

# Quantification of soluble solids and individual sugars in apples by Raman spectroscopy: A feasibility study

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## Abstract

This study reports the feasibility of using Raman spectroscopy for quantification of soluble solids and individual sugars in apples. Six different commercial apple varieties were measured by Raman spectroscopy at three different steps: 1) Intact apples with skin, 2) apples without skin and 3) juices obtained from apples. Results indicated that it is possible to measure Raman signals to a depth of 8mm into the apple with a wide area Raman probe. Multivariate calibration models were established to evaluate how well Raman spectra can be used to estimate the quality parameters SSC (%), total sugars, glucose, fructose and sucrose. Estimation accuracy for SSC was comparable with what is achievable with near-infrared spectroscopy: Root mean square error of cross-validation (RMSECV)=0.66, 0.46 and 0.72 % and coefficients of determination ( $R^2$ )=0.70, 0.85 and 0.63 for intact apples, apples without skin and juices, respectively. Sucrose and glucose were well estimated with RMSECV of 2.8, 1.9, 2.1mg/mL for glucose and 5.8, 3.9 and 3.7mg/mL for sucrose, for the three sample cases, respectively. Coefficient of determination was higher than 0.82 for all models. Regression coefficients for all calibration models highlighted identifiable Raman bands that could be related to the target sugars.