Journal of Natural Sciences Research
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.3, No.3, 2013

Measurement the Concentration of Alpha Emitters in the Urine In Vitro, Natural Exposure

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Abstract - This research describes the results that have been obtained from the alpha particles after carrying out the present study. The study was conducted on 60 urine samples taken from women, who were either infertile, had weak fertility. The age of those women ranged between (21-43) years. They further belonged to different locations in Iraqi Kurdistan region. The the main of track densety and concentration result obtained was 20.884 track mm^{-2} and 0.330 ppm in Sulaimania, and The the main of track density and concentration result obtained was 23.457 track mm^{-2} and 0.0.371ppm in Erbil which is near The higher concentration and the annual effective dose values were calculated for all women. Such a step was done by examining 20 ml of the women's urine samples.. The range of alpha particles in the surface of urine samples and CR-39NTDs was calculated using SRIM program. The average absorption of doses was 0.4754 $mSvy^{-1}$, which is lower than the normal level, 3-10 $mSvy^{-1}$l, reported by the ICRP. This denotes that there is no evidence of health problems.
Key words: infertility in women, Urine, Iraqi Kurdistan region , Alpha particles

1. Introduction

The parts of our environment are the radiation and radioactive materials. Such materials have been produced by many human activities. Today, the common and valuable tool in medicine is radiation though hazards of ionizing radiation usually come from certain levels of radiation. Radon is the most important source for natural radiation that affects human bodies, consider Figure 1 (Dua et al., 2011). The concentrations of radon are determined by measuring the emitted alpha particles. Which cause damage (latent track) in the surface of the detector (Pires et al., 2007). Solid state nuclear track detector (SSNTDs) is one of alpha particle detectors that is used to measure radon's progeny.

In the present work, the technique of SSNTDs has been utilized for examining the samples of urine (Akoto et al., 2011). A special type of this technique is CR-39 NTDs, this detector has many advantageous characteristics, like, good sensitivity, stability against various environmental factors, and high degree of optical clarity. Accordingly, the researchers opined using it (Pires et al., (2007).

The measurement of uranium can be done in different environments, such as (air, soil, water) and on different biological samples, such as (lichens, urine, blood)) Zhu et al., 2009). Inhalation, ingestion, or dermal absorption are facilities through which the radioactive materials can enter the body. Inhalation is the primary exposure mode for gaseous radionuclide's, as in radon. Because the half-life of radon is short, the measurement will be conducted in biological samples (Žunić et al**.,** 2009). Radon in human tissues is not detectable by adopting the routine medical testing. Testing such products is not generally and publically available (Tyburski et al., 2008). This process can be done by using the alpha particles detector, especially CR-39 NTD. Such a detector can be used in two different ways, the passive method (long term) and irradiation (short term) (Crawford et al., 2008).

Recently, scientists evidently stated certain pollutants in the environment may contribute at least to some cases of fertility problems in both males and females, because fertility issues are so prominent, it has become important to understand infertility, its causes and risk factors. The reproductive capacities of men and women are damaged by the environment radiation. It was suggested that urine sample detects radiation regardless of the percentage of its concentration. The CR-39 plastic detector and the long-tube (PVC) technique were used in this work, in order to measure the hazards of radon concentration in fresh urine. Many pieces of equipment were used to carried out this work. Moreover, the urine samples were collected from women that were of weak in fertility and that belonged to different locations in Iraqi Kurdistan region. These samples have been prepared in a suitable to be worked on under the supervision of the medical authority and institutions (Delanghea et al., 2000).

2. Materials and Research methodologies

2.1 *Materials*

- *Urine*

Urine is a liquid that is secreted by the kidneys through a process called urination. This process is very rich in nitrogen, and require elimination from the bloodstream. It represents the primary method for excreting water-

soluble chemicals from the body. The kidneys extract the soluble wastes from the bloodstream. If the blood contains a radiation, it filters in the kidneys. Accordingly, the urine contains the radiation after the process of filtration. The density values of urine varies between 1.003-1.035 gcm^{-3} (Wikipedia, 2009).

- *CR-39NTDs*

The CR-39 plastic track detector is a $C_{12}H_{18}O_7$ polymer with a density of 1.31 g cm^{-3}, which is Columbia Resin (Zhu et al., 2009). The detector used in the present study is the ideal detector; it is produced by the Intercast Europe SRL (43100 Parma, Italy), as it is shown in Figure 2. The rectangular piece of the NTD is 10×15×0.7 mm^3 in size. The efficiency of CR-39NTDs in the previous study was 79.5%. The Intercast CR-39 has a low background for a small etching process that can be used in radon dosimetry (SEK et al., 2006). The sensibility of CR-39 is such that it is physically able to register the low energy alphas. Its high degree of reproducibility from batch to batch ensures the correct determination of the background signal. The latter gives an accurate estimate of the actual radon concentration (Obed et al., 2011)

- *Tube technique (PVC)*

PVC tube is a plastic cylinder, made from PVC (Poly Vinyl Chloride). It is a cylinder that is 2mm thick, of 2.1cm diameter and 10.5 cm long. It has been used in this work to determine the absorbed dose in urine.

2.2 *Area under study*

The study area is shown in Figure 3 (Wikipedia, 2011), is located in the Northern part of Iraq including some location from two governorate of Kurdistan region (Erbil, Sulaymania). This study covered most parts of Iraqi Kurdistan and Kurdish provinces and the suburbs including Erbil, and Sulyamania. This region has cold atmosphere and is snow mountainous, and this part contains the uranium series and emit the alpha particles at the decay, and lives in there, a lot of women had problems in infertility. Iraqi Kurdistan is contain the three governorates comprise around 40,000 square and have a population of around 4 million. The areas under study were selected in this area

2. 3 *Research methodologies*

- *Samples collection*

Urine samples have been collected from the two selected governorate states in Iraqi Kurdistan. The sample consisted of 60 women, who have weak fertility, are infertile. The age of these women ranged between 21-43 years. An amount of 20 mL of urine has been obtained from each of the thirty women using clean plastic containers. The whole process was done in the hospital of Doctor Shahed Khaled in Koya. This hospital represents the medical authority in Kurdistan region in Iraq. Then, the collected samples have been brought to the research clinic at the end of the study to be labeled. Later, they were stored at 4 °C (Tsivouet et al., 2009), in the refrigerator of the hospital, particularly, as shown in Figure 3. The samples were collected on a daily basis and put in multiple. Then, each container was analyzed separately**.**

- *Sample preparations*

These samples have been weighted before being analyzed, each was 20 g /20 ml. Later, there were put in PVC containers of the volume 36.349 cm^3. Sample preparation was done after bringing the urine sample in ambient temperature (Agata, 2009). Urine was used in this work with 30 detectors of the type CR-39. The sizes of the detectors were 10×15×0.7 $mm^{3.}$ Then, the radon dosimeters were placed inside a PVC tube has 10.5 cm height and 1.05 cm radius. The detectors were immersed in the urine samples and hung inside the PVC tube. Then, the tubes that contained the urine samples with detectors were stored for 60 days in the fridge of the hospital. The purpose behind the storage was to ensure the samples reach an equilibrium state for the radionuclide's that exist in the samples.

- *Etching process and scanning process*

After completing the exposure time of 60 days, the detectors were removed from the PVC tube. All the dosimeters were collected at the end of the 2months exposure, etched chemically in a 6.25N NaOH solution at 70 ± 0.5 ◦C for 8 hours (Milenkovi, 2010). After then, the detectors were washed in distilled water. To determine the track density per cm^2, an optical microscope at 400X was used for scanning each detector (SAAD et al., 2010). Alpha emitters concentration in the urine samples was calculated using the formula in Ref.(Leghrouz et al., 2011) with using concentration of standard uranium(Shaima, 2009). According to this formula, The number of tracks per area was used to calculate the concentration level of the tested samples using the equation in Ref. (Leghrouz et al., 2011)

3. Results and discussion

Urine as part of an epidemiological Survey is used to determine public exposure to natural radiation and to estimate radionuclide level, in a high level back ground radiation, it is important to use urine to determine the extent of the public exposure to natural radiation. It further helps estimate the radionuclide levels in the highly radiated area of Kurdistan in Iraq, therefore, it is used in this study. The alpha concentrations were determined in 60 urine samples by using the CR-39 NTDs counting technique. It were noted that the maximum and minimum values of concentrations of alpha emitters in 20 ml of urine were 0.371 ppm in Sedokan(Erbil) and 0.259 ppm in Eiskan (Sulaymania), respectively, as shown in Tables 1, 2 and Figures 4, 5. Also the results showed that the concentration of alpha emitters varied from woman to another, depending on the extent to which women's bodies were allergic to the radiation, the age of women, the geological formation of the area being studied, and the exposure period.

Urine assay is the preferred method for monitoring alpha particles that emit into the human body from the radon decay and progeny. It is a valuable technique that helps evaluate the levels of alpha naturally in urine samples. The main of track density and concentration result obtained was 20.884 track mm^{-2} and o.330ppm in Sulaimania, and the main of track density and concentration result obtained was 23.457 track mm^{-2} and 0.0.371ppm in Erbil. The results in the Erbil city were higher than the results in sulaymania city depending on the geological formation of the area being studied,

When compared the results with the average result of alpha-emitters concentration in urine samples for painters female 1.179 ppm and 0.75ppm was found lower than them, therefore a matter of fact that indicated no health problems, however, it still represents a health risk that can be reduced (Salameh B., et al. 2011). Most health risks have come from the alpha particles that have been deposited in the body. Accordingly, it is highly recommended to keep the environment as secure and safe as possible. On the contrary, the high availability of uranium in some regions makes it a source of danger to the health of the public.

4. Conclusion

Most of the studied areas show a low alpha emitters concentration level in the area under study when compared with another study, therefore there is no health problems. Thus, these areas do not represent a source of danger to human life.

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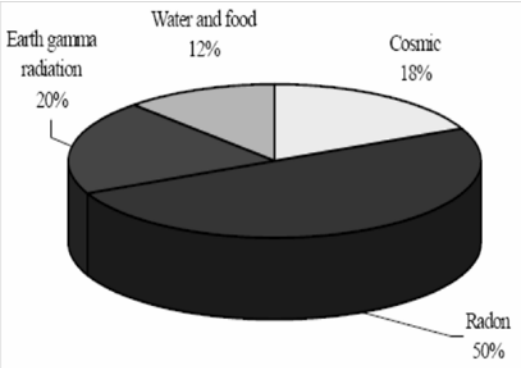

Figure 1 Radioactivity materials in environmental (Tyburski et al., 2008).

Figure 2 Map of Kurdistan Iraq- region under

Figure 3: Urine collected in this tube in hospital from women have weak in fertility

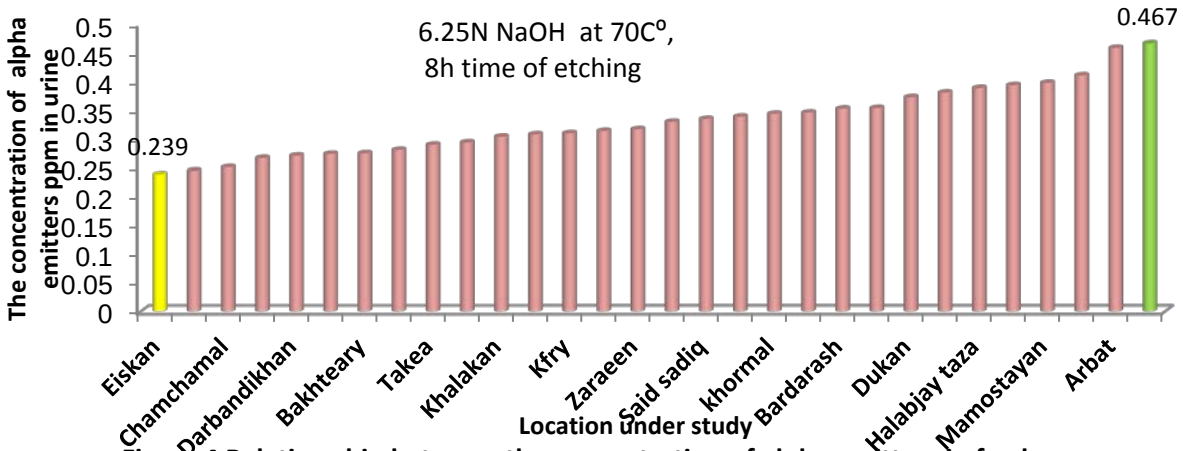

Figure 4 Relation ship between the concentration of alpha emitters in fresh urine for women and location under study by passive method in Sulaymania.

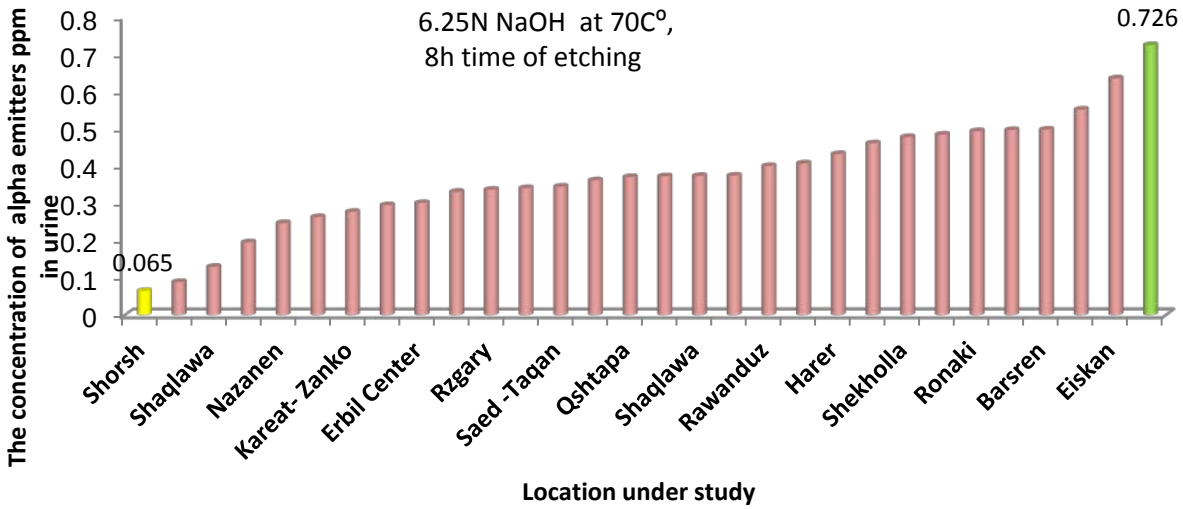

Figure 5 Relation ship between the concentration of alpha emitters in fresh urine for women and location under study by passive method in Erbil.

Table 1 valuation of concentration of alpha emitters in fresh urine for women in Sulaymania governorate in Iraqi Kurdistan region, by passive method

N.S.	Location	Age/ Years	Track density of alpha emitters track /mm^2	Con. (PPm)
1	Eiskan	22	15.302	0.239
2	Khurmal	26	15.520	0.245
3	Chamchamal	27	15.835	0.251
4	Shekhan	28	16.888	0.267
5	Darbandikhan	28	17.159	0.271
6	Rzgary	29	17.316	0.274
7	Bakhteary	30	17.373	0.275
8	Reaea	31	17.759	0.281
9	Takea	33	18.288	0.290
10	Kalar	33	18.602	0.294
11	Khalakan	34	19.216	0.304
12	Bazean	34	19.431	0.308
13	Kfry	35	19.588	0.310
14	Sharawany	36	19.873	0.314
15	Zaraeen	36	20.045	0.317
16	Toymalek	36	20.816	0.330
17	Said sadiq	36	21.173	0.335
18	Penjween	36	21.445	0.339
19	khormal	37	21.731	0.344
20	Zargata	39	21.831	0.346
21	Bardarash	38	22.316	0.353
22	Mawat	39	22.331	0.354
23	Dukan	39	23.616	0.373
24	Qaladza	39	24.102	0.381
25	Halabjay taza	40	24.573	0.389
26	Rania	40	24.873	0.394
27	Mamostayan	41	25.130	0.398
28	Sulaymania	41	25.931	0.411
29	Arbat	42	29.002	0.459
30	Halabjay kon	43	29.459	0.467
**			20.884	0.330

**=Mean

Table 2 Evaluation of alpha emitters concentration and radium concentration in fresh urine for Women in Erbil governorate in Iraqi Kurdistan region, by passive method

N.S.	Location	Age/ Years	Track density of alpha emitters track /mm^2	Con. PPm
31	Shorsh	21	4.281	0.065
32	Kas-Nazan	22	5.629	0.089
33	Shaqlawa	25	8.293	0.130
34	Salahadden	26	12.364	0.196
35	Nazanen	26	15.640	0.248
36	Holy- Zatd	27	16.657	0.264
37	Kareat- Zanko	27	17.546	0.278
38	Nawato dw	27	18.711	0.296
39	Erbil Center	28	19.062	0.302
40	Khalefan	28	20.950	0.332
41	Rzgary	29	21.321	0.338
42	Aeen-Kawa	29	21.599	0.342
43	Saed -Taqan	29	21.857	0.346
44	Sarsang	30	22.894	0.363
45	Qshtapa	31	23.449	0.372
46	Makhmur	31	23.578	0.374
47	Shaqlawa	32	23.634	0.375
48	Haji-Omaran	33	23.726	0.376
49	Rawanduz	34	25.225	0.400
50	Barzan	34	25.688	0.407
51	Harer	35	27.261	0.432
52	Taq-Taq	36	29.056	0.461
53	Shekholla	37	30.129	0.478
54	Prdea	38	30.622	0.485
55	Ronaki	28	31.147	0.494
56	Koya	38	31.332	0.497
57	Barsren	40	31.406	0.498
58	Deana	41	34.829	0.552
59	Eiskan	42	40.084	0.636
60	Sedakan	42	45.766	0.726
**			23.457	0.371

**=Mean

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