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Measurement of Naturally Occurring Radioactive Materials (NORM) in Black Sand and Soil Samples

In present study, gamma-spectrometric technique using scintillation detector NaI(TI) have been carried out in identification of gamma emitting radio-nuclides from soil and heavy sand samples. Soil samples were collected from Chaung Gyi, Mandalay Division, and black sand sample was collected from the Mae-palae stream, Myawaddy township, Kayin State, Myanmar for radiological assessment. The current research work was carried out aiming to determine the specific activity of NORM contents of the soil samples from gold mining area and the black sands with emphasis on zircon sands. Heavy sand minerals are of great interest in possible to contain enriched with NORM due to the content of heavy minerals such as zircon, ilmenite, garnet, rutile and hematite. NaI(Tl) 3x3 inch gamma ray spectroscopy system housed in lead shielding with CASSY sensor and CASSY LAB software were used in the measurements of radionuclide present in the collected samples. Energy calibration and efficiency calibration were carried out with four pairs of laboratory isotope source Ba-133, Cs-137, Na-22 and Ra 226 standard sources for covered the different energy range before measuring studied soil and sand samples. From the analysis of measured gamma ray spectra of soil samples, activity concentrations of each sample are calculated. The radioisotopes present in the samples are identifying by gamma ray energy from the measured spectra of soil samples SP 1 to SP 7. The results of soil samples are found to be uranium decay family of Ra-226 (632.4 keV), Pb-214 (918.6 keV) and Bi-214 (1777.2 keV). The average activity concentration observed in soil samples are 459.55 Bq/kg, 368.26 Bq/kg, 353.71 Bq/kg for Ra-226, Pb-214 and Bi-214 respectively. The measurement of naturally occurring radioactivity materials (NORM) in heavy sand minerals from the Mae-palae stream was carried out as the same procedure by using gamma spectrometry. Thorium decay series are observed from the measured black sand sample the gamma-ray lines of 250 keV (Bi 212), 348.7 keV(16.44) and 903.1 (36.5) keV from 228Ac and 581.2 (30.6) keV from 208Tl were used to determine the activity concentration of 232Th. The results showed that the major daughter nuclides found in the studied samples, were 214Pb, 214Bi and 226Ra for 238U series in soil samples and daughter nuclides observed from black sand sample were 228Ac, 212Pb, 208Tl and 212Bi for 232Th series. Activity concentrations in zircon sands determined by gamma spectrometry, ranged from 116.543 Bqkg-1, 166.372 Bq.kg-1, and 54.456 Bq.kg-1 for 212Bi, 228Ac and 208Tl respectively. In conclusion, the current research work needed to expend for different types of mineral sand samples with different locations and confirmation of the results by high resolution gamma ray spectroscopy system.
Key Words: black heavy sands, gamma ray spectroscopy, specific activity

Authors: Dr MYAING, Khaing Nyunt (Ministry of Education.Myanmar); Ms MYAING , Khaing Nyunt (Ministry of Education); Mr NAING, Kyaw Htay (Nuclear Physics Laboratory); Mr HTUN, Ye Pyae (Nuclear Physics)

Presenter: Ms MYAING , Khaing Nyunt (Ministry of Education)

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