Application Note 37: Analysis of Glycerol and Moisture in Synthetic Sausage Casings.

Introduction:

NIR Spectroscopy measures three chemical bonds, ie, C-H, O-H and N-H. Synthetic sausage casings are made from protein, water and glycerol, and as such, have excellent NIR spectra. This preliminary study is intended to show that NIR Transmission provides a rapid and convenient means of measuring Glycerol and Moisture in sausage casings.

Description:

Three samples of sausage casings were provided. Each sample was supplied with data on the glycerol and moisture contents.

The three samples were scanned using a NIR Technology Australia NIT-38 NIR Transmission Analyser with a 110mm long Squeeze Cell. Two strands or rolls of sausage casing were placed side by side in the Squeeze Cell and the windows closed together to form a flattened wad of casings. Care was taken to ensure that the windows were covered by the sample and that minimal light could pass through the space between the two rolls.

Five scans were collected from each sample. The cell was then repacked and 5 more scans were collected. As such a total of 3 x 2 x 5 = 30 scans were collected and stored in the NIT-38 memory. Figure 1. shows the NIT spectra of the sausage casing samples. Since there was one sample, ie, 23AEC511, which was red, while the other two, 22ABA007 and 26ABA306, were clear, there is a noticeable difference in the spectra, especially below 800nm, where colour is still observed. As such, the second derivative spectra were computed, see figure 2. The second derivative algorithm helps to remove baseline effects and to better show the areas of the spectra sensitive to the chemical components of interest. It can be seen that at approximately 820, 900 and 1000nm, the spectra show differences due to chemical composition, as well as scatter.

The spectral data was uploaded to a PC and the spectral file was imported into NTAS (NIR Technology Australia Software). The reference values for glycerol and moisture were entered and a Partial Least Squares Regression (PLS) was performed.

Results:

Figure 3. shows the plot of the NIT Predicted Glycerol and the Reference Glycerol. The Standard Error of Calibration (SEC) is 0.11 and the Correlation (R2) is 0.987. It was not possible to perform a calibration on the Moisture content, since two of the samples had the same moisture values. As an estimate, it would be expected that the SEC for Moisture would be similar to Glycerol, ie, 0.1%

Since there were only three different samples provided, the calibration data is only provided as an indication of the level of accuracy which the NIR technique may provide. Normally calibrations require 100 samples, however the sausage casings are very

consistent and there are very little matrix effects. This would enable a calibration to be developed with approximately 30 samples, as long as the samples covered an adequate range for glycerol and moisture.

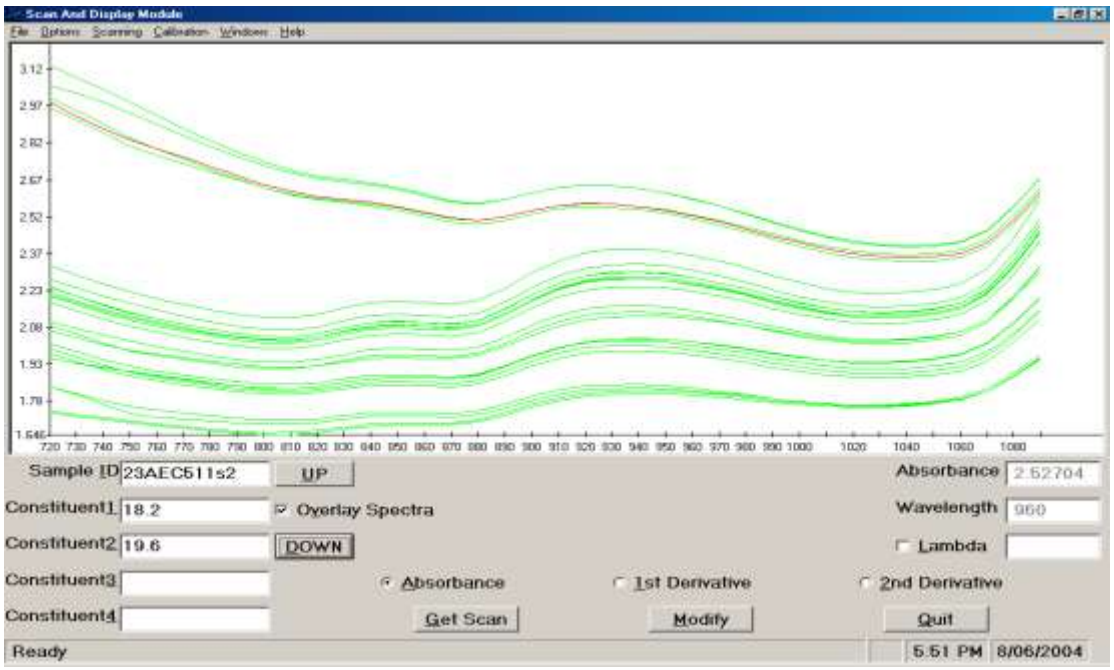

Figure 1. NIT Spectra of Synthetic Sausage Casings

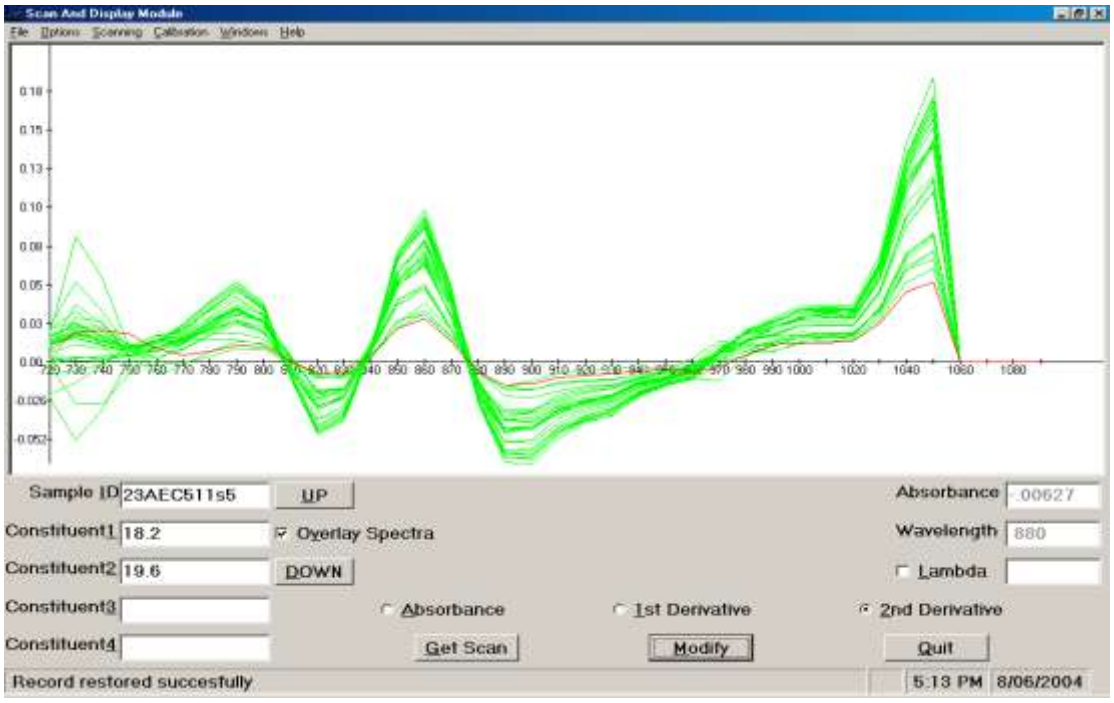

Figure 2. Second Derivative NIT Spectra of Synthetic Sausage Casings

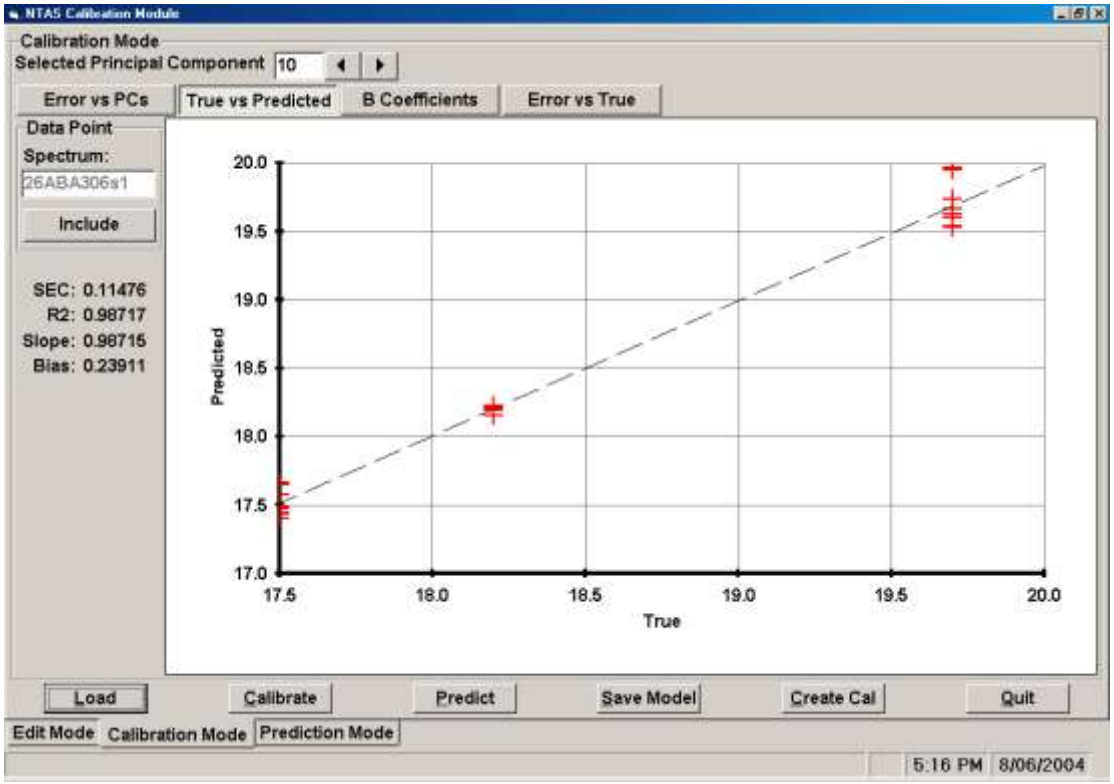

Figure 3. Calibration Plot – Glycerol

Conclusion:

This study is intended to be preliminary. It demonstrates that the NIT-38 can measure these samples without any sample preparation. The analysis time is approximately 30 seconds.

It was also observed that by making a sample cell with a narrower window, eg, 15mm wide, then it would be possible to place a roll of sausage casing into the Squeeze Cell and compress the sample to cover the entire window. This simple modification would provide a simple means of introducing the sample to the analyser and ensure better operator repeatability.

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