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Natural radioactivity of some Egyptian materials used in glasses manufacturing and glass ceramics

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► ***Original article***

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ABSTRACT

Background: The new glasses from harmful environmental waste such as cement dust; limestone phosphate, sand and borax (Genkare) were manufactured. Investigation of the radioactivity present in these materials (Phosphate rock, cement dust, limestone, sand and borax) enables one to assess any possible radiological hazard to humankind by such materials. ***Materials and Methods***: Fifteen samples were collected from five locations. Activity measurements have been performed by gamma-ray spectrometer, employing a high-resolution scintillation detector NaI (Tl) crystal 3 ×3 inch. In addition, the radiological hazards were calculated for the investigated samples. ***Results:*** The average values of activity ranged from 28±2 to 163±12, 2.8±0.7 to 40±3 and from 49±4 to 1337±74 Bq kg-1 for ^{226}R, ^{232}Th and ^{40}K, respectively. The values of absorbed dose rates, radium equivalent activities and annual effective dose due to 226Ra, 232Th and 40K respectively, are ranged from 22.05 to 101.59 nGy h-1, 45.90 to 224.22 Bq kg^{-1} and 27.04 to 124.59 µSv y-1. In addition, the values of external hazard index, internal hazard index and gamma index have been calculated. ***Conclusion:*** According to the obtained results, all materials would not present a significant radiological hazard except phosphate. The results of the study could serve as important baseline radiometric data for future epidemiological studies and monitoring initiatives.

Keywords: *Natural radioactivity, glass ceramics radiological hazards, phosphate rock, cement dust, limestone, sand, borax and glasses.*

INTRODUCTION

Natural radioactivity has always been present and broadly distributed in the earth's crust and the atmosphere [1] and it exists in various geological formations like air, rocks, plants, sand, water and soils. It is found also in our building materials constituting main sources of radiation exposure for human beings [2]. Soil radionuclide activity concentration is one of the main determinants of the natural background radiation [3]. Volcanic geographic structures as well as rocks that are rich in phosphate, granite and salt contain natural radionuclides like ^{238}U, ^{232}Th and ^{40}K [4]. The naturally occurring radionuclides are present in the rock, soil and are easily transported into the environment through plants and water [5, 6]. Long-term exposure to uranium (U) and radium (Ra) through inhalation has several health effects such as chronic lung diseases, acute leucopoenia, anemia, and necrosis of the mouth. Radium causes bone, cranial, and nasal tumors. Thorium exposure can cause lung, pancreas, hepatic, bone, and kidney cancers and leukemia [7]. Hence, humans should be aware of their natural environment with regard to the radiation effects due to the naturally occurring and induced radioactive elements.

The phosphatic rocks were considered as