Branscan

NIR and Image Analysis Systems

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Multi sensor systems

- NIR Analysis
- Image Analysis
- Colour sensor
NIR Analysis

- NIR spectroscopy is the measurement of the wavelength (800 nm - 2500 nm) and intensity of the absorption of near-infrared light by a sample.

- NIR spectroscopy is typically used for quantitative measurement of organic functional groups, especially O-H, N-H, and C-H.

- This technology can therefore be used to great effect to measure Moisture, Fat / Oil, Protein, Ash, Sugar etc.

- Each wavelength is accurate to +/- 0.2nm, with 1000 wavelengths being scanned, giving good correlation to Primary Methods of testing.
Important Factors
1-Sampling

NIR analysis demands that samples are presented in the **same way each time** to ensure that accuracy, precision and repeatability of results is not impaired by outside factors.

A clean operation is essential as dirt can change the baseline and thus the spectral shape.

The procedure for sampling and testing exists to reduce the risk of errors from:

- Temperature
- Grinding / sample preparation
- Atmospheric Conditions
- Uncontrolled tempering / leaving to cool
- Sample history (route taken / sample point)
Important factors
2- Technology

Previous Filter based NIR systems offer 3, 6, 9 or 19 wavelengths for scanning.

The Branscan Scanning Monochromator / Diode Array offers 1000 wavelengths
This is the information you see with 3 filters
This is the information you see with 6 filters
This is the information you see with 19 filters
This is the information you see with a Scanning Monochromator / Diode Array
This is the spectra that a Scanning Monochromator / Diode Array would see.
This is the spectra that a filter instrument could see.
Smaller bandwidth sees differences in CH (CH, CH₂ or CH₃) and OH (H₂O or H₃O⁺ & OH⁻)

Absorption Bands in the Near-Infrared

<table>
<thead>
<tr>
<th>3rd Overtone Region</th>
<th>2nd Overtone Region</th>
<th>1st Overtone Region</th>
<th>Combinations</th>
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<tbody>
<tr>
<td>CH</td>
<td>NH</td>
<td>OH</td>
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<tr>
<td>4th Ov</td>
<td>3rd Ov</td>
<td>2nd Ov</td>
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<th>*1st Ov</th>
<th>OH</th>
<th>SH</th>
<th>C=O</th>
<th>NH</th>
<th>CH+CH</th>
<th>CH+CC</th>
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<td>CH</td>
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</tbody>
</table>

- **OH**: 3rd Ov
- **H₂O**: 3rd Ov
- **ROH**: 3rd Ov
- **A₂OH**: 3rd Ov
- **RNH₂**: 3rd Ov
- **A₂CH**: 3rd Ov

- **CH**: 2nd Ov
- **CH₂**: 2nd Ov
- **CH₃**: 2nd Ov

- **NH**: 2nd Ov
- **N₂H**: 2nd Ov
- **NH₂**: 2nd Ov

- **SH**: 1st Ov
- **S₂H**: 1st Ov

- **C=O**: 2nd Ov
- **CO₂H**: 2nd Ov
- **CONH₂**: 2nd Ov

- **NH**: Combo
- **N₂H**: Combo
- **CONH₂**: Combo

**Wavelength μm**
- **0.7μm**
- **0.9μm**
- **1.1μm**
- **1.3μm**
- **1.5μm**
- **1.7μm**
- **1.9μm**
- **2.1μm**
- **2.3μm**
- **2.5μm**

**Wavenumber cm⁻¹**
- **14000cm⁻¹**
- **10000cm⁻¹**
- **9000cm⁻¹**
- **8000cm⁻¹**
- **7000cm⁻¹**
- **6000cm⁻¹**
- **5000cm⁻¹**
- **4000cm⁻¹**
IMAGING SYSTEMS
Reliable systems for measuring Specks and Impurities - Online or Offline
WHAT ARE THE FLOUR IMPURITIES?

Diagrammatic longitudinal section of wheat grain through crease and germ.
Specks and impurities are a determining factor of the appearance, grade and purity of the product. In some cases impurities can result in the rejection of whole batches.

**Fluoroscan** uses UV light to pick up the yellow specks of fluorescent aleurone and the dark specks of bran in flour products.

**Powderscan** uses visible light to pick up the specks and impurities in all dried powders and products.

Data can be displayed by the software as both aleurone and bran counts and speck percentages, as well as further data such as graphs.
Fluoroscan and Powderscan are based on well-established and proven image processing technology which has been used successfully within major manufacturers worldwide for nearly a decade.

- Live image and processed image displayed on the screen allowing the user to see the sample analysed in real-time. All data can be archived & exported.
- Ability for Fluoroscan to measure number and percentage of aleurone and bran (yellow and brown specks), and report on ash value.
- Scans at high resolution over a 1cm surface 22 times for unsurpassed accuracy.
- Algorithm and lighting system means daily calibration is not required.
- Configurable to give measurements that customers recognise & understand.
Fluoroscan Benefits

- Bran levels can be measured and controlled via Fluoroscan.

- Control via ASH reflects measuring a change in minerals, which is therefore a small range (typically 0.55 - 0.65)

- Bran levels can vary dramatically (typically 0.6 – 1.5), meaning that the range of control is larger, this gives the Miller better control over his process.
  
  - High Bran will affect functionality in terms of: water absorption (bran competing with endosperm for water); damage to the gluten network; hence resulting in low volume of bread
  
  - Low Bran will result in: added expense for the miller; doughy consistency of product; and larger air bubbles in bread

- Fluoroscan provides rapid detection of sifter bursts.

- Fluoroscan gives control of actual colour from measurement of “speckiness”, mimicking the old PECAR test

- Fluoroscan can help with Grist control, since it measures bran levels from milling different wheat varieties.

- Cleanliness of Durum can be effectively measured from the speckiness of the semolina
Fluoroscan F2000 Laboratory System

- Portable system weighing 12.5 kg ensuring results can be obtained anywhere they are needed.

- Quickly and easily installed with no need for specialist engineers or sophisticated PC.

- Rapid analytical process, obtaining results in 90 to 120 seconds from a given sample, compared to traditional tests taking anything from 3 to 9 hours.
WHAT DOES A FLUOROSCAN IMAGE LOOK LIKE?

The image shows a sample displayed using the Fluoroscan lighting system.
The Red (Aleurone) and Green (Bran) specks shows different constituents of ASH.

WHAT IS PROCESSED AND ANALYSED IN FLUOROSCAN?
**Hopperscan** can be used to rapidly scan 100% of granular products such as Pellets, Grains and powders passed under its camera.

The sample is then collected for batch auditing or retesting.

A valuable tool when assurance is needed for conformance to specification by quantity
**Totalscan** analyses 100% of the product and if the quality falls below acceptable levels, **Totalscan** diverts it away from the ‘good’ product, preventing contamination, waste and loss of profit.

With its flexible scanning area and variable resolution, **Totalscan** can be used anywhere in the production process.
Traditionally, Branscan instruments have non destructively tested powders for impurities using image analysis.

The addition of NIR and colour analysis to the online system is a natural progression.

*InNIRsCAN* is a modular instrument, consisting of up to three measuring sensors:

- **Camera for image analysis**
- **NIR for moisture analysis, etc**
- **Colour Sensor**
The **InNIRscan** NIR is a Diode Array scanner in a modular concept:

Sampling-interface, Fibres and spectrometer can be constructed in many possible setups.

A multiplexer makes it possible to extend to multiple channels.
InNIRsCAn Benefits

➢ Control of Moisture:
   - Cost effectiveness
   - The ultimate control measure
   - Effect on Tempering

➢ Control of Protein:
   - Control and effect on Grist
   - Cost reduction through the ability to use cheaper wheat, or utilising a gluten loop

➢ Secondary measurements for:
   - Ash, Starch Damage, Water Absorption
The InNIRscan is taking readings on average 4 times per minute, the data that is then sent to the Control PC, which in turn is connected to the PLC. The PLC can then ACCURATELY control the feed of Gluten into the flour using the Gluten Feeder.
NIR is installed at the input from the tempering bins.
This scans the grain for moisture levels.
The control PC is then connected to the PLC that in turn controls the bins.
The second phase would be to install a diverter valve and a grain moisturizer.
This would mean that if the NIR measured moisture in the grain it could be diverted through the moisturizer and back into the flow.
Again this would be controlled by the PLC which has information sent to it from the control PC.
InNIRsCAN may also be run as a multi head system, allowing easy measurement across multiple points in the mill, ideal for monitoring blending or debranning.

The new sample retrieval feature means that NIR calibration validation and verification has never been more simple.

With InNIRsCAN installed, laboratory testing is kept to a minimum, which in turn increases productivity and profits.
All of the measured values are displayed as both numbers and in a trend graph on the computer screen.

This data can then be automatically stored on a network, sent to a printer or even transmitted to a PLC.
NIR on the production line with moving finished product
NIR on the production line, both at finished product, and bulk intermediate stages