Measurement of Radon-222 Concentration in Soil Samples of some Regions in AL-Ansar Historical District in The Southern of AL-najf city Using Nuclear Track Detector CR-39

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الخلاصة

تم في هذه البحث قياس تراكيز غاز الرادون لاربعة وخمسون عينة ترابية من حي الانصار التاريخي الواقع الى الجنوب من مدينه النجف الاشرف وتم ايجاد تراكيز الرادون Rn^{222}عن طريق تسجيلِ اثار بواعث ألفا المنبعثة من غاز الرادون (Rn^{222}) في كاشِف الأثر النووي (CR-39).

تم تحديد التراكيز بالحسابات المعتمدة على المقارنة مع العينات القياسية، ومن خلال النتائج المستحصلة وجدنا ان تراكيز الرادون في نماذج الترب للمحلة الاولى بين ($56.2\text{-}758 Bq/m^3$) وللمحلة الثانية بين ($66.7\text{-}660 Bq/m^3$)وللمحلة الثالثة بين ($106.6\text{-}758.6 Bq/m^3$) , ويتضحُ من خلال النتائج انَّ تركيز غاز الرادون في هذا الحي عالية نسبياً مقارنة مع الحدود المسموحة بها والمقدرة مابين ($200\text{-}800 Bq/m^3$) اذ نلاحظ تسجيل عدد من الامراض السرطانية المختلفة كسرطان الرئة والغدد اللمفاوية والكبد والقولون وسرطان الثدي عند النساء لذا يجب معالجة هذه التربة .

ABSTRACT

In this study, concentrations of radon were measured for fifty four samples of soil from AL-Ansar historical district in the southern of al-najf The radon concentrations in soil samples measured by using alpha-emitters registration that emits from radon (^{222}Rn) in (*CR-39)* track detector.

The concentrations values were calculated by a comparison with standard samples. The results shows that the radon concentrations in first section varies from(56.2-758 Bq/m^3), second section (66.7-660Bq/m^3), third section (758.6-106.6Bq/m^3) we notice from the results radon concentration is above the normal value which around (200-800Bq/m^3) we noticed a bear different diseases such us a blood cancer and breast cancer in the women and we must treaded this soil.

INTRODUCTION

Radon (^{222}Rn)is a radioactive gas with a half-life 3.823d that is an element of the periodic table and falls within the noble group elements (Helium, Neon and Xenon, etc.). It is difficult to detect radon because it's a colourless and odorless gas. Its Atomic number is (86), boiling point (-61.8 ^{o}C), freezing point (-71.0 ^{o}C) and density (9.73 $Kg.m^{-3}$), and it is produced by the decay of the natural radioactive uranium series, which starts with uranium (^{238}U)[1].

Uranium is a very widely distributed element in the earth's crust, is presented naturally everywhere in soil, sand and rock in various concentration from one plac to an other. Radon can be considered to be one of the most dangerous radioactive elements in the environment [2]. Its character as a noble gas allows it to spread through the atmosphere. The greatest fraction of natural radiation exposure in humans result from inhalation indoor and work places of the decay products of radon.[3]

Radon gas can diffuse or be transported to some distance through fissures in the rock structure and find its way into the soil and surrounding material. Therefore, radon measurement is the most promising method for detecting uranium deposits.

A Can technique which used in this study based on the registration of alpha tracks from ^{222}Rn on alpha sensitive track detector that was developed for uranium or radon exploration. The detector is exposed to the soil gas to know length of time. The ^{222}Rn alpha tracks are registered on the detector. The alpha track density gives a measure of ^{222}Rn concentration in the soil. As it is a very simple technique, it can be implemented easily for field studies, since they do not require electronic system [4].

MATERIALS AND METHODS

1- Collection of soil samples

Samples of soil were taken from locations of study for fifty four samples of soil from AL-Ansar historical district in the southern of al-najf city which contain three sections ,at the first section 120 which consider the biggest section which have ninety six lane, then section 122 also have seventy fife lane, and finally section 124 which have eighty lane, both sections 122&124 towards the airport street which have around fifty to seventy house except section 120 which have around hundred house towards Abu sacker street ,the samples divided to the sections section 120 take twenty samples distributed to the lanes and the sections 122&124 take seventeen samples distributed to the lanes , the samples taken from depth (10-15 cm). Then the samples were dried, cleaned and milled by using special sieve (350 μm in diameter)[5].

2- Irradiation of the detectors.

Each sample of soil was taken with the weight (10g) and placed in plastic can. The dimensions of the can minimize the effect of thoron gas. Pieces of (CR-39) track detectors (1× 1 cm area) were fixed under the cover of plastic can, which contain the soil samples. The exposure time was (21 days), as shown in Fig. (1)[6,7].

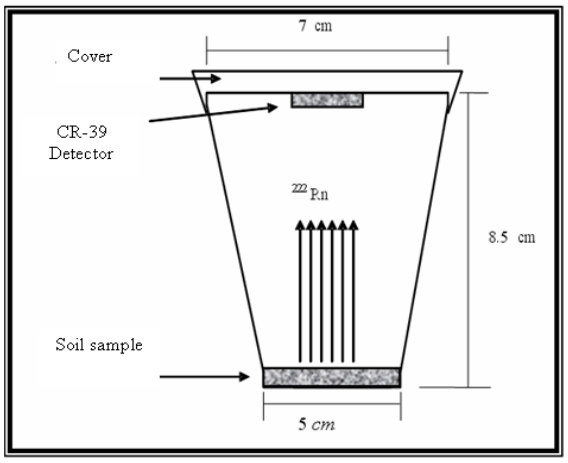


Figure -1: Radon gas (^{222}Rn) estimation by using (CR-39) detector for soil sample.

3- Chemical etching and microscopic scanning

After the exposure time, the detectors were etched in a 6,25 N aqueous solution of NaOH maintained at 60 ˚C in a water bath for 6hrs, which was the normal employed etching time[8][9]. The detectors were then taken out from the etching, rinsed with distilled water and dried in air. The track density was recorded using an optical microscope with (400x.

The density of the tracks (ρ) in the detectors was calculated according to the following relation:

$$(\rho_x) = \frac{N_{ave}}{A}$$

Where ;

ρ: Track density(track /mm^2)

N: Average of total tracks.

A: Area of field view.(mm^2)

4- Radon concentration

Radon gas (^{222}Rn) concentration in the soil samples was measured by making a comparison between track densities registered on the detectors of the sample and that of the standard geological sample, from the relation**:**

$$\frac{C_X}{\rho_X} = \frac{C_S}{\rho_S}$$

Where

C_S, C_X: radon exposure (Bq/m^3) for standard and sample respectively.

ρ_S, ρ_X: track density (Trtack/mm^2) for standard and sample respectively.

And $C_X = C_S \frac{\rho_X}{\rho_S}$

Figure (2) Shows this relation, when (slope = ρ_S/ C_S) =0.02

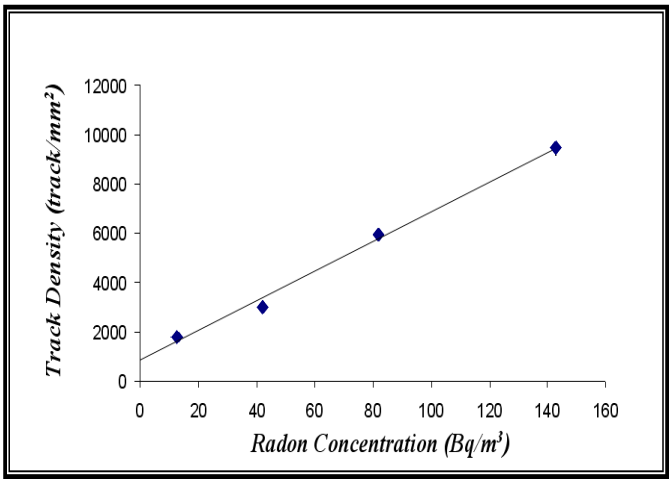


Figure -2:The relation between track density and radon concentration for standard geological soil samples.

RESULTS AND DISCUSSION

Table (1) shows the radon concentration in soil samples for three sections, The radon level in each location was abnormal and varies from (56.2.-758.Bq/m^3) for first section, (66.7.-660.Bq/m^3) for second section, (758.6.-106.6Bq/m^3) for third section concentration in, As a conclusion of the study Radon concentration in this district is relatively higher than the normal level,

Figure (3) shows the concentration of radon in the study areas where there was a marked difference between the soil samples due to difference in the composition of the area and its beside industrial district and the international airport and its may be to be exposed to damage from continuous military operations from the last wars.

In conclusion, we found that the radon levels in soil of this district are high with the internationally acceptable values (800 Bq/m^3) [10].

Section 120	*Radon concentration (Bq/m3)*	*Section 122*	*Radon concentration Bq/m³) (*	*Section 124*	*Radon concentration (Bq/m³)*
L2	300	*L1*	425.8	*L4*	375.9
L6	327	*L6*	256.1	*L9*	175.7
L13	758	*L10*	156.2	*L13*	106.6
L20	520	*L15*	309.7	*L18*	480.7
L25	227.6	*L20*	66.7	*L22*	356.6
L28	259.2	*L25*	606.8	*L29*	206.7
L32	420.8	*L30*	660.7	*L33*	356.2
L37	106.5	*L35*	406.1	*L38*	490.7
L40	477.5	*L40*	567.9	*L43*	758.6
L45	477.5	*L45*	545	*L47*	452.6
L48	615.7	*L50*	488.2	*L52*	199.3
L52	208.5	*L55*	256.8	*L59*	175.8
L60	606	*L60*	156.2	*L65*	115.8
L68	575.8	*L65*	107.7	*L71*	360
L72	410.5	*L70*	96.5	*L78*	445.7
L80	656.2	*L73*	321.6	*L80*	230.8
L85	556.1	*L78*	357.2	*L85*	210.4
L92	285.9		Average= 5.784.5		Average=5.338.1
L95	56.2				
L98	376.5				
	Average =7.744.1				

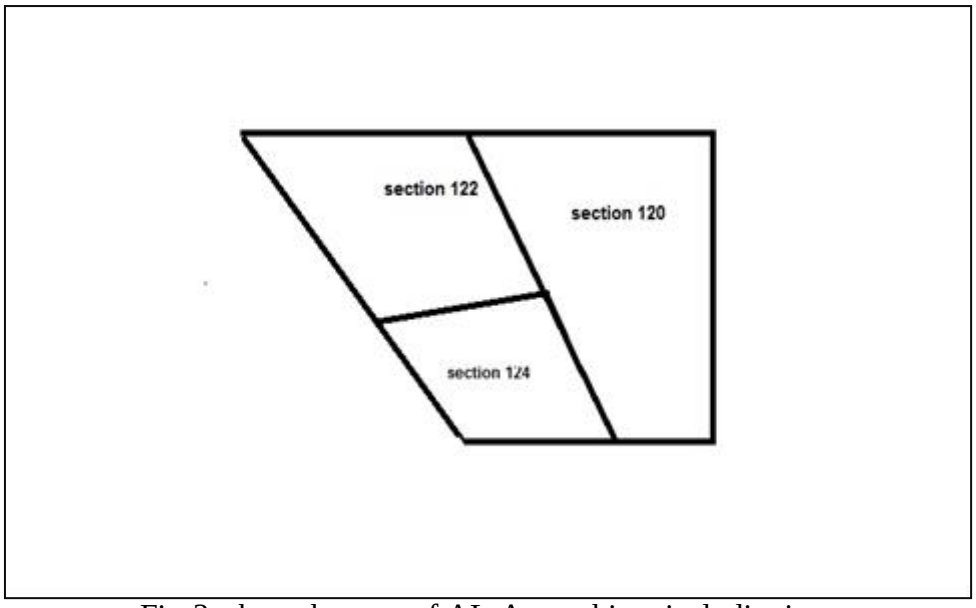


Fig-3: show the map of AL-Ansar historical district

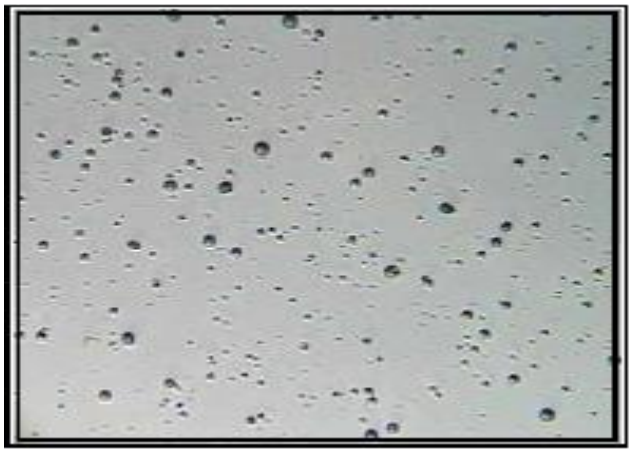
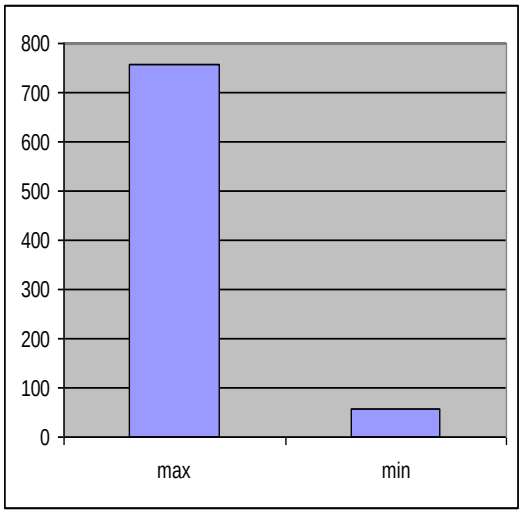
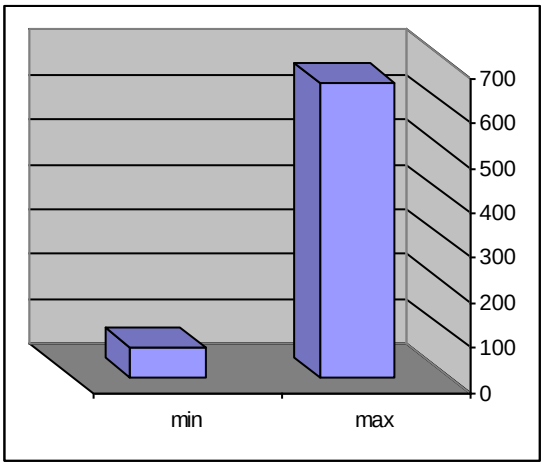


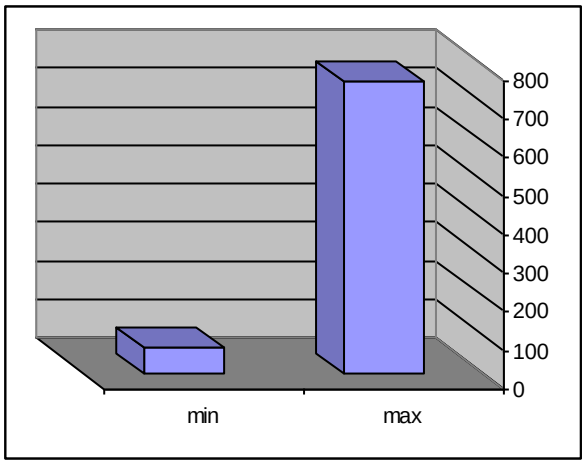
Fig -4- show the tracks of alpha particle in the detector CR-39



(A)



(B)



(C)

Fig -5:(A,B,C): show the compration between the maximum value and minimum value of Radon concentration for the three sections which have different lane .

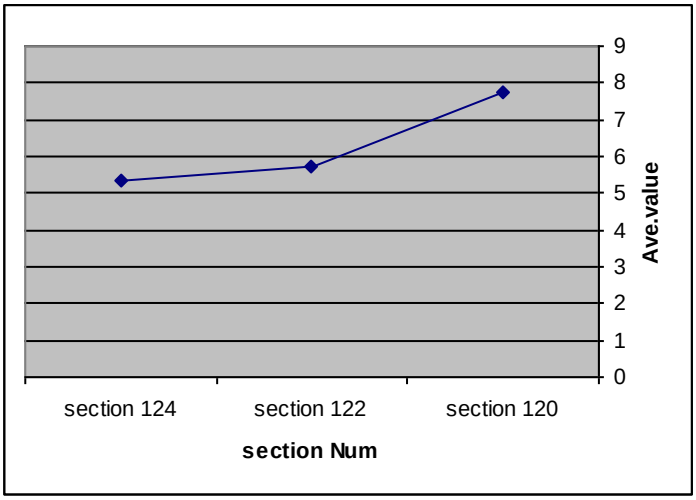


Fig-6: show the relation between the average concentration and the sections

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