Prediction of Chemical Organic Composition of Manure by Near Infrared Reflectance Spectroscopy

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The organic materials included in excreta of livestock are important resources for organic manure and for improving soil quality, although there is still far from effective using. One reason for this is still unclearly standard of quality for evaluation of manure made from excreta of livestock. Therefore, the objective of this study is to develop rapid and accurate analytical method for analyzing organic compositions of manure made from excreta of livestock, and to establish quality evaluation method based on the compositions predicted by near infrared reflectance spectroscopy (NIRS).

Sixteen samples of manure, each eight samples prepared from two treatments, were used in this study. The manure samples were prepared by mixing 560 kg feces of swine, 60 kg sawdust with moisture content was adjusted to be 65%. The mixture was then keep under two kinds of shelter, black and clear sheets, as a treatment on the effect of sunlight. Samples were taken in every week (form week-0 to 7) during the process of manure making. Samples were analyzed to determine neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) by detergent methods, and organic cell wall (OCW) and fibrous content of low digestibility in OCW (Ob) by enzymatic methods. Biological oxygen demand (BOD) was analyzed by coulometric respirometer method. These compositions were carbohydrateds and lignin that were hardly digested. Spectra of samples were scanned by NIR instrument model 6500 (Pacific Scientific) and read over the range of wavelength between 400 and 2500nm. Calibration equations were developed using eight manure samples collected from black sheet shelter, while prediction was conducted to the other eight samples from clear sheet shelter. Accuracy of NIRS prediction was evaluated by correlation coefficients (r), standard error of prediction (SEP) and ration of standard deviation of reference data in prediction sample set to SEP (RPD). The r, SEP and RPD value of forage were 0.99, 0.69 and 7.6 for ADL, 0.96, 1.03 and 4.1 for NDF, 0.98, 0.60 and 4.9 for ADF, 0.92, 1.24 and 2.6 for Ob, and 0.91, 1.02 and 7.3 for BOD, respectively. The results indicated that NIRS could be used to measure the organic composition of forage used in manure samples.