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RESEARCH ARTICLE

Measurements of Alpha Activities Produced by Different Building Materials in Indoor Air

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ABSTRACT

The measurements of alpha activity produced by the different building material have been carried out by cylindrical can technique. Different types of building materials such as plastered wall painted with poor quality distemper, cement concrete block, fired brick, unfired brick and fly ash was taken for the study purpose. It was found that the materials producing increasing order of alpha activity (in relative units) are the plastered and distemper painted wall .98, cement concrete block 2.76, fired brick 4.52, unfired brick 4.63and fly ash 1.50.The least value in the case of plastered wall is obtained because the cement already releases the least amount of radon. The bare brick (fired or unfired) releases the largest alpha activity in the surrounding air. The main objective of this research work is to measure the relative alpha activity produced by different building materials in the ambient air.

Key words: *alpha activity, building materials, FFNTD, LR-115*

INTRODUCTION

It has been well established that many building materials used in construction work contains radioactive elements such as Uranium (U-238), Radium (Ra-226) and Thorium (Th-232) and their decay products as well as ^{40}K.Radon is an alpha emitting gas [1]. It is a daughter product of ^{226} Ra and decay and decay with a half life of 3.82 days emitting alpha particle of energy 5.49MeV.The radioactive daughter products of radon viz ^{218} Po and ^{214} Po emits alpha particle of energies 6 MeV and 7.69MeV respectively. These daughter products are solid and have a tendency to attach themselves to aerosols in ambient air. When we breathe we also inhale radon and its daughter product along with the normal air. Although most of the radon is exhaled, its daughter products get lodged to the inner walls and membranes of our respiratory system and continue causing constant damage due to their alpha activity [2 and 3]. Thus building materials contribute significantly in increasing the natural radiation in the ambient air and poses a health hazard. Building materials are the main source of indoor gamma radiation. All stone-based building materials contain radioactive nuclides, which contribute to radiation exposure. Knowledge of the level of natural radioactivity in building materials is then important to assess the possible radiological hazards to human health and to develop standards and guidelines for the use and management of these materials [4 and5]. The main objective of this research work is to measure the relative alpha activity produced by different building materials in the ambient air.

EXPERIMENTAL DETAILS

The experimental arrangement used is shown in Fig.1 which is self explanatory. In this experiment about 500gm of different samples of building materials were kept in eight different sealed glass cylinders with the detector at a large distance >19 cm from the sample (Fig. 1). After the radioactive equilibrium(98%) between radium-radon members of the radioactive series was reached (in one month time), the detector LR-115 type II was exposed to record the tracks of alpha particles from radon gas emitted by building materials and fi11ed in the intervening space between the sample and the detector[6,7, 8 and 9]. This plastic detector has an energy window (E = 1.9Mev to 4.2Mev) for producing through etched holes of alpha particle tracks in the 13umthin sensitive cellulose nitrate layer deposited on a 100 um non-etchable polyester backing when etched for 2 hours in 2.5N NaOH at 60°C..

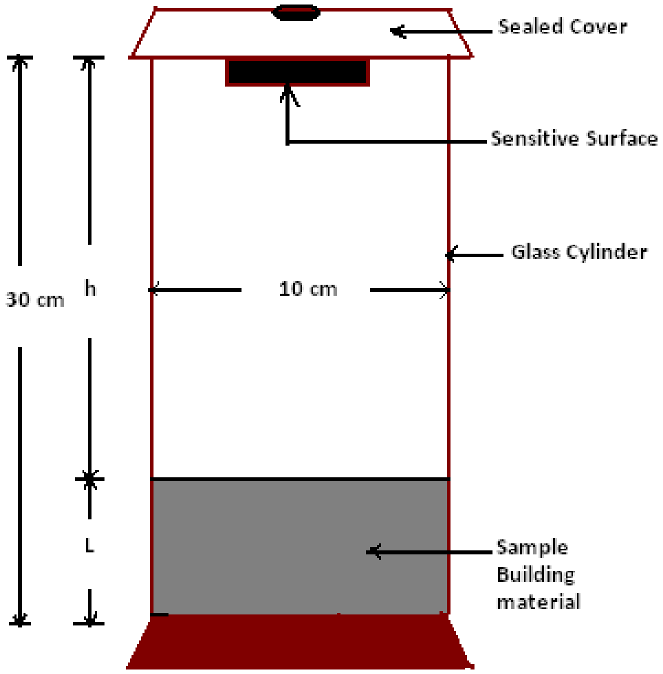

Fig. 1: Experimental Arrangement

RESULTS AND DISCUSSION

The alpha activity produced by the different building material is given in the table 1. It is evident from table 1 that the activity produced by a plastered and painted wall (with poor quality distemper) produces least activity while the bare clay brick produces maximum alpha, activity. The materials producing increasing order of alpha activity (in relative units) are the plastered and distemper painted wall .98, cement concrete block 2.76, fired brick 4.52, unfired brick 4.63and fly ash 1.50. Clearly the least value in the case of plastered wall is obtained because the cement already releases the least amount of radon (table 1) and moreover the coating with distemper further fills the pores on the wall reducing radon diffusion in the ambient air. The bare brick (fired or unfired) releases the largest alpha activity in the surrounding air.

Table 1: Observed values of alpha activity produced by the different building materials

S.No.	Building Materials (Dimensions)	Track Density (Tracks/cm²)	Relative Alpha Activity produced
1	Plastered wall painted with poor quality distemper	618	0.98
2	Cement concrete block (15cm×15cm×15cm)	1759	2.76
3	Fired Brick (23cm×11cm×6.5cm)	2930	4.52
4	Unfired Brick (23cm×11cm×6.5cm)	2938	4.63
5	Fly Ash (500gm)	265	1.50

The data given in table 1 can be used to calculate the exhalaration rate of radon and also the effective-equivalent radium concentration of the building materials [10, 11, 12 and 13]. The result of this work shows that values obtained for all samples are less than the internationally accepted maximum limits and the use of them as a building material pose no significant radiation hazard to individuals.

CONCLUSION

The alpha activity produced by the different building materials in indoor air are reported in table1.The result shows that the alpha activity produced in plastered wall painted with poor quality distemper is minimum where as alpha activity produced by the unfired brick is maximum. The minimum and maximum values of alpha activities are 0.98 and 4.63 respectively. Clearly the least value in the case of plastered wall is obtained because the cement already releases the least amount of radon and moreover the coating with distemper further fills the pores on the wall reducing radon diffusion in the ambient air. The fired or unfired bricks release the largest alpha activity in the surrounding air. The observed values of alpha activity as given in the table can be used to calculate the radon exhalaration rate and also the effective-equivalent radium concentration of the building materials. Result of this work indicates that values obtained for all samples are less than the internationally accepted maximum limits and as such, the use of them as a building material pose no significant radiation hazard to individuals.

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