Application Note 36: On Line NIR Analysis of Cheese Curd

Introduction:

Many dairy products such as Philadelphia cream cheese, cream cheese dips and spreads and processed cheese start out as cheese curd. The whey is separated from the curd, leave a fat, carbohydrate, protein and water mixture with a thick consistency. The curd is used as the base for many dairy products, however the only component that can be adjusted is the water content. Depending on the use for the curd, the water content may vary from 40 to 70%. The control of the water content is a critical parameter in optimising the cost of the product, but also the suitability for use. In other words, by adding water to the stream, less curd is required. However poor control of the water content may also lead to a mixture with poor physical properties and texture.

This study shows how a FOP-38 On Line Analyser has been used to measure the water content continuously in a pipe discharging cheese curd from a separator.

Description:

Figure 1. shows the FOP-38 On Line Analyser mounted on a wall bracket. A 6 meter fibre optic cable with a 8mm diameter bundle of fibres, is passes through the ceiling of the processing room, down to the on line flow cell, as shown in figure 2.

Figure 1. FOP-38 On Line Analyser

Figure 2. In Line Flow Cell

A 20 W lamp shines light through a 10mm pathlength cell as the cheese curd is pumped through the cell. The NIR light is collected by the fibre optic bundle on the adjacent side of the flow cell and carried up to the analyser. The NIR light is separated into a NIR spectrum, from 720-1100nm. In this sector of the NIR spectral region, fat, protein and water absorb energy at approximately 905, 970 and 1020nm. The FOP-38 NIR spectrometer uses a flat field spectrograph and a 38 pixel silicon photodiode array detector to measure the energy across this spectra range. The amount of light absorbed at each wavelength (nm) is used to measure the amount of fat, protein and water in the cheese curd. Figure 3. shows the NIR spectra of the cheese curd and figure 4. shows the second derivative spectra of the samples.

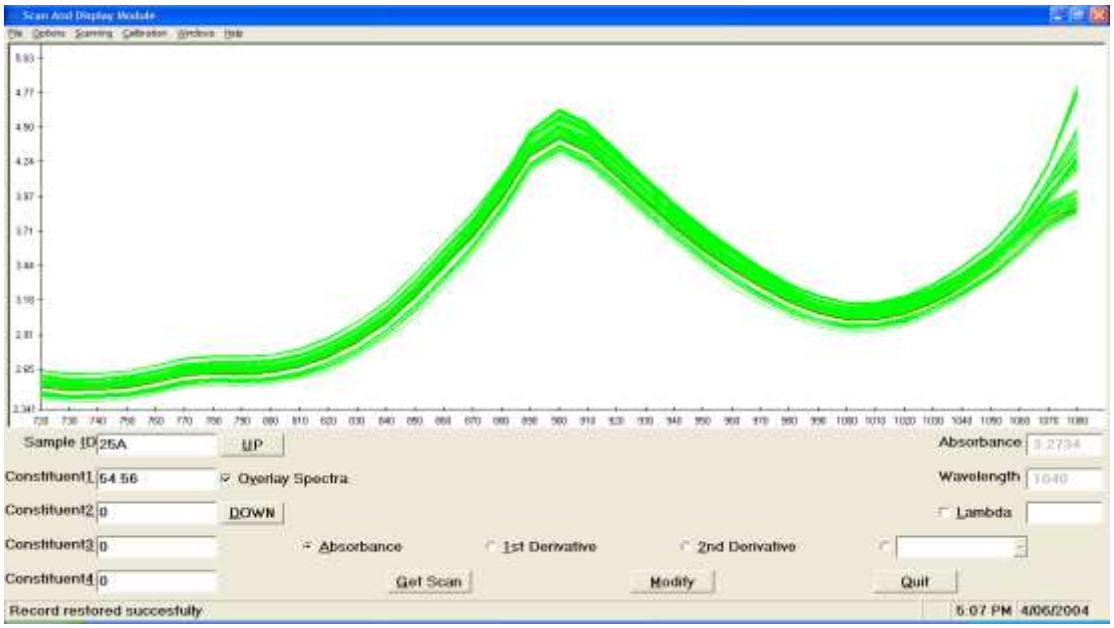

Figure 3. NIR Transmission spectra of cheese curd.

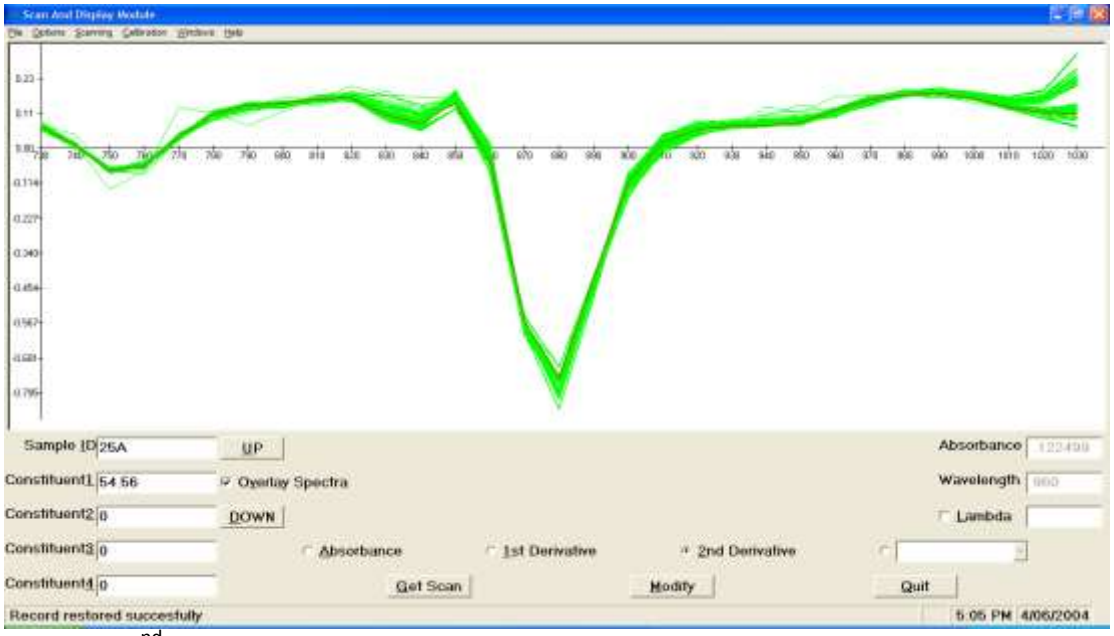

Figure 4. 2nd Derivative NIR Transmission spectra of cheese curd.

In this application of the FOP-38, only water was of interest, however fat and protein can also be measured simultaneously with water content.

Calibration:

To calibrate the NIR spectrometer, approximately 22 samples of cheese curd were collected from the discharge point while the NIR spectra were store in the instruments memory. The samples were analysed using the existing laboratory NIR analyser. The NIR spectra and their corresponding water contents were loaded into our software package, NTAS, and a PLS (Partial Least Squares Regression) analysis was used to develop a calibration model. Figure 5. shows the plot of the FOP-38 NIR Predicted water content versus the laboratory NIR water content.

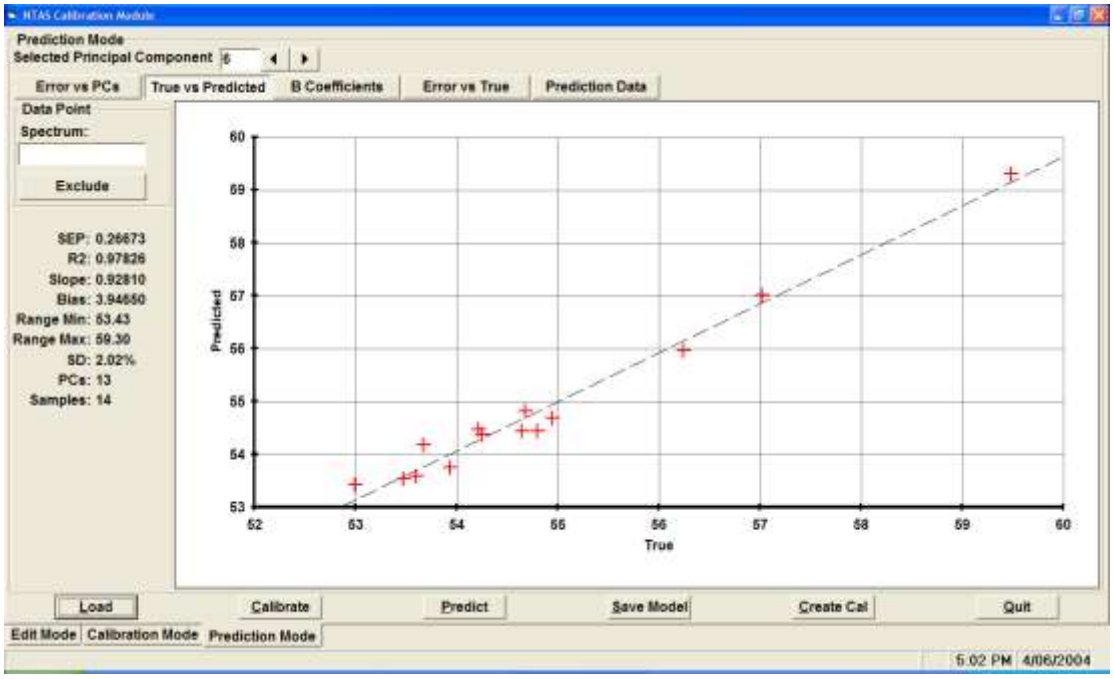

Figure 5. NIR Calibration: Plot FOP-38 Water vs Laboratory NIR Water

The calibration model was downloaded into the FOP-38 and the system was set to monitor the water content. Figure 6. shows a line graph of real time data collected using the FOP-38.

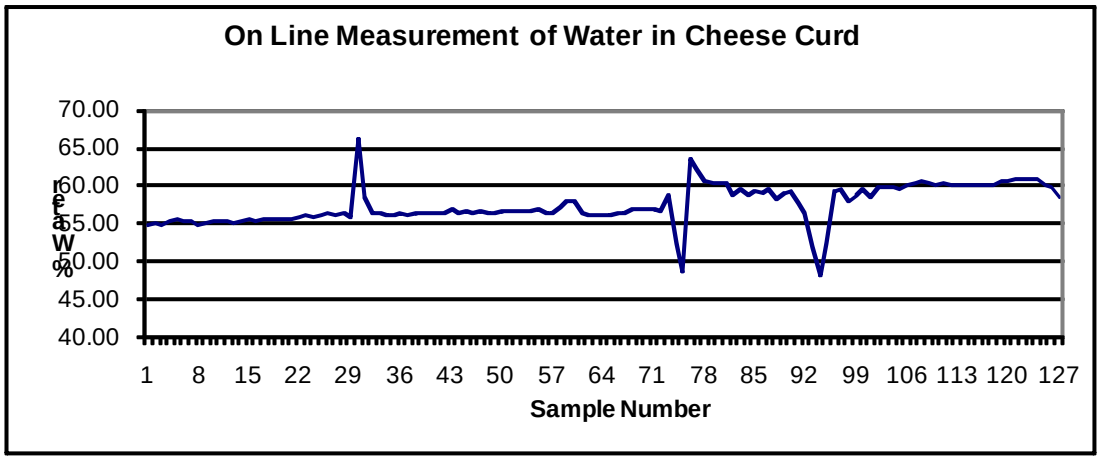

Figure 6. Real time analysis of water in cheese curd.

Discussion:

The calibration samples did not cover the entire range of water contents and so further collection was required. However the initial calibration proved to be adequate to provide a means of monitoring the water content. In figure 6. there are several spikes. These represent when the separator was stopped or when water was flushed through the line between batches. The FOP-38 On Line Analyser was very easily installed. The instrument works virtually continuously and has tracked the laboratory method over several weeks.

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