Short Communication

VARIATION OR RADON ACTIVITY OF SOIL SAMPLES WITH COLOUR USING CR-39 METHOD

Sk. Abdul Kader Arafin

Daffodil International University
102 Sukrabad, Dhanmondi, Dhaka 1207, Bangladesh
E-mail: skak_arafin@daffodilvarsity.edu.bd

The soil samples are collected from Barind area of Rajshahi (Godagari and Tanore thana) and Konabari thana, Gagipur. The samples locations are Mohadebpur, Tilahari, East Dorgapara, West Dorgapara, Kakonhat and Manduil of Godagari thana; Masinda, Domdoma, East Dewtola, West Dewtola, Mid Dewtola, Kaligonj and Gagrole of Tanore thana; and Chandona, Konabari and Kuddusnagar of Konabari thana, Gagipur.

The soil samples were collected from the depth of about 50cm from ground level to measure radon concentration in soil sample. Such levels were chosen in order to avoid the upper loose soil which may deposit by different phenomena of the earth (like air flow, soil erosion by rain water etc.) and to ensure an old age samples which may be representative of the particular place. After collection of the soil samples, the samples were dried in an oven at 60^0C for 8 hours. The dried samples were ground into small grains. The samples were then cleaned of coarse and bits of straw, grass etc. using a wooden sieve. Finally, 100 gm of each soil sample was prepared and was transferred to a plastic cans of 10.5cm height and 7.5cm diameter. To measure the radon activity in mud-built house, 5 different house of barind area, Godagari thana, Rajshahi were chosen on the basis of reddish colour painting and ventilation system.

The plastic sheets of CR-39 were preserved within paper cover properly so that it was not exposed to outside air or any other sources which may emit alpha particles. But it may somehow expose to alpha particles, before it is actually used for exposure. So that the five pieces of detectors were etched in proper etching condition and scanned under a microscope, then track density was determined for background correction.

In the present study plastic detectors with thickness of 300µm were cut into small square pieces (1.5cm×1.5cm). Detectors were arranged in two different ways for soil samples and rooms for the measurement of alpha track density due to radon gas. For soil samples, a detector was stuck on the bottom side of the can-lid. It was then closed and made airtight with adhesive tapes. For measurement of radon activity in mud built house one detector was stuck on the bottom side of the plastic can and another detector was stuck outside of the can. The open mouth of the can was covered with a semi permeable membrane and then it was hung on the top of the room by strong cotton.

Sample mass is important in the measurement of α-track density because track density highly depends on sample mass. To test the relationship between sample mass and α-track density, soil samples of different masses ranging from 40 to 120 gms in step of 20 gms were taken in separate plastic cans and CR-39 detectors were exposed for 53 days.

After completion of exposure, the detectors were etched in 6 normal (6N) NaOH solution at a constant temperature of 70^0C. A constant temperature water bath was used for this purpose. Before etching the exposed detectors were marked by sharp pin in a selected corner to properly identify while placing under a microscope. The solution of 6N NaOH in a beaker was filled up to three forth of its volume and kept into the water bath. While the water bath showed 70^0C temperature then four or five detectors dropped into the solution of beaker. The beaker was covered with a glass lid and stored for 4 hours. After elapse of etching time the detectors were picked by forceps and dropped into another beaker of normal water to reach at normal condition. After few minutes each detector was held

under a tap of flowing water of normal temperature for two three minutes for completely remove residual material. Finally the detectors washed in distilled water and soaked by tissue paper.

After etching, the detectors were ready for examination under an optical microscope. The central portion of the detectors strips was scanned using a binocular microscope at a magnification of 450 (45x objective and 10x eyepiece). By proper adjustment the α-track etch pits in the detector were identified. The total circular field of view was chosen as a single field of view. Alpha- tracks were searched inside the circle and were counted. The shielding base of the microscope was then moved so that the beginning of the next field of view coincides with the end of the first field of view. The scanning was continuous rather than discrete or erratic lest there should be prone to selecting portions where the tracks were more crowded. The count of each field of view was recorded. After completion of a detector scanning the counts were added and the number of blocks gave the average number of alpha track per area for the field of view. Using actual area of the field of view, the number of tracks per unit area in cm^2 (track density) was calculated. The α-track density of various masses of the sample soil was measured, which is shown graphically in Fig. 1. From this figure, it is delighting that the track density is linearly increased with the mass of the sample.

That is why, to get optimum track density 100 gm of samples were taken in this study.

The alpha track densities due to radon in soil samples of Barind area, Rajshahi (Godagari and Tanore thana) and Gazipur area (Konabari thana) were determined and displayed in Fig. 2. Average track density was found to be 1192 ± 16, 1021 ± 13 and 1045 ± 11 $cm^{-2}\cdot d^{-1}$ for Godagari, Tanore and Konabari thana, respectively. It is apparent from Fig.2 that the values for Barind area and Gazipur area are nearly same. The α-track density of different colour of soil sample of Godagari, Tanor and Konabari thana were measured which is shown in Fig. 3. The average track density was found to be 1347 ± 16, 717 ± 9 and 319 ± 8 $cm^2\cdot d^{-1}$for reddish, brown and gray samples, respectively.

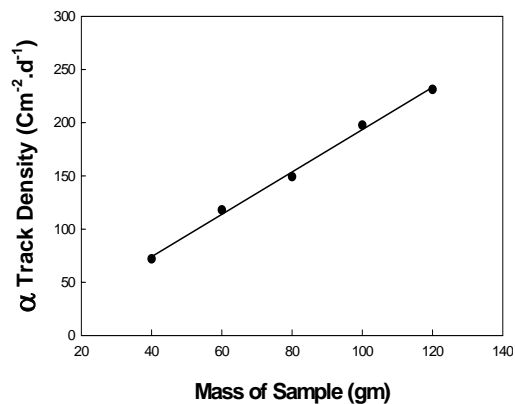Fig.1: Linearity of track density with mass for Soil sample

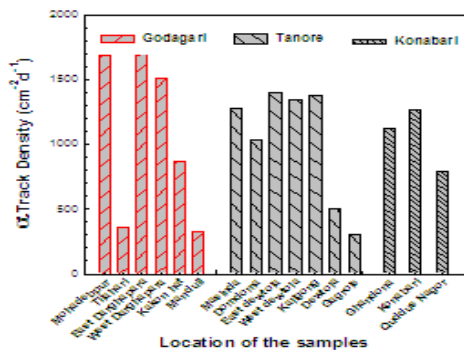

Fig.2: α-Track density of soil samples (location wise)

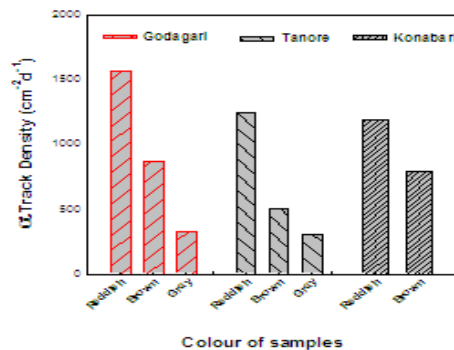Fig.3: α-Track density of soil samples (color wise)

It is apparent from this figure height track density for reddish colure soil samples. It seems that higher concentration of uranium is in reddish samples which are known as Barind reddish clay. The deposition of this clay has occurred in a particular in geological history. This deposition which is rich in iron that was oxidized later might have a source somewhere

in Garo-Rajmahal Hills. This high uranium concentration may have originated from this source of the reddish clay. Besides since iron is a metal, it may be accompanied by other metallic components including radioactive ones. Among other colored soils, the brown one has the most and the gray one, the least admixture of the reddish clay. This may explain diminishing uranium concentration from brown to gray samples.

The radon activities in 5 mud-built houses in Barind area are measured using Bare-mode and Filter-mode and summarized in Fig. 4. Higher activity was found in 1, 4 and 5 number house and this may be due to low ventilation, and lower activity was found in 2 and 3 number house due to good ventilation. House no. 1 has reddish soil painting on the wall and is found to have the highest radon activity. House no. 4 and 5 has no reddish soil painting but made by brown soil. Its high radon activity is due to ill ventilation. Although house no. 2 and 3 have partial reddish soil painting, its good ventilation decreased its radon activity. The highest radon activity that is found in house no. 1, 138.9 Bq/m^3 is, however, slightly less than the upper level 150 Bq/m^3 as per international recommendation by U. S. Environmental Protection Agency (USEPA) [5].
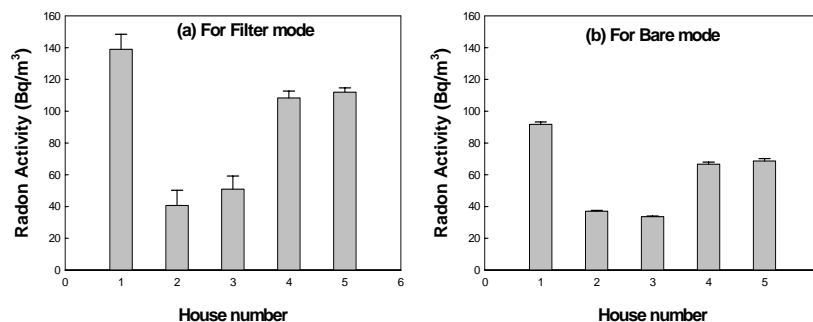

Fig.4: (a) Radon activity in Mud-built hose for filter mode and (b) Radon activity in Mud-built house for bare mode.

The concept of radon potential can be used as a basis for estimating indoor radon concentrations. Although it is not possible to accurately predict radon concentrations in individual house because of the highly variable nature of factors that control radon entry and concentrations in a specific house, one can estimate the distribution of indoor radon concentrations on a regional basis. The most recent maps of predicted indoor radon encompass a statistical analysis of variables that account for the greatest variation in indoor radon: geology, climate, and house structure.

References

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