

Near-Infrared Spectroscopy (NIR)

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Analysis of Monogastric Feed using the DA 7250 Analyzer

Introduction

Animal performance and feed milling cost are dictated by nutritional requirements of the feed products. Performing frequent checks against production specifications is important to ensure quality of the finished compound feed and reduce raw material costs.

The Near Infrared Reflectance (NIR) technology is highly suitable for these purposes. Instead of the time consuming and labor intensive traditional wet chemistry methods, with NIR the multi component analysis is done in seconds. The latest Diode Array Technology allows the benefits to be even further exploited not requiring sample grinding or special cups.

DA 7250 NIR Analyzer

The DA 7250™ is a proven, full-spectrum NIR instrument designed for use in the grain, food and feed industries. Using novel Diode Array technology, it performs a multi-component analysis in 6 seconds. Thanks to excellent signal-to-noise ratio, large analyzed surface and unique optical design, no sample grinding is required.

The instrument is handled by an intuitive touch screen interface and samples are measured in flexible dishes. As the sample is analyzed from above in open dishes, the problems associated with unclean sample cups are avoided and operator influence on results is minimal. The DA 7250 is dust and waterproof and can be used in the lab as well as in the production area.



DA 7250 NIR Analyzer

Method

More than 19000 monogastric type compound feed samples were collected over 15 years from feed producers globally, including pig, piglet, pig sow, broiler, layers and other poultry feed types. Spectral data for each sample were collected on multiple DA 7250 instruments using open faced large sample dish, analyzing samples without grinding or other sample preparation. Calibrations were developed to model the relationships between the collected NIR spectra and reference chemistry results using PerkinElmer Hongis Regression, HR, Artificial Neural Network Regression, ANN and Partial Least squares regression, PLS algorithm types.

Results and Discussion

Using HR and ANN calibration algorithms it was possible to include considerable product variability into models, while having high accuracy. The large product variability built into the calibrations will allow them to be robust and accurate even as raw materials and formulations change over time.

Table below summarizes statistics of developed calibrations. Reference vs NIR calibration graphs of the Moisture, Protein and Fat models are displayed in Figures to the right

Table 1. Statistics of DA 7250 monogastric feed calibrations

Parameter	N	Range	R
Moisture %	17000+	6.8 - 16.9	0.91
Protein % asis	19000+	7.2 - 47.2	0.98
Fat % asis	7400+	1.6 – 11.7	0.97
Fiber % asis	4400+	0.5 – 15.0	0.94
Starch % asis	800+	10.6 - 57.1	0.88
Ash % asis	1100+	3.9 - 24.3	0.92
Sugar % asis	400+	1.6 - 6.4	0.90
Calcium % asis	900+	0.2 – 4.7	0.83
Phosphorus % asis	900+	0.4 – 1.8	0.92

The differences between the DA 7250 and the reference method are of the same magnitude as typical differences between two different reference labs.

Conclusion

In summary it is concluded that the DA 7250 can analyze the aforementioned parameters in monogastric feed accurately in 6 seconds. The calibrations can be used on any DA 7250 instrument, for many different product types/formulations, and without any grinding of samples prior to measurement.

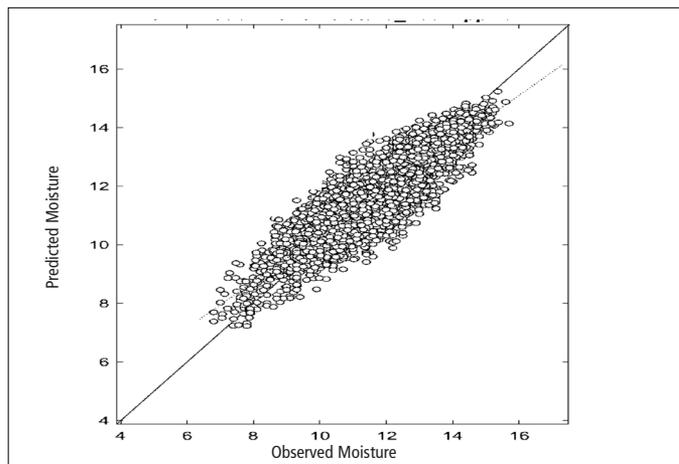


Figure 1. **Moisture:** The DA 7250 determines moisture very accurately. It is highly suitable for monitoring of the cooling/drying, and for verifying moisture content at load-out helping avoid mold issues.

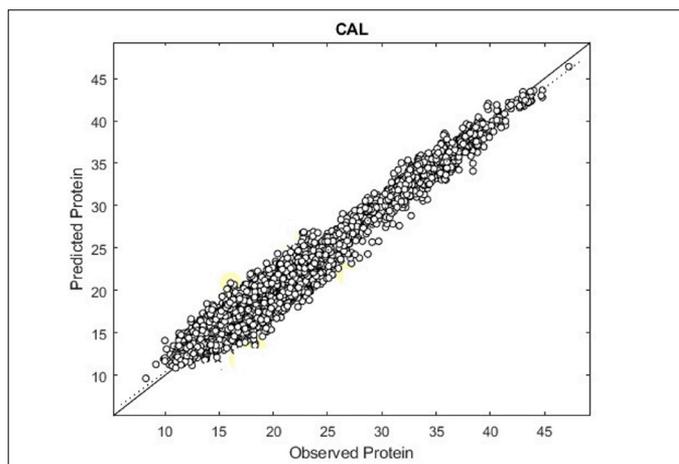


Figure 2. **Protein:** The calibration covers a wide range, enabling verification against protein specifications on many different compound feed types.

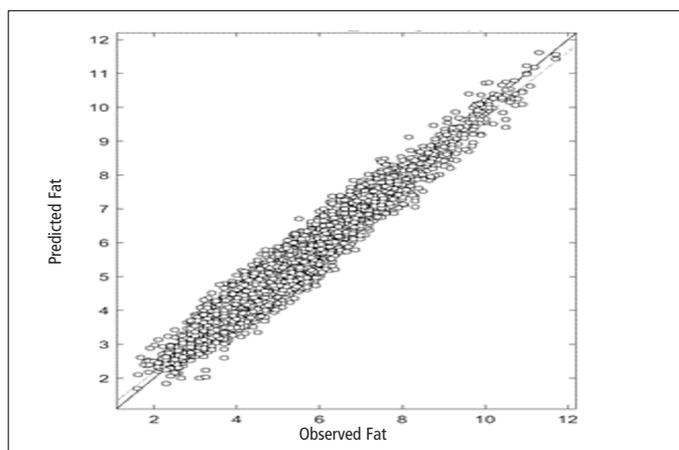


Figure 3. **Fat:** The wide calibration range allows for control of low as well as high fat feed samples.