Radon-Distribution Measurements With CR-39, LR-115 And CN-85 Dete Ctors

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Abstract

The aim of this work is to determine radon and its decay product concentrations indoor and outdoor in different areas in north and middle area of Iraq by using nuclear trak detectors , CR-39 , CN- 85 and LR-115.

For CR-39 detectors , the highest radon concentration was (64.07Bq/m^3)indoor and (52.4 Bq/m^3) outdoor , in Autumn season . And the concentration of that radon and its decay product indoor were greater than outdoor . Temperature seems to playsapredominant role in the formation of radon concentration .

Introduction

The radioactive elements Uranium and Thorium are present in earth`s crust in varying amounts at almost all the places on earth . These elements are the parent elements of two well know radioactive decay series , i.e Uranium and Thorium series . In both these series there is one element which is a gas , i.e. , ^{222}Radon and ^{220}Thoron . Both these gases are able to escape from the soil and enter the atmosphere. Atmospheric radioactivity concentrations from this source concentrations of Uranim and Thorium in the earth.(1,2).

There are several reports on measurements of radon concentration (3,4).

In this study we report results from measurements of radon and decay product concentration in different areas at north and middle area of Iraq (Table no.l) using three types of solid state nuclear track detectors , CR-39 , CN-85 and LR-115.

Experimental Technique

In the present work, three types of nuclear trackdetectors , CR-39 , CN-85 and LR-115 have been used for Radon and Thoron concentration measurement which has been used by many workers (Tawfik et al ., 1996, Bashaer et al, 1998, Khan et al, 1989).(8,9,5)

In this technique the detectors of 1x2 cm^2 are hunged in the middle of the room which is to be studied.

The detectors are left for period of two months . After the fixed time, the detectors were taken out out, etched by a (6.25N NaOH at 60°C for 4hr) (6,7)for CR-39 detector and (2.5 N NaOHat 60°C for 80 min) for CN-85 and LR-115 detectors (9,10 ,11) and counted for alpha tracks density by using an optical microscope. Then by using the following equation (2)the radon exposure was calculated.

$$\frac{Tx}{Ex} = \frac{Ts}{Es}$$

Where

Es,Ex :radon exposure (Bq/m^3).days for standard and sample respectivity.

Ts,Tx:Track density for standard and sample respectively

$\frac{Tx}{Es}$ is the slope of the figures [1,2,3].

The radon and it`s daughters concentration was measured by

$$Cx = \frac{Ex}{t}$$

Where t:exposure time

Result and Discussions

Radon -222 and its decay products concentrations obtained by etched track detectors in different areas for Autumn season are presented in Table no.2.

For CR-39 detector, the concentrations of randon and its daughters for building materials lying in the range of (64.07 Bq/m^3)- (50.37

Bq/m^3) indoor and (52.4Bq/m^3)-(23.7BBq/m^3)outdoor in Arbeel and Faloga locations .

For CN-85 dectector, the concentrations of radon and Its daughters for building materials lying in the range of(45.2Bq/m^3)indoor and(50.8Bq/m^3)-(35.9Bq/m^3) outdoor in Arbeel, Ramadi and Faloga location .

For LR-115 dectector , the concentrations of radon and Itsdaughters for building materials lying in the range of (61.6Bq/m^3)-(46.6Bq/m^3)indoor and (44.0Bq/m^3)-(36.0Bq/m^3) outdoor in Arbeel ,Ramadi and faloga locations.

The reason of the highest radon concentration was the type of building material, radon enters the rooms through the cracks in a poorly constructed concrete slab, and the low air exchange rate, this may be possible in houses with natural ventilation.

Table 2- also show that the indoor radon and decay products are greater than outdoor concentration , because it has low ventiliation (the doors and windows are closed) that increase radon concentration indoor.

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Table(1): Locations of dwelling and their sample number

No. of samples	*Location*
1	Arbeel / Mestofi
2	= /Ronaki
3	= / Sitikan
4	= / Ain - Kawaa
5	= / Eskan
6	= / Shaklawaa
7	Mosul / Hay Al-Masarof
8	= / = Al-Tayaran
9	= / = Al-Karama
10	Anbar / Ramadi
11	Baghdad / Abo-Gareb
12	Anbar / Faloga

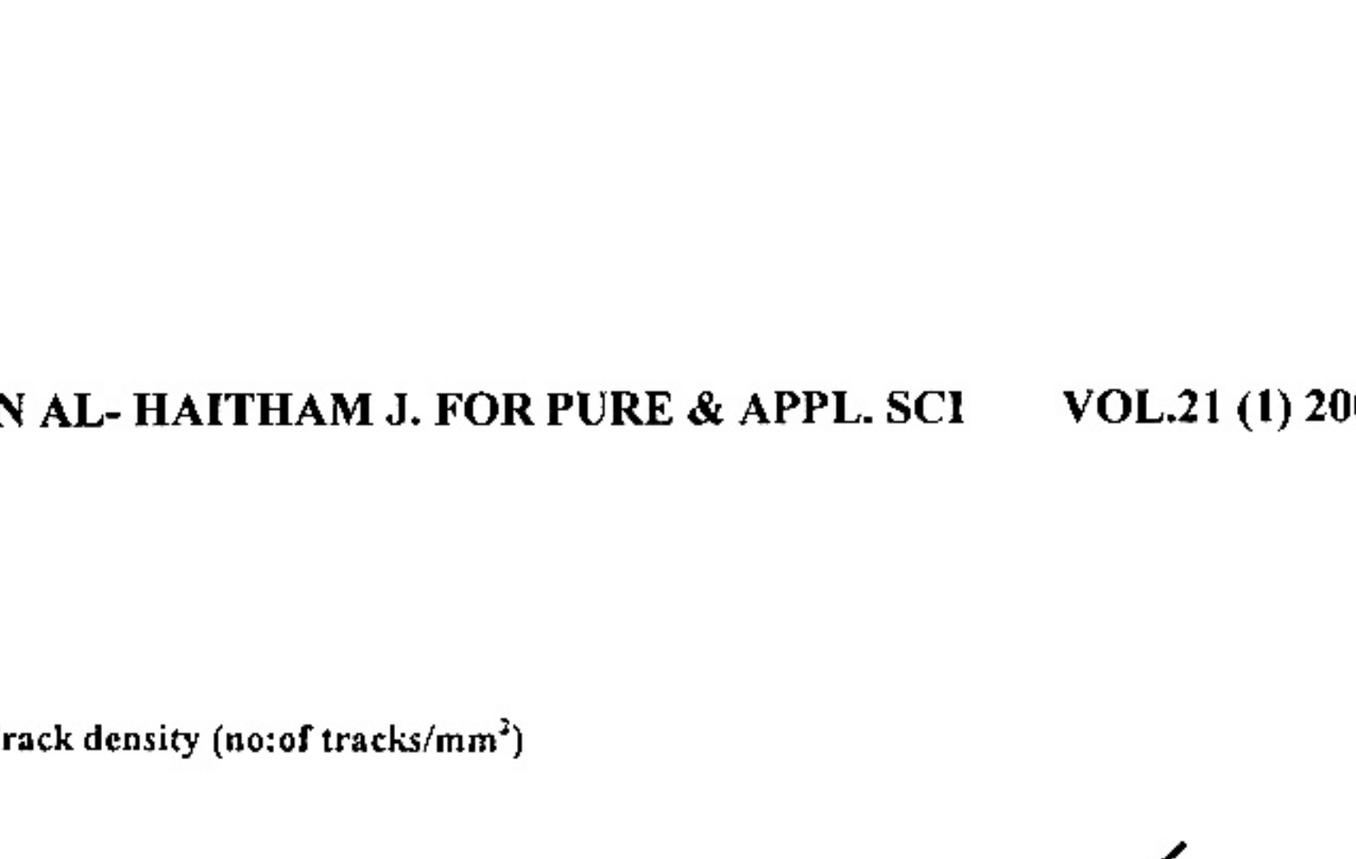
Table (2): Radon concentration measured in Autum seaseu by CR – 39, LR-115 and CN-85

sample number		CR-39		CN-85		LR-115	
		$\bar{f}x$	Cx	$\bar{f}x$	Cx	$\bar{f}x$	Cx
1	indoor	336	63.2	156	57.7	175	58.3
	outdoor	268	49.6	110	40.7	120	41.6
2	indoor	346.4	64.07	174	64.44	185	61.6
	outdoor	282	52.4	118	43.7	121	40.3
3	indoor	335	62.03	166.6	61.7	169	56.3
	outdoor	278.4	51.5	137	50.8	132	44
4	indoor	321	59.5	158	58.5	165	55
	outdoor	260	48	115	42.5	128	42.6
5	indoor	320.7	59.4	167	61.85	170	56.6
	outdoor	238	44.07	107	39.6	126	42
6	indoor	322	59.6	158.8	58.8	172	57.3
	outdoor	230	42.59	107	40.3	116	38.6
7	indoor	345	64.03	171	63.3	177	59
	outdoor	205	37.9	112	41.48	124	41.3
8	indoor	327	60.57	164.4	60.88	163	54.3
	outdoor	217	40.18	117	43.3	119	39.6
9	indoor	320.8	59.3	164	60.7	158	52.6
	outdoor	198	36.6	101	37.4	115	38.3
10	indoor	278	51.5	122	45.2	140	46.6
	outdoor	201	37.2	100	37.03	108	36
11	indoor	318.7	59.2	158	58.5	162	54
	outdoor	186	34.4	107	39.6	104	34.6
12	indoor	272	50.37	130	48.15	143	47.6
	outdoor	128	23.7	97	35.9	118	39.3

$\bar{f}x$: **Track density (no. of tracks/mm^2)**

Cx : **Radon concentration (Bq/m^3)**

ρ Track density (no:of tracks/mm^2)



Fig(1). the relation of track density and Radon exposure (Bq/m^3). Days for CR - 39 track detector..

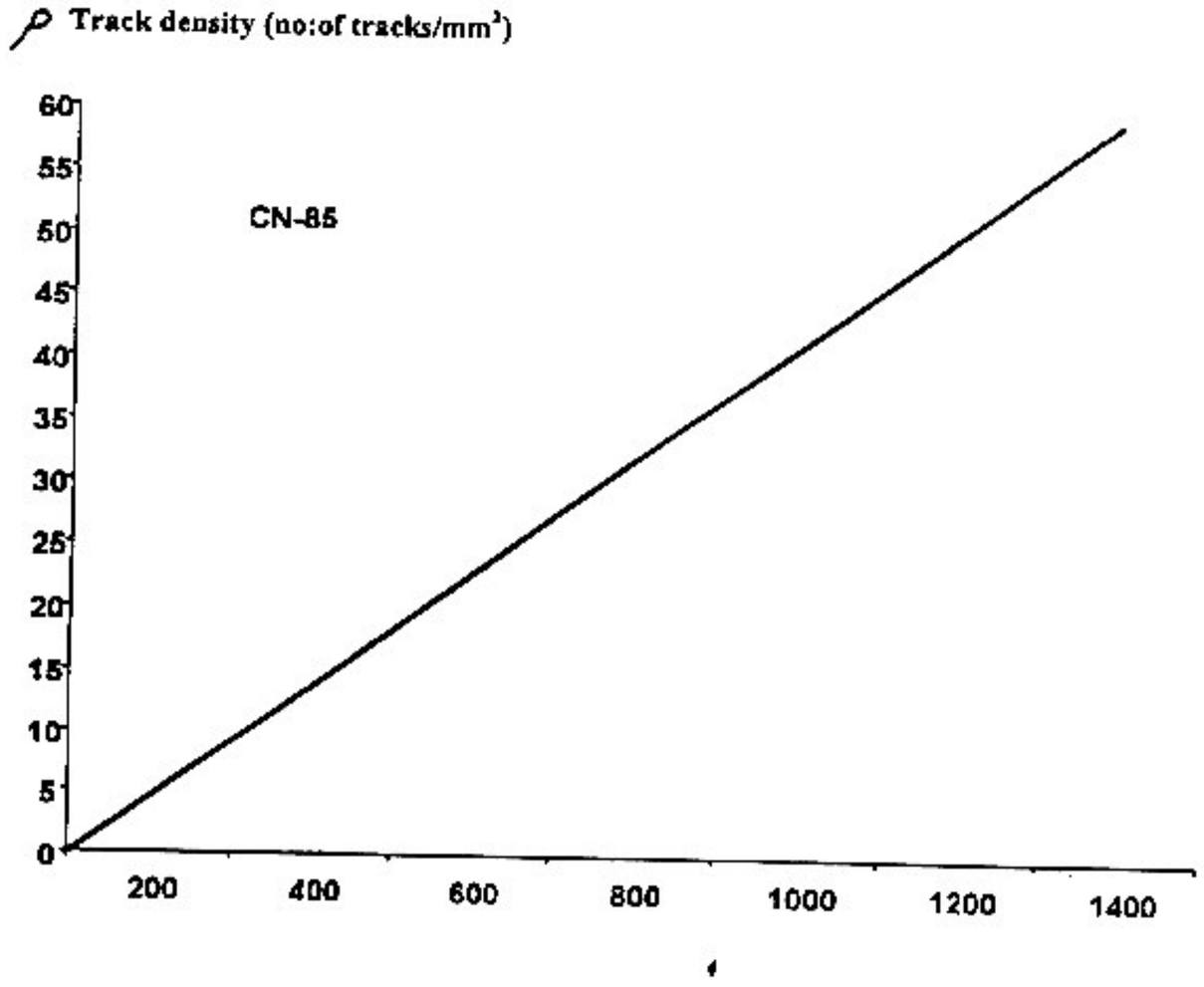


Fig.2. the relation of track density and Radon exposure (Bq/m^3). Days for CN -85 track detectors.

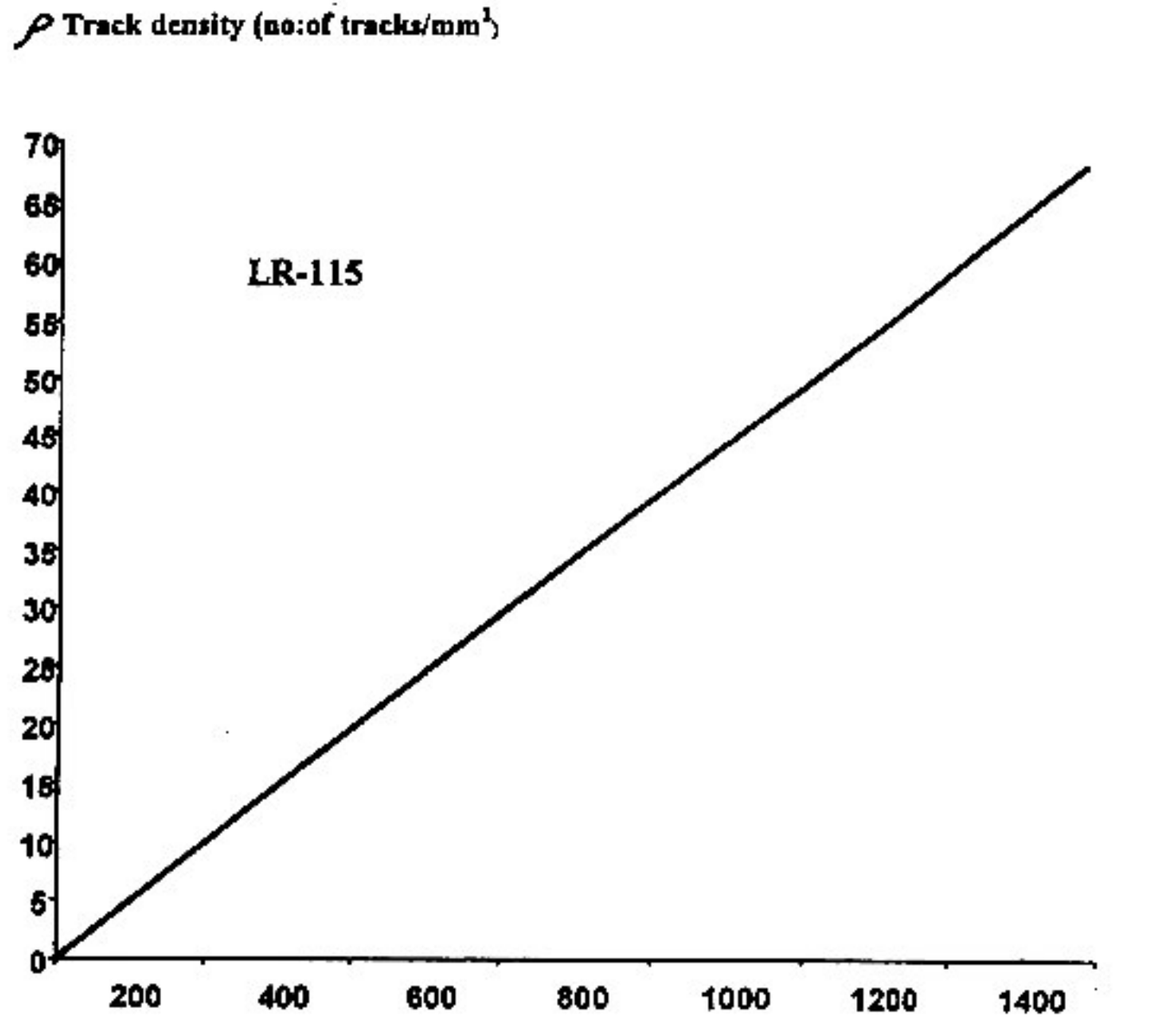


Fig.3). the relation of track density and Radon exposure (Bq/m^3). Days for LR-115 track detectors.

حساب تركيز الرادون باستخدام كواشف CN-85,LR-115, CN-39

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الخلاصة

ان الهدف من هذا البحث هو حساب تركيز الرادون ونواتج انحلاله داخل وخارج البنايات الواقعة في شمال ووسط العراق باستخدام كواشفCN-39, CN-85 LR-115.

اعلى تركيز للرادون كان 64.07 بكريل /م^3 داخل البنايات و52.4 بكريل /م^3 خارج البنايات باستخدام كاشف CR-39 وذلك في فصل الخريف .

حيث ان تركيز الرادون ونواتج انحلاله داخل البنايات اعلى من خارجها كما لعبت درجات الحرارة دورا" كبيرا" في تركيز الرادون.