Stabilize, optimize and speed up the MDF production with online spectroscopy measurement prior to refining process

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Abstract

APOS (measurement technology) and Andritz AG (Refiner technology) have jointly developed a system called DigesterView® that allows customers in the Panelboard and Pulp & Paper Business to control and adapt their production. This is the first application to measure moisture, wood type and more online under high process pressure and high process temperatures (e.g. the discharge of the digester).

Process optimization is a big issue in commodity production, as is the case in the wood industry. Only a high material throughput with consistent product quality leads to profitable, economical production. To ensure this, continuous control and optimization is required. One approach is to use process analytics. The aim of online analytics is to replace or supplement the traditionally used "feed back = reactive" approach with a "feed forward = proactive" method. Various measurement methods are available for this e.g. the optical spectroscopy. With this technology, the measurement of physical (morphological): strength / hardness, breaking strength, particle size, flowability etc. and chemical: ingredient content, excipient concentration, polymorphism, coating thickness etc. are possible. Chemically by absorbing light and morphologically / physically by measuring the scattering of light.

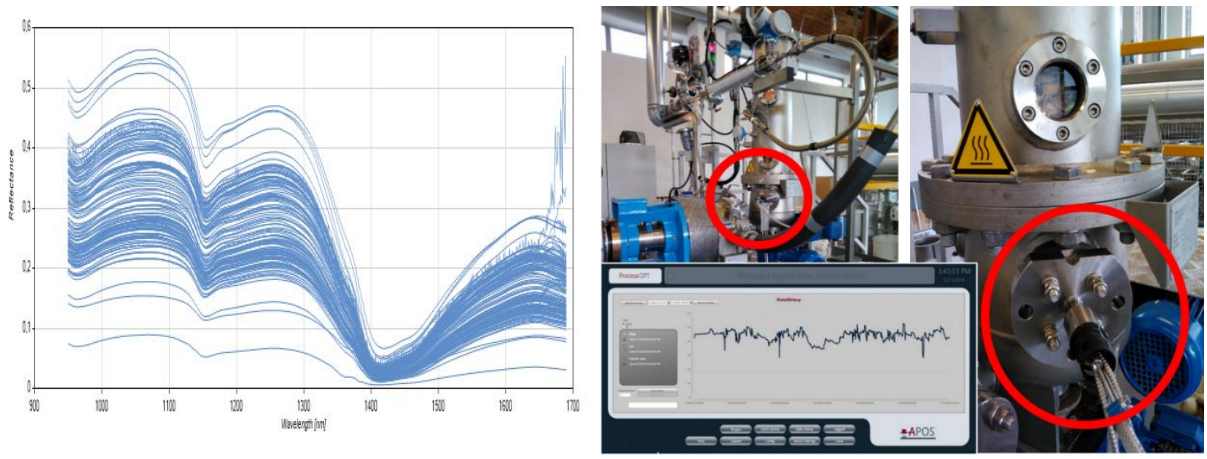

Figure 1: left: NIR spectra, right: ANDRITZ laboratorypilot plant with built-in sensor. Presentation of the measured value (online)

In optical spectroscopy (here NIR spectroscopy) there is an interaction between electromagnetic radiation and the measured material. The detected signals (spectra) are due to a material- and ingredient-dependent absorption of the radiation and provide important information. The molecular bonds of the different components are excited at the used wavelength range and depending on the compounds in the sample examined, certain wavelengths are absorbed. The recorded measurement data (absorption or reflection spectrum Figure 1 left) are linked to the reference values (desired

measurement parameters) and correlations are determined or calibration models are developed. If there is a sufficient correlation, the parameters can be predicted spectroscopically. This means that measured values are accessible online and without sample preparation.

This technology is used in many industries and also in the wood industry, e.g. to monitor the drying process by determining the water content.

With the new development, it is now possible to measure at the end of the digester process at high temperatures / pressures and to provide values online. The now accessible parameters can be used for process optimization

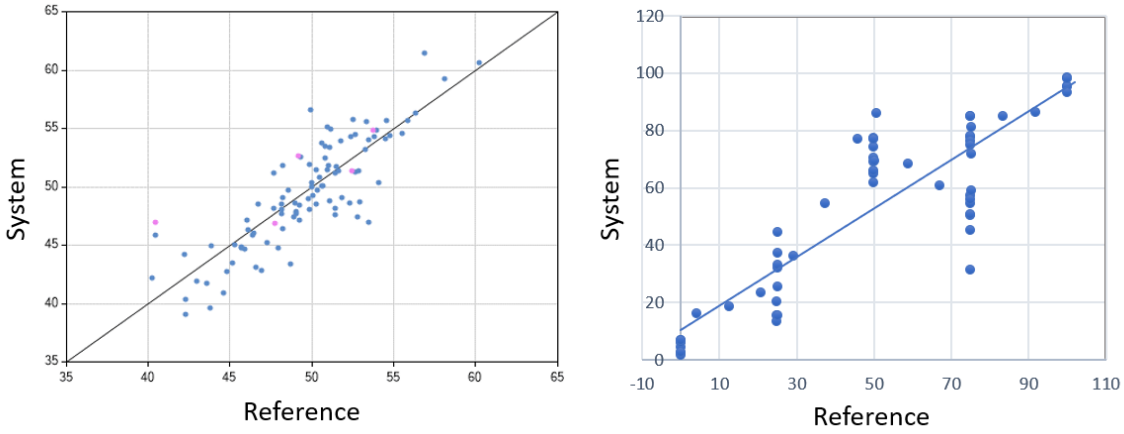

Figure 2: Correlation system vs. reference value. Left: water content [%], right: hardwood content [%]

To use this optical spectroscopy for measuring online data at industrial installations a sensor application for refining pressures and refining temperatures was developed. An existing Andritz laboratory plant (Figure 1 right) was adapted to install the sensor optics as planned for industrial plants and measurements was done in the required range of operating parameters (variations in pressure, moisture, material species and mix of species). The tests showed a high correlation (Figure 2 left) between the water content and the measurement signal (spectrum). It could also be shown that a prediction of the soft or hardwood content is possible with also a high correlation coefficient (Figure 2 right).

The most important stages for MDF fiber production (Figure 3 includes:

- Feeding pre-cleaned and classified material (e.g. wood chips) to the MDF process
- Atmospheric heating with steam up to approx. 85-95°C (pre-steaming of the feed material in the Pre-Steaming Bin). During the atmospheric heating process, condensate from steam increases the moisture (e.g. 20 %m based on bone dry material).
- Feeding the material to the pressurized part of the System with a Plug Screw Feeder that builds a pressure tight plug for the following pressurized heating in the Digester. The Plug Screw Feeder also reduces the moisture of the material by squeezing out water from the compressed chips.
- Pressurized heating in the Digester increase the temperature of the material to the lignin plasticization temperature what reduces the required specific energy for fibrillation and influence

the produced fiber quality. During the pressurized heating process, condensate from steam increases the moisture (e.g. 20 %m based on bone dry material).

- Fiber fibrillation in the Pressurized Refiner
- Gluing of fiber in the pressurized Blow Line after the Refiner
- Drying of glued fiber

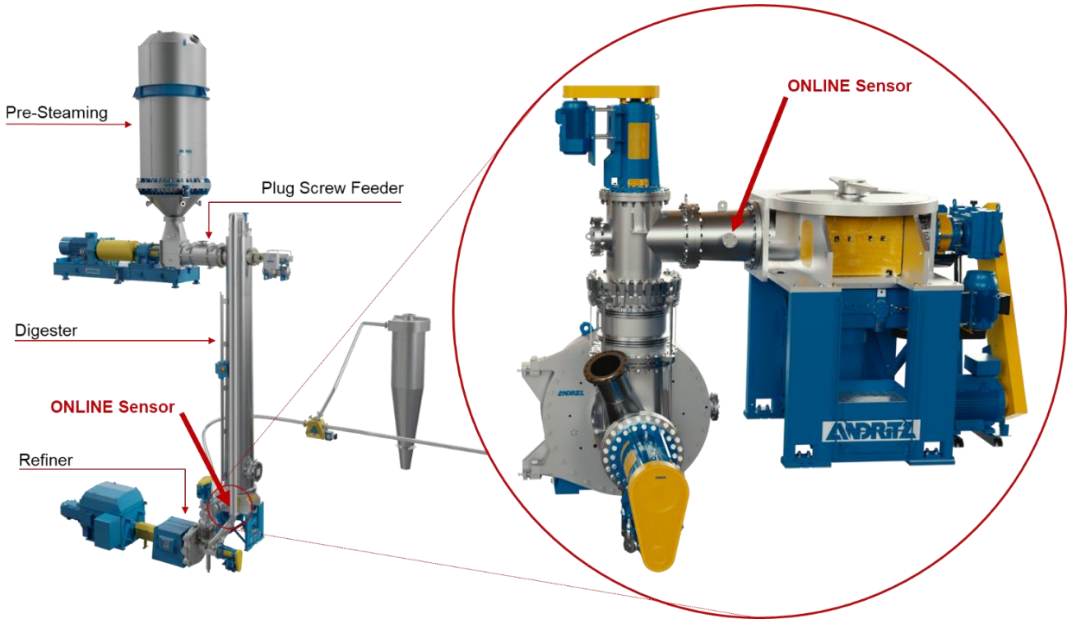

Figure 3: General overview of Pressurized Refining System. The right picture shows for example the installation position of the NIR ONLINE Sensor in the casing of the discharge screw from the pressurized digester bottom. This position is right after and short before the material enters the Refiner for fibrillation. The right picture shows the Pressurized Refining System (PRS) beginning with Pre-Steaming, Plug Screw Feeder, pressurized Digester, Discharge System, Refiner Blow Line, and Start-Up Cyclone.

This unique online measurement in the Pressurized Refining System will stabilize, optimize and speed up production of the complete board production line.

Online measurement of the moisture content, wood species and more prior to Refining was not possible until this new sensor was developed. With this online information prior to the further process it is possible to ensure stable and optimized process conditions.

The online values allow proactive control of:

- Specific Refining Energy (kWh/t) can be adjusted according detected moisture and mix of wood species.
- Glue quantities and additives can be adjusted according detected moisture, mix of wood species based on detected actual material properties.
- Proactive control for Drier (stabilization of unexpected moisture fluctuations).

Further to that:

- Online monitoring e.g. of wood mix and pH values allows to ensure quality of final products and can be used as quality monitoring parameter.