Brewery

Perspectives in Liquid Process Analytics

11 News

INGOLD

Leading Process Analytics

Optimization of Yeast Harvesting

With Turbidity Control

Turbidity is an important measurement parameter for identifying the various yeast layers that settle into the cone of the fermentation tank. Careful differentiation and separation of these layers enables optimization of the production processes and maximum utilization of the different yeasts.

Brasseries Kronenbourg

Brasseries Kronenbourg is Frances's leading brewing company with a nationwide market share of approx. 38% (with brands including Kronenbourg, 1664, Grimberger). The company produces 7.5 million hl of beer annually. In 2006, the total turnover of Kronenbourg (since July 19, 2000 part of the Scottish & Newcastle Group) amounted to 860 million euros. The unique production site in Obernai in Alsace is one of the most important and modern one in Europe

Turbidity measurement to separate beer/yeast phase

At this brewery, turbidity measurement has been successfully employed during separation of the beer/yeast phases. Recent tests have indicated that a turbidity sensor fitted at the outlet of a fermentation vessel could facilitate differentiation and separation of the different layers of yeast. In a move to put this idea into actual practice, the company turned to METTLER TOLEDO.

Harvesting of yeast

Cone-bottomed cylindrical tanks for fermentation processes have a volume of between 2,000 and 10,000 hl and are filled and emptied through the bottom. In these tanks, the beer wort is mixed simultaneously with air and yeast directly following the mashing process. Through reaction with oxygen, the yeast volume multiplies to the three- or fourfold of its initial volume. This is followed by the anaerobic fermentation phase in which sugar is converted to alcohol and CO_2. As soon as the desired alcohol content is reached, the

METTLER TOLEDO

Brasseries Kronenbourg

whole process is cooled down to 5 °C in order to halt fermentation. Yeast, depending on degree of flocculation, then settles in layers in the conical outlets of the tanks and has to be drawn off before proceeding further.

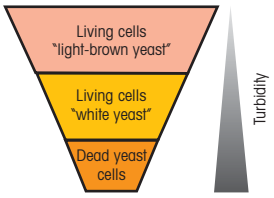
First yeast harvest

At the end of the above mentioned sedimentation phase, three distinct yeast layers can be distinguished.

- On the floor of the cone, mostly dead yeast cells.
- Above these lie living yeast cells, so-called white yeast. Such yeast cells can be marketed for other uses or prepared in a pure culture process for further use as brewer's yeast.
- The topmost layer is formed of yeast cells which, although alive, are of lower concentration due to being mixed with beer (so-called light-brown yeast). Prior to marketing, these cells have to be concentrated.

Turbidity measurement during the first yeast harvest

Turbidity measurement during the first yeast harvest acts as a basic parameter for distinguishing between the different yeast layers. The procedure is time-consuming and can take up to 12 hours as the flow stream may only be very weak in order to prevent the creation of a chimney-effect at the bottom of the tank. Measurements are taken during harvesting via upward-facing valves. At the beginning, the value measured in the pipe filled with water should be zero. When the flow makes contact with the dead cells, turbidity should practically immediately shoot up to the maximum value. After this rise, the measured value becomes stable during harvesting of the living yeast cells. Towards the end of the harvesting procedure, the measured value drops in line with the growing dilution of the yeast cells present in the beer. Differentiation of the yeast cells can be carried out on the basis of already established nominal values.



Second yeast harvest

After the above procedure, the beer is cooled and left for several days to mature. During this resting period, the residual yeast precipitates in different degrees of turbidity in the tank cone. These yeast cells are known as brown yeast since they have taken on a darkish appearance from the beer. After the beer has been drawn off, the remaining yeast mass must be removed as fully as possible.

Turbidity measurement during the second yeast harvest

The same turbidity measurement instrumentation allows detection of the dividing line between brown yeast and beer. Through appropriate adjustment of the set differentiation value, the turbidity, which has a negative affect both on filtration and on the quality of the beer, can be removed from the beer with a minimum loss of product.

METTLER TOLEDO solution

As a replacement for outdated equipment, Brasseries Kronenbourg chose a turbidity measurement system from METTLER TOLEDO:

- Transmitter Trb 8300 in a field housing
- Sensor InPro 8200/S/Epoxy/120,
- Static housing InFit 761/NC/0070/4435/D00/Si9 and
- inclined weld-in socket meeting hygiene requirements

InPro 8200.

InFit 761 e.

Trb 8300 transmitter.

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Customer's satisfaction

This turbidity measurement system conforms exactly to the requirements of Brasseries Kronenbourg:

- Rapid and reliable response
- Determination of reproducible nominal values
- Little or no maintenance
- Sanitary installation
- In-situ cleaning possible
- Insensitive to strong pressure deviations.

Reasons for system selection

The system was chosen by the Obernai brewery not only because it corresponded with their specifications but also because:

- it was able to make measurements over an extremely wide range without having to go back to single fiber systems.
- the system is even more economically and the sensor is already being used successfully in other applications.
- this turbidity measurement system enables the company to optimize the harvesting of yeast in vertical fermenters and to produce quality beers.

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InPro 7108 Conductivity Sensor

Use of Conductivity
to Control Rinse Time After CIP

Conductivity measurements are an excellent indicator for contaminants. They can save money by minimizing water consumption due to rinse cycle time management while assuring product safety and quality.

Water consumption and time management in CIP processes

In many cases a rinse cycle is based on a programmed timed sequence. This method typically results in longer than necessary rinse times increasing water costs. Concern for water conservation is driving companies to look at ways to reduce water consumption. Time saved by reducing CIP water rinse cycle times has additional payback by increasing production time.

Conductivity measurement to optimize rinse cycle

How much time is enough? This problem came to light when a major beverage producer wanted to control their rinse cycle using conductivity. They wanted to know when the sodium hydroxide cleaner was sufficiently rinsed from the process lines to assure product quality. The current method used was to rinse for a predetermined time and manually sample the line after the rinse cycle to ensure the line was properly rinsed. By using conductivity measurements to determine when the sodium hydroxide solution was removed from the process lines, the customer was able to significantly reduce rinse times resulting in water savings, labor savings by eliminating the manual sampling of the process and realize potential increased production capacity.

Feasibility tests at METTLER TOLEDO

Feasibility testing was first conducted in our lab.

A total of six samples were measured:

- Deionized water,
- Deionized water plus 25 ppm alkalinity (added sodium bicarbonate),
- Deionized water plus 50 ppm alkalinity,
- Tap water (Bedford, MA),
- Tap water plus 25 ppm alkalinity, and
- Tap water plus 50 ppm alkalinity.

Test results

For a first approximation, the conductivity of the sodium hydroxide solution is

additive to the baseline rinse water conductivity. Actual testing, however, revealed that the conductivity response was more involved. The slope of the resulting sodium hydroxide curve was found to depend on the chemical composition of the rinse water. Increased buffer capacity of the water resulted in a decreased slope, and therefore decreased measurement sensitivity. A one-point addition test can confirm the appropriate slope for the specific local rinse water. Based on the test results it was determined to compensate for the background conductivity using a differential conductivity value. The incoming water source would need to be monitored so that differential conductivity measurements ("Out" minus "In") could be made (measure fresh incoming water and at point following rinse).

M 700 transmitter.

Field tests at the customer site with INGOLD measuring system

Based on the results in the lab, testing was conducted at the customer site using

- a M 700 transmitter and
- an InPro 7108 conductivity sensor.

The 4-electrode sensor methodology is highly desirable for these applications since they are capable of measuring both the high conductivity value of the original chemical concentration, and they are also very sensitive at the low conductivity range of the final rinse stage. The sensor also provides a fast temperature response between the hot caustic cleaning solution and cold rinse water. The 4-electrode design permits the 4-electrode sensor to operate at much higher concentration ranges without suffering from polarization problems of 2-electrode designs.

Field tests confirm laboratory findings

The results at the customer site proved that we were able accurately control the rinse cycle time based on the conductivity measurement as indicated in the focus area in figure 2. There were two factors to consider:

- Product safety, assuring harmless levels of caustic remain and
- Product quality, the impact of sodium to product flavor.

Customer's benefit

By controlling the rinse cycle in lieu of a timed rinse the customer was able to see significant cost savings on water, with additional savings on labor, and potential increased production.

Summary

Electrolytic conductivity offers a wide dynamic range capable of measurement of ppb levels of salts in water, up to high percentage concentrations of acids or caustic. The sensors are rugged and require minimal maintenance to provide reliable results. Testing for the CIP application has demonstrated a linear relationship between differential conductivity increase and added sodium hydroxide. Site testing using local rinse water should be evaluated to confirm feasibility. Conductivity should be an excellent indicator of sodium hydroxide provided the differential conductivity for the "acceptable value" is greater than 10% of the incoming value. Conductivity serves as an excellent indication of the presence of contaminants and its use in control loops can save money by minimizing water consumption while assuring product safety and quality.

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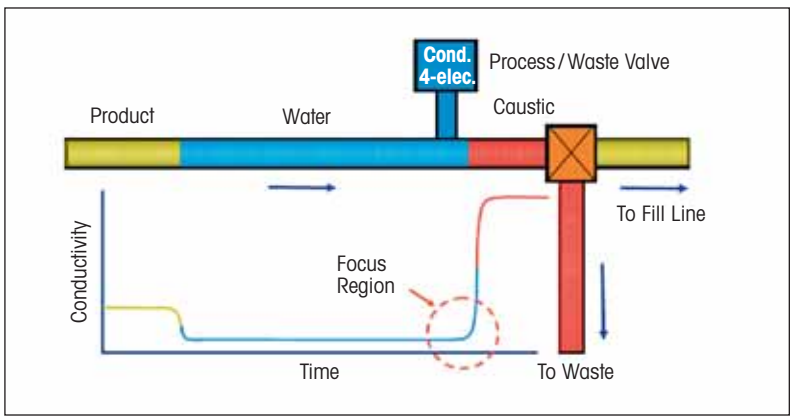


Fig. 2: Rinse water interface detection.


Fig. 3: Process connections.

Manage your ISM Sensors
the Easy Way

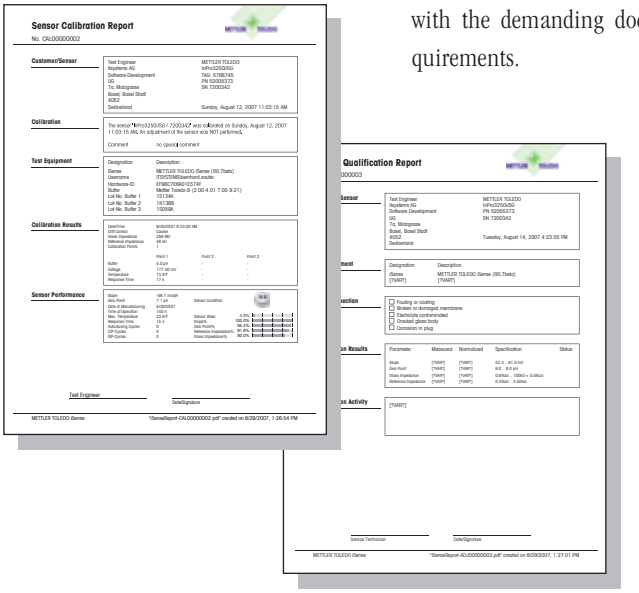
iSense ISM Asset Suite for the Process Analytics represents a big step into a more controllable future of your sensors life – starting at the first implementation into your process until to the decision to eliminate the sensor.

Raising demand on control data

With the volume of calibrations performed each year, calibration information has to be collected, managed and analyzed efficiently and consistently to satisfy regulatory requirements and make to the most of your limited time and resources.

ISM technology

The digital "Intelligent Sensor Management®" concept makes it decidedly easier to operate process analytical systems from initial installation to maintenance right through to sensor exchange. It ideally supports the vertical integration of diagnostics information into the process control environment. Predictive sensor wear or adaptive calibration timer information can be integrated into your PLC via fieldbus technology.


Sensor Calibration Report

Qualification Report

iSense – the key to maximize the benefits of the ISM technology

iSense allows verification and calibration of digital ISM pH electrodes and of digital sensors to measure dissolved oxygen in laboratory conditions.

Easy connection to your PC

Simply connect your ISM sensor via a USB port to your computer and follow the instructions of your iSense software. No transmitter will be necessary as an interface.

Complies with your documentation requirements

The documentation of the entire sensor history is a result of the iSense Asset Suite. This is ideal for organizations looking for a complete and reliable stand alone calibration solution to meet easily compliance with the demanding documentation requirements.

Intuitive calibration support

Enhance your productivity with the advanced software application for your sensor calibration management. An analysis showed that you can reduce drastically duration and frequency of calibration resulting in a saving of about 25% with a ROI as low as 3 months!

Manage your ISM sensor over its life cycle

A centric view of the sensor data is stored in a SQL database giving you a complete history of the sensor and all the equipment it has been installed on with various data export possibilities. Protection of your assets is guaranteed.

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iSense
ISM Asset Suite

Color plus Turbidity!

Simultaneous Measurement in one Sensor Head

Up to now two separate in-line systems have been necessary for dual angle turbidity and color measurements in beer lines. From now on investment and installation costs are drastically reduced with the unique combined turbidity/color system available from METTLER TOLEDO.

Successful inline turbidity sensor InPro 8600

In 2006, METTLER TOLEDO introduced a new technology platform for the in-line measurement of low turbidity. The measurement cell has been designed to strict hygienic standards, resulting in an EHEDG certified sensor. Based on the scattered light principle, the turbidity sensors of the InPro 8600 series have been successfully applied for breakthrough monitoring in separation processes in the food and beverage industry as well as for lauter tun and whirlpool control.

Dual angle sensor to monitor filter breakthrough and quality control

At the same time, a dual angle InPro 8600 sensor has also been developed to fulfill the needs in the filter cellars of breweries to detect filter breakthrough and to monitor beer brightness continuously. One wireless configuration tool for multiple sensor management can be used. Consequently investment and installation costs for transmitters commonly used with other systems are omitted. The sensor is equipped with standard 0/4 to 20mA outputs allowing direct integration in a process control system.

Color of beer – an important quality attribute

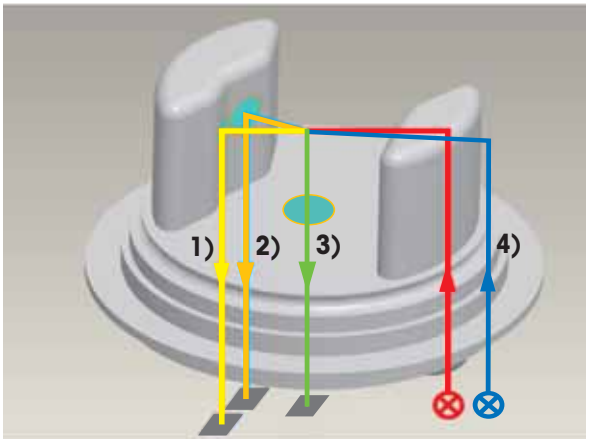
Besides turbidity measurement, the color of the finished beer is an important quality attribute before filling the beer into bottles and kegs. Many breweries use high-gravity brewing to increase productivity. With this technique, a strong beer is brewed and it is diluted to its target strength before filling. Precise control and monitoring of the beer color is essential for being able to maintain consistent quality.

In-line measurements – confidence in quality

Usually, the beer color is analyzed off-line in a laboratory spectra photometer. With in-line measurement, the brewer can continuously monitor the beer color during the entire production processes. Additionally, turbidity measurement is performed simultaneously, giving confidence and improving the quality of the production processes.

Measure the blue – control the yellow color

The color of beer is measured by photometric determination of the absorption of light in the visible blue. This is consistent with the MEBAK or EBC recommendation for the analysis of beer color. Blue light is used, since at these shorter wavelengths differences in beer color (yellowness) are most easily distinguishable. To eliminate



1) Absorbance and direct light
2) 25° scattered light
3) 90° scattered light
4) Blue and red light

InPro 8600 with color option.

possible sources of error in the process measurement, especially the interference of turbidity causing particles, the user has the possibility to apply a dichromatic method for compensation of turbidity. Technically this is realized by measuring the red light absorption in addition to the blue light absorption.

Reduce maintenance – improve reliability!

Many unique features are built into the sensor in order to reduce maintenance effort and increase performance reliability. Advanced sensor diagnostics and auto-recognition are implemented under the umbrella of ISM (Intelligent Sensor Management) which has been proven to be of significant benefit to the user, supporting sustained optimal functioning of the sensor. Using long-life devices such as LEDs (light emitting diodes) for the light source, as well as sapphire windows provides assurance of reliability during the complete lifetime of the sensor.

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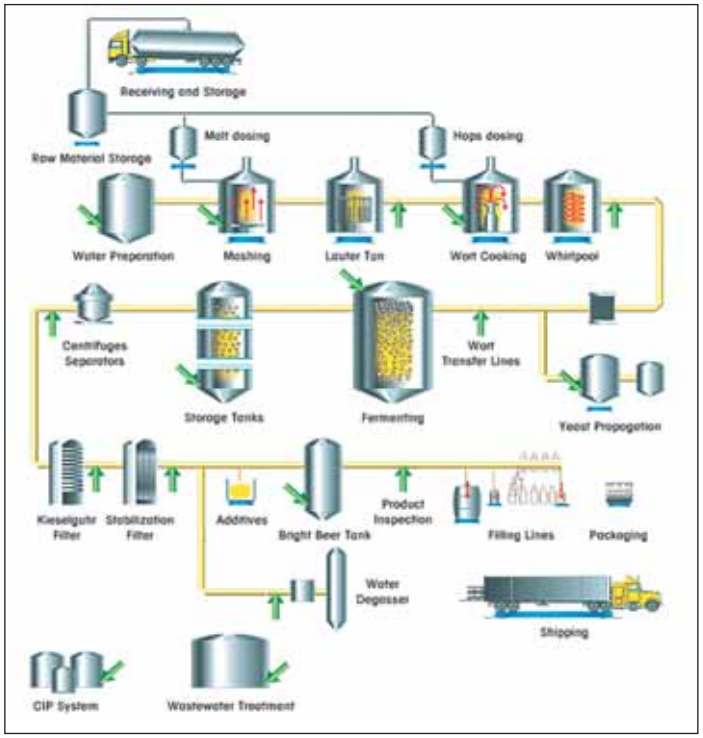
Interactive Site

All you Need to Know
About Process Analytics and Weighing Solutions

METTLER TOLEDO provides an enhanced interactive site where you find the complete offerings of METTLER TOLEDO for process analytics and weighing solutions.

www.mt.com/beer



www.mt.com/beer – to click through

Move the cursor over the graphic and click on any icon. A window will pop-up immediately offering you short information to the selected measuring point and indicating the benefits METTLER TOLEDO will provide.

Gain direct access

With a further click in the pop-up, you can gain direct access to the comprehensive product information on our homepage.

Key topics – quickly to download

In the right-hand column you will find important supplementary information relative to beer brewing.

This site is available in English and German only.

www.mt.com/beer

New Developments
in Process Analytics

METTLER TOLEDO delivers powerful solutions to optimize your processes and reduce maintenance costs. Recently, we introduced new intelligent technologies that allow you to improve handling and optimize maintenance thus addressing your most pressing needs.

ISM – the next generation of intelligent process analytics!

With the groundbreaking ISM technology METTLER TOLEDO provides another milestone in process analytics measurement!
Dissolved oxygen sensors and pH electrodes with integrated preamplifier are using a new technology with "Plug and Measure" and intelligent diagnostics functionalities. The Intelligent Sensor Management (ISM) technology simplifies all maintenance operations of the sensor. Process interruptions are shorter or even avoided, leading to enhanced productivity.

iSense – the key to maximize the benefits of the ISM technology

iSense ISM Asset Suite allows efficient and easy verification and calibration of METTLER TOLEDO digital ISM pH and DO sensors in an instant with an intuitive software application that includes advanced analysis and documentation functionalities to support your sensor management.

Digital transmitter line M300

The digital M300 transmitter represents an easy-to-use version of the M300 transmitter line. Its unique "Plug and Measure" features enable a fast start-up and robust measurements for digital pH/ORP and dissolved oxygen sensors. Its versatility and reliability make this instrument the ideal choice for a wide range of applications.

If you want to take advantage of these advanced products ask your local METTLER TOLEDO representative or visit **www.mt.com/ISM.**

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