

# NIRS prediction of dry matter content of single olive fruit with consideration of variable sorting for normalisation pre-treatment

Xudong Sun, Phul Subedi, Rachel Walker and Kerry B. Walsh

Postharvest Biology and Technology, Volume 163, May 2020, 111140

---

## Abstract

The assessment of dry matter content (DMC) as a surrogate for oil content of single olive fruit was considered in terms of spatial variation in DMC, optimisation of spectral pre-treatments, wavelength range and calibration transfer procedure. There was no consistent variation in DMC from apical to distal end of the fruit. Short wave near infrared spectra (to 1100 nm) were acquired of single fruit using an interreflectance geometry, with the small size of the fruit resulting in baseline variation between samples. The pre-treatment methods of first derivative ( $D_1$ ), second derivative ( $D_2$ ), standard normal variate transformation (SNV), normalized spectral ratio (NSR), variable sorting for normalization (VSN) and their combinations were applied prior to development of partial least squares regression models on DMC. Root mean square error of prediction (RMSEP) values were reduced with use of the SNV-VSN- $D_2$  pre-treatment (by 34 and 35 %) to 0.95 and 0.88 %, for two handheld NIRS instruments, used in prediction of an external set,  $n = 212$ . The percentage of the predicted population within the limits of  $\pm 5$  % of actual values was 92.5 and 88.7 % for the VSN PLSR models and 83.0 and 77.3 % for the original models, for two instruments, respectively. Variable selection allowed a further improvement in RMSEP values (to 0.93 and 0.87 %) for the two instruments, respectively. For transfer of models between instruments, model updating based on SNV-VSN- $D_2$  pre-treated spectra resulted in a RMSEP of 1.00 %, compared to 1.79 % for  $D_2$  pre-treated spectra, outperforming the classical calibration transfer methods of piecewise direct standardization (PDS) and spectral space transformation (SST). The results have significance to the practical implementation of NIRS-DMC estimation of olive fruit in field conditions.