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In-situ LaBr3(Ce) and NaI(Tl) gamma-ray spectrometry for the analysis of radioisotopes in the soil

Content

A portable HPGe (High Purity Germanium) has been using for in-situ gamma-ray spectrometry for environmental monitoring because of relatively high efficiency and good resolution. However, an HPGe detector has major drawback that it must be cooled to cryogenic temperature for appropriate data acquisition. Therefore, solid type of scintillation detectors to operate at room temperature have also been used for gamma-ray measurements on site. In the presentation, the applicability of LaBr3(Ce) and NaI(Tl) scintillation detectors is discussed as an in-situ gamma-ray detector for radioactivity analysis of radionuclides in the soil. For the study, 50.8 x 50.8 mm and LaBr3(Ce) 75.2 x 75.2 mm NaI(Tl) scintillation detectors were used. Each of the detectors was calibrated by using the conventional method (Beck, 1972). Two relatively flat fields were selected as a reference site for validation of the calibration, and gamma-ray measurements were carried out at a height of 1 m above the ground. Radioactivity of K-40 and gamma-ray emitting isotopes of U- and Th-series was analyzed from gamma-ray energy spectra obtained by each detector. In case of the LaBr3(Ce) detector, gamma-ray due to intrinsic activity was measured by self-counting in the ultra-low background lead shield with the thickness of 150 mm, in order to subtract the background gamma-ray counts by the La-138 and Ac-227 inside the detector from the measured count in the field. For the radioactive characterization in the field, soil samples were collected and pretreated through drying and grinding. Then, the samples were sealed in cylindrical containers and measured by using an HPGe detector with 30% relative efficiency after radioactive equilibrium between Ra-226 and daughters. The analysis results of gamma-ray emitting natural radionuclides by using the LaBr3(Ce) and NaI(Tl) detectors in the field were compared with those obtained in the laboratory. As the result, radioactivity by in-situ gamma-ray spectrometry agreed well with those obtained by laboratory analysis for each of the radionuclides.

About the Presenter

I'm integrative course in University of Science and Technology (UST). My major is radiation measurement and radiation safety and main research is in-situ gamma-ray spectrometry.

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