Pulp & Paper
Perspectives in Liquid Process Analytics

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News

INGOLD
Leading Process Analytics

Durable and Intelligent
Dependable pH Sensor for Sulfite Pulping

Regulating bisulfite feeding in sulfite pulping is a very demanding application for pH sensors. For a European paper mill, a METTLER TOLEDO solution not only tolerates the process, it has reduced maintenance by 50 %.

Global producer of paper products

Our customer is a Sweden-based producer of paper, packaging and wood products. It operates activities in in over 30 countries.

At one of its European mills it produces newsprint, improved newsprint and uncoated magazine paper. The focus within each product area is to supply high-quality products tailored to meet the specific requirements of individual customers. Production capacity is approximately 1 million tons a year on four paper machines.

Well-proven process

The sulfite pulping method of producing cellulose fibers was developed in Sweden in the 1870s, and it is this technique which is still used at the facility.

In sulfite pulping, regulating the bisulfite being fed to the liquor after the bleaching tower is very important. Process pressure is very high (5 – 6 bar) at this stage and the pulp is very thick (8 – 9 % solids), making successful in-line pH measurement extremely difficult, indeed all previously used sensors failed within weeks. However, bisulfite regulation via pH control would be very useful during the procedure, if a reliable system could be found.

Rugged and dependable solution

METTLER TOLEDO was convinced that we could supply pH instrumentation that would tolerate the pressure and the highly caustic solution, and would measure reliably in the thick pulp. After discussions with the chief mill engineer, we installed a system comprising the InPro 4801 i SG

METTLER TOLEDO

pH sensor, InTrac 785 housing and M400 transmitter.

The InPro 4801 i SG is ideal for this application for four main reasons:

1. It is designed to operate in pressures up to 13 bar.
2. The pH membrane is flat, making it suitable for measuring in thick pulp applications.
3. The very long diffusion path provides an excellent barrier against poisoning of the reference electrode.
4. Intelligent Sensor Management (ISM®) technology alerts engineers as to when maintenance or calibration will be required and predicts the remaining sensor lifetime.

Rapid start up

InTrac 785 is a retractable housing, allowing sensor maintenance or replacement without any interruption to the process. The M400 transmitter offers full ISM functionality including the Dynamic Lifetime Indicator and Adaptive Calibration Timer sensor diagnostic tools, and Plug and Measure for fast and easy measurement point start up.

Dramatic reduction in maintenance

Many months after installation, the chief mill engineer reports that the system is working extremely well, and that the original sensor is still operating reliably. He is delighted not just with the performance of the system, but also with a drop in sensor maintenance of 50 %, and the advance servicing notifications ISM supplies.

► **www.mt.com/InPro4800**

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Can You Be Sure
That Your pH Measurements Are Reliable?

The vast majority of installed pH measurement systems in the process industries still use analog glass sensors. And although such sensors are highly dependable, issues with cables and the environment around the process mean that your pH measurements could be out by several units! The answer? Digital technology.

The problem with cables

The issue of unreliable pH measurements does not lie in the use of glass sensors themselves. They have proven themselves to be reliable since they were first introduced 100 years ago. The cause of unreliable measurements lies elsewhere – with the cable, or more precisely, the signal that travels along it.

For example, moisture ingress at the cable connector can severely disturb a signal. As a glass sensor has a high electrical impedance of several hundred megaohms, liquid in the connection will cause a short-circuit, creating an equivalent impedance within the system. This can change the mV output of the sensor to such an extent that your transmitter will calculate pH values that are several units off the true level, or cause polarization effects that might be interpreted as drift.

Subassembly of a digital pH sensor

In a chemical environment, corrosive vapors can attack metallic connectors, generating unpredictable amounts of millivolts and resulting in pH measurements so wrong that you will no longer be able to properly control your process.

Using cable that is not properly shielded can also have undesired effects. Due to the high impedance nature of the measurement the cable acts like an antenna, and vibration and fields generated by surrounding equipment will manifest as continuously fluctuating pH values.

100 % signal integrity

All these effects are eliminated completely with the use of digital Intelligent Sensor Management (ISM®) technology. Using an on-board microprocessor, pH is calculated inside the sensor itself (which means it is more accurate) and forwarded to the transmitter in a digital format. Being digital, the signal is immune to the foreign influences that affect analog signals. Even in the presence of moisture and over long cables, ISM's digital transmission gives you 100 % signal integrity – all of the time.

Voltage drop shown at pH 4 (176 mV) due to sensor polarization caused by moisture ingress

▶ **www.mt.com/ISM-chem**

Developments in Process Analytics
for the Pulp and Paper Industry

Stefan van der Wal at METTLER TOLEDO is an expert in the deployment and use of process analytical measuring systems in pulp and paper production. He travels around the globe advising mills on how to improve their processes and increase profitability. Pulp and Paper News spoke to him about the growing role of process analytics.

Mr. van der Wal, process analytics is playing an increasingly larger role in the pulp and paper industry. How do you explain this?

I think there are several reasons. First of all, competition is pressurizing mills to do more with less. In-line analytics keep an eye on processes so personnel can concentrate on other tasks. Secondly, there is ever stronger environmental legislation that requires monitoring and control of waste effluent.

Thirdly, though being very conservative, the industry understands that in-line analysis has enormous benefits over laboratory analysis of grab samples. The value of a real-time continuous measurement at process conditions is so much higher than periodic analyses of samples that may have been taken hours beforehand and therefore no longer represent anything that's going on at the process side.

Pulp mills and paper mills are very different places. Is process analytics equally valid in both?

Because of the strong liquors produced and chemicals used in pulp manufacture, process analytics can play a major role in the control of reagent dosing, monitoring effluent, and so on. Also, as the quality of the pulp influences the quality of the finished product, tight control of pH, ORP and conductivity at the pulp mill is very important. Not only for pulp quality but also in the recovery of byproducts like tall oil.

At the paper mill, analytics are less important but there are still measurements that should be done in stock preparation and at the wet end to ensure fibers have the desired strength and retention.

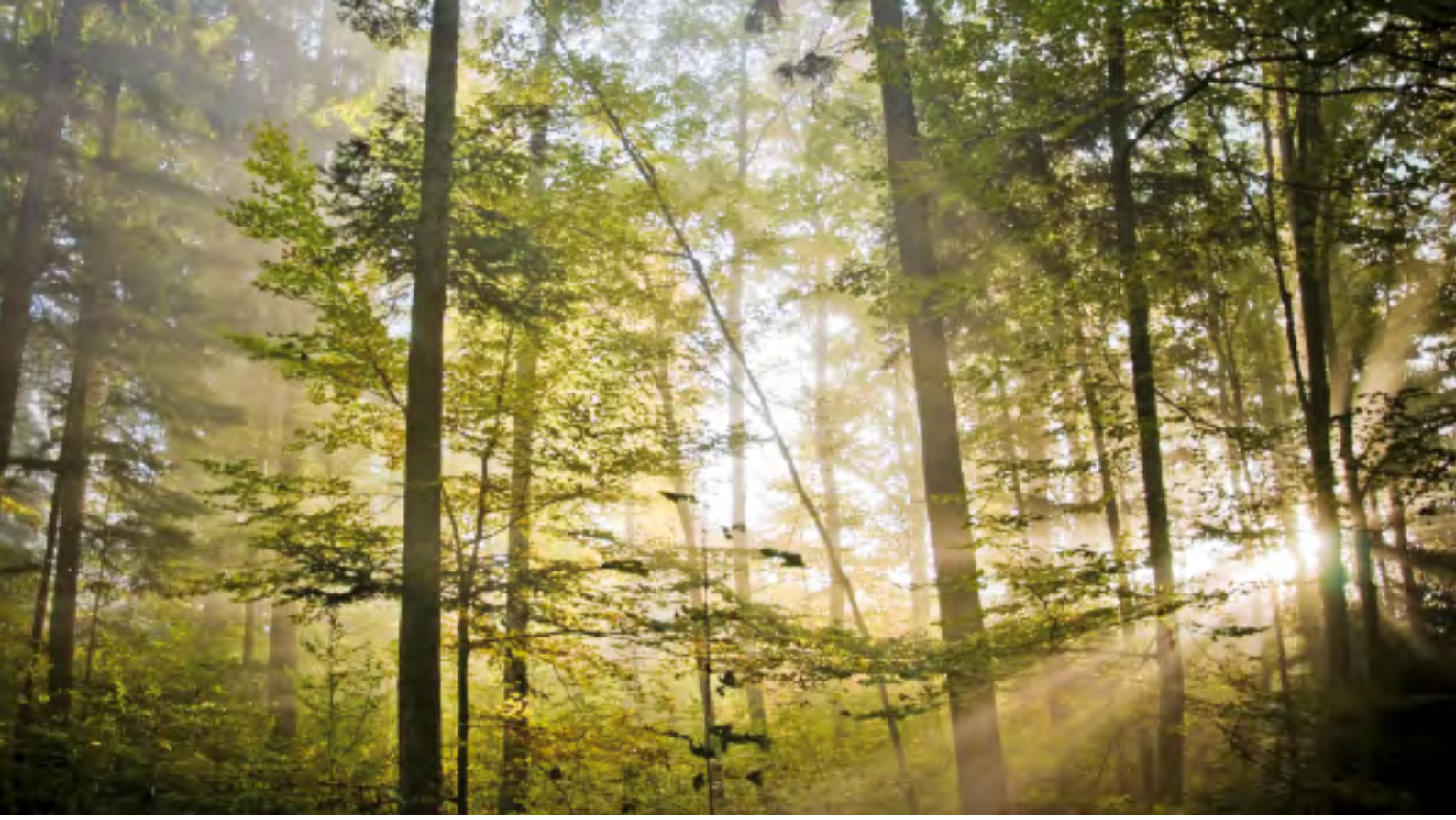
pH sensors haven't changed much in many decades. Why is that?

That is and isn't true. There are now different ways of measuring pH, but glass-membrane electrodes still offer the best technology and I can't see that changing. Also, the reference system in pH sensors has improved a lot. Long diffusion paths and better electrolyte fluids to protect electrodes from poisoning means sensor lifetime is much longer than it's been in the past.

And digital technology is making a huge change to sensors for pH and other parameters. Having a microprocessor inside a sensor opens up a host of advantages that normal analog sensors can't compete with.

Where does digital technology have the greatest impact?

There's a lot of moisture in pulp and paper mills, and moisture is not good for process analytical systems because it corrodes connections and interferes with measurements. Digital sensors simply don't have



those problems, so the measurement at the transmitter is more reliable.

Also, with our ISM technology we offer predictive diagnostics. In-depth on-line sensor diagnostics provide a wealth of information with regard to the measurement and the condition of the probe. Now the maintenance technician knows when each sensor will need calibrated or maintained, so he's not servicing sensors when they don't need it, or worse, when it's too late.

Do you think digital sensors will become the accepted standard in the pulp and paper industry?

Without doubt. The advantages are just too great. It's not only about the diagnostics and the digitized signal. Another major benefit of ISM is the possibility to do bench calibrations. No longer do you need to carry buffer solutions around the plant. ISM allows you to take a sensor out of the process and calibrate it at your desk under controlled conditions. Bench calibration and sensor diagnostics reduce cost of ownership.

And that's what matters most these days, isn't it?

That and avoiding standstills. Nobody wants unscheduled shutdowns due to some unreliable measurement or failing process equipment. That's why sensor diagnostics are so valuable.

Improved Process Efficiency in Tall Oil Production – Greater Yield with Less Chemicals

This white paper explains how robust pH sensor design combined with recent developments in analytical technology can lead to increased tall oil yield, and reduced chemicals use.

Download your copy today.
► **www.mt.com/pro-tall-oil**

Inductive Conductivity Sensors
Reduce Brown Stock Washer Costs

Achieving cost savings in brown stock washers requires careful control of the dilution factor. This lowers loss of chemicals and overuse of water. Measurements from inductive conductivity are an excellent indicator of washing efficiency and leads to improved brown stock washer control and reduced running costs.

Efficient brown stock washing

Brown stock, the "dirty" pulp coming out of the digester, is washed in a concurrent system with cleanliness increasing with each wash. The goal is to achieve clean stock using a minimum amount of fresh water and to avoid unnecessary dilution of the white liquor chemicals fed at the digester. These chemicals are concentrated in the recovery boiler, and a high concentration of water makes this process inefficient or even impossible.

The concentration of chemicals in the solution coming out of the last stage washer determines the cleanliness of the stock as well as the dilution factor. At this stage, fresh water is added to the system. The amount added determines the cleanliness of the stock, and the concentration of chemicals in the solution going to the recovery boiler. There is a fine balance between effective washing and conservation of the liquor concentration for downstream processing.

Even though it is called the dilution factor, concentration of the brown stock is fairly high and can be successfully determined by conductivity measurement. At this stage in the process, conductivity is in the range of 50 to 100 mS/cm, depending on the individual plant, process and stock. That corresponds to concentrations in the low one digit percent range. Dilution in that sense is relative to the two digit concentrations present in the digester.

Conductivity measurement at the brown stock washers requires a sensor that is immune to clogging from pulp fibers and that can tolerate the white liquor chemicals.

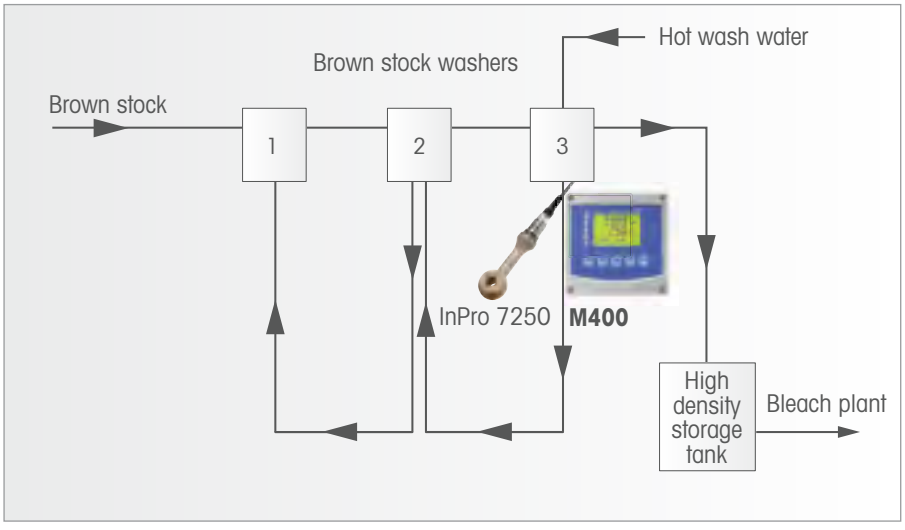
Process tolerant InPro 7250 conductivity sensor

The best solution for this application is an inductive conductivity sensor. With this type of probe, no electrodes are directly in contact with the process, they are therefore not directly affected by contamination. The InPro 7250 is constructed of PEEK, which is highly resistant to the white liquor chemicals. For best performance, the InPro 7250 should be installed where it will be in contact with a representative sample of the washing solution, e.g. in the washer itself or in the drain line.

M400 transmitter with diagnostics

As to the transmitter, the M400 is the best choice. Simple operation, precise and reliable measurements as well as low cost of ownership reduce effort and expense. The M400 accepts both analog probes and digital Intelligent Sensor Management sensors.

► **www.mt.com/InPro7250**



Brown stock washers process

M400 multi-parameter transmitter

- Wide range of chemical concentration curves
- User-defined concentration curves
- IP 65 waterproof rated enclosure
- Advanced PID controller for process safety

InPro 7250 inductive conductivity sensor

- Inductive design is ideal for dirty applications
- PEEK body is highly resistant to aggressive chemicals
- Robust design for maintenance-free operation
- Highly temperature and pressure tolerant
- Integrated temperature sensor

Magnesium Oxide Slurry Control
with a Diaphragm-less pH Sensor

The InPro 4260 i pH sensor has been developed for difficult applications such as slurry control. Its solid polymer electrolyte, resistance to poisoning, and advanced diagnostics ensure exceptional performance and reduce maintenance.

One goal, two results

The recovery of cooking liquor chemicals in pulp manufacture results both in a reduction of environmental loads and lower operating costs. Chemical recovery plants work on the basis of a wet process during which the sulfur dioxide (SO_2) and magnesium oxide (MgO) contained in the flue gas from the recovery boiler are converted into magnesium bisulfite.

Reaction steps where Mg $(HSO_3)_2$ is produced

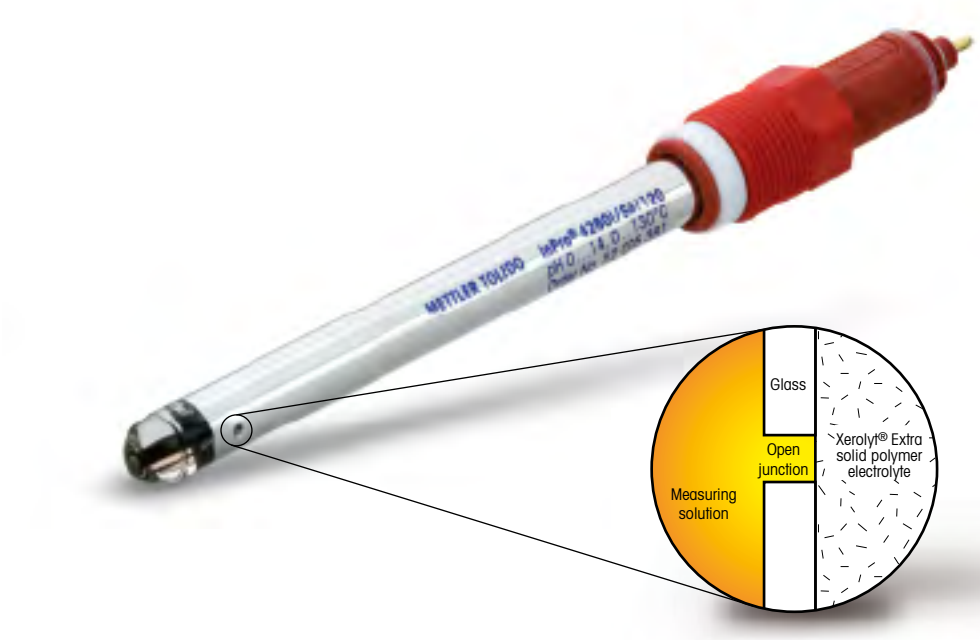
There are several stages to achieve this, one of which is SO_2 absorption. In the wet process, ash separation and flue gas saturation occur together in a wet scrubber. Absorbent preparation begins with the suspension of the separated ash. The magnesium oxide reacts with water to form magnesium hydroxide and serves as an SO_2 absorbent. In the alkaline sulfite stages, crystalline magnesium sulfite is formed which is converted into magnesium bisulfite through further contact with SO_2. This results in raw acid which is drawn off and passed on for acid preparation. After clarification, insoluble impurities can be discharged by means of sedimentation. With further fortification, cooking acid is produced for reuse in the process.

Overcoming a challenging situation

In order to obtain a reliable in-line pH signal for use as a control parameter for the recovery of chemicals in spent pulp liquor, proper sensor selection is critical: Product characteristics, requirements for acid flushing, temperature range, and reliability of the measurement must all be considered.

pH sensor with high process tolerance

The InPro 4260 i sensor is designed for high performance in this application. It features Xerolyt Extra solid polymer elec-



InPro 4260 i pH sensor with solid electrolyte

trolyte for precise pH measurement and longer sensor lifetime, even in the most difficult high particle concentration industrial environments.

This diaphragm-less sensor features an open junction, allowing direct contact between the process media and the sensor's electrolyte. As there is no diaphragm, the possibility of clogging is greatly reduced, and hence frequent cleaning is not necessary.

Maintain sensors only when necessary

The InPro 4260 i is part of the METTLER TOLEDO Intelligent Sensor Management (ISM®) range. Miniaturized circuitry in the sensor's head monitors for signs of stress or degradation and transfers the information to the connected transmitter.

The advanced diagnostics features of ISM interpret this data to inform the user when sensor cleaning, calibration or replacement is required. Thus, maintenance can take place when it is needed, rather than waiting until measurement performance from the sensor is reduced, or conducting regular maintenance when it may not be necessary.

▶ **www.mt.com/InPro4260**

Keep Silica at Bay
with a Low Maintenance Analyzer

Silica in boiler feedwater can very quickly lead to deposit formation in turbines. As it can only be removed during out-of-service cleaning, preventing silica from entering the water cycle is the best course of action. The 2800 Si Silica Analyzer quickly detects trace level contamination and calibrates itself automatically, saving valuable operator time.

Although it has no significant corrosive effect on boilers, silica's presence in water/steam is nonetheless very detrimental. It forms extremely hard coatings in water/steam passageways and on turbine blades, leading to reduction in heat transfer efficiency and unbalanced blades. If left unchecked, silica build-up can result in unplanned shutdowns and extra maintenance.

The 2800 Si is a highly reliable on-line instrument designed for water/steam cycle monitoring. It provides early ppb detection of trace silica contamination with minimal operator supervision.

Automatic zeroing after every measurement cycle ensures excellent stability.

► **www.mt.com/Thornton-silica**

At-a-glance monitoring

Simultaneous display of silica and measurement timing provides convenient analyzer status, saving operator time

Low maintenance

Large reagent containers enable a long service interval

Robust design

Rugged enclosure protects components and reagent containers from the mill environment

2800 Si Silica Analyzer

Get in-line with METTLER TOLEDO

Intelligent Sensor Management
for the Pulp and Paper Industry

ISM® is METTLER TOLEDO's digital technology platform for process analytical measurement systems. With ISM solutions, maintenance becomes predictable, sensor handling is simple, and process uptime is increased.

Visit our website and discover how ISM delivers:

Greater process reliability
Easy sensor handling
Reduced maintenance

▶ **www.mt.com/ISM**

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