

Determination of alpha particles concentrations in soil Samples taken from area situated in Anbar governorate by using nuclear track detector (CR-39)

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*Department of Physics, College of Education, Al-Mustansiriyah University

**Department of Physics, College of Science, University of diyala

Abstract

The aim of the present work is to determine the alpha particle concentration in soil samples emitted from the radioactive elements (radio nuclides) (U-238,Th-232,Ra-226 and Po-218) in soil samples by using nuclear track detector (CR-39) from area situated in Anbar governorate (Ameria-AL-Falluja,AL-Falluja,AL-Garma,Rawa,AL-Habania,AL-Saqlawia).

The results obtained have shown that the highest average alpha particle concentration in soil samples was found in Ameria-AL-Falluja region which was (4.79 ppm), while the lowest average alpha particle concentration was found in AL-Saqlawia region which was (1.26 ppm) .

Keywords: alpha particle concentration, soil samples, nuclear track detector (CR-39).

حساب تراكيز مطلقات الفا في نماذج التربة لمناطق مختلفة من محافظة الانبار باستخدام كاشف الأثر النووي (CR-39)

, فاطمة اسماعيل عباس*, محمد حميد عبد الله**, * , عيد محمد مناور محمود سالم كريم*
*قسم الفيزياء ، كلية التربية ، الجامعة المستنصرية
**قسم الفيزياء ، كلية العلوم ، جامعة ديالى

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الخلاصة

الهدف من البحث الحالي هو حساب تركيز مطلقات ألفا في نماذج التربة باستخدام تقنية عد آثار جسيمات ألفا المنبعثة من نماذج التربة للعناصر المشعة (النوى المشعة) (Po-218,Ra-226,Th-232,U-238) باستخدام كاشف الأثر النووي (CR-39) ولمناطق مختلفة من محافظة الانبار وهي (عامرية الفلوجة, الفلوجة, الكرمة, راوة, الحبانية, الصقلاوية). وقد أوضحت النتائج التي حصلنا عليها أن أعلى معدل لتركيز مطلقات ألفا في التربة في منطقة عامرية الفلوجة حيث بلغت (4.79 ppm) , بينما اقل معدل لتركيز مطلقات ألفا في التربة كان في منطقة الصقلاوية (1.26 ppm). الكلمات المفتاحية: مطلقات الفا, نماذج التربة, تقنية عد آثار جسيمة الفا.

Introduction

The radioactive elements emits ionizing radiation like alpha particles (α), beta particles (β) and gamma rays (γ), and its well known that all these types of ionizing radiation have a biological effects on the living system.

Alpha particles will travel only about (30 μ m) in soft tissue and, therefore, are unable to penetrate paper, glass, or even dead superficial layer of skin. Beta particles have greater ability to penetrate the skin. In contrast, γ -rays is extremely penetrating. As such, a γ -ray presents a hazard both internally and externally.

Radioactive elements emits alpha particles, which in direct physical contact, the insoluble parts of these particles enters the body of an exposed person, will stay there and consequently ionize the body organ and the tissue surrounding it and causing different types of cancer [1].

The health effects of alpha particles depend heavily upon how exposure takes place. External exposure is of far less concern than internal exposure, because alpha particles lack the penetration power of the outer dead layer of skin; However, if alpha emitters have been inhaled, ingested (swallowed) or absorbed into the blood stream, sensitive living tissue can be exposed to alpha radiation. The result of biological damage increases the risk of cancer in particular, alpha radiation is known to cause lung cancer in humans when alpha emitters are inhaled [2].

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The aim of the present work is to determine the alpha particles concentration in soil samples for selected regions in Anbar governorate by using alpha-emitters registrations in (CR-39) nuclear track detector.

Experimental Part

The determination of the concentration of alpha particles emitted from (U-238,Th-232,Ra-226 and Po-218) nuclei in soil samples by using the nuclear track detector (CR-39) of thickness of about (250 μm) and area of about ($1 \times 1 \text{ cm}^2$).

The soil samples were collected from different sites in Anbar governorate from depth (5 cm), and then were dried and cleaned from the doping grinds by using special sieve (0.27 mm in diameter). The soil samples of (0.5 g) weight were pressed in to a pellet of (1cm) diameter and (1mm) thickness, the soil samples were covered with (CR-39) track detector as shown Fig. (1).

After the radiation time (one month), the (CR-39) track detectors were etched in (6.25 N) (NaOH) solution at temperature of (60 $^{\circ}\text{C}$) for (6 h) [3], and the tracks density were recorded using an optical microscope with magnification (400x). The density of the tracks density (ρ) in the samples were calculated according to the following relation [4].

$$\text{Track density } (\rho) = \frac{\text{Average number of total pits (tracks)}}{\text{Area of field view}} \quad \dots\dots(1)$$

The alpha particles concentration in the soil samples were measured by the comparison between track densities registred on the detectors of the sample pellet and that of the standard soil sample pellets from the following relation as shown Fig. (2) [5].

$$C_x = \rho_x \cdot (C_s / \rho_s) \quad \dots\dots\dots (2)$$

Where : C_x : alpha particles concentration in the unknown sample (ppm).

C_s : alpha particles concentration in the standard sample (ppm).

ρ_x : track density of the unknown sample (track/ mm^2).

ρ_s : track density of the standard sample (track/ mm^2).

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Results and Discussion

The results obtained for the concentration of alpha particles emitted from the radioactive elements (radionuclides) (U-238,Th-232,Ra-226,Po-218) in soil samples by using nuclear track detectors (CR-39).

Table (1) present alpha particle concentration for soil sample in different sites in Anbar governorate in regions (Ameria -AL-Falluja , AL-Falluja,AL-Garma, Rawa, AL-Habania ,AL-Saqlawia) we show that ,the highest average alpha particles concentration in soil samples was found in Ameria-AL-Falluja region which was (4.79 ppm), while the lowest average alpha particles concentration was found in AL-Saqlawia region which was (1.26 ppm) as shown Fig. (3).

The present results show that the alpha particles concentration in soil samples in regions Ameria-AL-Falluja and AL-Falluja are (4.79 ppm)and (4.44 ppm) respectively and that is more then the allowed limit from ((ICRP) agency which is (3 ppm) [6], while the regions (AL-Garma, Rawa, AL-Habania ,AL-Saqlawia) is below allowed limit of (ICRP).

Conclusions

From the present work, it can be concluded that the highest average alpha particles concentration in soil samples was found in Ameria-AL-Falluja region which was (4.79 ppm), while the lowest average alpha particles concentration was found in AL-Saqlawia region which was (1.26 ppm) .

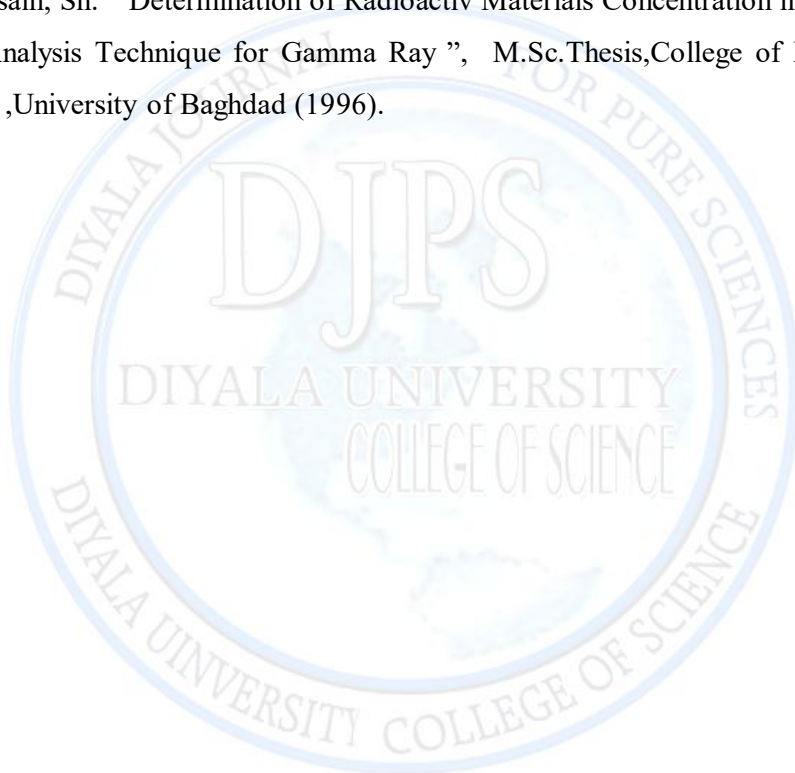
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Table (1) show the Alpha particle concentration for soil samples in Anbar governorate.

Region		Samples					Mean
		1	2	3	4	5	
Ameria- AL-Falluja	Track density Alpha particle	5.7	5.07	4.92	4.64	3.66	4.79
	Concentration (ppm) (Track .mm ⁻²)	81	72	70	66	52	68.2
AL-Falluja	Track density Alpha particle	6.47	5.7	4.64	3.45	1.97	4.44
	Concentration (ppm) (Track .mm ⁻²)	92	81	66	49	28	63.2
AL-Garma	Track density Alpha particle	4.29	3.3	2.81	2.25	1.19	2.76
	Concentration (ppm) (Track .mm ⁻²)	61	47	40	32	17	39.4
Rawa	Track density Alpha particle	4.29	3.02	2.32	1.19	0.63	2.29
	Concentration (ppm) (Track .mm ⁻²)	61	43	33	17	9	32.6
AL-Habania	Track density Alpha particle	2.8	2.3	1.61	0.98	0.7	1.67
	Concentration (ppm) (Track .mm ⁻²)	40	33	23	14	10	24
AL-Saqlawia	Track density Alpha particle	2.25	1.69	1.12	0.77	0.49	1.26
	Concentration (ppm) (Track .mm ⁻²)	32	24	16	11	7	18

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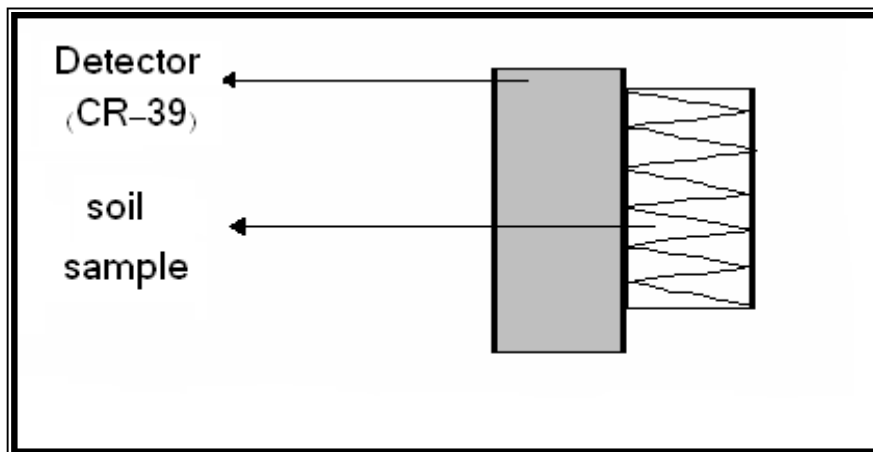


Fig. (1) Radiation of the detector by soil sample.

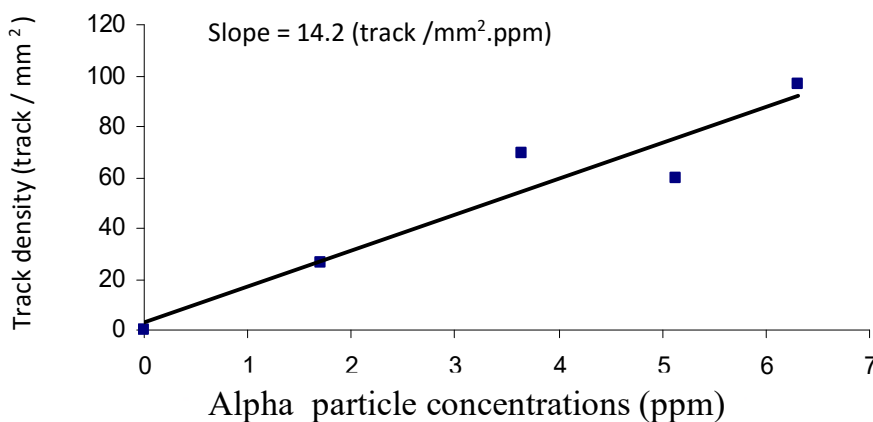


Fig. (2)The relation of alpha particle concentrations and track density in the standard samples.

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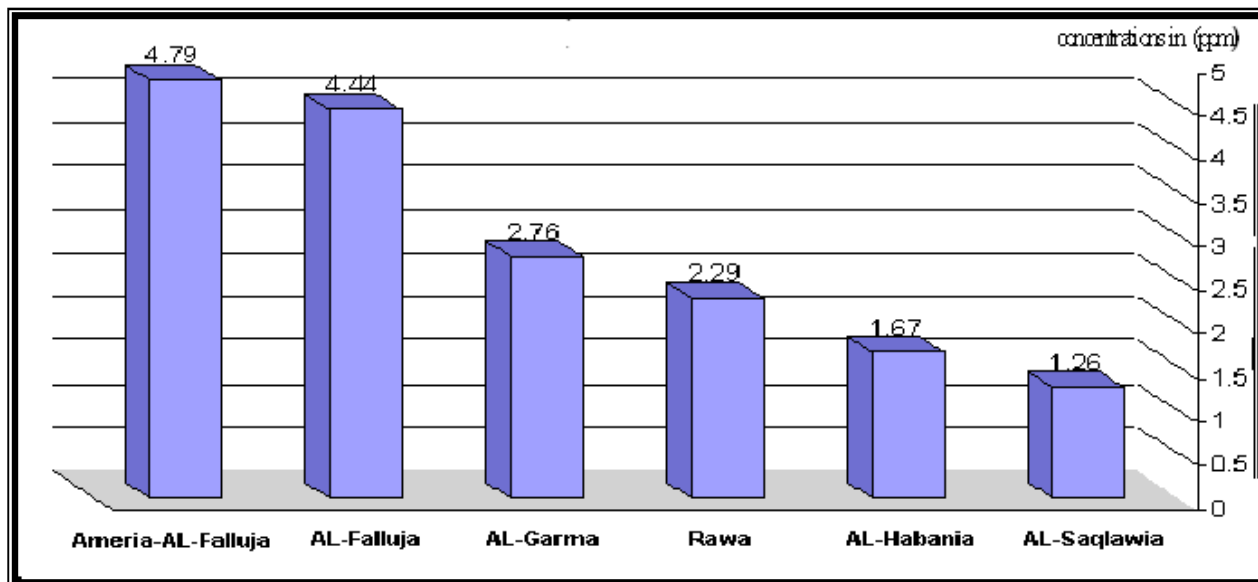


Fig. (3) Alpha particle concentrations for soil samples in regions studied.

