In-line Near-Infrared Analysis (NIR) of Mechanically Separated Poultry for Moisture, Protein, Fat, and Ash

Introduction

Accurate control of moisture, protein, and fat in mechanically separated poultry meat is important for quality and cost-effectiveness. Accurate blending is vital to profitability. Fat and protein are cost drivers while moisture impacts viability, texture and end-use of products. Cost savings are dependent both upon the accuracy of the analyses and the availability of real-time results. Using the DA 7300 in-line NIR a production facility can have real-time 24/7 analysis capability. The instrument is integrated directly to production control systems allowing for automated or manual adjustment for process optimization.

The NIR technique is particularly suited for measurement of mechanically separated poultry. Modern Diode Array technology is fast and accurate, and results are easily integrated in to existing plant control systems. Processors know the high variability of raw meat and poultry ingredients. The instrument analyzes moving product directly in a pipe allowing users to significantly reduce sampling error associated with grab samples. It also provides a complete analysis profile of the entire batch. Reduction in sampling error and the use of stable instrumentation developed for rugged process environments yield data that can be used to achieve true process control. It is well proven in hundreds of installations worldwide.

Diode Array Instruments

The DA 7300 is a full-spectrum, NIR instrument designed specifically for in-line use in food processing industries. The DA 7300 is based on Perten's 3rd generation diode array optics. It performs multi-component analysis in seconds. During this time, a large number of full spectra are collected and averaged. Analysis frequency is programmable to suit individual needs. Since the sample is analyzed directly in the process with the DA 7300, operator influence on results is removed. Importantly, the **DA 7300 has USDA Sanitary approval** for installation in meat and poultry processing plants.

Data Collection

Approximately 200 samples of mechanically separated chicken from several US processing plants served as the calibration set. The spectral data was collected using two DA 7200 at-line instruments equipped with the Disposable Cup Module and a DA 7300 in-line instrument mounted in the process. Reference chemistry was supplied by the customers and was conducted following AOAC methods: Moisture – Microwave 985.14, Protein – Combustion 990.03, Fat – Microwave/NMR 2008.06, Ash – Furnace 942.05. Calibrations were developed using Partial Least Squares (PLS) regression. A Perten proprietary harmonization method was applied as a pre-treatment to the spectra.

Results and discussion

The DA results are very accurate when compared to the results from the reference methods. Statistics for the respective parameters are presented in the table below and graphs are displayed on page 2.

Parameter	Range	Samples	R
Moisture	63.47 – 75.03%	180+	0.750
Protein	12.32 – 16.41%	180+	0.762
Fat	11.31 – 19.35%	180+	0.673
Ash	0.9 – 1.38	60+	0.774

The differences between the DA and the reference methods are of the same magnitude as typical differences between two different reference labs. The DA instruments are more precise than the reference methods, meaning that replicate analyses are generally more repeatable and representative.

In summary, the DA 7300 in-line NIR from Perten can accurately analyze mechanically separated poultry. The speed of analysis allows users to easily and accurately analyze many samples a day in real-time with the DA 7300 in-line instrument. The rugged design, accuracy, and reliability of diode array technology make it ideal for use in meat and poultry plants worldwide.
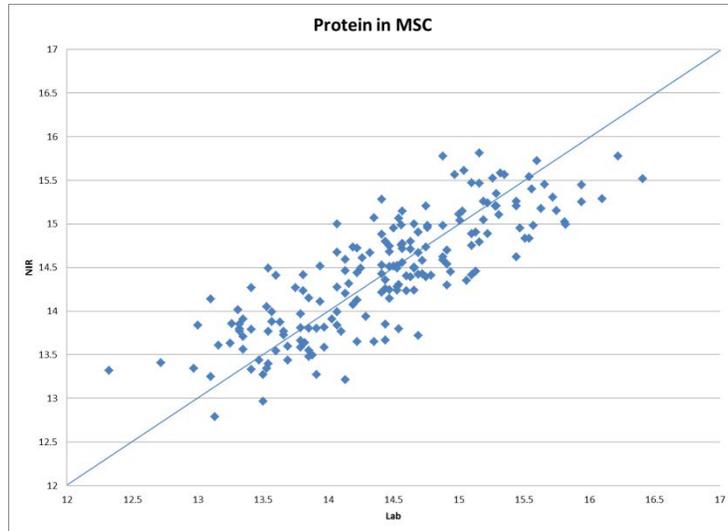
Moisture

Moisture is an important and accurate measurement using NIR.

Moisture in MSC
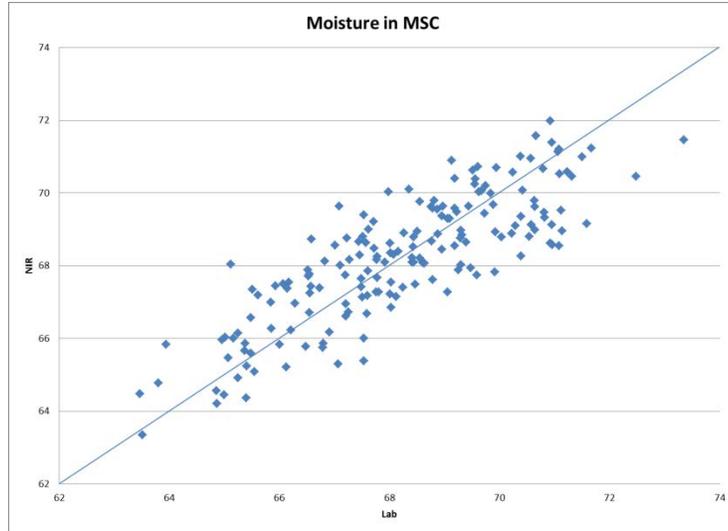
Protein

Protein is an important nutritional value for mechanically separated meats.

Protein in MSC

Fat

Accurate and fast Fat analyses are essential to monitoring the efficiency and profitability of a mechanically separated meat facility.

Fat in MSC