Development of a universal calibration model for quantification of adulteration in Thai jasmine rice using near-infrared spectroscopy

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Abstract

In the event the substituent rice variety present in adulterated Thai jasmine rice cannot be identified, the adulterant rice in unknown samples could be inconsistent with that used to establish the calibration model resulting in inaccurate quantitative prediction of the adulteration level. In this research study, near-infrared (NIR) spectroscopy was applied to quantify the adulteration level of Thai jasmine or Khao Dawk Mali 105 (KDML105) rice based on the use of partial least squares (PLS) regression. To cope with the inconsistency between the training and test rice samples, a chemometric technique known as orthogonal projection (OP) was applied to extract variation of the target KDML105 rice, which then was exclusively used for establishing the prediction model. Furthermore, calibration transfer (CT) was used to adjust the NIR spectra of the adulterated samples to comply with the prediction of the calibrated model. The predictive abilities of the developed models were improved resulting in relatively lower root mean square error of prediction (RMSEP) values with higher determination of coefficient (Q^2) values. In addition, the combined uses of the preprocessing methods provided a data treatment strategy that yielded a more stable model in the subsequent calibration step with the lowest standard deviation of RMSEP. This development was allowed for the quantitative prediction of the adulterations in the rice without the need for information pertaining to the blended rice.