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Estimation of Uranium Concentration in Urine Samples of Kidneys Failure Patients in Al- Muthanna Governorate

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Abstract

The measurement of uranium concentration in human urine is very important in assessment of occupational and public exposure to uranium. In the present work, the fission track technique was used to decide uranium concentration in blood of Kidneys Failure Patients in Al- Muthanna Governorate. The uranium concentration values in urine samples of Kidneys Failure Patients ranged between 0.92 $\mu g/L$ to 4.87 g/L , while Healthy group results were ranged 0.91 $\mu g/L$ to 1.82 $\mu g/L$. Results showed that the concentration of uranium in the URINE increases in kidney failure patients.

Keywords: Uranium concentrations, Urine samples, Fission Track technique.

1.Introduction

Uranium is a standout amongst the most genuine defilement concerns due to its radioactivity and substantial metal harmfulness. Uranium and its mixes are profoundly lethal, which is a danger to human wellbeing and environmental equalization [1]. Uranium is across the board in nature, and it exists as solid, liquid, and gaseous compounds. It promptly combines with different components to shape uranium oxide, silicates, carbonates, and hydroxides [2]. Natural U comprises of three radioactive isotopes with the accompanying relative isotopic bounties: (^{234}U (0.00515%), ^{235}U (0.71192%), and ^{238}U (99.282%).1 Regarding toxicity for people, the aerosol presentation pathway is basic for risk appraisal in which inward breath introduction to moderately insoluble U oxide particles represents a potentially long haul supply of inside alpha rot action that can cause cell harm [3]. Albeit variable amounts of either solvent or insoluble normal U are routinely ingested by utilization of nourishment and drink, little of this U is retained into the blood stream [4]. As indicated by the World Health Organization, around 98% of U entering the body by means of ingestion isn't consumed, however is wiped out by means of defecation [5]. The human body contains, by and large, roughly 90 µg of U from typical admissions of water, nourishment, and air.

Around 66% is found in the skeleton, 16% in the liver, 8% in the kidneys, and 10% in other tissues [6,7]. U excretion in feces and urine for non-uncovered subjects is commonly on the the order of some nanogram per day,7 yet it might depend on the dietary habits [8]. Solid-state nuclear track detectors (SSNTDs) are normally used to determine the uranium concentration in
human urine [9, 10]. The fission track technique was suggested by Fleischer et al. [11]. The aim of this study is to determine the uranium concentration in the urine of Kidneys Failure Patients in Al- Muthanna Governorate and the healthy group using CR-39 nuclear track detector.

2. Experimental method

The experimental technique for the investigation of uranium concentration is the same as reported elsewhere [9,10,12,13]. In this study, 26 urine samples of individual volunteers (21 patients and 5 healthy), male and female, were taken from Al- Muthanna Governorate. The volunteers had no past history occupational exposure presentation to ^{235}U. They finished an extensive poll about statistic data, for example, age and gender. In this research, we employed the natural exposure method for the measurement of uranium concentrations in the urine samples. Prior to the treatment, the samples were left for (28-30) days to achieve the equilibrium state for the radionuclides that exist in the samples. The natural exposure method includes exposing the detectors to the urine samples directly for a certain period of time. The detectors were immersed and stored in the urine samples of adequate amounts at room temperature. The exposure times were 4 weeks, and the experimental set up is shown in **Figure 1**. In this technique, the urine samples were irradiated with thermal neutrons from (Am-Be) neutron source for seven days so as to make inert harm to the detector due to ^{235}U (n, f) reaction. The total neutrons flounce was ($3 \times 10^5\ n\ cm^{-2}$).

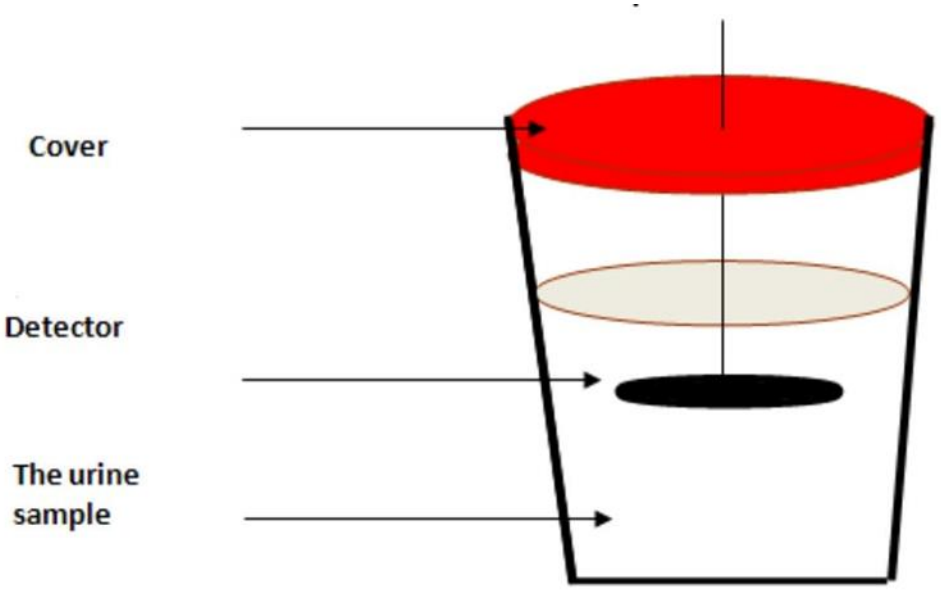

Figure 1. The apparatus of uranium estimation by using CR-39 detector for urine samples.

The process of irradiating samples was carried out in (Department of Physics, College of Education for Pure Sciences / Ibn Al-Haitham, Baghdad University, Baghdad, Iraq), The induced fission fragments were obtained according to the following (n, *f*) reaction:

$$^{235}_{92}U + \ ^{1}_{0}n \rightarrow ^{236}_{92}U^{*} \rightarrow ^{141}_{56}Br + ^{92}_{36}Kr + 3^{1}_{0}n$$

After the exposure period, all the detectors were etched in NaOH solution with 6.25 N at 60ºC for 4 hrs. The detectors were then washed in distilled water and were scanned under the optical microscope with magnification of 400×. The fission track densities were measured on surfaces showing uniform distribution of uranium.

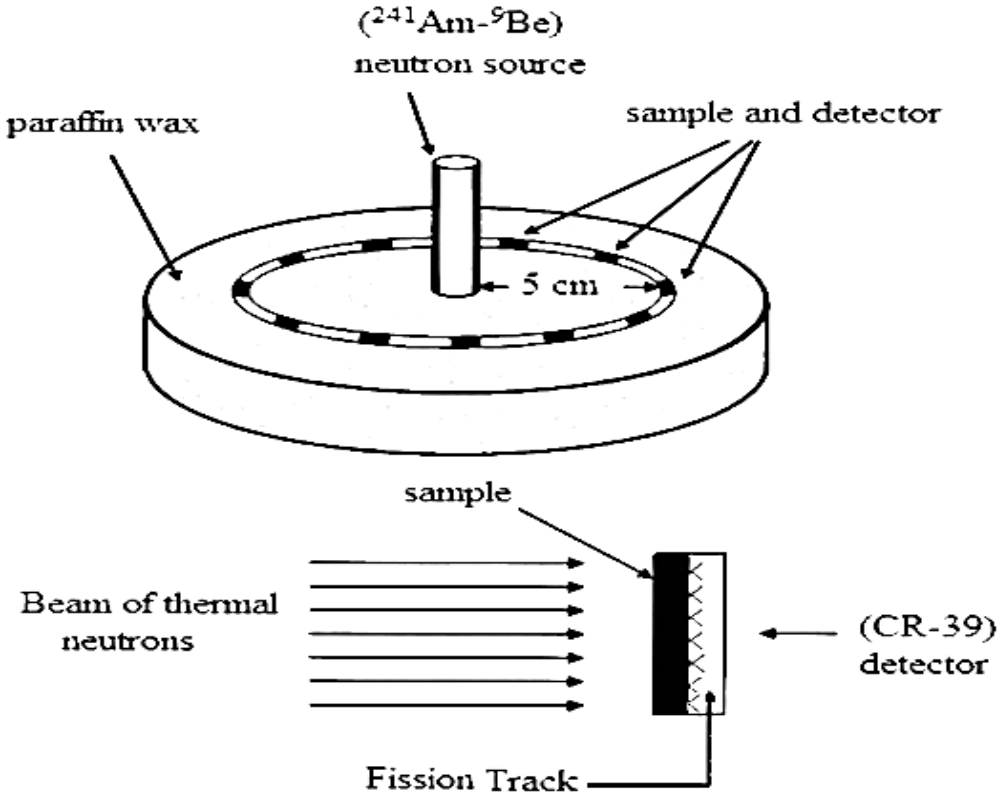

Figure 2. Irradiation of the detectors and urine samples by the neutron source [14].

3. Calculations of uranium concentrations

Uranium concentration in the urine samples was measured by comparison between track densities registered on the detector of blood samples and that of the standard samples by (Eq. 1) [15].

$$CX = CS \ . \ (\rho X / \rho S) \qquad (1)$$

Where ρX and ρs are the induced fission track density for unknown sample and standard sample in (tracks/mm2), Cx and Cs denote the uranium concentration for unknown sample and standard sample in (μg/L).

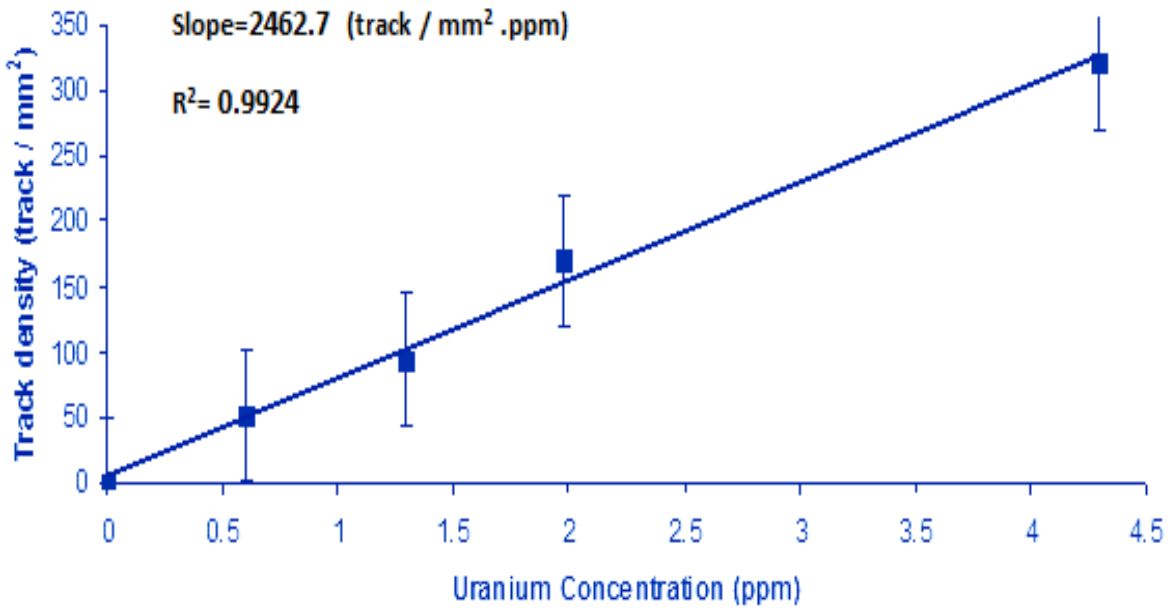

Figure 3. The relation between track density and uranium concentration in (μg/L) for standard samples.

4. Results and Dissection

Uranium concentrations in urine samples of individual volunteers in Al- Muthanna Governorate are summarized in **Table 1.** from this table the uranium concentration in urine samples of kidney Failure Patients ranged between 0.90 $\mu g/L$ to 3.44 $\mu g/L$, with the average value of uranium concentration was 1.90 $\mu g/L$.]. The uranium concentration in urine samples of healthy group ranged from 0.91 $\mu g/L$ to 1.82 $\mu g/L$, with the average value of uranium concentration was 1.16 $\mu g/L$. From the results obtained we notice that the concentration of uranium in urine samples for kidney Failure Patients are very high as compared with concentration of reference healthy people. The explanation for such outcomes can be credited to the way that in Al-Muthanna Governorate was the focal point of military exercises amid the Gulf Wars I and II, and the discarded weapons are as yet lying around in this locale. This shows the general population living in Al-Muthanna Governorate presented to the uranium levels higher than those living in different urban communities. The results obtained for healthy people were within the internationally tolerable limits when compared with the results of healthy group concentrations of uranium. Small quantities of heavy elements as well as actinides are absorbed by living organisms through the food chain. However, normal physiological functions of the body help in excreting all the surplus quantities of these elements.

Table 1. Range and average of uranium concentration (μg/L) in urine samples Kidneys Failure Patients in Al-Muthanna Governorate.

Sample code	Gender	Age year	Uranium concentration μg/L
S1	Female	48	2.2 ± 0.143
S2	Male	77	4.87 ± 0.382
S3	Female	48	2.81 ± 0.188
S4	Male	70	3.11 ± 0.422
S5	Female	48	2.81 ± 0.07
S6	Male	68	3.1 ± 0.204
S7	Female	46	1.94 ± 0.115
S8	Male	48	2.51 ± 0.208
S9	Female	45	2.21 ± 0.211
S10	Female	50	2.44 ± 0.205
S11	Male	67	3.11 ± 0.327
S12	Male	55	2.85 ± 0.251
S13	Female	50	2.8 ± 0.149
S14	Female	49	1.95 ± 0.073
S15	Female	70	3.12 ± 0.388
S16	Male	57	2.66 ± 0.296
S17	Female	62	2.64 ± 0.348
S18	Female	43	2.05 ± 0.109
S19	Female	47	1.93 ± 0.144
S20	Male	41	1.927 ± 0.245
S21	Female	19	0.92 ± 0.104

Table 2. Range and average of uranium concentration (μg/L) in urine samples Healthy group in Al- Muthanna Governorate.

Sample code	Gender	Age year	Uranium concentration μg/L
S1	female	29	0.91 ± 0.116
S2	female	32	1.1 ± 0.124
S3	male	51	1.82 ± 0.134
S4	male	41	1.204 ± 0.086
S5	male	33	0.93 ± 0.040

5. Conclusions

1. The uranium concentration in urine samples of kidneys failure patients' group were higher than the value from the healthy group.
2. The uranium concentration in the urine samples of the groups of study increased with increasing number of years age.
3. The average of uranium concentration for females for patients and healthy were higher than for males.
4. Results show that the uranium concentration in the urine of healthy group is close the allowed limit from ICRP agency (0.5 ug/l)

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