Title Miniature handheld NIR sensor for the on-site non-destructive assessment of post-harvest quality and refrigerated storage behavior in plums

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Abstract

This study evaluated the feasibility of using a handheld micro-electro-mechanical system (MEMS) spectrometer working in the 1600–2400 nm range for the measurement of quality-related parameters (soluble solid content, firmness, variety and post-harvest storage duration under refrigeration) in intact plums. Spectroscopic measurements were also made for each fruit using a diode-array Vis–NIR spectrophotometer (400–1700 nm) for purposes of comparison. A total of 264 plums (*Prunus salicina* L.) cv. 'Black Diamond', 'Golden Globe', 'Golden Japan', 'Fortune', 'Friar' and 'Santa Rosa', received and stored at 0 °C and 95% RH for 9 days, were used to build calibration models using different spectral signal pre-treatments and the modified partial least squares regression method. The two NIR instruments evaluated provided good precision, although the diode-array instrument yielded slightly greater precision for soluble solid content; statistic values were r^2 = 0.73 and the standard error of cross validation (SECV) = 1.11% for calibration, and r^2 = 0.68 and the standard error of prediction (SEP) = 1.22% for validation. Firmness measurements were less precise in both instruments, though again slightly better in the diode-array instrument: r^2 = 0.64 and SECV = 1.77 N for calibration; and r^2 = 0.61 and SEP = 2.30 N for validation, respectively. The performance of the two instruments for classifying plums by variety and by refrigerated post-harvest storage duration (0, 6 and 9 days) was evaluated using partial least square-discriminant analysis. A total of 96.5 % of samples were correctly assigned to their variety, while 94.5 % of plums were correctly assigned to their refrigerated storage day. In general, promising results were obtained with both instruments, with similar levels of accuracy for the measurements for soluble solid content, variety and refrigerated storage duration; the prediction model developed using the diode-array spectrophotometer provided better results for firmness.