Evaluation of Firmness and Sweetness Index of Tomatoes using Hyperspectral Imaging

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Abstract

The objective of this study was to evaluate firmness, and sweetness index (SI) of tomatoes (Lycopersicum esculentum) by using hyperspectral imaging (HSI) in the range of 1000−1400 nm. The mean spectra of the 95 matured tomato samples were extracted from the hyperspectral images, and the reference firmness and sweetness index of the same sample were measured and calibrated with their corresponding spectral data by partial least squares (PLS) regression with different preprocessing method. The results showed that the regression model developed by PLS regression based on Savitzky−Golay (S−G) second-derivative preprocessed spectra resulted in better performance for firmness, and SI of tomatoes compared to models developed by other preprocessing methods, with correlation coefficients (rpred) of 0.82, and 0.74 with standard error of prediction (SEP) of 0.86 N, and 0.63 respectively. Then, the feature wavelengths were identified using model-based variable selection method, i.e., variable important in projection (VIP), resulting from the PLS regression analyses and finally chemical images were derived by applying the respective regression coefficient on the spectral image in a pixel-wise manner. The resulting chemical images provided detailed information on firmness, and sweetness index (SI) of tomatoes. Therefore, these research demonstrated that HIS technique has a potential for rapid and non-destructive evaluation of the firmness and sweetness index of tomatoes.

Keywords

Hyperspectral Imaging, Tomato, Firmness, Sweetness Index, Partial Least Squares Regression

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