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The concentration of uranium in soil samples in the center region Omara Governorate was tested using the CR-39 detector

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Abstract The uranium content of soil samples taken from various residential, industrial, and agricultural sectors in southern Iraq's center Omara governorate was determined using the method of neutron activated technology for solid-state nuclear track detectors CR-39. . The results indicated that uranium contents in soil samples ranged between 0.65 and 6.42 ppm. Soil samples were gathered to a depth of 10 cm. When compared to publicly available data, the results were found to be within tolerable boundaries.

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Keywords: *Uranium content, Soil samples, CR-39 detectors, Environmental hazards*.

1. INTRODUCTION

An lustrous, silvery metal with a long half-life, uranium is a naturally occurring radionuclide. Uranium is the heaviest element in the universe. It is one of the largest environmental hazards due to its radioactivity. Uranium and its compounds pose a threat to human health and the environment due to their severe toxicity [1-3]. Common elements can exist in solid, liquid, or gaseous states, such as uranium. Food, water, soil, rocks, natural materials, and the surrounding environment can all contain it. When uranium interacts with other elements, uranium oxide, silicates, hydroxides, and carbonates are easily generated [2,4]. The physiological impact of uranium compounds is dependent on their solubility. Soluble uranium has controlled chemical toxicity, whereas its less soluble counterpart has unregulated radioactive properties. However, because of its long retention duration in human tissues and delayed absorption via the lungs, it will cause the most radioactive harm to internal organs through cancer mortality risk, rather than offering a serious chemical risk to the kidneys [6]. The human body may absorb uranium through a variety of pathways. It either directly affects the human body by ingestion of uranium-contaminated water or inhalation of dust particles, or it indirectly affects the body through the food chain from the fertile soil layer [1,7]. A CR-39 detector performs better when searching for uranium trace quantities in biological and geological materials [1, 2, 8]. Scientists looked at the quantity of uranium in soil samples because of the importance of the problem and its effects on humans and the ecosystem [9–12]. This study uses neutron activated techniques for the nuclear tract sensors CR-39 to assess the uranium content of selected soil samples collected from various residential, industrial, and agricultural sectors in the central Omara governorate in southern Iraq. This study was conducted in the governorate of center Omara since there had been no previous research on the issue and no database on uranium contents in soil samples had been established.

2. MATERIAL AND PROCEDURE

2.1. The collecting of samples

For this investigation, 30 soil samples were obtained from 30 different places in southern Iraq's central Omara governorate (see Fig. 1). Earth samples were gathered from a depth of 10 cm. Table 1 depicts the research areas, which included zones for residential, agricultural, and industrial use. After cleaning 30 soil samples and removing stones, pebbles, and root pieces, the quantity required for the fission-track analysis technique was determined. The samples were stored in polypropylene containers labeled with sample codes.

2.2. Experimental method:

To determine the uranium content in soil samples, a solid state nuclear track detector (CR-39, Pershore Moulding Ltd, UK) was used. After six hours of drying at 70°C in an electric oven, the soil samples were crushed into a fine powder with a grinder. The binder consisted of 0.5 g of powdered soil and 0.1 g of methylcellulose. A 1.5 mm thick, 1 cm diameter manual piston

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was employed to compress the mixture into a pellet. Both sides of the pellets are covered with a CR-39 track detector (1.5*1.5 cm). To cause latent damage to the detector owing to the 235U reaction (n,f), the pellets were irradiated for 7 days in a paraffin wax dish at a distance of 5 cm from the neutron source (Am-Be) with a thermal flounce of (3.024105 n.cm-2.s-1). After radiation exposure, the detectors were subjected to controlled chemical etching in (NaOH) solution, as previously stated [1,13]. The density of induced fission tracks was assessed using an optical microscope at 400 magnification, and the traces were visible using an optical camera. Equation 1 shows that the density of fission tracks (ρ) was determined by dividing the average tracks by the field view area. Track density

$$(\rho\times) = \text{average of track / area of field view} \quad \ldots(1)$$

2.3. Calculation :

The uranium content of the soil samples was measured by comparing track densities observed on the detector of the soil samples to those found on the detector of the reference samples using the previously described equation [1,2].

$$Cx = Cs\ \rho x / \rho s \quad \ldots.(2)$$

where Cx and CS are the uranium concentrations (ppm) for the unknown and standard samples, and x and x are the induced fission track densities (tracks/mm2) for the unclear and standard samples, respectively.

***Figure1**:shows the locations where samples were obtained in the Center Omara Governorate*

***Table 1**: Using SSNTDs to measure uranium concentrations in soil samples from the Central Omara Governorate areas.*

Sites numbers	Sites	Tracks density(tracks/mm^2)	Uranium Concentration in ppm
S1	Hay Alsalam 1	300	0.72 ±0.36
S2	Hay Alsalam 2	371	0.9 ± 0.40
S3	Hay Alsalam 3	857	2.08 ±0.59
S4	Hay Alsalam 4	271	0.65±0.29
S5	Hay Alsalam 5	514	1.25 ± 0.47
S6	Hay Alsalam 6	400	0.97 ±0.45
S7	Hay Alsalam 7	400	0.97 ± 0.45
S8	Hay Alsalam 8	386	0.93±0.39
S9	Hay Alsalam 9	357	0.86 ± 0.48
S10	Hay Alsalam 10	343	0.83 ±0.41
S11	Hay Alnahawand 1	414	1.0 ±0.21
S12	Hay Alnahawand 2	357	0.86 ±0.48
S13	Hay Alnahawand 3	329	0.8 ±0.33
S14	Hay Alnahawand 4	342	0.83±0.41

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S15	Hay Alnahawand 5	357	0.86 ±0.48
S16	**Maysan gas plant1**	**314**	**0.76±0.28**
S17	**Maysan gas plant2**	285	0.69±0.20
S18	**Maysan gas plant3**	328	0.79±0.32
S19	**Maysan gas plant4**	342	0.83±0.41
S20	**Maysan gas plant5**	528	1.28 ±0.40
S21	**Maysan gas plant6**	371	0.9±0.40
S22	Maysan plastic factory1	357	0.86±0.48
S23	Maysan plastic factory2	528	1.28±0.40
S24	Maysan plastic factory3	328	0.79±0.32
S25	Maysan plastic factory4	385	0.93±0.38
S26	Nahawand Althaletha 1	285	0.69±0.20
S27	Nahawand Althaletha 2	314	0.76 ±0.28
S28	Nahawand Althaletha 3	414	1 ± 0.21
S29	Nahawand Althaletha 4	385	0.93 ± 0.38
S30	Nahawand Althaletha 5	342	0.83±0.41

3. DISCUSSION

Table 1 summarizes the analytical results acquired from the soil samples used in this investigation. The highest uranium value in a surface soil sample was 2.08 ppm in sample S3 from Hay Alsalam 3 , while the lowest was 0.65 ppm in sample S4 from Hay Alsalam 4. Uranium concentrations in soil samples taken from the ground surface. The mean uranium concentration in surface soil samples from the Center Omara governorate is less than the allowed limits stipulated by [14]. The findings indicate when soil depth expands, the amount of uranium in the soil decreases. These impacts can be linked to erosion and the loss of dirt's outer layers. The highest level of radioactivity is measured at the soil surface in the first few months following contamination, when winds and rains can remove up to 90% of the radioactive element [15]. In addition to the chemical content of Iraqi soil, which is very rich in calcium carbonate, iron oxides, and aluminum, the interaction of these components with the soil's solid component exposes the soil's propensity to store radioactive pollutants and limit their movement. Figure 2 depicts the average uranium concentration of center Omara governorate soil samples according to location.

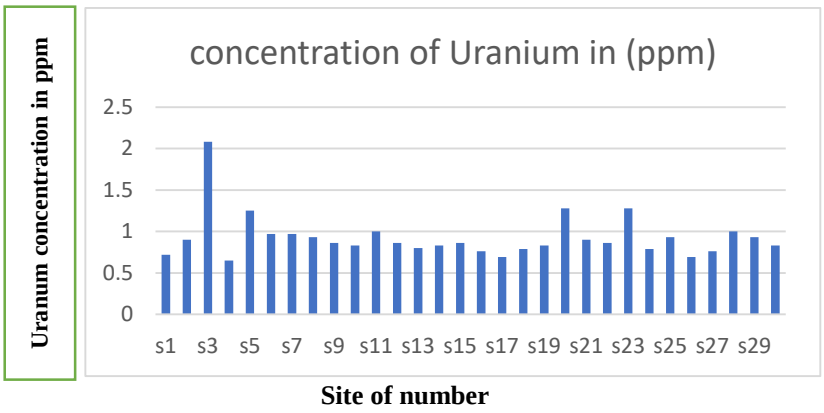

Figure 2 *depicts the average uranium concentration in soil samples as a function of geographical location.*

4. CONCLUSION:

The uranium content of soil samples was determined using solid-state nuclear track detectors (SSNTDs). The findings of this study revealed that uranium concentrations rise faster in industrial locations than in residential areas, although the results were within the norm so do not cause worry at this time.

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