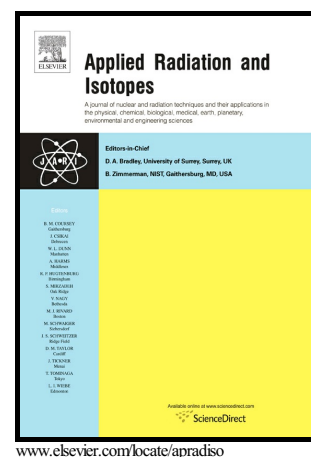


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Quantification of some elements of nuclear and industrial interest from zircon mineral using neutron activation analysis and passive gamma-ray spectroscopy

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Abstract

A combined of various nuclear and analytical techniques were used for characterization of Egyptian zircon ore. Neutron activation analysis has been used for determination of the major, minor and trace elements from zircon ore. Non-destructive gamma-ray technique is also used for the radiometric analysis of zircon ore to quantify the natural radionuclides such as ^{238}U , ^{235}U , ^{232}Th , ^{226}Ra and ^{40}K . Zircon ore has been characterized by different analytical tools such as Fourier transformer infrared (FTIR), X-ray fluorescence (XRF), powder X-ray diffraction (XRD), and scanning electron microscopy (SEM). In this study, a significant concentration of U, Th and rare earth elements (REEs) has been reported. The obtained results showed that the average activity concentration of ^{238}U , ^{235}U , ^{226}Ra , ^{232}Th and ^{40}K are 4771 ± 338 , 230 ± 17.1 , 3588 ± 125 , 982 ± 47.7 and 217 ± 48.5 Bq/kg, respectively. The results indicated that 297, 318 and 838 mg/Kg for U, Th, REEs, respectively, using NAA. These results are consistent with those obtained by gamma-ray spectroscopy and/or XRF. It can be concluded that zircon ore is a riche with a valuable nuclear materials such as U, Th, Zr, and Hf. It is also containing a REEs of economic and industrial interest. Also, the different radiation hazardous parameters were found much higher than the permissible values.

Keywords: *Zircon, Natural radionuclides, Radiation risk, Thorium, Neutron activation analysis.*

1. Introduction

Natural zircon is present in silicate mineral and is available in many locations all over the world. Many zircon varieties contain traces of thorium (Th) and uranium (U) at about 100-1000 mg/kg (Okada, 1973) and may exhibit natural radioactivity level. It has been demonstrated (Kirsh and Townsend, 1987 and Chee et al., 1988) that zircon exhibits

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