A Computer Code for the Calculation of Efficiency Correction Factors due to Self-attenuation in γ-Spectroscopic Analysis of NORM

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Measurement of natural radioactivity with γ-spectroscopy remains a complex procedure, mainly due to the various parameters affecting detection efficiency. Self-attenuation inside the samples poses a major challenge, which is particularly intense for Naturally Occurring Radioactive Materials (NORM). For the accurate analysis of NORM, efficiency corrections need to be performed, especially for the low energy photons. The development of a MATLAB® code as a standalone application [1], focusing on the calculation of correction factors for self-attenuation, has been the goal of this on-going work. The Efficiency Correction Factors (ECF) are calculated with the "Integral Method" [2], for different materials, densities, source-to-detector configurations and photon energies. Several parameters affecting calculations were studied, namely material matrix, density and effective interaction depth inside the detector. The initial code results were compared with efficiency calculations from Monte Carlo simulations and proved promising, while also indicating that self-attenuation corrections should not only be limited to low energy photons (e.g. below 200 keV) as they may be important for much higher photon energies as well.

[1] Alafogiannis, I., Tugnoli, F., Mitsios, I., & Anagnostakis, M. (2022). Development of a Computer Code for the Calculation of Self-absorption Correction Factors in γ-Spectrometry Applications. *HNPS Advances in Nuclear Physics*, 28, 98–103. https://doi.org/10.12681/hnps.3607

[2] Debertin K., & Helmer R.G. (1988). *Gamma and X-ray Spectrometry with Semiconductor Detectors*. Amsterdam: Elsevier Science Publisher B.V.