Alternative analysis

TECHNICAL PROFILE

An internet-enabled analytical NIR system provides real-time results and supply chain integration without the need for specialist expertise

by Suzi Fraser Dominy and Emily Buckley

In the thirty years since it was first introduced, NIR — Near-Infrared Technology — has become a household word in the grain based industries: flour millers rely on this rapid and accurate method of analysis to determine the ash, protein and moisture content of flour; feed millers analyze raw materials for crude protein, fat and starch to optimize formulations and to assure the quality of finished feeds leaving the plant; while grain handlers depend on it to perform load-by-load protein checks, to set prices and make possible segregation of grains and oilseeds.

Yet despite its versatility, speed and accuracy, the technology is still not fully exploited, since it requires capital outlay, skilled operation and time and expense in initial and on-going calibration.

To overcome these drawbacks, an Internet-enabled NIR system has been developed by Cognis Corporation. Its unique QTA system, which stands for Quality Trait Analysis, takes a different approach to NIR systems as it supplies its clients with an FT-NIR machine and simply charges a fee per analysis, while offering the ease of remotely monitoring a client's unit and

maintaining all calibrations. Because Cognis monitors calibrations from off-site via an Internet connection, it is possible to ensure NIR units in separate locations have consistent results based on client-specified customizations.

EASY TO USE

At a client's facility, the QTA system comprises one or more NIR units, which is connected to a notebook computer that uses the Internet to access the Cognis-maintained central processor.

Calibrations are developed with clients for analyzing traits of materials that meet their specific needs, and calibration models are stored in the central processor.

Performing an analysis is simple, and users do not have to know how to choose NIR measurement parameters or how to develop/maintain calibration models. The user only has to go to QTA's website (www.QTA.com), select the test material from a drop-down list specific to each client (such as canola seeds, wheat, soybean, sunflower, corn, etc.) and the traits to be analyzed (such as linolenic acid, moisture, protein, etc.). Users then follow step-by-step instructions to measure the sample's NIR spectrum. The obtained spectrum and the user input are sent to the central processor via the Internet connection.

The central processor uses the appropriate specified calibration models (according to the user input in earlier steps) and computes the sample for analysis. The results are then returned to the client.

Analysis data, along with sample identification and tracking information input by the customer, is stored in a secure central database, so that users can access the data to create reports or show records of sampling times. The stored information can be transferred, used and leveraged throughout an organization, providing ready access to comprehensive product quality information that could facilitate pricing and enhance marketing.

Cognis developed a Chingometrics centralized calibration system to increase consistency, eliminate the need for on-site recalibration and to provide simple operation.

EQUIPMENT

The FT-NIR sampling system is a rotating cup with a glass bottom and a diameter of about 100mm. The NIR beam illuminates an area approximately 20mm in diameter at one time.

When starting a measurement, the cup starts to rotate and a tumbling device also moves the sample material from the

bottom layer to the upper layers. Therefore, this system can be used to analyze inhomogeneous solid materials including powder, grains, pellets, etc.

The NIR system provided to clients is based on the Bruker Matrix FT-NIR with an integrating sphere and PbS detector. The Bruker Matrix system is designed to work in a production environment, as it is waterproof, dust-proof and very rugged. An industrial notebook computer with touch screen function is also integrated with the NIR system. Via the Internet, it is possible to remotely monitor the instrument performance, and often to identify and solve problems remotely.

The system's use of Fourier transform (FT) NIR technology allows calibration models from any type of NIR system to be transferred since FT-NIR can be adjusted to simulate the spectrum of any type of NIR system, including a different brand of FT-NIR, dispersive NIR, AOTF NIR and diode array NIR. The wavelength accuracy of FT-NIR also makes the Internet-enabled NIR system easier to use the same calibration model for different client NIR units.

CENTRALIZED MODEL BUILDING

QTA also builds single models for entire networks of NIR units, not just calibration models for individual NIR analyzers. It is very important that these models predict consistent results of the same sample from different client NIR analyzers. QTA uses special calibration techniques to compensate for instrument variances of the FT-NIR systems, so the calibration model can be used by different NIR units including the units already in service.

QTA models not only compensate for hardware variances, but also for variances from sample and environmental changes. Therefore, the same sample measured by the NIR instruments at different locations, different days or after hardware changes (such as light source and laser replacement) still produce consistent results.

Since all the models are stored at the central processor, they can be remotely developed or modified by NIR experts at the central location and used by all the client NIR systems simultaneously. Therefore, even without on-site NIR experts, the NIR applications for a client system can still be easily expanded.

Rapid, accurate, reliable on-site NIR analyses of multiple traits or material characteristics of both solids and liquids — without the need for skilled analytical personnel and without significant site-to-site, instrument-to-instrument, or day-to-day variations — is now a reality. And since all the spectra and predicted results are stored in a database that resides at the central location, either the current analyzed data or the historic data can be shared across the entire supply chain. WG

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