Pulp and Paper Industry

Optimizing Chemical Recovery in Pulp Mills with online spectroscopy (NIR)

Metrohm
Process Analytics

Benefits of online monitoring in the pulping process

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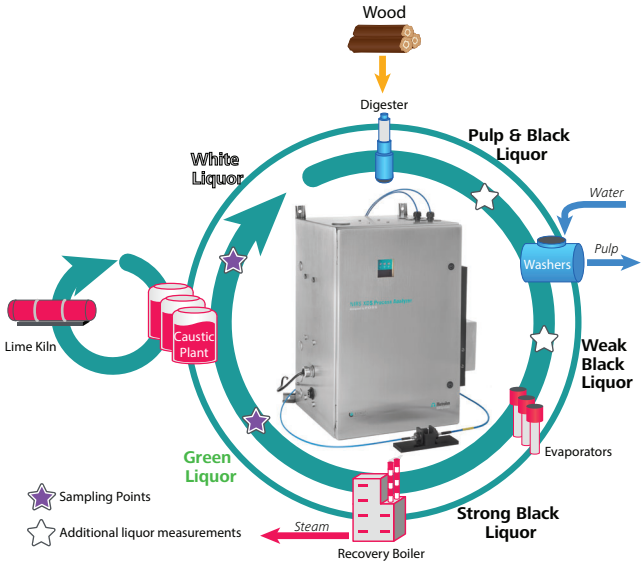
In a pulp mill, chemical recovery is a key process as it does not only allow the reuse of chemicals but also provides utilities (steam, power) throughout the pulping process. Optimizing this process can lead to significant cost reductions and product quality improvements. This can be realized by monitoring in real-time the composition of the white and green liquors.

Alkali determination in white and green liquors

During Kraft pulping, the precise and continuous analysis of white and green liquors from the recovery boiler to the digester is of utmost importance to guarantee the highest chemical recovery efficiency. The proper optimization of the liquors' composition reduces chemical waste, lime usage, and maintenance, while increasing product quality and increasing company profits.

Traditionally titration (ABC Tests) has been the method of choice for online/atline monitoring of pulping liquors to ensure pulp quality. Despite some evident benefits of wet chemistry to differentiate the three primary chemicals, faster, reagentless, and maintenance - free instrumentation is needed to meet the high demand. Near-Infrared spectroscopy (NIRS) guarantees process control in real-time and seamless integration to all industrial environments.



Benefits of online NIRS in a pulp mill

Greater and faster return on investment

- Cost reductions (lime purchase, utilities, maintenance) by process optimization
- No chemicals and reagents required, greatly reducing operational costs

Improved product quality and manufacturing efficiency

- Increase the degree of reduction efficiency and causticizing efficiency
- Improves production rate (continuous and optimized feed to the digester)

Save analysis time, faster time to market

- Multiple parameters are simultaneously determined every 30 seconds
- Optimized operation, real-time monitoring leads to an increased throughput of product quality

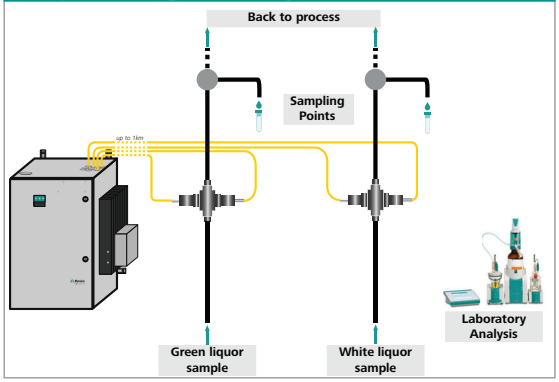
Metrohm Process NIRS for Alkali determination in liquors

NIRS is well-established across many industries as a versatile, fast, and nondestructive analytical technology. Pulping liquors can be successfully subjected to Near-Infrared (NIR) analysis despite their complex and harsh composition.

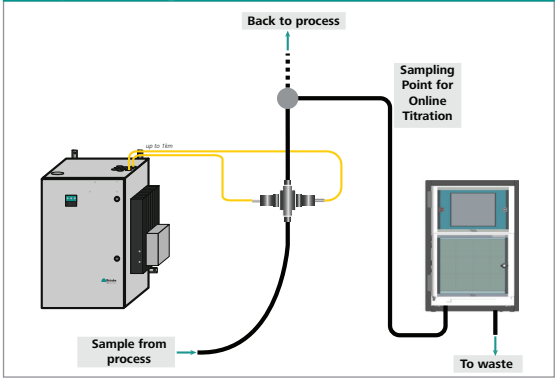
Real-time optimization of the liquor quality enables improved liquor reutilization, reduced equipment maintenance, and increased recovery efficiency and causticizing efficiency. In pulp mills, alkali determination is commonly made through ABC-tests either in the laboratory (every hour) or online (every 30 min).

Online NIRS can complement titration-based methodologies offering reagenteless automated measurements with no need to carry samples to the laboratory and easy 24/7 operation. Results are directly sent to the plant's PLC or DCS every 30 seconds.

Complementing laboratory titration



Complementing online titration



- **Offline Titration - Online NIR**

Metrohm NIR Process Analyzer can measure up to 9 independent sampling points. The ideal online implementation consists of 2 circulating loops connected to flow-through cells, one for each liquor type. Each sampling point can be a hundred of meters apart. The nondestructive character of NIRS allows the samples subjected to analysis to be sent back to process.

- **Online Titration - Online NIR**

Online titrators have a sample stream coming to the instrument. To implement Metrohm NIR Process Analyzer, a flow-through cell is placed on the sample stream. White and green liquors are flowed through sequentially after cleaning intervals. An identification step is being implemented at this stage to allow liquor type determination. This step is crucial for simplifying alkali determination at the correct process stages.

Alkali determination by NIRS

Online NIR solutions gradually have gained ground against the dominant wet chemical analytical strategies in the pulp and paper industry. Currently, ABC-Tests are widely used to determine Alkali (active (AA), effective (EA), and total titratable (TTA)) in white and green liquors, from which sodium carbonate (Na_2CO_3), sodium sulfide (Na_2S), causticizing efficiency (CE) and recovery efficiency (RE) are derived. Online monitoring with NIR can go a step beyond and provide fast, precise, and reliable results allowing a real-time control of the chemical recovery process.

Quantification Parameters: Accuracy

	White Liquor (g/L; ±)	Green Liquor (g/L; ±)
AA	0,5	0,6
EA	0,4	0,3
TTA	0,5	0,4
Na_2CO_3	0,6	0,5
Na_2S	1	1

NIRS solutions in papermaking

Metrohm Process Analytics offers two NIRS lines: XDS and PRO. The NIRS PRO can be configured for contact measurements (for moisture in wood chips for instance), while the XDS can handle up to 9 independent measuring points. These analyzers come with a wide portfolio of fiber optics and probes ready to handle any sample. Here are some additional parameters that our NIRS Process Analyzers can measure:

• Kappa number	• Moisture
• Lignin content	• Resin
• Kraft pulp yield	• Brightness
• Tall oil	• Wood species
• Coatings	• Hardwood/Softwood ratio
• Component analysis (clay, TiO_2, fillers, ash, etc.)	

Related documents

• For more details about our solutions in the pulp and paper industry check our brochure: **8.000.5221 - Paper and pulp industry – reliable online, inline, and atline analyzers for paper manufacturing.**

• For more details about our process analyzers, check out our brochure: **8.000.5175 - Industrial Process Analyzers – Multi-purpose analysis systems for online, inline, and atline applications**

• Contact your local Metrohm Process Analytics organization for more details about alkali determination with NIR: **AW NIR NL10-2052-062019 - Determination of Alkali in Kraft liquors by process NIRS in Pulp and Paper industry**

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