

Nitrate (NO_3^-) prediction in soil analysis using near-infrared (NIR) spectroscopy

Abstract

Nutrient composition in soil analysis is investigated by using nitrogen (N) in form of nitrate (NO_3^-) as a representative factor correlated with NIR spectroscopy spectral absorbance. NIR spectroscopy method of sampling has been tested to overcome time consuming, complex chemical analysis procedure and invasive sampling method in order to identify nitrate content in soil samples. Spectral absorbance data from range 950 nm to 1650 nm correlated with nitrate reading then tested through few pre-processing techniques. Five techniques have been listed as top performer, which are Multiplicative Scatter Correction using Common Offset (MSCCO), Multiplicative Scatter Correction (MSC), Range Normalization (RN), Mean Normalization (MN) and Reduced (R) technique. Data calibration and prediction of both data is evaluated using Partial Least Square Regression (PLSR) model. In the final analysis, R technique has achieved as top performer pre-processing technique for both calibration and prediction results, with the coefficient of determination (R^2) values of 0.9991 and root mean square error (RMSE) values of 0.0886 for prediction. Overall, the correlation of NIRS absorbance data and nitrate can be obtained using PLSR model with R pre-processing technique. Henceforth, we can conclude that the NIRS method of sampling can be used to identify nitrate content in soil analysis by using time saving, non-invasive and less laborious method of sampling.