Title Transmission measurements on intact apple moving at high speed

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Citation J. Near Infrared Spectrosc. 12, 37-43 (2004)

Keywords NIR; spectrometers; non-destructive analysis; apples; dry matter

Abstract

Two different near infrared spectrometric systems, both based n readily available optical components, were investigated for direct transmission mode measurements on intact apples (*Malus domestica* Borkh.) moving at high speed (500 mm s^{-1}). One system was based on the principle of time-delayed integration spectroscopy (TDIS) in which light emanating from a moving object was electronically tracked as it moved through the field of view of the spectrometer. The other system, a large aperture spectrometer (LAS), was a more conventional design in which the light from the object is accumulated in a series of one-short measurements as the fruit progresses through the field of view. The systems were each optimally configured, using the same core optic components, to detect the low levels of light diffusely transmitted through apples between 650 and 950 nm. Performance comparisons were made in the context of dry-mater predictions; an important metric for apple quality. Modelling and validation statistics (R^2, *RMSEP*) for dry-mater predictions were (0.87, 0.43%) for the LAS and TDIS systems, respectively. These accuracies are excellent and similar to what is normally achievable on the more common but slower interactance-type NIR fruit measurement systems. Hence, the results have demonstrated that use of a direct transmission mode is a viable option for high-speed fruit measurement, even for a very opaque fruit like apples.