Application Note 55: Analysis of Fat, Protein, Carbohydrates and Solids in Ice Cream.

Introduction:

Near Infrared Spectroscopy, NIRS) measures fat, protein, sugars and water based on the presence of C-H(fat), N-H(protein), C-O-H(sugars) and O-H(water) bonds in a product such as ice cream. To demonstrate the feasibility of NIRS to measure components in ice cream, 6 samples of ice cream and sorbet products were purchased from the local supermarket. The study is not intended to prove the method, but more to illustrate the potential for this application.

Description:

Samples of 6 different brands and types of ice cream and desert products were selected to provide a range of fat concentrations between 1 and 14%. Three samples were white and three were chocolate flavoured. One of the chocolate samples was a sherbet, ie, 1% fat content. The samples were left at room temperature to bring them to a liquid consistency.

100ml of each sample was poured into a glass petri dish and loaded into the Series 3000 Food Analyser. 10 Scans of each sample were collected between 720 and 1100nm. All samples were scanned in duplicate. Figure 1. shows the NIT spectra of the samples.

The spectra were imported into Excel where the component levels were added to the spectral data. The component levels were taken off the nutritional labels of each package.

The edited spectral file was imported into NTAS(NIR Technology Australia Software) where the spectra were examined. It can be seen that the chocolate samples absorbed very strongly below 820nm. Normally spectra should be between 1 and 4 absorbance units, ie, between 10 and 0.01% energy throughput. Spectra with absorbance above 4 and especially 5, should not be used for calibration.

The Calibration routine in NTAS uses Partial Least Squares(PLS) regression to derive a calibration model for each component between the spectra and the component levels. Figures 2 through 5, show the calibration plots for fat, protein, carbohydrates and solids.

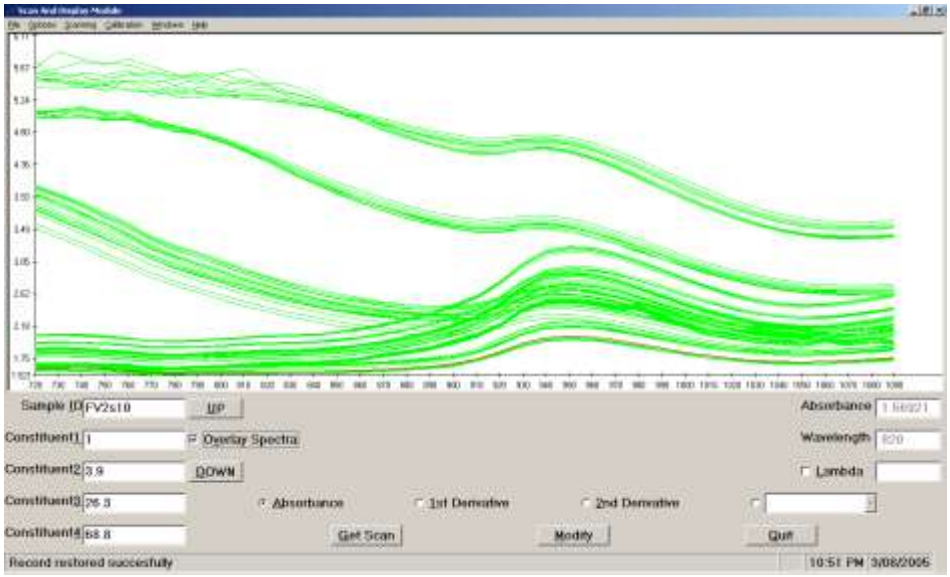

Figure 1: NIT Spectra of Ice Cream Samples

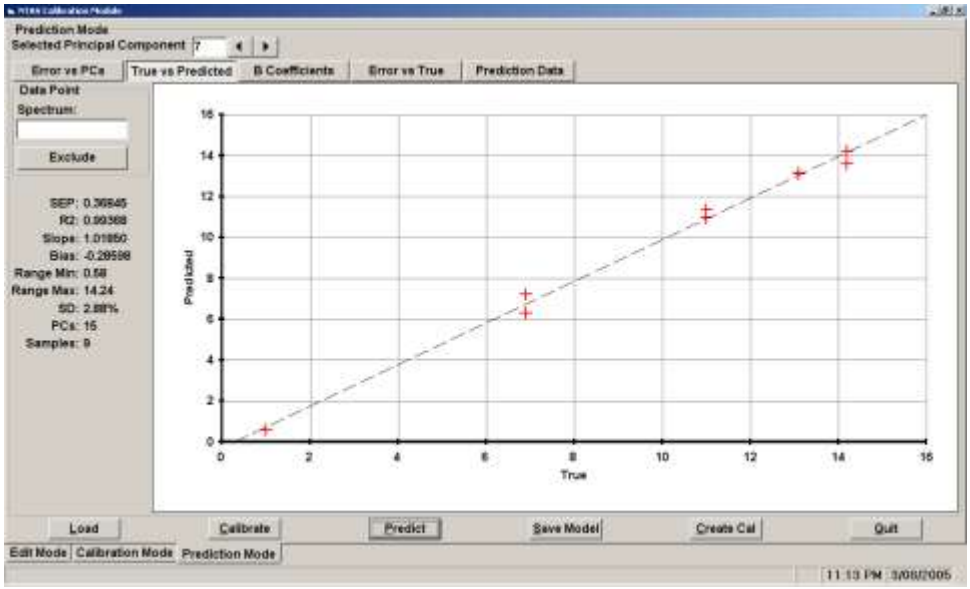

Figure 2: Calibration Plot – Fat

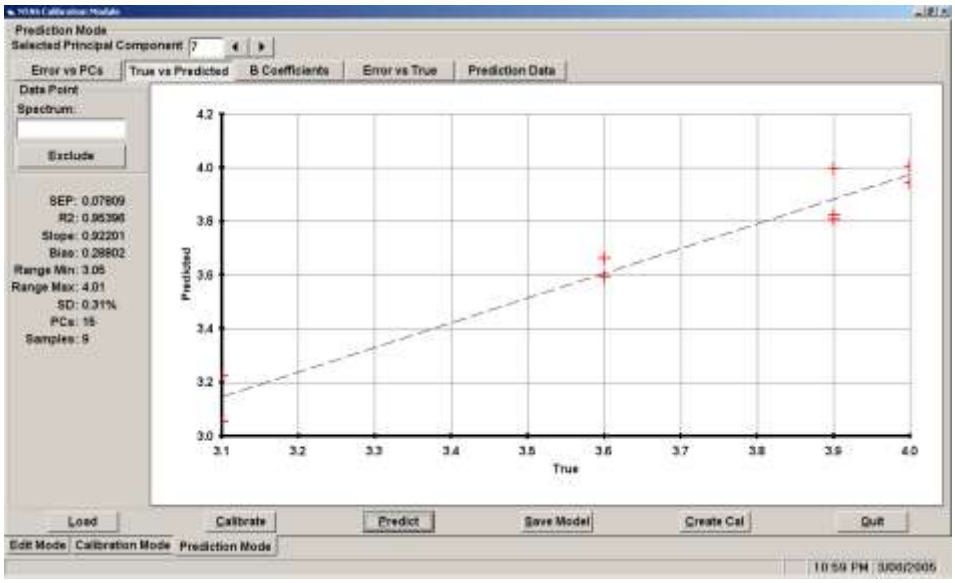

Figure 3: Calibration Plot – Protein

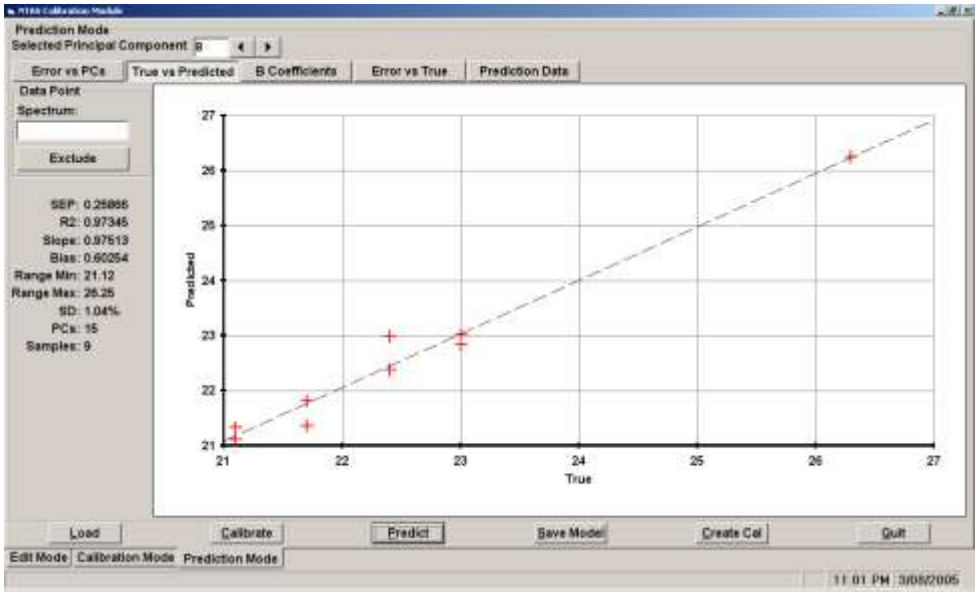

Figure 4: Calibration Plot – Carbohydrates

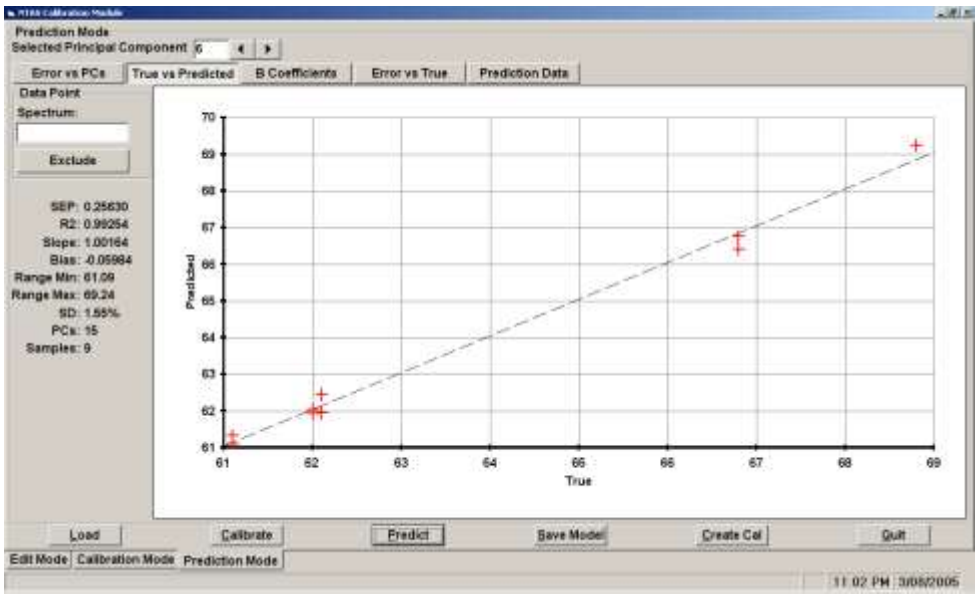

Figure 5: Calibration Plot - Solids

Discussion:

The calibration plots for fat and solids demonstrate excellent linearity and low errors. This data indicates that the Series 3000 Food Analyser is capable of measuring fat and solids in ice cream. The plots for protein and carbohydrates are not as strong as for fat and solids. The range of protein values is too small to properly develop a calibration. And the distribution of carbohydrate in these samples is skewed to 21 to 23%. More samples between 23 and 27% would be required to develop a reasonable calibration. Nonetheless the errors of calibration for all four components are considered in line with other analytical techniques.

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