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Measurment of Radon concentration in the ceramics samples using SSNTD(LR115 II)

قياس تركيزغاز الرادون في نماذج السيراميك بأستخدام كاشف الأثر النووي(LR115 II)

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Abstract :-

In this work,we have measured the concentration of radon gas in nine ceramics samples from different origins by using of long-term measurement of radon decay products with solid state nuclear track detectors which alpha particles that emitted from radon gas was detected using (LR115II) nuclear track detector. The obtained results show that, the highest average radon gas concentration in ceramics samples was found in Chinese (Porclain)sample, which was (16.88 Bq/m^3) ,while the lowest one was found in (U.M.A) (Porclain) sample, and found to be (6.732 Bq/m^3) .

Keywords:- Radon , LR115II , Ceramics , Density track, Activity.

الملخص :-

في هذا البحث تم قياس تركيز الرادون في تسعة عينات من مادة السيراميك المصنعة من مختلف المناشئ العالمية والمتوفرة بالاسواق المحلية في محافظة المثنى ، تم أستخدام تقنية طويلة الأمد للكشف عن غاز الرادون بأستخدام كاشف الأثر النوويLR115 II، فأظهرت النتائج أن أعلى تركيز لغاز الرادون كان في نموذج السيراميك الصيني نوع بورسلين حيث بلغ (16.88 Bq/m^3) بينما كان أقل معدل لتركيز غاز الرادون في نموذج البورسلين الاماراتي (رأس الخيمة) (6.732 Bq/m^3).

Introduction

We live in a milieu of radiation and exposed to ioinizing radiation from natural sources . Natural radioactivity is wide spread in the earth's environment and it exists in various geological formations in soil ,rocks,plants ,water and air [1,2]. Radon(^{222}Rn) is a colorless, odourless and radioactive nobel gas, which occurs in the natural radioactive series of uranium (^{238} U) as an immediatedecay product of radium (^{226}Ra). As (^{238}U) is very widely distributed element in the earth's curst, radon and its daughter products are also distributed in rocks and soil gas [3,4]. The radon exhalation from ground is vital for an enhanced radon levels and it may show an indication for assessment of a high risk area [3]. The Radiation Dose from radon inhalation constitute a major part of the total matural background dose recievied by man . The United Nation Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) reports that nearly half of dose received by man from natural sources is due to breathing radon and its progenies in the indoor environments as shown in figure(1).Radon is the second leading cause of lung cancer after cigarette smoking [5]. Lung cancer ,skin cancer and kindney diseases are the hazards by inhalation of radon decay products [6]. Ceramics canbedefinedasinorganic,non-metallicmaterials and are made of mixtures of raw materials that are crushed to powder, press molded and calcinedat high temperature (upto 1250 C^o) toformaceramic. Ceramic wall and floor tiles are commonly used as coverings or decorative building materials in bathrooms, toilets and kitchens [7].

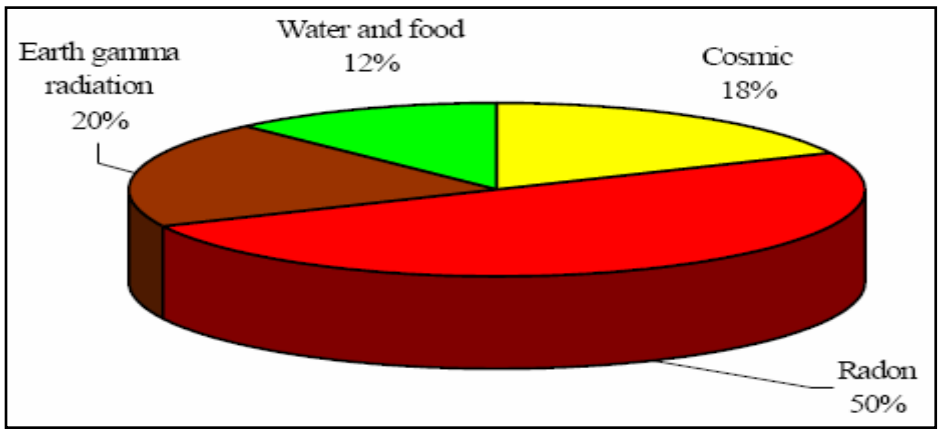

Fig (1):- Sources and average distribution of natural background radiation for the worldpopulation[5].

Experimental Part:-

The determination of alpha particles concentrations emitted from radon gas in ceramics samples were performed by using the nuclear track detector (LR115II) of thickness (4.5 μm) and area of about (1×1cm^2). The radon gas concentration in ceramics samples was obtained by using the Test tube technique.

After irradiation time of 60 days the LR115 track detectors were etched in (2.5N) of (NaOH) solution at temperature of (60 ^{o}C) for (0.5 hr), and the tracks density were recorded by using an optical microscope with magnification of (40x).The density of the tracks (D) in the samples were calculated according to relation [8].

We used the test tube technique covered by tightly closed from the top and sealed , assuming the average density of track and proportional to cylinder volume (h .cm),between the detector surface and surface sample equal(7cm)[9]. We can find radon activity (radon concentration) to decay daughter (^{218}Po,^{214}Po) by using the relations:-

$$D_{R222} = KC \quad \text{.....(1)}$$

$$D_{R222} = \frac{C}{4}(R_{MAX} - R_{MIN})\cos^2\theta_c \quad \text{.....(2)}$$

Where D = Background corrected alpha track density due to radon (Track cm^{-2})
C = radon gas concentration.(Bq.m^{-1}).
r = radius of tube (0.75 cm).
R=Alpha particles range in air product (^{222}Rnequal) (4 cm).[10]
h = Distance between the detector and top of the sample (7cm)
A = Surface area of sample (m^2)
K = Sensitivity factor (Tracks cm^{-2} day^{-1} / Bq m^{-3})
W = Mass of sample (gm)equal(10.2gm).
θ_c = detector Critical angle for LR115 equal(40^o) [8]

When the values of (R, r, h, θ_c) are substituted in eq. 2, the values of activity can be found by Bq unit as in eq.3.

$$A = CV \quad \text{.....(3)}$$

The valume (V) and specific activity (S.A)were calculated from eqs (4) and (5) respectively

$$V = \pi r^2 h \quad \text{.....(4)}$$

$$S.A = A/W \quad \text{.....(5)}$$

Table (1) Radon gas concentration for ceramics samples from different countries Samples

State	company produced (ceramics types)	Net no. of Track	Radon gas concentration $Tr.cm^{-2}.hr^{-1}$	Activity $(Bq.m^{-3})$	Specific Activity $(Bq.gm^{-1})$
Chinese	Almayh	148	0.287289	14.87093	3.458356
Chinese	Shancsen	82	0.159174	8.2393	1.864095
Iranian	Atlas	140	0.27176	14.0671	3.430999
Indian	Regesity	100	0.194114	10.04793	2.128798
U.M.A	Porcelian	67	0.130057	6.732111	1.584026
Egypt	Celopatra	91	0.176644	9.143613	1.924971
Chinese	Darc	96	0.18635	9.64601	2.352685
Chinese	Porcelian	168	0.326112	16.88052	3.661717
Syria	Zenobeaa	84	0.163056	8.440259	1.791987

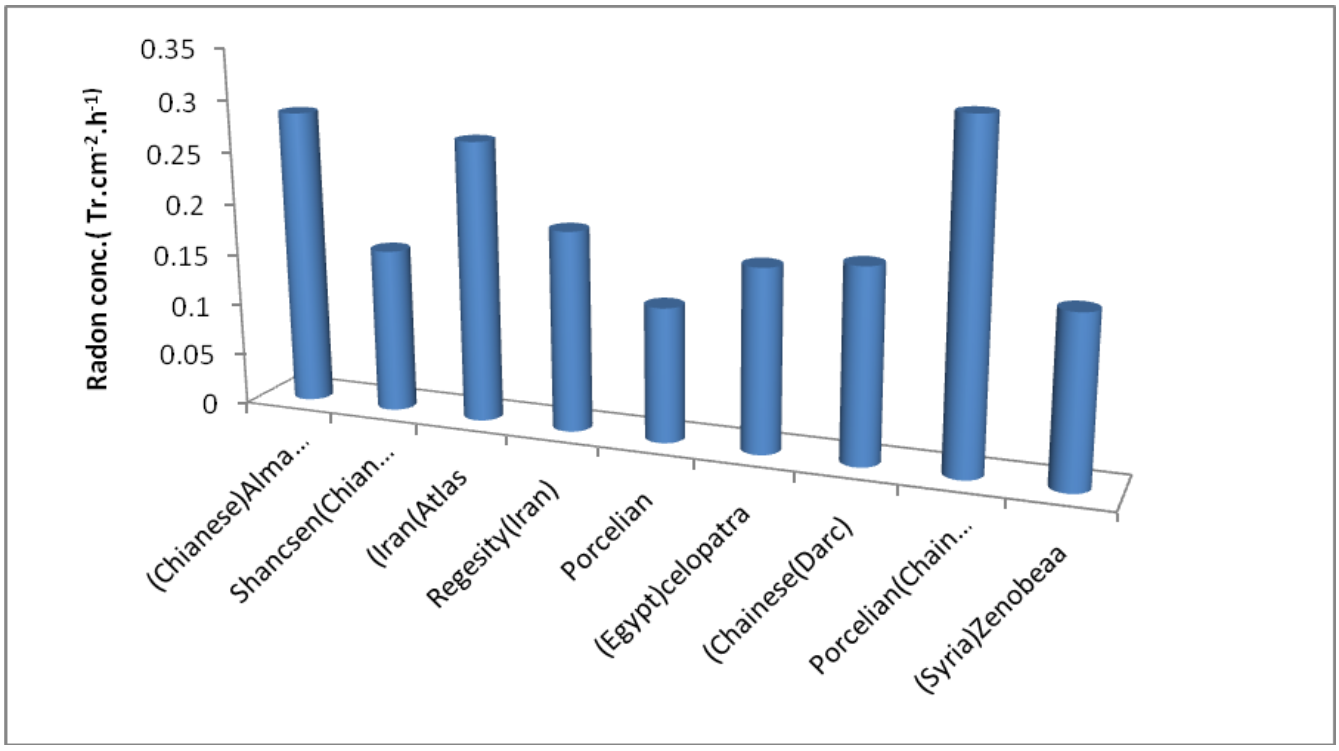

Fig 2. relation of radon gas concentration and Ceramics samples.

Results and Discussion :-

Our present investigation is based on the study of nine samples from different origin of ceramic which was available in the local markets; We found the radon gas concentrations by using Long-term method which alpha particles are emitted form radon gas in (LR115II) nuclear track detector.Table(1)represent the radon gas concentrations for ceramic samples in different countries. It can be noticed that, the highest average radon gas concentration in ceramic samples was found in Chinese ceramic (Porcalin) sample, which was (16.88 Bq/m^3),while the lowest average one was found in (U.M.A) Porcalin sample, which was (6.732 Bq/m^3) as shown in Fig .2. It might be mentioned that, thoron gas is an alpha emitter which is also present in soil and the other investigated materials. However, the average diffusion distance of thoron gas is very small compared to that of radon [10].It is requrid from in charge of joining ceramics bulding materials put special workshop for test and sample diagnosis material when country intering,due to conservation onto environmental fineness,pollutant lacking

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