ANDRITZ has teamed up with Savcor, a Finnish technology provider specializing in the use of electrochemistry for corrosion prevention and structural health monitoring, and have together developed a novel method to measure alkali levels inside the digester.

At the moment, the only way to measure and monitor residual alkali levels from the digester is from side streams, which include circulation flows. These measurements not only give a late reading, but they also only provide an average reading as it is only a sample that may contain many discharge points. ANDRITZ, with its expert knowledge of the cooking process, and Savcor with its advanced sensor technology, have developed a completely new way to control the digester and cooking process. The system is suitable for both continuous and batch cooking.

During the cooking process, residual alkali strength fluctuates with changes in chip composition due to wood species, moisture, and concentration of cooking chemicals. The new measurement method is based on electrochemistry, measuring the rate of selected electrochemical reactions occurring on the probe surface. With the correct measurement parameters, the reaction rate correlates with alkali concentration and temperature. The temperature effect can be calibrated by measuring the temperature at the tip of each probe, giving additional information of variation inside the digester. The output values of each probe are alkali concentration (g/l) and temperature.

**ENVIRONMENTAL BENEFITS**

The new measurement technology enables more efficient methods to control the digester and the cooking process. The system is expandable so the mill could start with a smaller amount of sensors and then later add additional sensors based on the results obtained from the measurements. This means mills can start with a smaller investment and build up as the results help to improve digester performance.

This technology is suitable both for continuous and batch cooking. Similar benefits are achieved in both technologies.

The new system also offers substantial potential to decrease the environmental impact by cooking wood chips in optimal conditions and avoiding chemical overdosing. Excess cooking liquor addition will decrease the Kappa number and yield and will lead to higher alkali residuals, potentially causing corrosion in the evaporation plant. Higher alkali residuals in the pulp out of the digester also decreases washing efficiency downstream, which results in a greater effluent load and corresponding negative environmental impact as well as increased makeup chemical costs.

Conversely, insufficient cooking liquor addition will result in higher than desired Kappa numbers and increased rejects as well as increased risk of lignin precipitation and vessel corrosion, particularly in carbon steel vessels.
By optimizing the alkali application rate, the mill’s environmental impact and carbon footprint can be reduced while simultaneously ensuring maximized yield and pulp quality.

The alkali measurement system is currently in the piloting phase but interest has already resulted in two further installations at customer mills. The technology is being proved to follow alkali levels accurately and provides huge benefits especially for mills that run different grades, have variations in raw materials, or cook different wood species in one cooking line, for instance pine and birch.

**MEASURES DIRECTLY INSIDE THE DIGESTER AND OPTIONALLY FROM CIRCULATION LINES**

**NO CONTINUOUS SAMPLING, NO CHEMICAL ANALYSIS**

**ON-LINE MEASUREMENT – NO DELAY**

**SELF-CLEANING SENSORS**

**IN A NUTSHELL**

Savcor has been measuring electrochemical phenomena inside digesters for almost 40 years as part of its anodic protection systems, which are designed to prevent digester wall corrosion by passivating the steel with direct current. This experience with corrosion related measurements spawned the idea of measuring alkali concentration, which is a major factor in corrosion potential. The sensor technology was already robust and had a proven track record, but the measurement algorithms required rethinking.

ANDRITZ and Savcor have been working together since the 1990’s in reducing the corrosion costs of the kraft pulping process. ANDRITZ has been able to push the development further by relying on Savcor AP system to stop the corrosion. It was only natural to start an even more extensive cooperation in on-line alkali profile measurement, developing a product now marketed under the ANDRITZ brand.

**Equipment**

- Chip feed
- Cooling EA adjusting outlet
- Impregnation inlet and outlet
- Cooling liquor inlet and outlet
- LT accumulator outlet
- Washing inlet and outlet
- To evaporation
- EA1
  - EA2
  - EA3
  - EA4
  - EA5
  - EA6
  - EA7
  - EA8
  - EA9

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Sensor after one year of operation shows no scaling on sensor surfaces.