

Measurement of radioactive pollution in the dust storms of the city of Tikrit by using the nuclear track detectors CN-85

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ABSTRACT

This research was a study of radioactive pollution of the dust storms of the city of Tikrit, where samples they were collected for two consecutive years (2010-2011) and by eight samples were identified as concentrations of radon(Rn-222) using nuclear track detector (CN-85) The results of the study showed an increase in radon concentrations ranged from (0.8-1.05ppm)and compared with the amount of background radiation (0.05ppm) This refers to the presence of radioactive pollution , as well as the dust storms are frequent and frequently led to increased concentrations of radon Any increase in concentration of mobile molecules by any air increases the likelihood of the arrival of these molecules to the lung.

Introduction:

The reasons for the emergence of dust storms in abundance in recent years, especially since most of the territory of Iraq is located within the areas is not guaranteed rain per year, including Salahulddin north and Anbar west of Baghdad and the Euphrates and the southern provinces and the atoms of air-borne dust storms could reach very long distances up to thousands of kilometers, especially molecules of less than (2.5 micron) and the prospect of reaching the lungs in the case of inhalation [1] That radon contributes (with the nascent radioactive nuclides resulting from the dissolution) about three-quarters of the annual effective dose equivalents received by the rights of the individual sources of natural ground [2,3]And about more than half of the total dose from all natural and industrial sources combined and returns a majority of these potions to the inhalation of these radio nuclides with air [2,3,4] .

The measured concentration of air alradon(Rn-222) very important for the prevention and human safety and that measure provided in the air and soil is a technique widely used to indicate the presence of uranium,(U-238) the simplest way to measure the concentration is the use of solid-state nuclear track detectors (SSNTD) When the decay of radon(Rn-222) in the air, the members of the nascent chain nuclei remain suspended in the air to Maand breathing (inhalation) and the entry of air saturated with these gases to the human lung A large proportion of which are deposited on the walls and lining of the respiratory system and therefore lead to absorption doses of-mediated bronchial[2,3]And statistics and estimates made suggest that all (2 00) deaths occur each year (10^5) people of the population is only a result of exposure to background radiation and radon derivatives [5,6] says the University of Frankfurt, the field research conducted in the kurdistan region show that the dust storms that blow over the region is

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full of elements harmful such as uranium, a major source of cancer[7] .

The researcher [8] calculates the concentrations of radon soil Salahalddin province, and the study shows an increase in the concentrations of radon gas, suggesting the presence of radioactive pollution . As well as another team of researchers to find concentrations of uranium through the creation of concentrations of radon in the rocks used in the manufacture of cement in the Iraqi province of Nineveh. It was found that the concentrations of uranium quarry Sinjar (1.25 Ppm) [9]

Theoretical part:

Known nuclear track detector as the insulating material electrically help to measure the amount of radiation for the purposes of scientific research or prevention of radiation where there is a change in the properties. As a result of exposure to doses of radiation and its ability to store the impact of radiation for a period of time is relatively long and appear in the form of Tracks [10,11] . Which is caused by damage to heavy in the order of atomic and show these effects in the beginning are the effects of thin, such as the form dendrite branches and the dimensions of the length of $10\mu\text{m}$ and display (50-100Ao) [12] and used IT chemical Etching to show the of tracks of nuclear track detection easy to do and provide solutions etchant along with their effectiveness high zoom tracks to sizes suitable can be seen under the microscope [13,14] and the process of etching it deployment of the Etchant Solution in damage region where the attacking zone and dissolved it leaving substances into the vessel containing the etchant solution and the subject inside the detector [15] and the different solutions used in etchant tracks .

Effect in general different materials that are detectors in organic detectors are alkali metal hydroxides (such as sodium hydroxide NaOH and potassium hydroxide KOH) suitable for the process of etching them[16]. Chemical structure of the detector nitrate cellulose is $(\text{C}_{12}\text{H}_{14}\text{N}_6\text{O}_{22})_n$ the hydrogen ratio about (2%) and longer detector nitrate cellulose of organic detectors good-sensitive alpha particles, neutrons and heavy particles (protons and fission products) and non-sensitive to light and electromagnetic radiation, such as (X-ray, γ) [17].

There are many types of detectors nitrate, cellulose vary in their ability to record the tracks and detectors commonly used are (CA-8015) as the detector (CN-85) is the upgraded version on detector (CA-8015)[18] and detector (LR-115) type I & II, which is covered a layer of nitrate Alsellaoz placed on the base of thick polyester ($6\mu\text{m}$) [19] .

Practical part:

1 - materials and equipment used:

Water bath Use water bath to heat the solution chemical etching (NaOH) to the required temperature (60C°) and water bath-type user (Memmert).

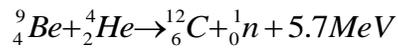
2 - optical microscope Optical microscope to count the effects of the user type (Novel) Chinese-made and strong zoom (100x).

3 - Detector Use the impact of nuclear track detector CN-85 to record the effects of fission fragments and thick ($175\mu\text{m}$) and the approximation space ($2 \times 1 \text{ cm}^2$)

4 - Radioactive Source:

Source of radioactive used for the purpose of irradiation of the models is the source neutron isotope americium beryllium ($^{241}\text{Am}-^9\text{Be}$) very effective is equal to (12 Ci) of excess neutron ($10^5 \text{ n.cm}^{-2}\text{s}^{-1}$) and target material (beryllium) send alpha nuclei of

radioactive particles and these particles interact with beryllium to produce neutrons by the following reaction:



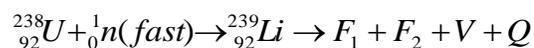
Preparation of samples:

Collected eight samples of dust deposits caused by dust storms that swept the city of Tikrit for two consecutive years (2010-2011) in periods of time apart.

Were then weight (0.5 gm) of each sample was pressed pressing device located in the laboratories of the Faculty of Education, Department of Physics at the University of Tikrit in diameter (1.2 cm) and thickness (0.8 cm) and pressure (compressor) 9tan/cm².

Irradiation:

Conducted irradiation of the models in the Faculty of Education, Ibn al-Haytham / Department of Physics it cutting detector (CN-85) with an approximate area (2x1 cm²) and put detectors on the forms are contiguous been samples and detector within a system of shield cadmium (for the purpose of obtaining neutrons highways) and arranged on the source neutron in the form of circular and was the face of the sample which does not contain a detector in front of the source neutron of flux amount (105n.cm⁻²sec⁻¹) for seven days have been to a rain neutron amount (6.048x10¹⁰n.cm⁻²) for tracks of fission fragments and by the following reaction [20]



As F₁, F₂ represents the fission fragments and V associated with the number of neutrons per fission process and Q is the energy liberated by fission.

chemical Etching:

After a process of irradiation taken nuclear track detectors for chemical etching it using sodium hydroxide solution (NaOH) and normalty (2.5%), which

is obtained by dissolving (25gm) of NaOH in (250ml) of distilled water. Using a bottle for identifying concentrations that take into account the low level of water in the bottle as a result of evaporation heat generated from the process of Dissolving where water is added to the bottle after it is thermal equilibrium with the ocean. Calculate the normalty using the following equation [21]

$$W(\text{gm}) = N \times V \times W_{\text{eq}}$$

As:

W_{eq}: molecular weight (NaOH)

V: volume of distilled water required

N: normalty

To investigate the process of chemical etching is put the pot solution etching in a water bath for the purpose of heating to the point (60Co) and attached reagent (CN-85) to be placed inside the solution etching and for a period (80 min) and after the expiration of the term etching taken detectors to wash with distilled water and dried.

Micro Scopic Viewing:

At this stage to detect tracks by choosing a magnification appropriate ability magnification was equal to (100x) and then counting effects unit area using a special lens is divided into several boxes has been linked to a camera with a microscope to portray the promised effects and the camera is connected with the computer to show pictures effects on a computer screen, where taken 10 attempts for each samples are then calculated rate No. of tracks obtained each sample and the calculated area of the square status scale special is on a glass slide in front of objective lens and it is calculated along the side of the large box or small and then calculate the area and then dividing the average number of track (Nave) to the sample (X) calculated on the space (A) to get the density tracks (px) and photo(1) describes

the tracks of nuclear fission fragments in the detector (CN-85) to one of the sample studied failure by the camera mentioned above

px: (no.of tracks/mm²)

Nave: rate track in the total area A A: Area (mm²).

Using the method to compare the relative tracks of the number of standard sources (which have been prepared from the dust container on the different concentrations of uranium, the figure(1)) with the studied samples can calculate the concentration C_x

$$\frac{\rho_x}{\rho_s} = \frac{C_x}{C_s}$$

$$C_x = C_s \frac{\rho_x}{\rho_s}$$

As:

C_s: concentration of uranium in the samples standard

ρ_s: (no. of tracks/mm²) in the sample standard.

The same technique can be replaced with concentration C_s with specific activity A_s by considering that all (12 Bq / Kg) of uranium-238 equivalent (1ppm) of the nuclide itself [22].

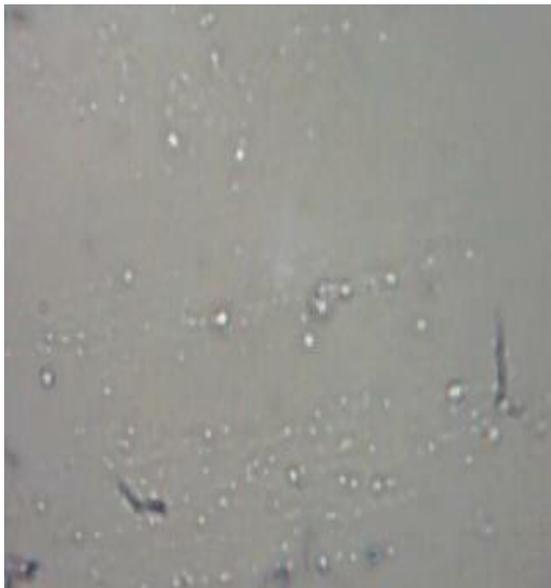
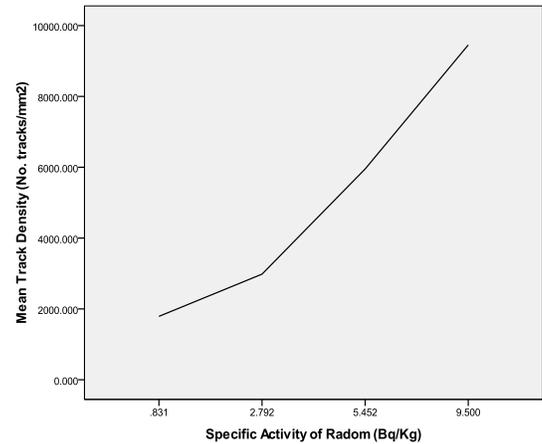


photo (1) describes the effects of nuclear fission in detector(CN-85)for the samples studied



Figure(1)shows the relationship the number of track and specific Activity of radon of the standard samples

Results and discussion:

The table(2) shows dates of collection of samples of the dust storms and specific activity and concentrations of radon in the samples under study where it was observed a significant increase in the concentrations of radon gas in the models for the background radiation failure to the Tikrit area, which is equal to (0.05 ppm) by half of all samples as well as the value of concentration increase for the month for February 2010 and April for the year 2011 when there was dust storms during the two months of twice a row which shows that the frequency of dust storms increases the concentration of residue particles held by the air, because the nano-particles of depleted uranium through this mechanism suspended in the atmosphere for tens of days [23]raising the possibility of the arrival of these molecules to the lung in the case of inhalation because the wind factor is the best carrier for all types of pollution and thus more likelihood of disease, cancer

Conclusions:

From the above results has been reached in this research we can deduce the following:

- 1 - the emergence of a significant increase in the concentrations of radon gas in the samples of dust storms studied in this research ranged between (0.8-1.05 ppm) compared with the background radiation and that of (0.05 ppm) and the increase was high, equivalent to more than double any presence of radioactive pollution in this region.
- 2 - The dust storms are frequent and frequently lead to increased concentration of mobile molecules by any increase in air concentration of radioactive pollution of the air conditioner.

Table (1) illustrates the specific activity of radon -222 samples of dust in the dust storms With concentration .

Samples Date	Specific activity of Radon (Bq/Kg)	Concentration(ppm)
13/1/2010	10.46	0.8716
20/2/2010	11.47	0.956
26/2/2010	11.57	0.962
13/7/2010	10.96	0.914
5/9/2010	10.007	0.833
28/2/2011	11.108	0.925
13/4/2011	11.81	0.9847
19/4/2011	12.60	1.05

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قياس التلوث الإشعاعي في العواصف الترابية لمدينة تكريت باستخدام كاشف الاثر النووي CN-85

هدى سعدي علي

الخلاصة

في هذا البحث تم دراسة التلوث الإشعاعي للعواصف الترابية لمدينة تكريت حيث تم جمع النماذج لسنتين متتاليتين (2010-2011) وبواقع ثمانية نماذج حيث تم تحديد تراكيز الرادون (Rn-222) باستخدام كاشف الأثر النووي (CN-85) وقد بينت نتائج الدراسة زيادة في تراكيز الرادون تراوحت بين (0.8 إلى 1.05 ppm) بالمقارنة مع الخلفية الإشعاعية البالغة (0.05 ppm) وهذا يشير إلى وجود تلوث إشعاعي , و كذلك إن هبوب العواصف الترابية بشكل متكرر ولفترات متقاربة أدت إلى زيادة تراكيز الرادون أي زيادة تراكيز الجزيئات من قبل الهواء , إي زيادة الجزيئات الواصلة إلى الرئة.