Are $LaBr_3$:Ce detectors the optimum instruments for naturally occurring radioactive materials (NORM) activity measurements?

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Abstract

$LaBr_3$:Ce (2" x 2") detectors were used to measure soil samples placed in Marinelli beakers in singles and coincidence modes. Time-stamped data were acquired and background removed offline by using photon time-of-flight in addition to measurement of the two photon energies in coincidence. Coincident gamma-ray pairs from ^{238}U (^{214}Bi) and ^{232}Th (^{208}Tl) series were identified in measured samples. The activity concentrations of ^{238}U and ^{232}Th series radionuclides inside the samples were determined in both singles and coincidence modes. The internal activity of the $LaBr_3$:Ce detector increases the MDA at 1460.8 keV and 2614.5 keV, which limits the measurement of ^{40}K radionuclide with low activity concentration in singles mode. The measured internal activity of ^{138}La in the $LaBr_3$:Ce detector crystal is 263.8 ± 26.8 Bq kg^{-1} which is comparable to the calculated activity of 293.3 Bq kg^{-1}. The suitability of the use of these detectors for NORM measurements was evaluated.