

## Prediction of Feed Compositions in Ecofeed by Near Infrared Spectroscopy (NIRS)

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### Abstract

Ecofeed is an animal feed made from food, beverage and agricultural by-products and that is expected to reduce feed processing cost, increase feed self-sufficiency in Japan and urge effective utilization of unused resources. However, ecofeed has some disadvantages like unstable chemical composition because of high water contents in the feed, variable supply of the materials, and so on. Therefore, rapid determination of the nutritive compositions is needed for managing the feed and materials quality, and calculating feed formulation. Therefore, near infrared spectroscopy (NIRS) is focused as a rapid analysis method of nutritive value of feedstuffs. In this study, NIRS calibration models for predicting feed nutritive compositions, crude protein (CP), ether extract (EE), crude ash (CA), crude fiber (CF) and nitrogen free extract (NFE) in ecofeed and the materials collected in Okinawa were developed. In this study, 121 samples (ecofeed and the materials) were collected from industrial waste collector in Okinawa. Then, 100 samples were used for creating calibration models (calibration sets) and 21 samples (validation sets) were for evaluate the models. Collected samples were oven dried at 65°C for 48h and powdered finely. The feed nutritive compositions in CP, EE, CA CF and NFE were analyzed by using general methods. NIRS scanning was done by NIRS instrument (InfraXact, Foss AB, Hillerød) and the absorbance was measured in 2nm increments from 570 nm to 1848 nm. After scanning, the spectrum data were differentiated twice and the calibration models developed by multiple linear regression (MLR) and partial least squares regression (PLSR). Moreover, created models were evaluated by coefficients of determination of calibration (R<sup>2</sup>C), standard deviation of calibration (SEC), coefficients of determination of validation (R<sup>2</sup>V), standard deviation of prediction (SEP) and ratio of performance to deviation (RPD; Standard deviation (SD) of analyzed value in validation sets/SEP-1). All PLSR calibration models were better than MLR models. R<sup>2</sup>C, SEC, R<sup>2</sup>V, SEP and RPD values of PLSR model were 0.94, 2.52, 0.98, 2.02 and 6.83 for CP, 0.93, 2.29, 0.98, 1.14 and 7.82 for EE, 0.59, 2.61, 0.32, 1.63 and 0.98 for CA, 0.81, 1.82, 0.75, 1.79 and 1.90 for CF, and 0.95, 4.07, 0.94, 3.98 and 4.16 for NFE, respectively. Williams (2001) suggested that calibration model with RPD > 3.1 is suitable for screening and model with RPD > 6.5 is suitable for process control. Considering the above result, CP, EE and NFE calibration models could be developed with high accuracy by PLSR.

**Keywords:** Animal feed, Food and beverage byproducts, Near infrared spectroscopy,

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