Abstract

Two prototype on-line NIR transmission systems were used to non-destructively measure the percentage of internal tissue browning (ITB) in 'Braeburn' apples (*Malus domestica* Borkh.) afflicted with Brownheart. One system was based on the principle of time-delayed integration spectroscopy (TDIS) in which light transmitted through a moving object was electronically tracked as it moved through the spectrometer's field-of-view. The other, a large aperture spectrometer (LAS), was a more conventional design in which the light from the object is accumulated in a series of one-shot measurements as the fruit progresses through the field-of-view. The systems were each optimally configured to operate at typical grader speeds (500 mm s^{-1} or approximately five fruit per second) and detect the low levels of light diffusely transmitted through apples in the wavelength range 650–950 nm. Regression models developed by PLS calibration methods gave reasonable correlations with ITB ($R^2 \sim 0.7$–0.9) and low prediction errors (RMSECV ~ 4–7%). The LAS system was superior in every case with the best results ($R^2 \sim 0.9$, RMSEP ~ 4.1%) being obtained when two separate spectral measurements, made around the circumference of the fruit, were averaged. Multiple measurement LAS systems are recommended for fast on-line measurement of ITB in apples.