Application Note 27: Analysis of Chemical Lean in Raw Meat

Introduction

125 samples of ground raw beef were scanned using the NIR Technology Australia NIT-38 Meat Analyser. A calibration was developed to measure Chemical Lean in raw meat. This application note provides data comparing the NIT-38 to a microwave method for measuring Chemical Lean.

Sampling Procedure

The meat samples were placed in a heavy-duty homogeniser and processed for a specific time to provide uniformity in sample presentation. Approximately 80g of the sample was placed in the centre of the cell and the lid brought down to enclose the sample. Any excess sample was removed from the edges to allow the cell to close completely without any pressure. If too little sample was presented, more was added to fill the gaps.
The sample was then scanned on the NIT-38 analyser, 5 sub-scans per analyses and the average of these scans was used to compute the final result.

Results.

The 125 NIR spectra of meat were regressed against the Chemical Lean data from the microwave method. Partial Least Squares (PLS) regression was used to develop a calibration model. Table 1 provides a summary of this data along with statistical analysis and figure 2 shows the plot of the NIR and Microwave measurements.

Table 1: Calibration statistics for the determination of chemical lean in meat samples (no data pre-treatment).

					Calibration		Prediction	
	n	***Outliers***	**Range (%)**	**PC's**	**R**	**SEC (%)**	**R**	**SEP (%)**
Raw Meat	125	5	55-95	7	0.93	1.99	0.93	2.01

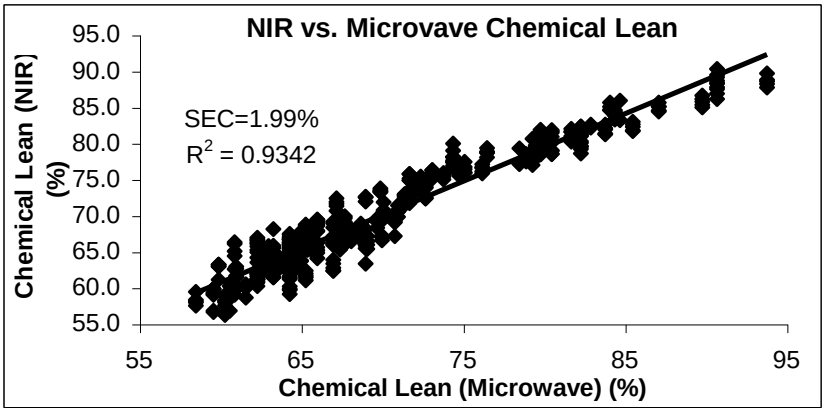

Figure 2: NIR vs Microwave Chemical Lean data in raw meat (no data pre-processing).

It is apparent from figure 2 that there is a considerable degree of curvature in the model, R=0.93. The standard error of calibration SEC is around 2%, giving it comparable accuracy to the

microwave method. If the data is separated in two and recalibrated so that one calibration measures between 55-75% CL and the second between 75-95% CL, the calibration and hence predictive statistics improve significantly.

According to Naes and Issakson, data pre-processing with a multiplicative scatter correction (MSC) followed by regression, should correct for the non-linearity and allow CL to be measured across the 55-95% range. Table 2 and figure 3 provide a summary of the results obtained by applying MSC to the spectral data and repeating the PLS calibration.

Table 2: Calibration statistics for the determination of chemical lean in meat samples (MSC pre-treatment).

					Calibration		Prediction	
	n	***Outliers***	**Range (%)**	**PC's**	**R**	**SEC (%)**	**R**	**SEP (%)**
Raw Meat	125	3	55-95	5	0.97	1.48	0.97	1.45

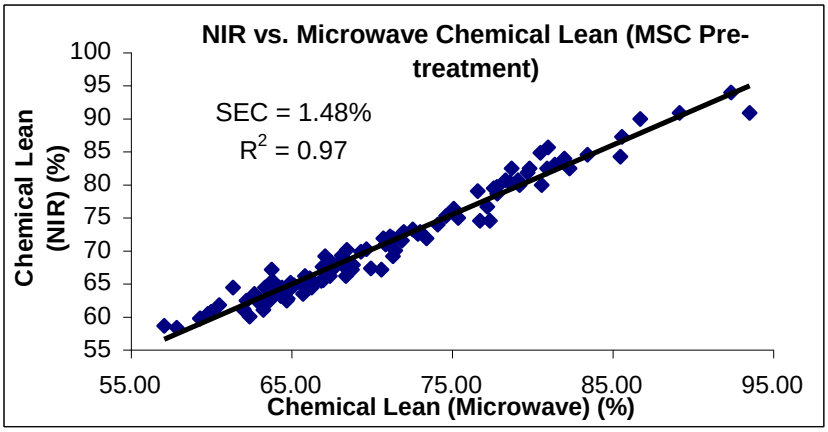

Figure 3: NIR vs Microwave Chemical Lean in raw meat (MSC pre-processing).

Application of MSC improves the calibration in all aspects. Figure 3 shows the calibration is now more linear and the SEC is now 1.48%. The other point to notice about this model is that it required less principal components (PC's) to describe the system. This reduces the likelihood of the model over-predicting future samples and also from becoming unstable.

Conclusion.

From the data obtained from this study, the determination of chemical lean in raw meat samples using the NIT-38 analyser is possible and a reproducible sampling technique has been developed. The standard error of calibration (i.e. accuracy) of the calibration is 1.48%, which is the level required for these measurements.

The results of the meat meal calibration will be presented in another document, as the results have not been obtained yet.

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