Non-invasive measurements of ‘Yunhe’ pears by vis-NIRS technology coupled with deviation fusion modeling approach

Lei-Ming Yuan, Fei Mao, Xiaojing Chen, Limin Li and Guangzao Huang

Postharvest Biology and Technology, Volume 160, February 2020, 111067

Abstract

Visible-near infrared spectroscopy (vis-NIRS) technology has been broadly and effectively implemented in the measurements of internal quality for food and agricultural products, coupled with the most common partial least square (PLS) modeling method. However, only the top latent variables (LVs) are employed in this optimized PLS model, and the residual LVs are discarded, resulting in the loss of spectral information. In this study, soluble solids content (SSC) of ‘Yunhe’ pears was non-invasively measured by a miniature vis-NIRS device in interactance spectral reading mode, coupled with a fusion modeling strategy based on two member models. One model was the optimized PLS model with the first 12 LVs, generally aiming at minimizing the root mean square errors of cross-validation (RMSECV) in the stage of calibrating the model, and the other was the derived multiple linear regression (MLR) model, which was developed with the remaining 8 LVs. These 20 LVs utilized in the PLS model accumulated over 99.99 % of the original spectral information. Two fusion strategies, including stacked fusion and the deviation fusion, were comparatively employed to fuse the above two member models. The deviation consensus model provided the weightings of 0.9077 and 0.0923 for the PLS and MLR model, respectively, and performed better than that of any univocal model or the stacked model, with an r_p of 0.9026, as well as a root mean square errors of prediction (RMSEP) of 0.59, decreasing the RMSEP of 7.5 % compared to that of the optimal PLS member model. It can be concluded that the strategy of deviation consensus modeling can use the spectral information from two member models, and can improve the model prediction overall.