FITNIR

FITNIR BENCHTOP

FITNIR Benchtop is a compact, plug-and-play pulp liquor analyzer that utilizes Near Infrared (NIR) spectroscopy. FITNIR Benchtop reliably measures a complete suite of key liquor properties throughout all process areas of the mill to improve efficiencies, profitability and safety. Fast and accurate measurements drive process control and optimization. With proven applications for the recovery boiler, dissolving tank, recausticizer, digester, brownstock washer, and chlorine dioxide generator, FITNIR is the next generation of process analyzers.

Innovative Solution to Traditional Measurement Challenges

TRADITIONAL MEASUREMENT CHALLENGES

The measurement of true liquor properties in the Kraft liquor cycle has been a challenge for the pulp manufacturing industry. Much of the previous generation of analysis relies on techniques such as density, conductivity, and manual titrations. However, these tests lack the ability to take rapid and accurate measurements needed for optimal performance.

INNOVATIVE SOLUTION

FITNIR Benchtop uses the same FT-NIR (Fourier-Transform Near Infrared) principles as FITNIR's flagship product, FITNIR Online, to analyze and measure a full scope of liquor properties. The technology is based on the concept of near infrared spectroscopy. All molecules have different light absorption and vibrational patterns. When NIR light is directed at a sample, its molecules absorb light in a unique way according to its molecular bonds. The spectrometer measures the liquor sample and its unique spectral properties are recorded. The spectral features allow for white liquor (WL), black liquor (BL), green liquor (GL), and chlorine dioxide (ClO_2) generator liquor properties to be measured.

A compact plug and play unit that does not need to be physically integrated into the mill, FITNIR Benchtop is a cost-effective solution. Its low cost of ownership easily replaces older lab-based systems with leading-edge technology that provides more rapid and accurate results. It also provides mills with an opportunity to trial the technology prior to making a full investment in FITNIR Online, FITNIR's automated, online system. Models from FITNIR Benchtop can easily be transferred to a FITNIR Online system, simplifying the transition.

APPLICATIONS

FITNIR Benchtop has applications for the digester, recovery boiler, recausticizer and ClO_2 generator process areas within pulp mills. Our technology can measure an extensive breadth of liquor properties, all integral for optimizing process control and efficiency. FITNIR's analyzers boasts an ability to measure the broadest spectrum of liquor properties using a single instrument. More applications continue to be developed to meet mills' measurement needs.

WL and GL ABCs and Black Liquor Residual Effective Alkali (REA) are key measurements for our pulp mill customers. FITNIR Benchtop measures WL ABCs, provides data to determine the extent of causticizing throughout the causticizers, and final WL strength for digester EA-to-wood charge. Its ability to measure REA provides fast feedback information on Effective Alkali (EA) consumption and delignification rate. Lignin concentrations further assist with controlling digester operation. Moreover, complete ABC measurements of clarified green liquor (CGL), including sulfate, provide critical information for dissolving tank and slaker control.

Applied to active and total polysulfides (PS), FITNIR Benchtop successfully quantifies polysulfide concentrations. PS is formed from the catalytic oxidation of the WL sulfide to form di-, tri-, and penta-sulfide. These longer chain polysulfides have been shown to improve pulp yield through the retention of hemicellulose. The measurement of PS has historically been difficult, as it is necessary to accurately quantify both the active and inactive PS. With FITNIR Benchtop, active and total polysulfides, as well as residual sulphide, can be simultaneously measured. The benefits are numerous. Active polysulfide allows for catalyst optimization and maximizes PS strength. Inactive polysulfide (or thiosulfate) content measurements make it possible to monitor the deadload in the recovery operation. And, residual free sulfide eliminates the need for standard ABCs while helping to optimize the oxidation process.

KEY FEATURES

- ***Heated vial holders***
- ***Disposable vials for contamination-free operation***
- ***No chemical reagents or dilution required***
- ***Large patented pathlength for high accuracy and precision***
- ***Measurements completed in seconds***
- ***Samples from any location can be tested immediately***
- ***Printable reports and historical values***

SAMPLE PREPARATION AND ANALYSIS

FITNIR Benchtop does not require any sample preparation or chemical additions. Not only does this eliminate user errors, but it also decreases employee exposure to the harmful chemicals of standard titration methodologies, some of which are suspected carcinogens. Samples are simply collected in disposable vials for analysis.

It takes only approximately one minute to analyze a sample in three easy steps:

Step 1 - Initiating Analysis: Within the software application, the user selects and initiates the procedure (Figure 1). The procedures available to the user will depend on what has been configured. The reference (water) stream is chosen to initiate zeroing of the system.

Step 2 – Sample Scanning: On the same screen, the liquor type to analyze (i.e., GL, BL, WL…) is chosen to initiate sample analysis. The test sample in the vial is inserted into the measurement slot and the analyzer acquires and runs the sample. Once the analysis is done, another sample can be analyzed by selecting the appropriate sample stream. Complete liquor compositions can be measured simultaneously.

Step 3 – Results: Absorption and raw spectra and the analysis results, including complete liquor properties, are shown immediately after the analysis (Figure 2).

FITNIR Benchtop generates a comprehensive collection of output and features resulting from the analysis. Diagnostics are available to indicate the validity of measurements. Data output can be sent directly to the DCS or other data historian, significantly reducing transcription errors that often accompany manual methodologies. The application also locally tracks data along with analysis history and corresponding properties and spectra. A results report can easily be generated with the click of a button.

KEY BENEFITS

- ***Low cost of ownership***
- ***Provides a safe lab environment***
- ***Eliminates manual preparation errors***
- ***High repeatability and accuracy of measurements***
- ***Reduces test time and operators' lab time***
- ***Quicker analyses improve per sample cost***
- ***Chemical savings***
- ***Simple to use***

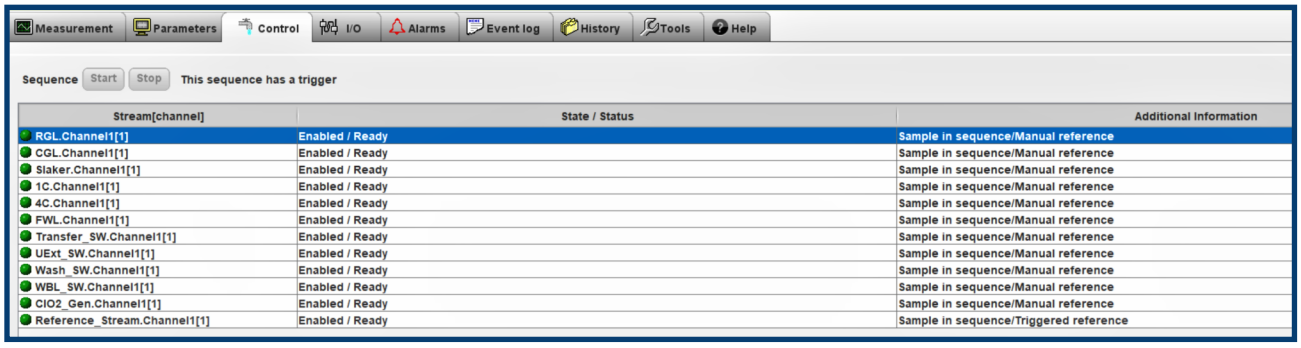


Figure1: Initiating analysis in the FITNIR Benchtop Software.

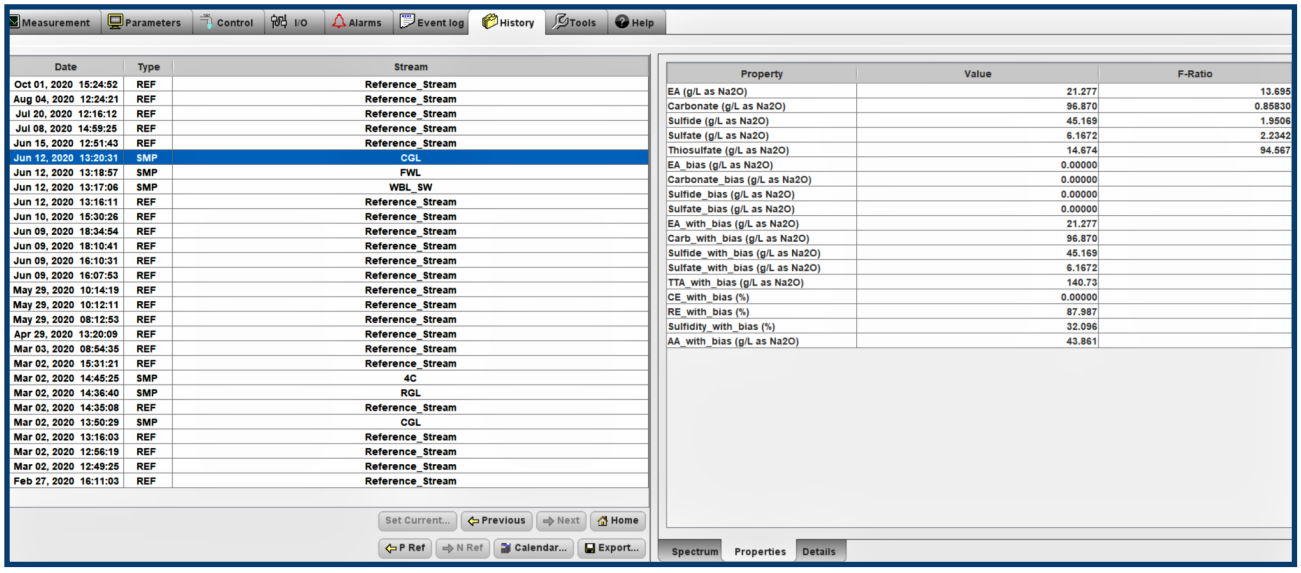


Figure 2: Analysis results.

Properties Measured by FITNIR Benchtop

Slaker and Causticizers - Clarified GL & WL ABCs

- EA (Effective Alkali)
- AA (Active Alkali)
- CE (Causticizing Efficiency)
- Sodium Carbonate (Na_2CO_3)
- Sodium Sulfate (Na_2SO_4), Sodium Sulfide (Na_2SO_4), Sodium Thiosulfate ($Na_2S_2O_3$)
- Polysulfides: Active, Inactive, Total, Residual Sulfide

Recovery Boiler - Unclarified & Clarified GL

- TTA (Total Titratable Alkali)
- EA
- AA
- Sodium Sulfide (Na_2S), Sodium Sulfate (Na_2SO_4), Sodium Thiosulfate ($Na_2S_2O_3$)
- RE (Reduction Efficiency)

Digester Liquor Properties

- BL: REA, Lignin
- Density

ClO_2 Generator

- Acid and chlorate concentrations

Brownstock Washer

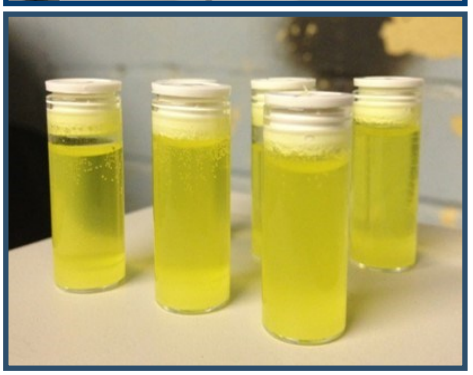
- COD/ClO_2 Demand

MEASUREMENT PERFORMANCE

As a platform technology, the same device can be applied to analyze and measure multiple types of liquor and properties.

Typical measurement performance is shown in the table below.

PROPERTY	MEASURED RANGE	ACCURACY *(1 SIGMA VALUE)*
EA	4 - 120 g/L Na_2O	± 0.5 g/L
AA	6 - 120 g/L	± 1.0
TTA	10 - 150 g/L	± 1.2
Na_2CO_3	4 - 100 g/L	± 1.0
Na_2S	2 - 50 g/L	± 1.0
Na_2SO_4	1 - 20 g/L	± 0.5
$Na_2S_2O_3$	1 - 15 g/L	± 0.5
BL REA	2 - 50 g/L Na_2O	± 0.5



FITNIR SUPPORT

At FITNIR, we understand your business. Our expertise in both the lab and in the field goes into every aspect of our products and services. 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 (i.e., 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 optimize your pulp production.

FIT NIR

The Next Generation of Process Analyzers

1268 Vernon Drive
Vancouver, BC V6A 4C9 CANADA
+1 604-221-2230
info@fitnir.com
www.fitnir.com/benchtop

In Partnership with FPInnovations