In Line NIR Analysis

Protein and Moisture Analysis Using a Near Infrared Transmission Analyser with a Fibre Optic Sampling Device

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Australian Designed and Manufactured
Project Goals - On Line NIR Analysers for Grain

To develop a fibre optic based sampling system to determine the protein and moisture content of grain in a flowing stream.

The system is to be compatible with the calibrations developed on the Cropscan 2000B NIR analyser and the Foss Infratec.

The system is to operate continuously or on demand basis.
Design Considerations

Device operates in transmission mode:
  ie: same as Cropscan and Infratec

Must have the facility to:
  - Measure 100% signal at regular intervals
  - Measure numerous sub-samples before collecting next reference scan
  - Compatible with an external PC and PLC.
Applications for In Line NIR

- Grain Intake at Silos – payment on quality
- Grain Outloading – continuous grading of grain
- On Combine Analysis – Load by load segregation and Paddock Mapping for PA
- Feed Production – Separating grains based on quality.
Technology Description

- Transflectance

Pass light through a sample of grain by reflecting off the kernels. NIR energy is absorbed by Protein, Moisture and Starch.
NIR Technology System’s Technology Description

NIR Spectrometer

Lamp
Sampling Device
Fibre Optic Cable
Optics – Diffraction Grating
Detector
Technology Review

NIR Spectrometer Optics – Flat Field Spectrograph

Fibre Optic Cable  Lens  Slit  Diffraction Grating

Detector
Technology Review

Diode Array Spectrometer

- Today’s Technology – Flatbed Scanner, Fax, Digital Cameras
- Provide Full Spectra
- Rapid Scanning: 2-3 seconds
- No Moving Parts in Optics:
  - Vibration and Orientation Independent
- Lower Cost Optics = Lower Cost Analysers

NIT Spectra of Wheat

![NIT Spectra of Wheat Graph]
Calibrations for Protein and Moisture Wheat

- Master calibrations for wheat and barley developed over 8 seasons
- AWB Report validated performance
- Used in over 240 instruments in Australia wheat industry
NIR Technology System’s
Technology Description

Lamp → Sampling Device → Fibre Optic Cable → Optics – Diffraction Grating → Detector

NIR Spectrometer
2006 Brush Wheel Sampling Head

- Designed by Graeme Mann, Victoria
- 2 Brush Wheels, Top and Bottom of Cell
- Bypass Stream
- No magnets for timing
- Interchangeable Cell
  - Wheat, Canola, Lupins
- Significant improvement in reliability
- Self cleaning as grain flows thru
Brushwheel Mechanism
Flour Mill Installation
FOP-38 On Line NIR Analyser

- Fitted Plunger Sampling Device onto Coming Grain Elevator
- Ran for 1-2 weeks.
- Identified system requirements – sample collection and cleaning
- Demonstrated significant variation in incoming grain
Cropscan 2000H On Header Analyser

In Cabin NIR Spectrometer:
- Rugged IP-66 Enclosure
- Keypad and LCD Screen
- PC or Zynx Interface
- GPS Interface

Remote Sensing Head:
- Mounted on Clean Grain Elevator
- 5m of Fibre Optic Cable back to cabin.
2008 Trials

SPAA
- John Deere header
- Brush Wheel Sampling System
- Remote Controller
- Zynx ZX20 running Topcon Mapping Software
Road paddock 2008: Wheat yield, protein and N removal
Conclusion

FOP-38 On Line NIT Analyser

1. Ideal for On Combine, On Auger or In Silo use.
2. Transferable Sampling Heads.
3. Possible to multiplex 4 heads to 1 spectrometer.