14 ±0.0 4ppm. The average annual effective dose due to ingestion of uranium radionuclide was $13.77x10^{-5}$ mSv/y, which is below the world average annual committed effective dose of 0.3 mSv/y for ingestion of natural radionuclides.

Keywords: Medical Herbs, Uranium concentration, fission tracks technique, CR-39 track detector, Annual committed effective dose

تركيز اليورانيوم في بعض الأعشاب الطبية

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الخلاصة

تم تحديد تركيز اليورانيوم والجرعة الفعالة السنوية الموصى بها في بعض النباتات الطبية المختارة شائعة الاستخدام في العراق باستخدام تقنية قشط اثار شظايا الأنشطار في اثني عشر عينة من النباتات الطبية باستخدام كاشف الأثر CR–39. أظهرت النتائج أن تركيز اليورانيوم تراوح من 0.044 ±0.012 جزء في المليون بيكرل/ كغم في عينة الزعتر، الى 0.2 ±0.03 جزء في المليون في عينات الفلفل الأسود والهال بمعدل 0.14 ±0.04 جزء في المليون 1.7 بيكرل/كغم. كان معدل الجرعة الفعالة السنوية بسبب تناول النويدات المشعة لليورانيوم يساوي 13.77×10^{-5} ملي سيفرت/ سنة والذي أقل من المتوسط العالمي السنوي للجرعة الفعالة هو 0.3 ملي سيفرت/ سنة من تناول النويدات المشعة الطبيعية.

Introduction

Naturally occurring radioactive materials (NORMS) are found in every constituent of the environment; air, water, soil, food and in humans.

Radionuclides in soil may enter the food chain through direct deposition on leaves or through translocation to parts of plants used for medicinal purposes since plants are the primary pathway of natural radionuclides entering into the human body through the food chain. The absorption of soluble radionuclides in soil-water by root uptake, direct deposition from the atmosphere and resuspended natural radionuclide from the soil. The naturally occurring radio- nuclides ^{226}Ra. ^{232}Th and ^{40}K are the

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main sources of radiation in soils and rocks. These radio-nuclides pose exposure risks externally due to their gamma-ray emissions [1].

Dependent upon the soil activity concentration, and as well depends of root uptake on the properties of soil, for example PH, the composition of mineralogical, organic matter content and status of nutrient in the same time the properties of metabolic and physiological for the plant kinds [2].

The exposure of human beings to ionizing radiation from natural sources is a continuing and inescapable feature of life on earth; for most individuals, this exposure exceeds that from all man-made sources combined [3].

For the world, the plants raw parts and the extracts were at products medical products. it was calculated that recent doctors of 25% were obtained by medical herbs of flowering plants were generality. Also above 250,000 of the species of flowering plant which do as resources of new drugs, orthodox or traditional production [4].

In recent decades, consumption of medical plants has increased and become a regular of consumption and the safety of these products has become a public health concern. Therefore the study aims to calculate the normal specific activity for medical plant symbols taken of imported herbal symbols (12 symbols) which were the familiar at Iraq, also appreciate the connected of risk radiological of using medical plants.

Techniques and Material

1- Symbols Preparation

Different medical herbals used in Iraq has been selected off Iraqi shops during 2016, were shown in Table-1.

Table 1- The names of familiar symbols

Symbols	Symbols Names
S1	Cinnamon
S2	Chamomile
S3	Latency
S4	Thyme
S5	Cubebs
S6	Black Cumin
S7	Black Pepper
S8	Nutmeg
S9	Cardamom
S10	Cumin
S11	Coriander
S12	Ginger

The fine powder of these samples were grounded by ball grinder of stainless steel, ball grinder, where samples of 0.5g and 0.1g of $C_6H_{10}O_5$ powder were mix up. The piston of 3 ton were used to press the mixture into a pellet. The pellet were covered with CR-39 track detectors on one side and put in a plat of paraffin wax at a distance of 5cm from (^{241}Am-^{9}Be) neutron source of activity of about 12 Ci and thermal neutron flux 5000 n/cm^2.s.

With normality 6.25 N NaOH solution, the path detectors CR-39 were etched for 6h at temperature 60^{o}C, after 7 days irradiation time. An optical microscope with magnification 400X were used to record the track density [5].

Calculations

Uranium concentrations in herbal or medicinal samples were determined using the relation [5];

$Ux = Us\ \rho x/\rho s$

x and s subscripts represent the unknown and the standard, respectively;

U, is the content of uranium , ρx and ρs described the fission tracks density for both the unknown and standard samples respectively.

The mean value for annual effective dose, E_{ave} (mSv/y), of ^{238}U by medical plants ingestion which can be calculated by using equation below [6,7]:

$$E_{ave} = DCF_{ing} .R . A$$

DCF_{ing} which equal to 4.5×10^{-5} mSv Bq^{-1} and it belong to the factor odose convectionfor ingestion, of all radionuclide for an adult, the consumption by intake of naturally occurring radioactive materials in herbal samples denoted by R (kg/y) also A (Bq/kg) is the specific activity for the medicinal samples [8,9].

Results and discussion

In herbal (medicinal) samples the uranium concentrations was shown in Table- 2. It is clear that the highest value of uranium concentration was found in (Black Pepper and Cardamom samples) which is equal to 0.2 ppm, while the lowest value found in Thyme sample which is equal to 0.044 ppm with average value of 0.14 ±0.04 ppm.

Uranium concentrations are commonly expressed in parts per million by weight (ppm) or in terms of the "speci5c activity" expressed in becquerel per kilogram (Bq=kg). These units are related by the conversion factor for 238U: 37 Bq=kg=3:0 ppm [10].

Table 2- Uranium concentrations in herbal or medicinal samples

Samples Codes	Uranium Concentration ppm	Specific Activity Bq/kg
S1	0.08±0.008	0.99
S2	0.10±0.004	1.23
S3	0.14±0.002	1.73
S4	0.044±0.012	0.54
S5	0.13±0.012	1.6
S6	0.14±0.02	1.73
S7	0.2±0.03	2.47
S8	0.15±0.017	1.85
S9	0.2±0.03	2.47
S10	0.16±0.008	1.97
S11	0.15±0.009	1.85
S12	0.16±0.03	1.97
Average	0.14±0.04	1.7

The specific activity of uranium in herbal samples was calculated and presented in Table- 2. The specific activity of ^{238}U varied from 2.47 Bq/kg in (Black Pepper and Cardamom samples) to 0.54 Bq/kg in Thyme sample of mean amount of 1.7 Bq/kg.

The higher value for specific activity has been found in (Black Pepper and Cardamom samples), while the lower value was found in Thyme sample as shown in Figure-1.

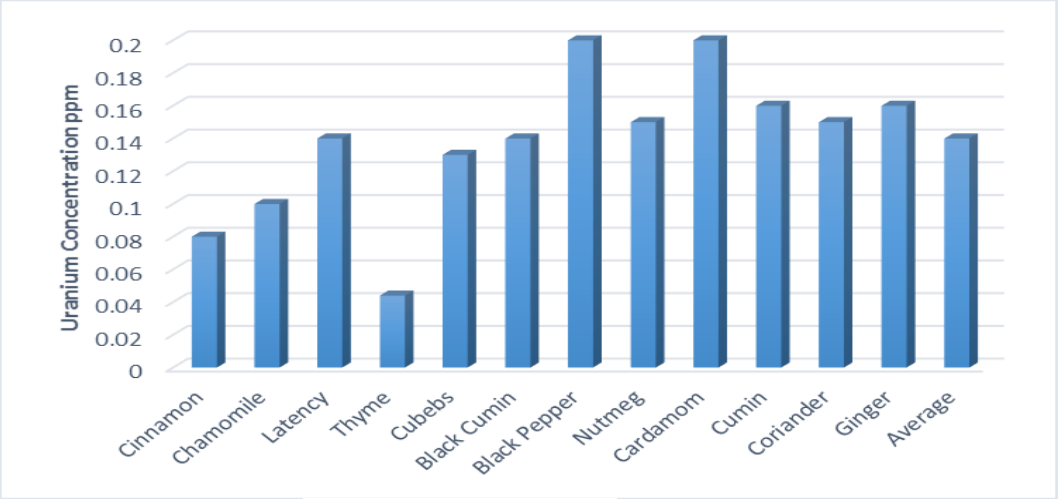

Figure 1- Uranium concentrations in herbal plants samples

The annual effective dose from herbal consumption by adults was shown in Table-3 and Figure-2, which notes that all amounts of dose for Annual Effective belong to every samples were lowest as compared with the value of permissible limit of 0.3 mSv/y recorded via ICRP [11,12].

Table 3- Annual Effective Dose in Herbal samples

Samples Codes	Annual Effective Dose $x10^{-5}$ mSv/y
S1	8.02
S2	9.96
S3	14.01
S4	4.37
S5	12.96
S6	14.01
S7	20.01
S8	14.99
S9	20.01
S10	15.96
S11	14.99
S12	15.96
Average	13.77

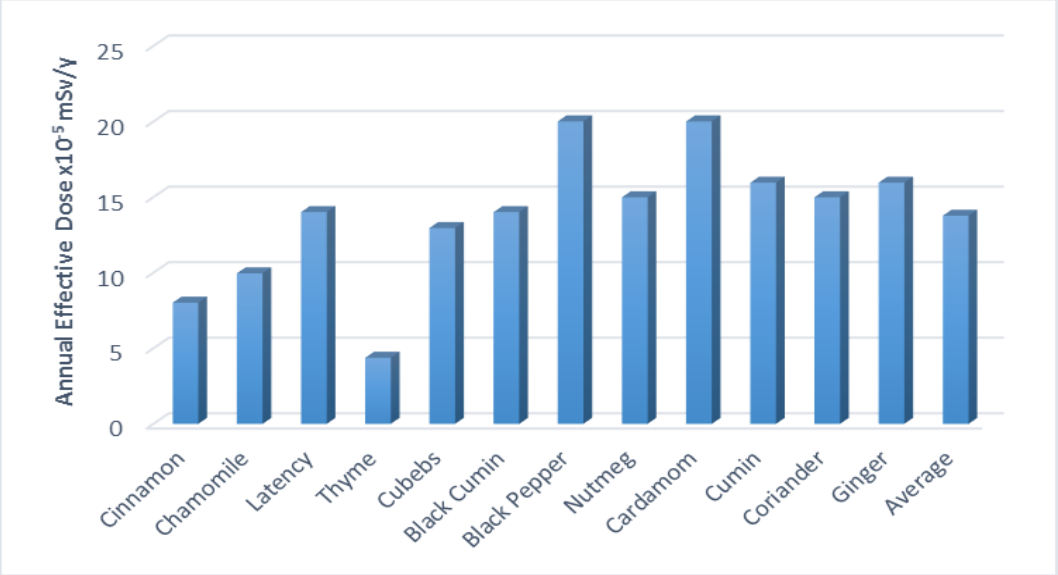

Figure 2- Annual Effective Dose in Herbal samples

Conclusions

Specific activity of ^{238}U natural radionuclide in all samples are lower than the worldwide median values (32Bq/kg) reported by UNSCEAR report .

Dose of annual effective belong to natural radionuclide ^{238}U ingestion by adults are lower than the recommended limit by ICRP .

The result shows low value of dose for annual cultivated effective relative to employ of the medical plants at Iraq.

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