Application Note 18: Determination of the Components in Meat Meal Samples.

Introduction:

In December 2001, a study was performed to determine if an NIR analyser operating in transmission mode could determine the following components of meat meal: Protein, Moisture, Fat and Ash content. The study involved the development of a reproducible sampling technique and a calibration model capable of determining the properties to an acceptable level of accuracy.

Procedure:

Meat meal samples (provided by Rockdale Beef Pty Ltd.) were analysed for the properties to be determined and the lab data is presented in table 1. Also listed is the laboratory methods used for the determination of the properties (table 2).

Sample No.	Protein (%)	Moisture (%	Fat (%)	Ash (%)
1	56.5	6.1	12.7	22.5
2	51.1	5.5	10.2	30.1
3	56.2	5.7	11.2	27.2
4	54.5	5.4	10.2	28.2
5	49.7	6.2	9.2	33.4
6	51.7	8.1	8.8	28.3
7	54.1	5.7	11.9	26.1
8	48.9	5.5	8.3	37.7
9	57.4	6.0	11.6	24.4
10	52.7	5.0	10.1	28.5

Table 1: Laboratory Analysis Results for Meat Meal Samples.

Property	Method
Protein	Rockdale Beef method TM6
Moisture	Rockdale Beef method TM4
Fat	Rockdale Beef method TM5
Ash	Rockdale Beef method TM7

Table 2: Methods Used to Determine the Properties Listed in Table 1.

The samples were used as received as moist brown powders. A hinged “squeeze” cell with a 5mm pathlength was used for the NIR analyses. The powder was placed on the sample window, levelled off with a spatula, closed and scanned on an NIT2000 (NIR Technology Australia) 38-element spectrophotometer. All measurements were performed in triplicate and the spectral data, along with the laboratory data, were regressed using Partial Least Squares (PLS) Regression using the Pirouette software package. The results are presented in the next section.

Results: All data was averaged over the individual scans and the following data presents the statistical analyses based on the averages. Overall, there was one outlying sample, (sample 6) which was omitted from the calibration.

- **Protein**: Figure 1 shows the predictive ability of the calibration for the protein data.

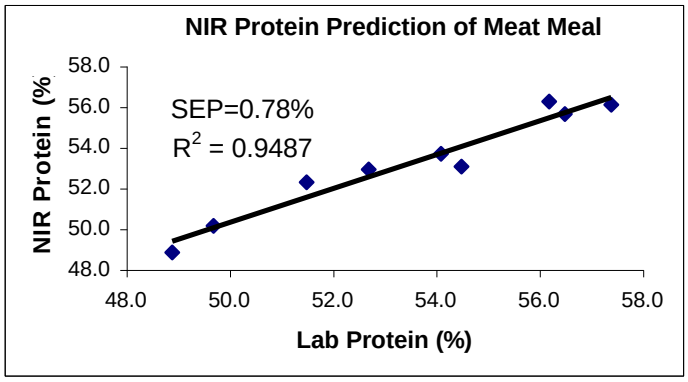

Figure 1: Predicted Protein Results.

Figure 1 clearly shows that there is a good correlation between the predicted and laboratory data. An error statistic of 0.78% is very low considering the protein content is usually in excess of 50% of the composition.

- **Moisture**: Figure 2 shows the results for the moisture prediction.

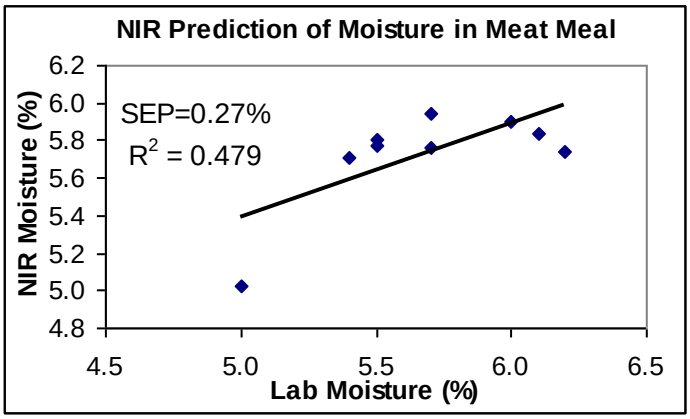

Figure 2: Predicted Moisture Results.

The results of figure 2, on first inspection, do not look promising, but if the fact that the range of moisture samples available for the calibration was very narrow is taken into consideration and the error of prediction was 0.27%, then with a larger set of samples, a reliable calibration should be able to be developed.

- **Fat**: Figure 3 shows the predictive ability of the calibration for the determination of fat.

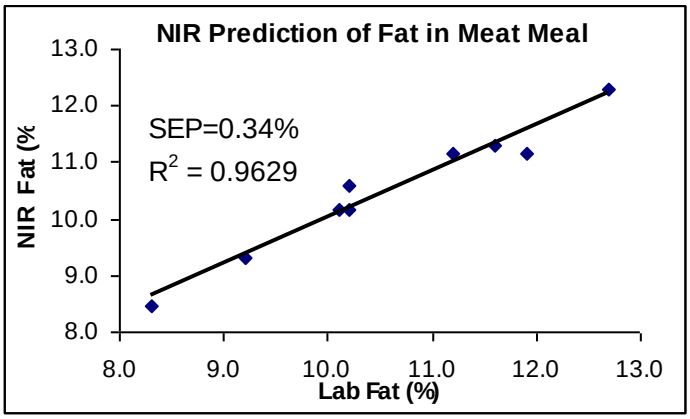

Figure 3: Predicted Fat Results.

Figure 3 shows a very good correlation between predicted and laboratory fat results, as indicated by the high correlation coefficient. An error of 0.34% is very low, hence calibrating for fat content should be possible.

- **Ash:** Figure 4 shows the predictive ability of the calibration for the determination of ash content.

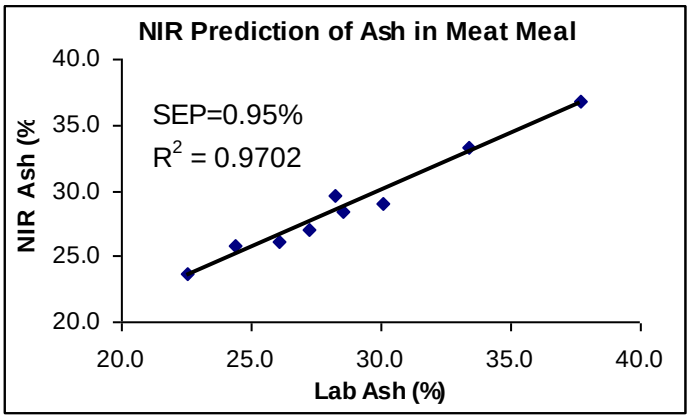

Figure 4: Predicted Ash Results.

Figure 4 shows that there is a high correlation between predicted and laboratory ash (0.97) and the error of determination is under 1%.

Conclusion: From the above preliminary investigation, the determination of the composition of meat meal by NIR transmission spectroscopy seems possible. With the inclusion of more samples in the calibration set covering a broader range of constituents and some refinement in the sampling technique, it would seem likely that a robust calibration should be able to be developed.

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