Model development for soluble solids and lycopene contents of cherry tomato at different temperatures using near-infrared spectroscopy

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Abstract

The near-infrared (NIR) spectrometer is a powerful tool for rapid nondestructive testing of fruit, foodstuff and agricultural products in the laboratory. However, traditional NIR spectrometers are large and inconvenient to implement for online detection, and it is sensitive to external environmental factors such as temperature, which can affect products with high water content and decrease accuracy of measurements. A mixed temperature correction method and external parameter orthogonal (EPO) method combining portable NIR spectrometer, in terms of applicability, complexity and predictive performance of the algorithm, was used to reduce the effect of temperature changes on the NIR spectra of soluble solids and lycopene in cherry tomatoes. Of a total of 176 samples, 120 and 840 spectra for 120 samples were tested at 5, 10, 15, 20, 25, 30 and 35 °C. The remaining 56 samples were used to test the prediction effect of samples at different temperatures. The EPO method has better prediction results than the mixed temperature correction model, for external multi-temperature samples, the R_P of the soluble solids content was 0.8988, and the RMSEP was 0.292%, the R_P of the lycopene content was 0.8023 and the RMSEP was 7.45 mg/kg, indicating that the EPO method had a good correction effect for temperature. Moreover, fewer samples were required for modeling. A portable NIR spectrometer that was developed by the EPO method revealed no significant difference between the predicted value and the standard value of 15 external samples by t-test. Therefore, the EPO method can be used to reduce the effect of temperature on the NIR spectra of cherry tomatoes and is of great significance for the real-time online detection of the fruit by a portable NIR spectrometer, and it may be useful for online rapid detection of the internal quality of other fruit.