Application Note

No. 080-IR-205-E

Non-destructive NIR measurement of cherry fruit for evaluation of sugar concentration

Introduction

The NIR technique is widely used for non-destructive measurement of perishable foods and crops for evaluation of freshness, moisture, sugar, protein or fat content, etc. In this application, the correlation between the sugar concentration of cherry fruits (Sato-Nishiki; a Japanese brand) and the NIR spectrum was evaluated. A good correlation between the two parameters was confirmed with the PLS (Partial Least Square) chemometric model as obtained using the NIR spectrum and sugar concentrations examined using a saccharimeter.

Apparatus

The Model VIR-9650 Portable NIR Spectrometer (NIR source; halogen lamp, detector; InGaAs) was used with an accessory, the Model VIR-NRF-N Diffuse Reflectance accessory. The appearance of the instrument and accessory attachment is shown in Figure 1. The sample, a cherry was placed directly on the sample stage of the diffuse reflectance accessory (Figure 2). The NIR source energy is introduced from the bottom of the accessory stage into the sample, the diffusely reflected light from the sample then collimated and introduced into the InGaAs detector. A commercially available saccharimeter (IUCHI SEIEIDO, Japan) was used for the quantitation of sugar concentration.

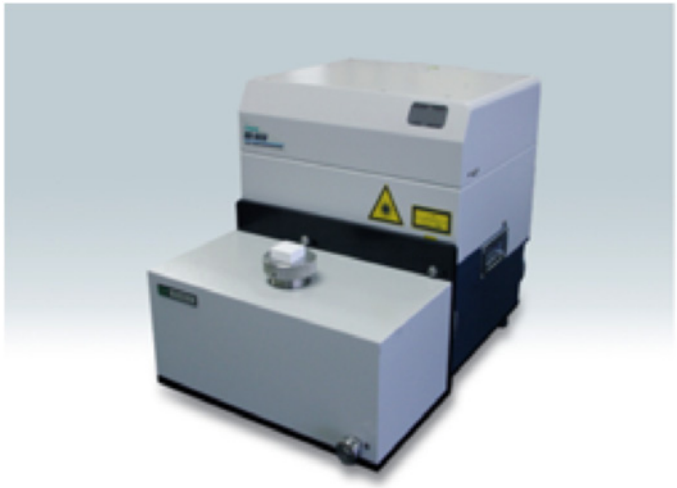

Figure 1: VIR-9650 and VIR-NRF-N accessory

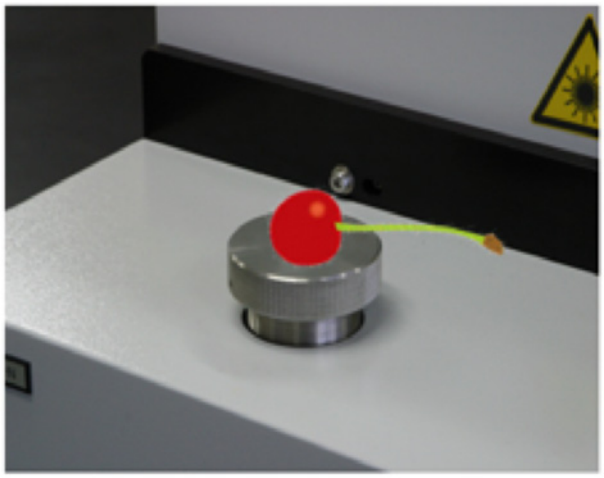

Figure 2: Cherry sample placed on sample stage

Results

The NIR DRIFTS spectra of several different sampling points on a single cherry sample are shown as Figure 3. The spectrum baseline varies as a result of the different color or shape of each sampling point. This variation can be corrected by obtaining the 1st order derivative of the spectra and an optimum selection of the useful calculation range such that a good calibration model is obtained. The highlighted ranges in the figure were selected for the sugar content calculation. The PLS calibration model obtained with the estimated and actual sugar content (saccharimeter) is outlined in Figure 4. A reasonable correlation coefficient (0.9128) was obtained and indicates that the non-destructive NIR measurement can be applied to other products such as perishable foods, crops and pharmaceuticals for quantitation of abstract qualities such as composition, moisture, sugar, protein or fat content, etc.

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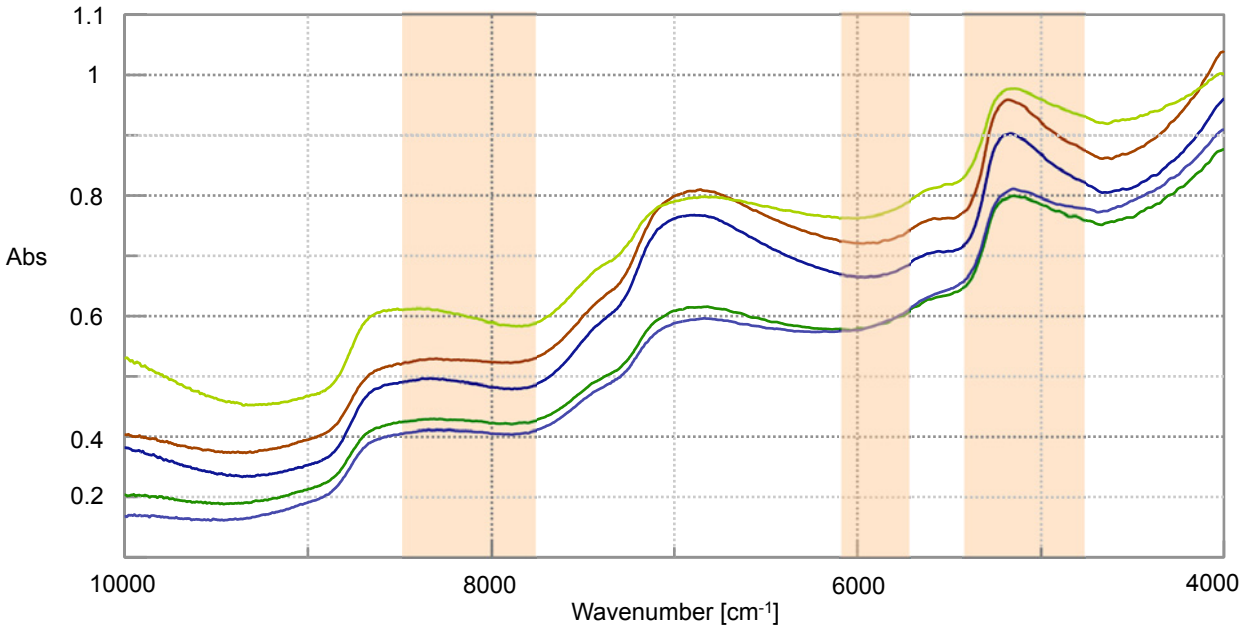
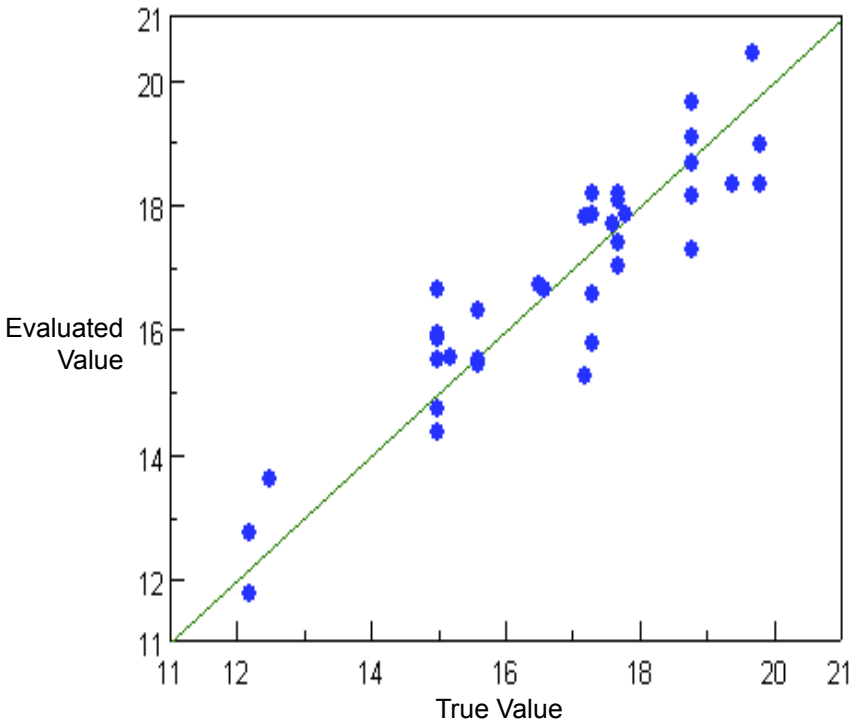


Figure 3: NIR DRIFTS spectra of several different sampling points on a cherry sample



Correlation coefficient: 0.9128
RMSEP: 0.825
Calculation parameters:
No. of factors: 7
Pre-processing: 1st derivative
Data thinning: 4
Scaling: off

Figure 4: PLS calibration model obtained with NIR spectrum (estimated) and actual sugar content (saccharimeter)

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