Characterization of Soil Particles using Complementary XRF Analytical Methods

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The determination of actinide elements in a soil matrix can be important in basic research as well as in safeguards, nuclear forensics, waste management, and environmental remediation activities. The complementary techniques of micro x-ray fluorescence (MXRF), high resolution x-ray (hiRX), and confocal MXRF each present unique advantages depending upon the type and level of sample characterization that is required. MXRF is well suited to spatially resolved qualitative, multi-element analysis, while hiRX permits quantitative, selective detection of actinides. Use of confocal MXRF provides three dimensional elemental distributions. In this study, the Pu content of contaminated soil particles was characterized using all three approaches. In addition to the actinides present, co-located elements such as Ti, Fe, Cu, and Zn were of interest as they may provide clues to chemical behavior in the environment. The performance of each of the methods including precision, accuracy, and limit of detection was evaluated using contaminated environmental samples and spiked soil. The capability to offer nondestructive, spatially resolved elemental characterization on the micrometer scale with microgram to nanogram sensitivity will be highlighted.

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