Prediction of Water Content in Indonesian Green Coffee Beans Using near Infrared Spectroscopy

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Abstract

Water content in green coffee bean is one of the most important factors with direct influence on its quality. Usually, water content is analysed using a gravimetric method including 16–24 h oven drying. The aim of this study is to evaluate the feasibility of near infrared spectroscopy (NIR) for non-destructive and fast prediction of water content in Indonesian green coffee beans using multivariate analysis. Green coffee beans were obtained from different origins in Indonesia, n=5 for Arabica and n=7 for Robusta. Coffee beans were placed in a climacteric chamber at 25°C and relative humidity (RH) of 30–85 % in order to obtain a wide range of water content. NIR spectra were collected using a bench top Fourier transform (FT) NIR instrument in the wavelength range of 1000–2500 nm in diffuse reflectance (log 1/R) mode. Water content was analysed according to ISO 6673 as reference. NIR spectra were collected from 108 samples, n=64 for calibration and n=44 for prediction. Partial least squares regression (PLSR) using raw data with 3 latent variables factors yielded the best prediction with coefficients of determination (R^2) for calibration, cross validation, and prediction of 98.3 %, 97.9 %, and 96.4 %, respectively. Weighted regression coefficients from PLSR revealed that the wavelengths 1409, 1724, 1908 and 2249 nm are highly correlated with the water content. Using these selected wavelengths for multiple linear regression (MLR) yielded R^2 for calibration, cross validation, and prediction of 97.6 %, 96.9 %, and 97.3 %, respectively. To conclude, NIR combined with chemometrics is a promising method for rapid and reliable water content prediction in green coffee beans.

Keywords: Coffee bean, MLR, near infrared, PLSR, water content

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