Application Note 162. Measurement of Tuna for Fat, Protein and Moisture using the MultiScan Series 2000 Near Infrared Transmission Analyser

Introduction:

Near Infrared Transmission (NIT) spectroscopy is an unique technique for measuring multiple components in food and agricultural products. Over the past two years, NIR Technology Systems has demonstrated the ability to measure fat, protein and moisture in meat samples including, beef, lamb and pork. The same technology can also be applied to fish and fish meal samples.

When NIR light between the wavelength range from 720-1100nm, is passed through a sample of minced tuna fish, energy is absorb by the molecular bonds, i.e., C-H (Fat), N-H(Protein) and O-H(Water) at specific frequencies of light. The amount of energy absorbed at each frequency is proportional to the concentration of the Fat, Protein and Moisture.

The MultiScan Series 2000 Near Infrared Transmission Analyser and the Series 3000 Food Analyser are instruments suitable for both the measurement of meat and fish. The Series 3000 is simpler to use due to the rotating dish sampling system, however the Series 2000 has the added advantage of being able to measure powders and liquids.

Series 2000 NIT Analyser

Series 3000 Food Analyser

This study is intended to demonstrate the suitability for the MultiScan range of NIT analysers for the measurement of Fat, Protein and Moisture in Tuna.

Procedure:

8 samples of canned tuna were selected from a local supermarket. The samples were selected to provide as wide a range in fat, water and protein as possible. 50grams of each tuna samples were blended in a Tefal La Moulinette as shown below.

The blended sample was then loaded into the Series 2000 Squeeze Cell. The window was closed and fastened to squeeze the tuna paste between the glass windows. The Squeeze cell was then placed into the Series 2000 NIT Analyser where 10 scanned were collected and stored in memory. Each tuna sample was repacked to provide two sets of 10 spectra.



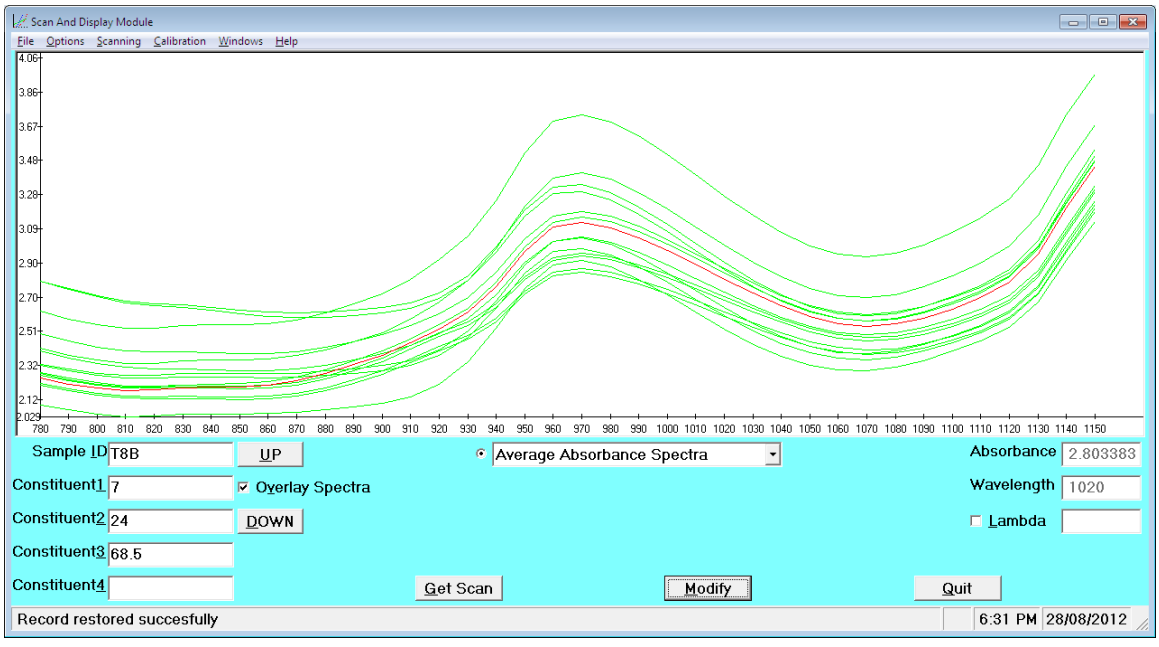




The spectra were then uploaded to a PC using NTAS (NIR Technology Analysis Software). The spectral data was edited by adding the reference values for Fat, Protein and Moisture corresponding to each sample. A Partial Least Squares (PLS) regression analysis was performed on the spectra file in NTAS in order to develop the optimum calibrations for Fat, Protein and Moisture.

Results:

Figure 1 presents the Near Infrared Transmission spectra for the 8 tuna samples. Note that there are 2 spectra per sample.



Figures 2, 3 and 4 show the calibration plots for Fat, Protein and Moisture.

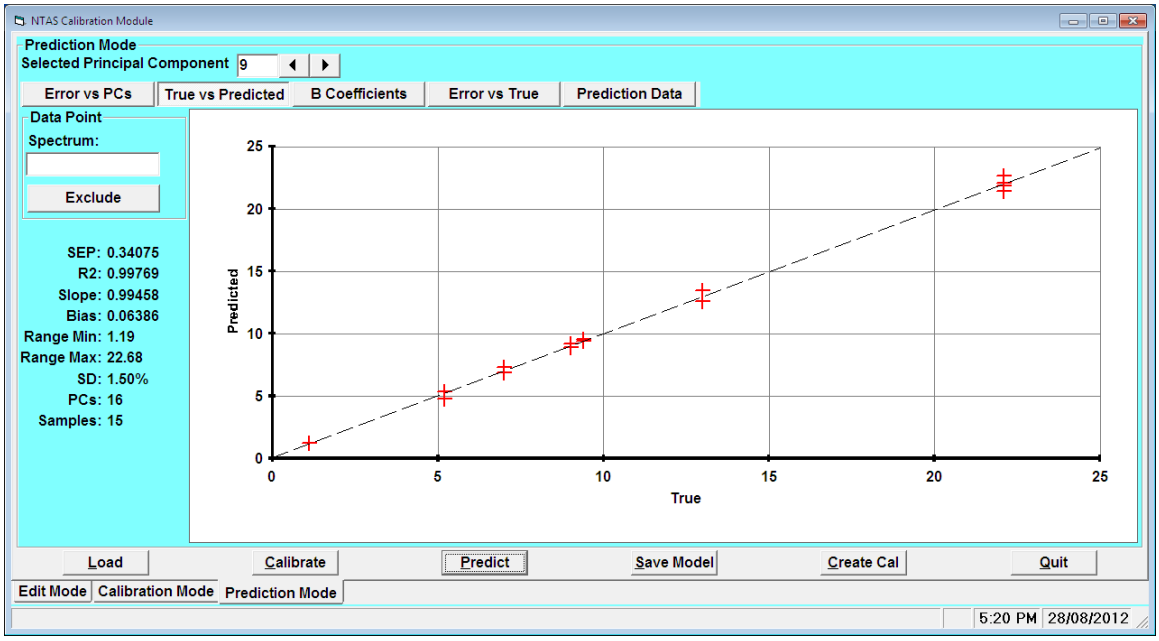


Figure 2. Calibration Plot for Fat in Tuna

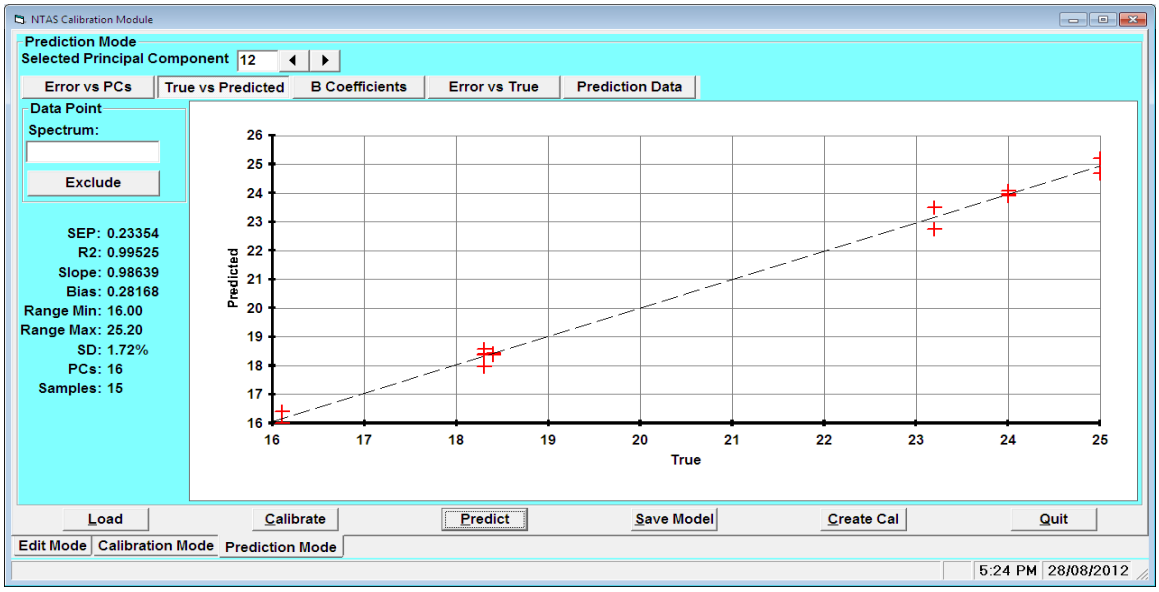


Figure 3. Calibration Plot for Protein in Tuna

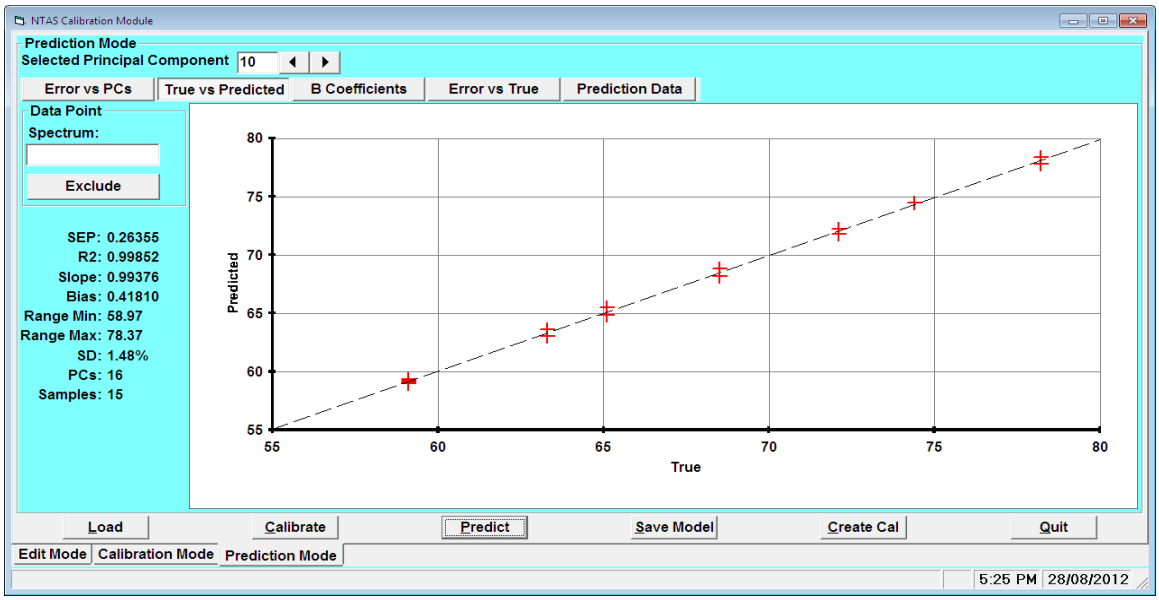


Figure 4. Calibration Plot for Moisture in Tuna

The above plots and the associated statistics are summarised below:

Component	SEC (Standard Error of Calibration)	R^2 (Correlation Coefficient)
Fat	0.34%	.997
Protein	0.23%	.996
Moisture	0.26%	.998

Discussion:

This study uses canned tuna samples rather than whole tuna pieces. It is understood that in tuna pieces the concentration of the fat, protein and moisture may be different to that found in canned tuna. However a previous study conducted on whole tuna showed fat and moisture levels to be between 5 and 45% for fat and 30 and 90% for moisture. Once a piece of tuna is blended it is the same as that obtained from a can of tuna. As such, it is our opinion that the data from this study can be directly applied to whole tuna pieces.

This study is not intended as a thorough calibration development since there were only 8 samples used in the study. Approximately 30-50 samples are considered sufficient to develop a robust calibration for these three components.

The SEC and R2 values shown above indicate that the Near Infrared Transmission technique is more than suitable for measuring Fat, Protein and Moisture in Tuna.

NIR Technology Systems
366 Edgar Street, Condell Park, NSW, 2200, Australia
Tel: 612 9708 5068, Fax: 612 9708 5537
Email: nirtech@nirtech.net, Web: www.nirtech.net