Exploring activity concentration measurements of environmental samples containing heavy metals and their remediation

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In the present article, a methodology has been discussed to evaluate the influence of activity concentration of soil samples containing heavy metals in the environment. The approach leverages a simulated germanium detector and a cylindrical geometry sample configuration to analyse soil samples with varying densities. The results showed a positive correlation between the soil densities and activity concentration, with an average correlation coefficient of 0.99 indicating that variations in density affect the activity concentration measurements. To mitigate this error, a demonstration of the self-absorption correction as a function of density, being an essential part of the present study has been included.

Keywords: Activity concentration, density, detector, natural radioactivity, self-absorption.

as germanium (Ge) detectors, which have excellent energy resolution and sensitivity[5–7]. A specific detector-sample arrangement should be utilized with an efficiency calibration curve for the determination of the activity concentration of radioactive materials with various gamma-ray energies. It is important to carefully consider the density factor when designing and conducting gamma-ray spectrometry experiments[8–13]. In experimental techniques, there prevail certain limitations, such as the difficulty in controlling certain parameters (like complexity of the experimental setup, environmental factors, and limitations of the instrumentation used) and the need of sensitive measurement techniques. Therefore, computational simulations can be a better choice that can be used to model the behaviour of the sample and predict the results. Monte Carlo (MC) simulations are computational techniques that use random sampling to simulate the behaviour of a system. The simulation