Quantification of Water, Protein and Soluble Sugar in Mulberry Leaves Using a Handheld Near-Infrared Spectrometer and Multivariate Analysis.

Abstract: Mulberry (*Morus alba* L.) leaves are not only used as the main feed for silkworms (*Bombyx mori*) but also as an added feed for livestock and poultry. In order to rapidly select high-quality mulberry leaves, a hand-held near-infrared (NIR) spectrometer combined with partial least squares (PLS) regression and wavelength optimization methods were used to establish a predictive model for the quantitative determination of water content in fresh mulberry leaves, as well as crude protein and soluble sugar in dried mulberry leaves. For the water content in fresh mulberry leaves, the R-square of the calibration set (R^2_C), R-square of the cross-validation set (R^2_{CV}) and R-square of the prediction set (R^2_P) are 0.93, 0.90 and 0.91, respectively, the corresponding root mean square error of calibration set (RMSEC), root mean square error of cross-validation set (RMSECV) and root mean square error of prediction set (RMSEP) are 0.96%, 1.13%, and 1.18%, respectively. The R^2_C, R^2_{CV} and R^2_P of the crude protein prediction model are 0.91, 0.83 and 0.92, respectively, and the corresponding RMSEC, RMSECV and RMSEP are 0.71%, 0.97% and 0.61%, respectively. The soluble sugar prediction model has R^2_C, R^2_{CV}, and R^2_P of 0.64, 0.51, and 0.71, respectively, and the corresponding RMSEC, RMSECV, and RMSEP are 2.33%, 2.73%, and 2.36%, respectively. Therefore, the use of handheld NIR spectrometers combined with wavelength optimization can fastly detect the water content in fresh mulberry leaves and crude protein in dried mulberry leaves. However, it is a slightly lower predictive performance for soluble sugar in mulberry leaves.