Improving moisture and soluble solids content prediction in pear fruit using near-infrared spectroscopy with variable selection and model updating approach

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Postharvest Biology and Technology, Volume 171, January 2021, 111348

Abstract

To obtain robust near-infrared (NIR) spectroscopy data calibration models, variable selection and model updating with recalibration approaches were used for predicting quality parameters in pear fruit. For variables selection, interval partial least-squares regression and covariate selection approaches were used and compared. Model updating with recalibration was performed by incorporating a few new samples in the calibration set of existing batch data. The interaction of variable selection and model updating was also explored. The results showed that with variable selection, the model performance when tested on a new independent batch of fruit was greatly improved. Further, the model updating with only a few new samples resulted in a reduction of the bias when tested on the new batch. In the case of MC prediction, the variable selection reduced the bias from 1.31 % to 0.19 % and the RMSEP from 1.44 % to 0.58 %, compared to the standard partial least-squares regression (PLS2R). In the case of SSC prediction, the variable selection reduced the bias from -0.62 % to 0.07 % and the RMSEP from 0.90 % to 0.63 %, compared to the standard PLS2R. With a combination of variable selection and model updating the bias and RMSEP were further reduced. The interval-based method performed better compared to the filter-based method. As few as only 10 samples from the new batch already lead to a significant improvement in model performance. In the case of MC, spectral regions of 749-759 nm and 879-939 nm were identified as the most important region. In the case of the SSC, 709-759 nm and 789-999 nm were found to be important spectral regions. Robust models made on selected variables combined with model updating strategy can support to make NIR spectroscopy a preferred choice for non-destructive assessment of quality features of fresh fruit.