

Near-Infrared Spectroscopy

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Analysis of Meat and Meat Products Using the DA 6200 NIR Analyzer

Introduction

For meat processors and producers of meat products it is critical to be able to monitor and control key nutritional parameters such as fat, moisture, protein, collagen, salt and ash.

With Near Infrared (NIR) technology multi-constituent results are available in seconds rather than several hours as with many traditional chemical analysis methods. With the ability to analyze as often as desired with results in real-time, producers of ground meats, sausages, separated poultry or other meat products can reduce product variations and thereby improve quality and profit.

DA 6200 NIR Analyzer

The DA 6200™ is a new NIR instrument making routine meat product analysis easier than ever. It is based on transmission Diode Array NIR technology with the measurement light transmitted through the sample. This means a very large and representative sample volume is analyzed in each measurement. The multi-component analysis is done in 30 seconds using easy to handle magnetic coupled plastic sample cups.

The instrument is operated through a touch screen interface. Measurement auto-start is also possible with measurement started as soon as sample cover is closed. A light weight design with battery operation allows the analyzer to be easily moved between sampling points.



Method

More than 500 meat and meat product samples were collected in cooperation with multiple meat processors, institutes and universities. Samples included raw meats (beef, poultry and pork), in-process products, and various finished products (sausages, hams and cured products). Raw meats and finished products were homogenized prior to measurements. In-process samples were measured as taken from mixer. Samples were analyzed on multiple DA 6200 instruments using magnetic coupled plastic sample cups, 14 mm depth.

Reference values for calibration development were a combination of wet chemistry methods and results from DA 7250 NIR analyzer using global master meat calibrations. Several multivariate regression techniques were evaluated for calibration development, including ANN and PLS.



Results and Discussion

Combined calibrations including all meat samples types were developed for fat, moisture, protein, salt, ash, collagen and collagen to protein ratios. Fat, moisture and protein calibrations were of similar accuracy as the typical magnitude of difference between two different reference labs. Collagen, salt and ash calibrations can be used as additional guideline parameters. Statistics of developed calibrations are summarized in table 1 and 2. N is number of calibration samples, correlation strength is denoted R and range the variability of each parameter. Fat, moisture and protein calibration graphs are displayed to the right.

Table 1. Statistics of fat, moisture and protein calibrations.

Parameter	N	Range	R
Fat % _{asis}	500+	0.1 – 51.4	0.98
Moisture %	500+	17.7 – 84.6	0.98
Protein % _{asis}	500+	8.6 – 34.4	0.98

Table 2. Statistics of additional guideline calibrations.

Parameter	N	Range	R
Collagen % _{asis}	500+	0.0 – 5.8	0.70
Collagen-free Protein (BEFFE) % _{asis}	500+	2.5 – 23.8	0.92
Collagen/Protein Ratio %	500+	0.0 – 35.6	0.74
Salt % _{asis}	500+	0.0 – 5.2	0.94
Ash % _{asis}	500+	0.0 – 6.9	0.87

It is concluded that the DA 6200 can accurately determine multiple parameters using one calibration for a wide range of meat and meat products. This makes it highly suitable for incoming raw materials inspection, analyzing samples in production to optimize lean/fat usage, and verifying finished product quality.

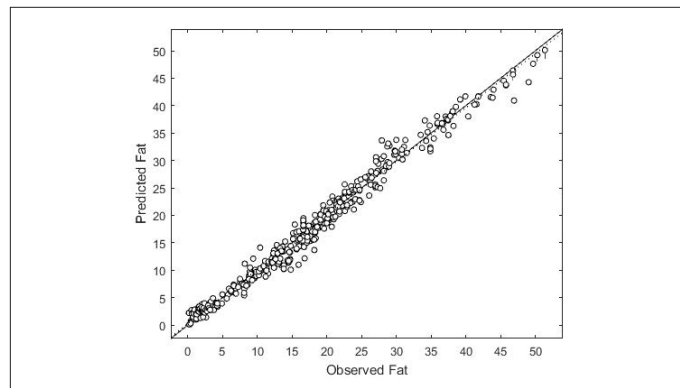


Figure 1. NIR vs Reference calibration graphs for Fat calibration.

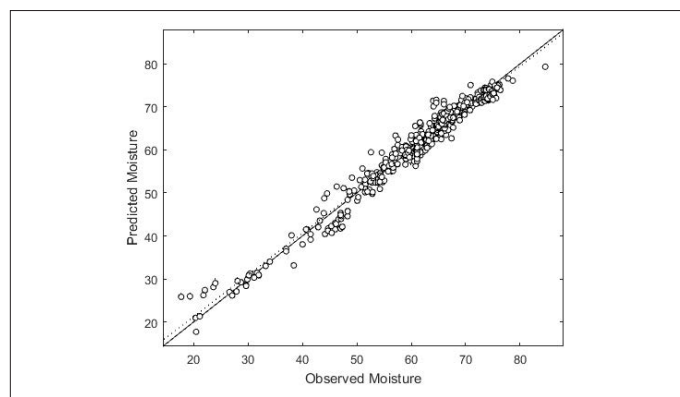


Figure 2. NIR vs Reference calibration graphs for Moisture calibration.

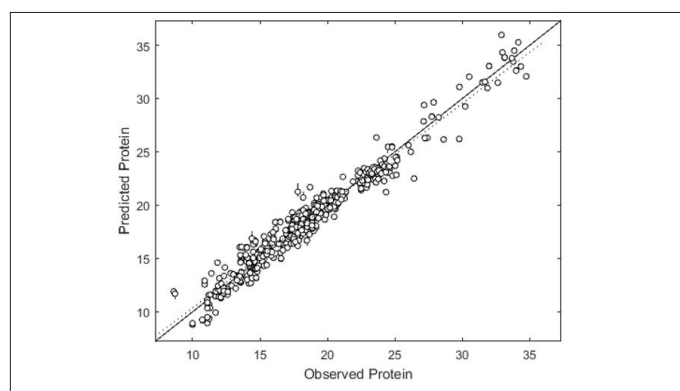


Figure 3. NIR vs Reference calibration graphs for Protein calibration.

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