Case Study: Summary of Studies Predicting Various Meat Quality Attributes using LabSpec® 4 with Contact Probe

Challenge:

Over the past several years, researchers from around the globe have begun to test the ability of near-infrared spectroscopy (NIRS) to predict various meat quality traits in both live animals and on carcasses in the slaughterhouse. Studies conducted by research groups in multiple countries have evaluated the ability of NIRS to predict diverse quality traits in various meats. This was accomplished by directly measuring the reflectance spectra using a high-intensity light source coupled with a fiber-optic probe on an exposed piece of meat or live animal.

In recent years, meat quality has become a more relevant topic for consumers with regard to health and sensory characteristics. In addition, industry stakeholders are paying more attention to meat quality as it affects how profitable their business is. Changing standards for producers and manufacturers to verify the quality and safety of various meats demand accurate testing of food quality throughout the supply chain.

Unfortunately, current measurement methods of several quality traits (e.g., shear force, cooking loss, intramuscular fat content) require the destruction of a meat sample. The reference analysis of meat is costly and consumes the sample that is tested. Additionally, the reference measurements are time-consuming and the analysis itself is often expensive.

Solution:

Three independent studies all utilized ASD's portable and NIRS spectrometers with a high-intensity contact probe to test the ability of this technique to predict various meat quality attributes, including determination of fatty acids, total fat content, protein, pH, color, aging and collagen.

A 2009[1] study in Spain sought to develop NIRS technology for determining the fatty acid composition both in live Iberian pigs and on carcasses in the slaughterhouse. NIRS is ideal for these because the technique is totally harmless to the live animal and non-destructive to the carcass. A separate study conducted in Italy in 2013[2] evaluated the ability of NIRS to predict beef quality traits in the slaughterhouse through the use of a fiber-optically connected probe on the carcass surface. Most recently, in 2015[3], a Canadian study examined the potential of NIRS to discriminate or identify enhanced quality pork based on changes to production factors and post-harvest strategies.

All three studies utilized NIRS because prediction using near-infrared models are sensitive, rapid and non-destructive, and they do not require costly reagents or produce waste.

Results:

The results of each study are encouraging and highlight the ability of near-infrared (NIR) spectroscopy to quickly and cost-effectively predict various meat quality traits in both live animals and on-line carcasses in slaughterhouses and cutting plants.

The results of the 2009[1] study confirm the feasibility of NIRS technology for the on-site inspection and control of Iberian pigs, both in the field and in the slaughterhouse. The on-site NIRS system evaluated in the study enabled the analysis of individual live pigs and carcasses for the prediction of fatty acid profiles without interrupting the processing system.

Results from the 2013[2] study revealed the limits of the technique to predict Warner-Bratzler shear force, but the promising ability to predict color, cooking loss, and pH of M. longissimus thoracis. The ability to predict beef quality using an on-line system without depreciating the carcass is a crucial point for the beef industry as well as breeding companies.

The 2015[3] study concluded that NIRS technology has the potential to segregate pork samples according to pig breed and discriminate the moisture enhanced from non-moisture enhanced pork samples as well as the 2 day from 14 day aged loins. Additionally, the study found that this technology "could hold value for on-line application in processing plants and at retail to discriminate pork of enhanced quality."

In the end, the need for inexpensive methods of verifying food quality and safety has never been as pressing as it is today. These studies exhibit that ASD's instrumentation can be used to increase the frequency of testing or the number of analysis points during production processes without requiring the use of costly laboratory techniques. The results show that NIR spectroscopy is a proven and accepted method of food analysis and the technique offers significant advantages, including real-time analysis, non-destructive testing, no sample preparation, decreased operational costs and increased yields. ASD's measurement technology allows producers and manufacturers to conduct quality measurements virtually anywhere — on the production floor or manufacturing facilities, on the receiving dock, in the warehouse, through glass and clear plastic bags and bottles — and whenever it is most convenient. it affects how profitable their business is. Changing standards for producers and manufacturers to verify the quality and safety of various meats demand accurate testing of food quality throughout the supply chain.

1. Pérez-Marín, D., et al. (2009) "A feasibility study on the use of near-infrared spectroscopy for prediction of the fatty acid profile in live Iberian pigs and carcasses." Meat Science 83 (4), 627-633.
2. De Marchi, Massimo. (2013) "On-line prediction of beef quality traits using near infrared spectroscopy." Meat Science 94 (4), 455-460.
3. Prieto, N., et al. (2015) "Rapid discrimination of enhanced quality pork by visible and near infrared spectroscopy." Meat Science 110, 76-84.

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ABOUT PANALYTICAL

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