Measurement of Quality Parameters of Honey by Reflectance Spectra

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The objectives of this study were to develop models to predict quality parameters of Korean bee-honeys by visible and NIR spectroscopic technique. Two kinds of bee-honey from acacia and polyflower sources were tested in this study. The honeys were harvested in the spring of 2000 and stored in the storage facility at 20℃ during experiments. Total of 394 samples of honey were analyzed. Reflectance spectra, moisture contents, ash, invert sugar, sucrose, F/G (fructose/glucose) ratio, HMF (hydroxymethyl furfural), and C12/C13 ratio of honeys were measured. The average values for the tested honeys were 19.9% of moisture contents, 0.12%of ash, 68.4% of invert sugar, 5.7% of sucrose, 1.27 of F/G(fructose/glucose) ratio, 14.4 mg/kg of HMF, and -19.1 of C12/C13 ratio.

A spectrophotometer, equipped with a single-beam scanning monochromator (NIRSystems, Model 6500, USA) and a horizontal setup module, was used to collect reflectance data from honey. The reflectance spectra were measured in wavelength ranges of 400~2,498 nm. with 2 nm of interval. Thirty-two repetitive scans were averaged, transformed to log(1/Reflectance), and then were stored in a microcomputer file, forming one spectrum per measurement. A sample cell and reflectance plate were made to hold honey samples constantly.

Spectra of honey samples were divided into a calibration set and a validation set. The calibration set was used during model development, and the validation set was used to predict quality parameters from unknown spectra. The PLS(Partial Least Square) models were developed to predict the quality parameters of honeys. The first and the second derivatives of raw spectra were also used to develop the models with proper smoothing gap. The MSC (multiplicative scatter correction) and the SNV & Dtr.(standard normal variate and detranding) preprocessing were applied to all spectra to minimize sample-to-sample light scatter differences. The PLS models showed good relationships between predicted and measured quality parameters of honeys in the wavelength range of 1100~2200 nm. However, the PLS analysis was not good enough to predict HMF of honeys.

Keywords: NIR, spectroscopy, quality parameter, honey, PLS