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Assessment of cyanide contamination in soils with a handheld mid-infrared spectrometer

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ABSTRACT

We examined the feasibility of using handheld mid-infrared (MIR) Fourier-Transform infrared (FT-IR) instrumentation for detecting and analysing cyanide (CN) contamination in field contaminated soils. Cyanide spiking experiments were first carried out, in the laboratory, to test the sensitivity of infrared Fourier transform (DRIFT) spectrometry to ferro- and ferricyanide compounds across a range of reference soils and minerals. Both benchtop and handheld diffuse reflectance infrared spectrometers were tested. Excellent results were obtained for the reference soils and minerals, with the MIR outperforming the near-infrared (NIR) range. Spectral peaks characteristic of the $-C\equiv N$ group were observed near 2062 and 2118 cm^{-1} in the MIR region for the ferro- and ferricyanide compounds spiked into soils/minerals, respectively. In the NIR region such peaks were observed near 4134 and 4220 cm^{-1} . Cyanide-contaminated samples were then collected in the field and analysed with the two spectrometers to further test the applicability of the DRIFT technique for soils containing aged CN residues. The prediction of total CN in dry and ground contaminated soils using the handheld MIR instrument resulted in a coefficient of determination (R^2) of 0.88-0.98 and root mean square error of the cross-validation (RMSE) of

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