

Title Postharvest quality of apple predicted by NIR-spectroscopy: Study of the effect of biological variability on spectra and model performance

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Abstract

The effect of cultivar, season, shelf-life and origin on the accuracy of near infrared (NIR) calibration models for the soluble solids content (SSC) and firmness of apple was studied based on a large spectral data set based on approximately 6000 apple fruit from different cultivars, origins, shelf-life exposure time and seasons. To interpret the variance in the spectra with respect to biological variability, functional analysis of variance (FANOVA) was used. From the FANOVA analysis it was concluded that the effects of cultivar, origin and shelf-life exposure time on the NIR spectra were all significant. The largest differences in the spectra were found around the water absorption peaks (970, 1170 and 1450 nm). External validations using independent data sets showed that the accuracy of the models increased considerably when more variability was included in the calibration data set. In general the RMSEP for predictions of the SSC were in the range 0.6–0.8 °Brix, while for Magness Taylor firmness it was 5.9–8.8 N, depending on the cultivar. It was shown that atypical data can lead to large validation errors. It is, therefore, important to collect a calibration data set which is sufficiently representative for future samples to be analyzed with the developed calibration models and to develop simple procedures for model adaptation during practical use.