ABSTRACT

Regional geochemical database is a prerequisite for sustainable management of soils. The diffuse reflectance spectroscopy (DRS) approach has shown great advantages over conventional approaches to estimate multiple soil attributes in a noninvasive manner. To examine the DRS approach for studying the weathering state and geochemical mapping of agricultural soils, a new approach using Partial-least-squares regression (PLSR) analysis was developed using proximally-sensed spectral reflectance over visible to near-infrared (VNIR) and mid-infrared (MIR) region of electromagnetic spectrum to estimate the basic soil properties including geochemical properties and twelve different weathering indices (WIs). The models were calibrated based on 1) all features in spectra of VNIR, MIR and (VNIR + MIR), and 2) features obtained by variable importance projection, that was denoted by VNIRvip, MIRvip, and (VNIR + MIR)vip for WIs. The robustness of these spectral models were evaluated using residual prediction deviation (RPD). Results showed that the MIR reflectance data provided superior estimation capability for all elemental constituents and WIs compared with the VNIR reflectance data. However, the best prediction were obtained when the important spectral features such as VIP values derived from both VNIR and MIR data were combined to build the spectral algorithms. The best prediction obtained for index of lateritization (IOL; RPD = 6.13) based on (VNIR + MIR)vip model. The chemical index of alteration (CIA), A-CN-K ternary diagram suggests moderate to high source area weathering of feldspar to granite source rock composition. The enrichment of Silica (Si) suggests the presence of quartz/ feldspar dominated terrigeneous sands which is also inferred from Herron's diagram. This study demonstrates for the first time that the estimation of WI values and geochemical characterization of soil may be possible in a rapid and non-destructive way in situ.

Key: Weathering indices; Geochemical characterization; Diffuse reflectance spectroscopy; Visible to near infrared; Mid infrared; Partial-least-square regression, Residual prediction deviation.

Name: Biswajita Mohanty, Roll No: 11AG92P06.