



FITNIR MC

FITNIR MC utilizes NIR spectroscopy to deliver rapid online moisture content measurements. A non-contact, open sensor unit installed above the conveyor, FITNIR MC provides accurate and reliable moisture content measurements of both frozen and unfrozen wood chips to the digester, and hog fuel to the power boiler, for control strategy integration. FITNIR MC's high-quality and timely data provides clarity of feedstock properties; properties essential for cost savings and process optimization. An improved approach to process control and optimization, FITNIR MC is the next generation of process analyzers.

Innovative Solution to Traditional Measurement Challenges

TRADITIONAL MEASUREMENT CHALLENGES

Short and highly variable in supply, wood chips represent 40% to 50% of the cost to produce a ton of pulp. Mills are challenged with finding solutions to optimize processes and save costs. This requires clear insight into their feedstock properties. Traditionally, the industry has used manual sampling and oven-drying methods that lack high-quality and timely data necessary for control. More recent technologies available in the market present their own challenges: contact with chips that potentially result in feed losses and equipment damage, safety concerns, low accuracy, measurement difficulties with chip variability, and calibration issues.

INNOVATIVE SOLUTION

Developed by FPIInnovations in collaboration with FITNIR Analyzers, FITNIR MC addresses the material challenges and fills in the gaps of the available technology. Based on NIR spectroscopy, FITNIR MC characterizes moisture content along with the potential to analyze other biomass properties. Online measurement is performed via an over-the-conveyor, open sensor unit consisting of a head that does not come in contact with the wood material and consequently requires little maintenance (Figure 1). Measurements are done in real-time with a scanning rate of 30Hz and an average frequency of one measurement output per minute. The software and database developed in-house seamlessly send data directly to the mill's DCS.

DIGESTER APPLICATION

Analyzing the moisture content of the wood chip feed to the digester, FITNIR MC computes oven-dry mass flow rate to the digester. Control via a true digester rate results in increased production, reduced EA-to-wood liquor charge, and reduced kappa variability.

POWER BOILER APPLICATION

FITNIR MC also measures the moisture content of hog fuel for air control of the power boiler furnace to improve combustion. The result: efficient and stable operation and cost reductions associated with decreased fossil fuel usage, power boiler downtime, and maximized use of forest biomass for fuel.

EXPANDABLE APPLICATIONS

FITNIR MC's expansive potential gives way to a whole host of potential applications throughout the pulp mill including:

- Lime mud moisture or solids content for kiln operation.
- Measurement of other feedstock properties (i.e., density, lignin and extractives content, calorific value).
- Moisture content measurement of a variety of biomass and wood products (i.e., pellets, veneers, OSB strands).

KEY FEATURES

- > **Full spectrum NIR sensor**
- > **Non-contacting, over-the-conveyor (OTC) system**
- > **Online measurements in real-time**
- > **High accuracy (+/-2.5%) and repeatability**
- > **Applications for the digester and power boiler**
- > **Expandable applications**
- > **Robust and transferable calibration models**
- > **Large moisture ranges for measuring both frozen and unfrozen materials**
- > **Industrially designed analyzer**
- > **In-house software and database with direct communications to the DCS**



Figure 1: FITNIR MC sensor head over the conveyor.

CALIBRATION TRANSFERABILITY

FITNIR MC's calibration has been developed both online and in the laboratory, generating a rugged calibration model that is transferable to a wide moisture and temperature range. FITNIR MC is the only moisture content sensor able to measure both frozen and unfrozen materials.

PROVEN REPEATABILITY AND ACCURACY

FITNIR MC is proven to deliver accurate and reliable moisture content measurements in real-time. Validated during a one-year mill trial, FITNIR MC demonstrated a strong correlation between laboratory moisture content measurements and analyzer measurements to the digester (Figure 2) and to the power boiler (Figure 3).

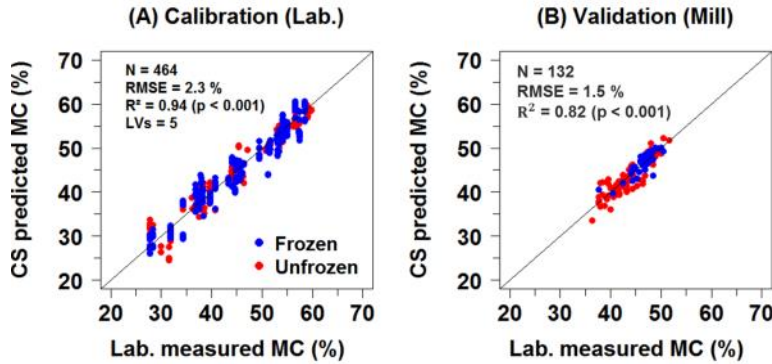


Figure 2: Digester Calibration — Wood Chip Moisture Content

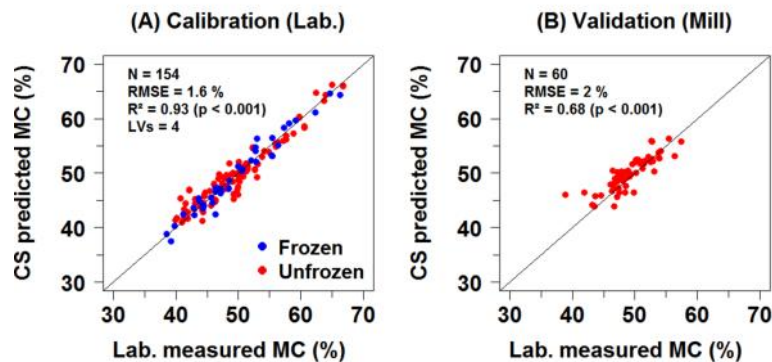


Figure 3: Power Boiler Calibration — Hog Fuel Moisture Content

DIGESTER BENEFITS

- > *Improves control and rate of digester production*
- > *Chemical savings from reduced white liquor addition*
- > *Reduces kappa number variability*
- > *Eliminates feed losses and risk of equipment damage*

POWER BOILER BENEFITS

- > *Reduces power boiler instability and downtime*
- > *Cuts fuel consumption costs by maximizing use of forest biomass*
- > *Decreases fossil fuel consumption and environmental impact*
- > *More reliable and profitable steam and power production*
- > *Improves biomass fuel price forecasting from early detection of biomass moisture content changes*

MEASUREMENT PRINCIPLES

FITNIR MC uses diffuse reflectance NIR spectroscopy as the basis of measurement. Energy from the NIR light penetrates the sample and is absorbed by the bound and unbound water. Optics collect the diffusely reflected light, registering its absorption on the infrared detector and generating the spectrum with its unique features. The spectral data from the analyzer is then correlated with a previously built calibration model to determine moisture content.

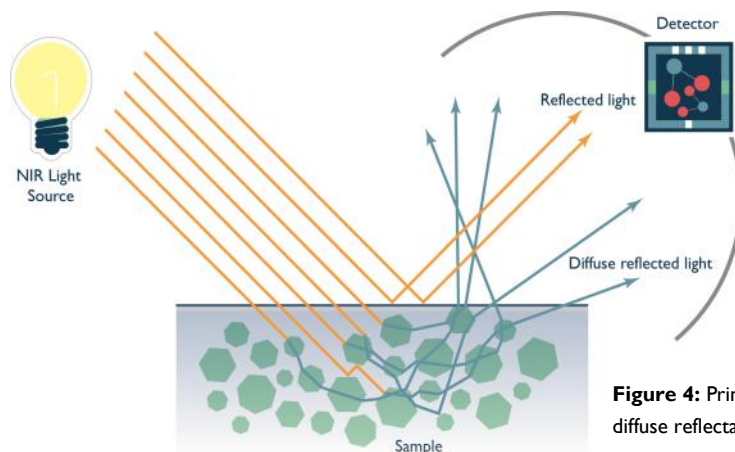


Figure 4: Principle of NIR diffuse reflectance spectroscopy

IMPLEMENTING FITNIR MC: MEANINGFUL RESULTS

A one year FITNIR MC trial, in combination with a supporting control strategy, significantly stabilized the flow of wood chips to the digester of a 2000 ADMT/d kraft mill. FITNIR MC data made real-time chip meter speed adjustments possible, stabilizing the wood chip feedrate. Prior to the trial, chip meter speed was held constant causing a variable supply of wood

chips to the digester (Figure 5).

Implementing FITNIR MC in conjunction with the control strategy suggests an overall increase in production of 2.5%, increasing mill revenue by an estimated \$3.5 million per year. Eliminating large swings in the dry chip feedrate is expected to improve overall digester operation and reduce pulp quality variability by providing more consistent control of chemical dosing and vessel hydraulic loading.

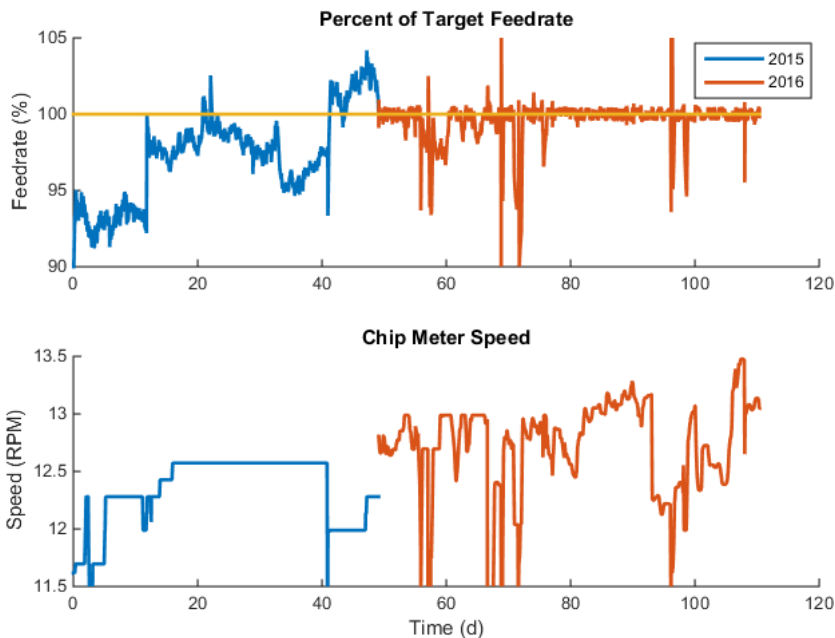


Figure 5: Comparison of wood chip feedrate to the digester. A constant chip meter speed in 2015 caused variable supply, while in 2016 FITNIR MC and a complementary control algorithm significantly stabilized the feedrate.



Figure 6: FITNIR MC Spectrometer

FITNIR MC EQUIPMENT: PRACTICAL AND ROBUST

FITNIR MC's sensor is located above the conveyor and is not confined to any housing, providing the most accurate readings. The sensor head does not come into contact with the feedstock on the conveyor, preventing wood material disruption, unnecessary material losses, and equipment damage.

The instrument cabinet housing the spectrometer is industrially designed to withstand harsh mill environments (Figure 6). Fibre optic cable connects the spectrometer to the sensor.

FITNIR MC's software and database, developed in-house by FPIInnovations and in collaboration with FITNIR Analyzers, supports applications and communications to mills' Distributed Control Systems.

FITNIR SUPPORT

At FITNIR, we understand your business. Our expertise in both the lab and in the field goes into every aspect of our product development. Our innovations, process knowledge and dedication are focused on supporting your business success.

FITNIR offers a wide range of customer support services, including project coordination, application engineering (including kickoff meeting, system configuration calibration and validation), system verification and testing, application documentation, training and after-sales support.

Contact FITNIR Analyzers Inc. to find out how we can partner with you to help optimize your mill.

FITNIR

The Next Generation of Process Analyzers

604.221.2230
1268 Vernon Drive
Vancouver, BC CANADA V6A 4C9
info@fitnir.com
www.fitnir.com/MC