

Title Non-destructive tests on the prediction of apple fruit flesh firmness and soluble solids content on tree and in shelf life

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Citation Journal of Food Engineering, Volume 77, Issue 2, November 2006, Pages 254-260

Keywords Apple; Fruit quality; Fruit flesh firmness; Non-destructive sensing; OHD; Shelf life; Sensor fusion; Soluble solids content; Spectral analysis

Abstract

Acoustic impulse resonance frequency sensor and miniaturized VIS/NIR spectrometer were applied on apple fruit *Malus domestica* 'Idared' and 'Golden Delicious' ($n = 800$) to predict fruit flesh firmness and soluble solids content (SSC) on tree and in shelf life. Partial least-squares calibration models on acoustic data and VIS spectra of 'Golden Delicious'/'Idared' apple fruits on tree were built for predicting the fruit flesh firmness: coefficients of determination (R^2) and standard errors of cross-validation (SECV) of $R^2 = 0.93/0.81$ and $SECV = 7.73/10.50$ [N/cm²] were calculated. SSC prediction of freshly harvested apples using NIR spectrometry was obtained with $R^2 = 0.20/0.41$ and $SECV = 1.29/0.94$ [°Brix]. Prediction of SSC and fruit flesh firmness of stored 'Golden Delicious'/'Idared' apple fruits showed high errors or was not possible.

The fruit maturity stage on tree was predicted as classes based on calendar weeks for 'Golden Delicious'/'Idared' apple fruits with 64%/66% correct classification and 92%/84% correct plus neighboring class with $SECV = 0.9/0.9$ [weeks]. Classes of 'Golden Delicious'/'Idared' apple fruit at different quality levels due to different storage conditions were non-destructively discriminated with 77%/84% correctly classified fruits and 93%/99% correct plus neighboring class with $SECV = 0.8/0.5$ [classes].

The results show the potential of non-destructive sensors for predicting accepted fruit parameters enabling the determination of optimum harvest date and fruit quality in shelf life.