



Application Note AN N251

Incoming Grain Monitoring

Bruker Optics offers quality control solutions for incoming grain based on Near Infrared (NIR) spectroscopy.

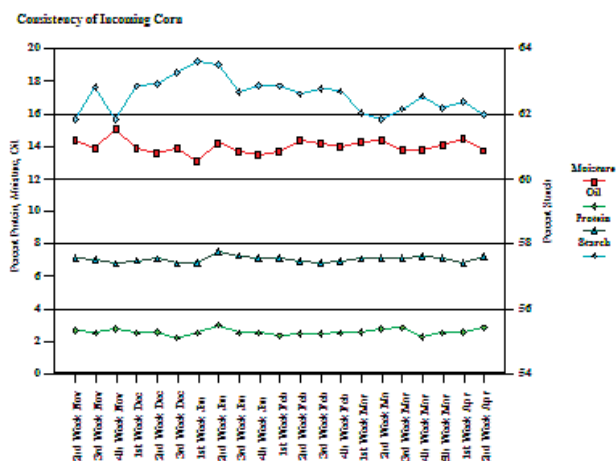
Among the grains, corn is approximately 90% of the distillers' mash bill while 100% of the fuel ethanol producers' mash bill. It is the largest expense to a distillery or a fuel ethanol plant, thus the quality control of incoming grain is essential for fuel ethanol producers and distillers, yet it goes largely unmonitored throughout the distilling industry and fuel ethanol industry. The components those are important to monitor including moisture, protein, oil and starch.

Moisture content of incoming grain is of critical importance. If moisture becomes too high it can cause mechanical problems with a hammer mill and cause downtime in the plant. Typically, a maximum specification of 15% moisture should be targeted. If moisture levels are above 15% there is also less starch available to make alcohol. Protein content of whole kernel corn is another parameter that can be analyzed, because it affects the composition of the DDGS, a valuable by-product at the end of distillation.

The reason that it may be important to measure oil is that genetic varieties of corn with high oil content exist in the commercial market. Measuring incoming loads for oil allows

the distiller to prevent high oil corn varieties from entering the system. Starch is component that has the largest effect on overall yield, because it is the source of fermentable sugar for yeast growth and ultimately alcohol production. The traditional wet chemical analysis of those contents can take up to 3 days, which makes the analysis not practical at the loading area for quick check. Also the wet chemical analysis involves the usage of reagents and solvents and tedious sample preparation.

Accumulated corn data



Advantages of NIR Incoming Grain Monitoring

Near infrared (NIR) spectroscopy, on the other hand, is fast (measurements less than a minute) and can analysis multi-components with only one measurement. In addition, it is a non-destructive method without any sample preparation such as grinding, and does not require the use of any solvents or reagents.

There are several benefits to use NIR spectroscopy as a primary tool for determining the quality of corn:

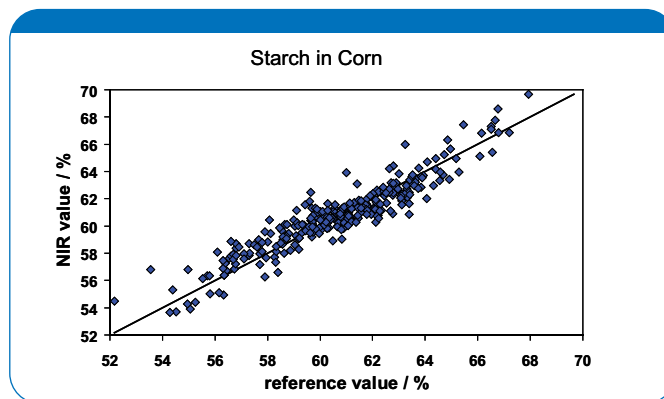
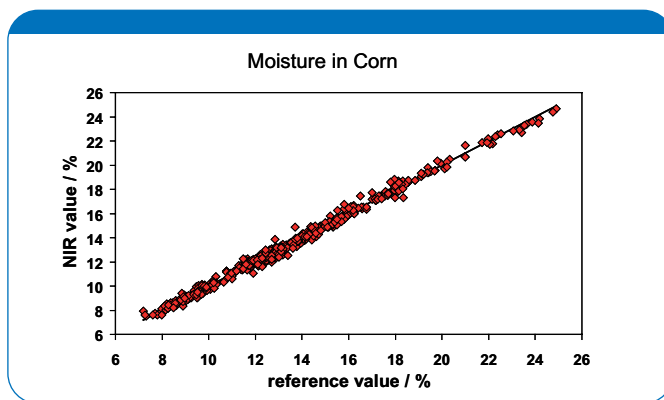
- The distiller can track corn suppliers more closely to prevent becoming the victim of fraud.
- Production efficiencies can be tracked more closely. Accurate determination of production efficiency is important, because it helps the distiller make improvements and reduce costs.
- More crop data is accumulated each year. (Figure 1)
- Variety selection for desired characteristics is possible.

Corn samples can be measured using Bruker Optics Fourier-transform near infrared (FT-NIR) spectrometer MPA II or MATRIX-I with an internal integrating sphere, specially designed for fast and accurate measurements of inhomogeneous samples. The spectrometer is mounted with a sample rotator for additional spatial average capability.

Bruker Corn calibration models are based on corn samples grew at different locations and collected in several years period.

Automation and Use Interface

A user-friendly interface OPUSLAB was developed to acquire and analyze samples using the Bruker Optics OPUS software package and the quantitative analysis model. The prediction result is automatically output to a spreadsheet for the QC lab record. If desired, electronic signature and other 21 CFR 11 requirements are available for the reports.



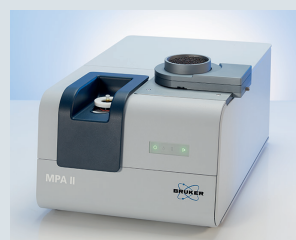
FT-NIR Spectrometers: Bruker Optics offers various FT-NIR spectrometer models for lab, at-line and on-line applications:

TANGO



FT-NIR analyzer for routine use in the lab.

MPA II



Multi Purpose Analyzer for maximum flexibility.

MATRIX-I



At-line analysis with optional NEMA4/IP66 protection.

MATRIX-F



Process monitoring with probes and measurement heads.

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