

Introduction.

Tallow is the fat extracted from animals. It is used in cosmetics and for producing soap and detergents. The level of free fatty acids (FFA) in the tallow is significant because it reflects the quality of the tallow. The lower the FFA level the higher the quality and the more stable the product, ie. less likely to go rancid. This study shows that Near Infrared Transmission spectroscopy can be used to measure FFA in tallow.

Instrumentation.

The MultiScan Series 3000 Near Infrared Transmission spectrometer uses a rotating sample drawer to analyse a wide range of materials. The instrument uses a diode array spectrometer to scan the wavelength region 720-1100nm at a resolution of 10nm. The instrument scans the sample ten times and then gives the average of the sub scans in the final predicted result.



Sampling Technique.

6 samples of tallow were provided by a rendering company. The tallow samples were relatively solid at room temperature. Each sample was spooned out of the sample container and spread into the Series 3000 lexan sample dish and smoothed level using a plastic slide. The sample dish rotates in the light beam and the instrument collects 10 Near Infrared Transmission (NIT) spectra, 720-1100nm, from the sample. Each sample was scanned twice and as such $2 \times 10 \times 6 = 120$ spectra were collected and stored in memory. The spectra were uploaded into NTAS (NIR Technology Analysis Software) and Partial Least Squares Regression (PLS) was used to develop a calibration for Free Fatty Acid.

Results

Calibration Data

Figure 2.1, below, shows the NIR spectra for the Tallow samples.

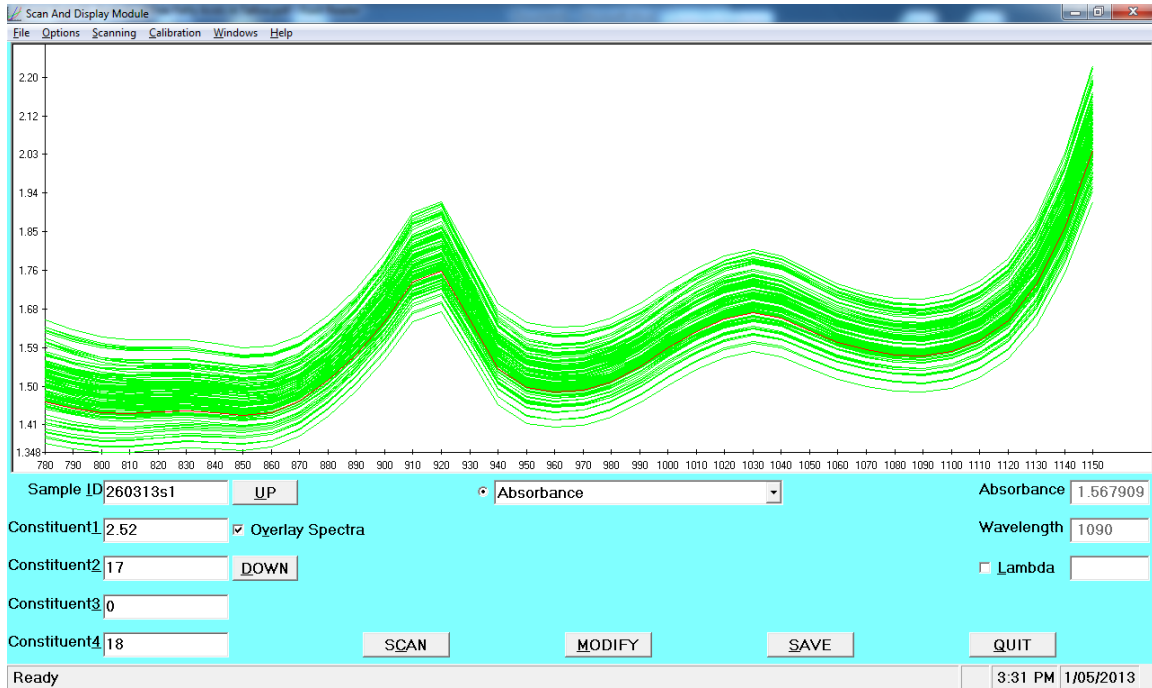


Figure 2.1: Plot of NIR Spectra for Tallow.

Figure 2.2 shows the calibration statistics for the NIR Free Fatty Acids values versus the reference values.

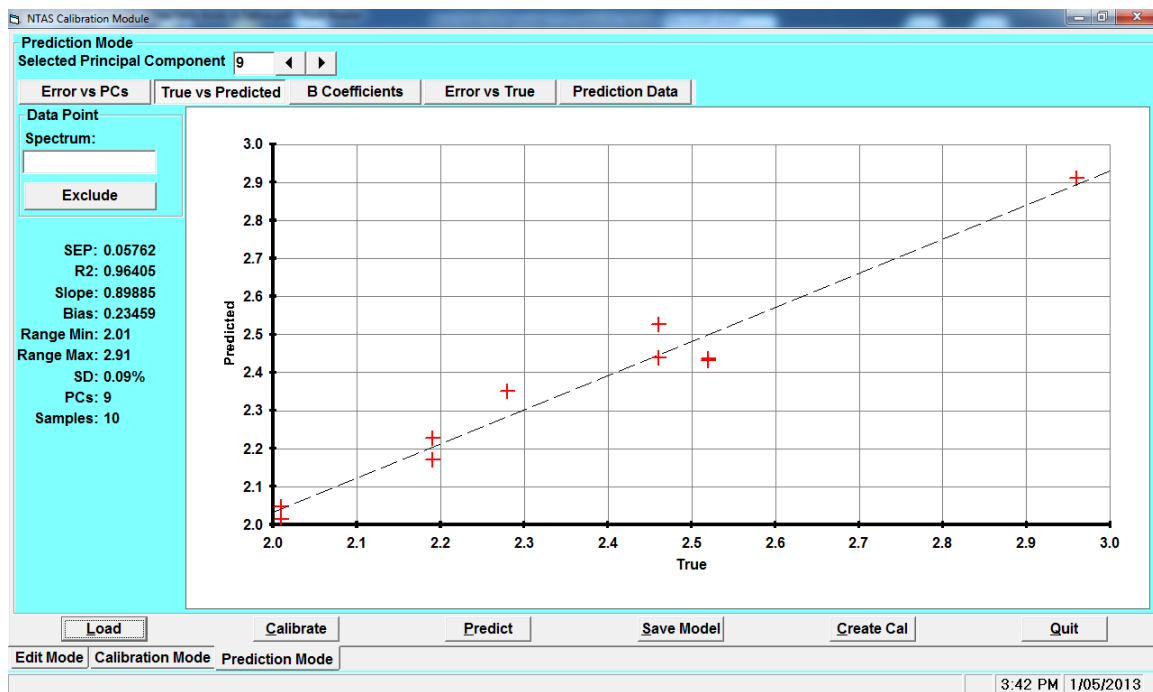


Figure 2.2: The Standard Error of prediction is 0.06% with a correlation (R2) of 0.96.

Prediction.

6 samples from the batch were tested to check the model for prediction. Ideally you would test samples not used in the calibration set. These samples were used as a test set to evaluate the accuracy and precision of the calibrations. Table 1 provides a summary of the predicted FFA results comparing against the Lab FFA values.

Table 1: Predicted FFA results Vs lab FFA results.

Sample ID	NIR	LAB	Errors
220313s	2.35	2.28	-0.07
250313Bs	2.91	2.96	0.05
260313s	2.43	2.52	0.09
260313Bs	2.44	2.52	0.08
280313s	2.05	2.01	-0.04
280313Bs	2.01	2.01	0.0
270313s	2.23	2.19	-0.04
270313Bs	2.17	2.19	0.02
020413s	2.53	2.46	-0.07
020413Bs	2.44	2.46	0.02

Average	0.00
SEP	0.06

Conclusion.

This study shows that a NIT calibration can be developed for Free Fatty Acid in Tallow. It is considered that the Standard Error of Calibration (SEC) is acceptable considering the range of samples used in this study. More samples will be required to develop a more robust calibration for FFA. Next Instruments have a high degree of confidence that the MultiScan Series 3000 Food Analyser is suitable for the analysis of FFA in tallow.