Turbidity – new systems for brewing process optimization

METTLER TOLEDO is well established in the brewing industry, providing analytical inline instruments used by brewers around the world to help establish more cost-effective and reliable process automation. Previously our customers have been able to select systems for continuous measurement of dissolved oxygen, pH and conductivity. However, we are pleased to announce the release of a new turbidity line with specific advantages for brewing – accompanied of course by the same high standard of application and service support that master brewers and quality assurance managers appreciate from a competent partner.

What is turbidity?

Turbidity is basically cloudiness in a liquid, which in wort or beer is caused by the presence of undissolved particles such as yeast, proteins or diatomaceous earth. These particles scatter the incident light and consequently lead to a milky or even opaque appearance of the liquid. The principle of light scattering is used in inline turbidimeters to measure the concentration of the undissolved particles: the higher the particle concentration the higher the scattered light intensity. The information on particle concentration is directly used to control individual process steps.

What are the optical set-ups?

Different particle concentration ranges require different optical set-ups for reliable and reproducible measurements. The measurement of forward and 90° scattered light has been proven to be the best optical method for turbidity in the range 0…100 EBC (0…400 FTU). Higher particle concentrations – up to 250 g/l dry matter – are measured with backscattered light systems. The influence of different colored liquids on the intensity of the scattered light beams must be compensated by simultaneous measurement of a reference light beam or by the use of a light source emitting light in the near-infrared range of the spectra. One of these techniques is always implemented in the turbidimeters described here.
Trb 8300/InPro 8100 system still provides information for enhanced process control.

In the filtration field, the most important applications are:
- control of centrifuges (similar to the measuring points in the brew house)
- control of diatomaceous earth (Kieselgur) filters

Especially in the last application, simultaneous measurement of forward and 90° scattered light provides important additional information on the type of particle producing the turbidity. Typically, the 90° measurement value is between 0.3 and 2 EBC, representing turbidity caused by smaller particles such as proteins, which can be a key indicator for the shelf life of the final product. If this value is too high, the filter performance can be improved by changes in the Kieselgur dosage. Independent of this value, the forward scattered light signal should be smaller than the 90° signal. If this is not the case, then there are too many coarse particles in the beer. This is frequently an early warning sign of filter breakthrough, which could lead to very costly unscheduled downtime.

The recommended systems for the filtered beer measurement is:
- a Trb 8300 F/S transmitter
- an InPro 8100 dual-angle sensor (forward/90°)

Similar to the InPro 8400 sensor line, InPro 8500 sensors are available in widely used line sizes, with different process connections and sapphire optics.

What are the applications?

In the brew house, the most important measurement points are after:
- the lauter tun
- the whirlpool
- hot wort centrifuges

In all three cases, inline turbidity measurement provides valuable information on the performance of the wort/solids separation process and allows immediate action to control the process. For example, after the lauter tun the switching point from lautering to wort pumping is optimized or the self-desludging mechanism of a centrifuge is controlled by the turbidity value in the clarified wort. The ideal measuring system consists of:
- a Trb 8300 F/S transmitter with high level operation
- an InPro 8400 forward-scatter light sensor for direct pipe installation

In the fermentation sector, backscattering systems provide important information on the cell growth of yeast in fermenters – the higher the cell concentration, the higher the light scattered back from the yeast cells. A typical measurement system consists of:
- a Trb 8300 transmitter with application-specific calibration routines
- an InPro 8100 probe for direct installation in a fermenter
- an InFit 761 CIP housing

Due to the backscattered light principle and the use of fiber optic technology, the system shows a much wider linear measuring range than do competing absorption measurement systems. Even at extremely high yeast concentrations, where absorption systems have long reached their saturation limit, the Trb 8300/InPro 8100 system still provides information for enhanced process control.

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What is your benefit?

These new turbidity systems are complementary to the existing process analytical solutions from METTLER TOLEDO and help you to get the best out of your process.
New portable DO measurement system for control of your process quality!

In the beverage industry, dissolved oxygen (DO) concentration is one of the most important process parameters for controlling the quality of the final product. The InTap 4000 e / 4004 e allow users to perform DO measurements wherever and whenever required. Typical applications are product quality control or leak detection in process plant equipment. The InTap 4000 e and 4004 e were designed and engineered for maximum operational efficiency, ease-of-handling, reliability, and the highest possible security. A convincing concept in any case – regardless of how you measure dissolved oxygen in your plant, either with or without Zwickel connection hardware.

**Time saving, easy handling and user-friendly**

INGOLD InTap 4000 e or InTap 4004 e DO analyzers can easily be connected to your process. Both analyzers have an intuitive control menu, resulting in maximum convenience for users during calibration, measurement and maintenance procedures.

**Cost-saving**

InTap 4000 e and InTap 4004 e offer our best price / performance ratio ever. The sensor maintenance cycle takes just two minutes, thereby minimizing operating expense. And, the analyzers are now powered by three standard, user-replaceable, batteries.

**Long lifetime**

The watertight measuring unit and the impact-resistant protective casing provide assurance for reliable DO measurements, even under the harshest operating conditions encountered in the beverage industry.

**Precise and fast measurements**

The optimized measuring chamber and advanced sensor design guarantee fast, stable and repeatable results, unaffected by flow rate or very low DO concentration.

**Two-minute-maintenance**

The modular METTLER TOLEDO INGOLD sensor design allows easy and rapid maintenance to save you time.

**Fast response time and low detection limit**

Time savings through fast-response measurement of oxygen concentration. Fast tank-to-tank equilibration even at values below 10 ppb.

**Data management**

InTap 4000 e / 4004 e can store up to 200 measurement values. The accompanying Paraly® software allows data transfer to a PC for further processing using standard spreadsheet programs.
INGOLD solutions – reliable quality helps to optimize productivity

The most critical point for pH control throughout the brewing process is certainly during mashing because of the resulting impact upon the subsequent wort and beer processes. Control of dissolved oxygen is just as crucial because it is a fundamental indicator for taste, shelf life and clarity. Oxygen uptake at the lauter tun already has a direct influence on turbidity and color as well as on quality of bitterness. INGOLD DO, pH and newly introduced turbidity measurement systems ensure optimal inline process control and help you produce the highest quality beer possible.

**pH measurement**

A complete range of hygienic and CIP suitable pH electrodes are available with low drift and long service life, including gel-electrolyte, temperature compensated pH electrodes

The InPro 3200 makes high-accuracy performance possible under low pressure due to a partly flowing reference junction. Conversely, the InPro 3100 is purposely designed for high pressure applications.

**“Advanced Line” pH transmitter**

The pH 2100 e offers high quality performance with an easy-to-use interface, diagnostic information, two current outputs and integrated PID controller. Two wire units are available with HART® or PROFIBUS® interfaces.

**EasyClean – the automated pH measurement**

In applications with frequent calibration requirements automated cleaning and calibration systems help ensure reliable measurements, longer sensor life time and a resulting lower cost of operation.

**Comprehensive range of sterilization**

The retractable housing family InTrac 797 e and InTrac 799 e are optimally suited for sterilization of pH electrodes as well as for DO and turbidity sensors. InTrac 798 offers enhanced safety and improved cleanability (with EHEDG certified process connections).
Turbidity measurement

Wort quality control with turbidity

The forward/side scatter turbidity sensors InPro 8400/8500 are calibrated in EBC turbidity units and are directly inserted into pipes. The flow-through sensors are CIP suitable and available with a variety of process connections and pipe sizes.

The turbidity transmitter Trb 8300 F/S offers high user convenience through plain text menus. The built-in ProCal® calibration routine allows an easy adaptation of turbidity values to laboratory results.

Dissolved oxygen measurement

Unmatched hygienic design

The well proven DO sensor InPro 6800 offers a reliable and accurate measurement in a variety of brewhouse applications in mashing, lautering and wort processes. Now in the third product generation our sensor complies with EHEDG and 3-A standards and comes with 3.1B material certificates. The service-friendly design of the inner body guarantees optimal cost-of-ownership.

Enhanced performance

The O₂ 4100 e is an advanced performance transmitter with a unique sample calibration routine that assures highly accurate measurements, particularly in continuous processes. The standard version features two current outputs and a PID controller. A PROFIBUS® version offers remote communication and diagnostics.

Approved hygienic design allows:

- Safe insertion and withdrawal of sensors
- Sensor and electrode exchange during ongoing process.

For standard applications METTLER TOLEDO offers an optimal and flexible solution with the well proven InTrac 777 e.
In the final process of beer production, beer is filled into bottles or cans. In the filler machine, an amount of beer stored in a tank is filled into the bottles by applying differential pressure through CO2 injection.

In this process beer is filled into the bottle by applying CO2 with a pressure of 0 to 6 bar. During the CIP (Cleaning-in-Place) process, cleaning solution and water is circulating both in the machine and in the pipes that bring beer from the production to the packaging area.

By the time the final wash-cycle of the CIP has ended, the pipes and filling machine are completely filled with water. When production is resumed, the actual filling process usually commences only after a specified time delay (drainage), and the first bottles then have to go through a lab analysis to determine which bottles have to be rejected and which have the correct concentration of beer (no water contamination) to go to the market.

If the waiting time is set too short, this results in a loss of bottles/cans. If the time is set too long, good beer will be sent down the drain. In addition, an operator is tied to the drain trying to visually determine by color the exact moment when water ends and beer starts.

Typical process conditions:
- Media: water, beer
- Pressure: up to 6 bar
- Temperature: -2...25 °C, 28...77 °F
- Conductivity range: beer approx. 1500 µS/cm, water approx. 100...150 µS/cm

The use of a conductivity system to control the exact phase separation between water and beer ensure the correct start for the filling process, results in a fully automated process with minimal loss of bottles and beer, as well as reduces labor costs.

**The METTLER TOLEDO solution**

METTLER TOLEDO offers a series of reliable sensors with a variety of process connections for this application. The system used is a Cond 7100 e, with an InPro 7002 series sensor, the sensor being installed in the pipe that feeds beer to the filler machine.
Precise phase detection

The InPro 7002-VP conductivity sensor is used to detect the exact switch-over from one phase to the other. This is registered very rapidly and precisely due to the fast response time for both conductivity and temperature measurements, combined with a factory-determined cell constant.

Instantaneous response

2-electrode conductivity systems have a response time of about one second. The distance between the sensor and the (filler) valve should be used in the calculation for setting the timing, provided installation possibilities allow for it. The sensor must be installed upstream from the valve.

Minimization of media loss

With fast and precise phase detection, the loss of product in the installation can be remarkably minimized.

Certified quality and materials

Accurate measurements are only possible if the cell constant has been determined accurately. 2-electrode sensors from METTLER TOLEDO are delivered with a certified and documented NIST/ASTM- traceable cell constant, ensuring the highest degree of accuracy. All materials in contact with the media are FDA compliant MaxCert™, a package of certificates, supports the validation and qualification process.

Instrumentation

As far as the transmitter is concerned, the Cond 7100 e series is the best choice for simple operation, precise and reliable measurements as well as low cost of ownership. The dual current outputs not only monitor the conductivity value but also temperature. The use of two completely independent parameter sets allows the system to control phase detection very precisely, even if the conductivity change spans several orders of magnitude.

With its unique user interface (pictographs) and continuous instrument and sensor diagnostics, this transmitter can be employed in all relevant process applications.

www.mtpro.com/conductivity
InTrac 798 –
for the most demanding hygienic requirements

With the InTrac798, METTLER TOLEDO INGOLD offers a retractable housing specifically designed for the pharmaceutical and food industries. Increasing demands for hygienic equipment design and the need to access the sensor at any time, have led to the development of this advanced housing model.

This completely new housing raises the bar for sanitary design. The InTrac 798 is certified in accordance with EHEDG and 3-A guidelines. It is equipped with a state-of-the-art flushing chamber designed to optimize cleanability. The unit is outstanding for its array of advanced features such as:

- totally drainable flushing chamber due to the positioning of the O-ring
- use of 12 mm sensors of uniform length (120 mm)
- suitability for applications in the food processing and pharmaceutical industries, using tested and EHEDG-certified process connectors such as Tuchenhagen Varivent, Neumo-BioControl, Tri-Clamp, and Ingold cap nut.

- safe steam sterilization of the sensor in the flushing chamber
- process connector and flushing chamber formed from a single piece of stainless steel
- complete absence of crevices or slits
- full hygienic cleaning

The hygienic process connection (flange) and drainable flushing chamber are ingeniously combined into one single element, making this retractable housing a real innovation in its field.

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