



In-line control and monitoring of pH and dissolved oxygen in yeast production

Sugar, in the form of molasses, is the most commonly used and suitable substrate for the production of biomass or yeasts for bread-making. Whatever substrate is used, the production process for yeast can be synthesized in two main stages: prefermentation and fermentation. In-line control and monitoring of the parameters of pH and dissolved oxygen are more than a simple passive monitoring of these stages, but can be used to improve the yield and quality of production.

Production of yeast for bread-making

A major French company which specializes in the production of yeasts for bread-making (pressed or bakers' yeast and active dried yeast) recently launched a series of tests with the object of optimizing the different stages of fermentation. A strain of pure yeast (*Saccharomyces cerevisiae*) and molasses – a sucrose-rich by-product obtained in refining beet sugar – were used in the tests. The influence of critical parameters such as pH and dissolved oxygen was evaluated in a 100 l pilot fermenter. Optimal values for these two parameters were determined as precisely as possible for each stage of production.

Measurement of pH and dissolved oxygen

One of the main requirements for the smooth running of these tests is to ensure reliable and continuous in-line measurement of pH and oxygen. The purpose is to enable real-time intervention in the progress of the fermentation process and adjustment of external parameters. The solution provided by METTLER TOLEDO comprises:

- a 2100e transmitter, an InPro 3100 electrode and an InFit 761CIP housing which allows the electrode to be adapted to the fermenter – to measure pH
- a 4100e transmitter linked to an InPro 6800 sensor – to measure dissolved oxygen.

The InPro 3100 electrode is perfectly adapted to this type of procedure thanks to



Contents

SugarNews 5

In-line control and monitoring of pH and dissolved oxygen in yeast production

Tailored pH measurement solutions in starch slurry for optimal cost of ownership

www.mtpro.com – Know-how for your daily operations

Low to medium turbidity measurement when clarity matters most in industrial process control

Imprint

Publisher

Mettler-Toledo GmbH
Process Analytics
CH-8902 Urdorf, Switzerland

Editorial office

process.marketing@mt.com

Production

Marcom
CH-8902 Urdorf, Switzerland

Illustrations

Archives of
Mettler-Toledo GmbH, Urdorf (CH)

Subject to technical changes.
© Mettler-Toledo GmbH 12/04
Printed in Switzerland.

its design which precludes any clogging or contamination. Care must be taken during the various fermentation processes to avoid any risk of bacterial contamination. By maintaining a slightly acidic pH and sterilizing the measuring instruments as well as the initial mixture of molasses it is possible to prevent any bacterial proliferation.

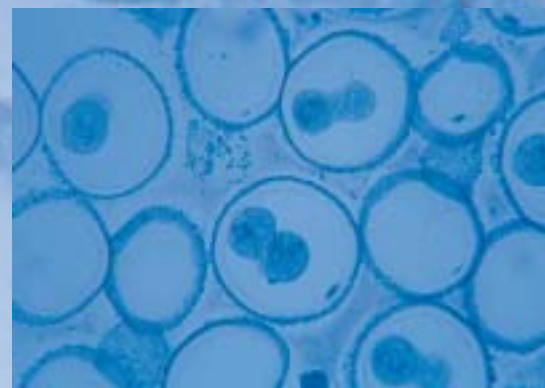
The InPro 6800 dissolved oxygen sensor from METTLER TOLEDO is also in total compliance with these requirements, combining advanced hygiene features (sterilizable, autoclavable and surface smoothness rating of N5) with high-precision measurement. The use of these two electrodes ensures precision and reliability of measurement and safety of the procedure.

Results: increased yield and quality

Precise values for pH and dissolved oxygen were determined in order to achieve a significant improvement in yield and in the quality of the final product. The tests demonstrated that better results could be obtained with pH values between 4.5 and 8 between 4.5 and 5 pH units during preparation of the molasses mixture and then between 5 and 8 pH units during the stages of fermentation. Precise values were obtained for the quantity of dissolved oxygen and correlated with the quantity of substrate added during the progress of the reaction. This makes it possible to prevent the formation of ethanol (and other dissolved volatile compounds) due to the transition from aerobic fermentation to anaerobic fermentation. After this pilot

phase, the values recorded were extrapolated for direct application in production using fermenters of larger capacity (10 000 and 15 000 l) where METTLER TOLEDO electrodes for pH and dissolved oxygen are used to control the smooth operation of the different fermentation processes.

Finally, thanks to the possibilities offered by METTLER TOLEDO transmitters, the next fixed stage is the automation of the addition of dissolved oxygen in accordance with limiting values determined during the pilot phase. This stage will allow genuine control, in real time, of the fermentation processes as well as more efficient and precise calculation of the quantity of substrate to be added. ■



Yeast cells.

Tailored pH measurement solutions in starch slurry for optimal cost of ownership

Acid or base modification of corn starch is used to obtain semi-finished products for the paper and packaging industry. Accurate pH measurement in these industries leads to better production control. METTLER TOLEDO's automated pH measuring solutions ensure up to 5 times longer sensor life and low maintenance requirement.

Possible applications in the starch industry

Besides the acid or base modification of corn starch applications as food processing, glucose molasses, fermentation and waste water characterize the starch industry.

Process characterization

The duration of the batch process lasts eight hours under the following conditions:

- pH control with HCl and NaOH
- pH range for acid modification pH 2 to 7 and for base modification pH 7 to 11
- temperature range 45 to 50 °C
- slightly under pressure
- high viscosity
- vessel material: polypropylene or special duplex steel (high chlorine content)
- batch cleaning with high pressure tap water at 50 °C

The major difficulties with this application concern the high maintenance requirements: manual cleaning every hour and short calibration intervals due to drifting signals caused by unstable reference potentials. Experience with conventional

liquid-filled and gel pH electrodes from competitors showed that their electrodes did not have a long lifetime due to scaling (without cleaning); the minimal electrolyte outflow of the gel-type electrode also caused drifting problems. Both competitors' electrodes lasted only between one week and two months.

Extended sensor life and cost-savings with METTLER TOLEDO

Installation of an in-line liquid-filled pH measuring system with automatic cleaning of the electrode by flushing with water (20 °C) at user-determined intervals reduced maintenance of the electrode to a minimum. Furthermore, by using a liquid-filled electrode in combination with overpressure (2 bar), drifting of the reference electrode is avoided. Because of this, the lifetime of the electrode can increase to ten months! We recommend the InPro 2000 pH electrode in conjunction with an InTrac 776e retractable housing. The 2100e pH transmitter is compatible with all METTLER TOLEDO pH electrodes, including the InPro 2000. The above system will ensure increased production control with no production stoppage, minimal maintenance, and extended electrode lifetime.

2100 e pH Transmitter

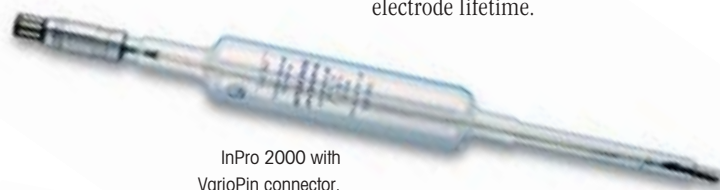
- Operational safety and reliability
- Loop autonomy and maintenance-free pH measurement
- Flexibility with 4 wire installation or alternatively 2-wire execution with HART® and/or Profibus® and/or FF communication and EEx applications

Combination InPro 2000 pH electrode

- Refillable for increased electrode lifetime and reduced maintenance
- Liquid-fill design ensures fast response, highest accuracy and reliability
- Silver-ion trap to minimize electrode contamination
- Rugged IP 68 VarioPin (VP) connector

InTrac 776 e retractable housing

- Rugged 316LSS or PVD construction for maximum chemical resistance
- Automatic cleaning and calibration reduces overall system downtime
- Guarantees complete separation of process from the outside environment
- Safety interlocks prevent sensor removal from housing while in measuring position
- Manual or pneumatic operation



InPro 2000 with VarioPin connector.



InTrac 776 e (pneumatic type, made of PP).

Welcome to the Mettler-Toledo Process Analytics portal. Whether you are planning an investment or already use a METTLER TOLEDO solution, take advantage of our local and global expertise at www.mtpro.com.

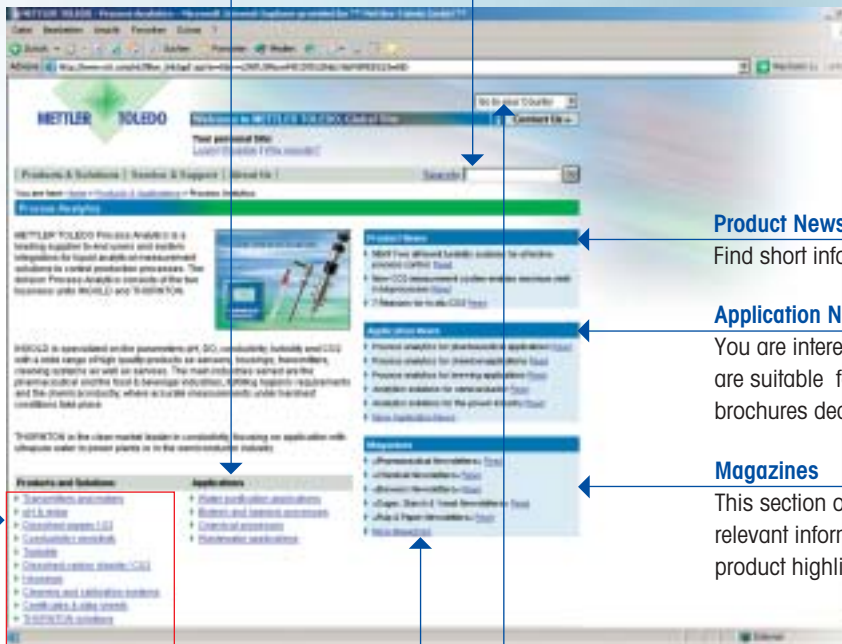
Products and applications

Simply select from the product ranges or browse through our products and applications. Each product and application page supplies a wealth of information for download:

- Detailed descriptions and documents
- Brochures and datasheets for download
- Access to operating manual, declaration of conformities, MSDS, buffer certificates.

Search tool

If you don't know where to find information just enter the keyword and you will be led to the right place.



Product News

Find short information on new product information.

Application News

You are interested in an overview which products in which combination are suitable for a specific industry. Here you'll find the industry brochures dealing with this topic.

Magazines

This section offers you all available Newsletters providing market relevant information as success stories, applications, case studies, product highlights and others.

Fast online contact if you need more

After opening a product page you may post a question or just learn more about a product or application: simply click on the "Request more information" or the "Get a quote" button. Your inquiry is automatically passed on to the country of your choice.

Specific country information

Depending on the country you preselect you will get – in addition to globally provided information – further specific news of this country. For countries whose language is not supported and/or do not provide local information the information defined as international is presented.

Product Documentation

- Product Brochures
 - Family flyer CPI low-maintenance pH-electrodes [Download \(pdf\)](#)
- Declaration of Conformity
 - [Go to Support Center](#)
- Certificates
 - [Go to Support Center](#)
- Operating Instructions
 - [Go to Support Center](#)
- Technical Specifications
 - List with order numbers for our low maintenance pH electrodes [Download \(pdf\)](#)
 - Technical data pH electrode InPro4800 and InPro4801SG [Download \(pdf\)](#)

User Manuals

- Ex-classification and FM approval for pH electrodes (pdf)
- Instruction manual pH electrodes InPro4800 and InPro4801SG (pdf)

Certificates

- ATEX certificate pH electrodes InPro2XXX, InPro3XXX, InPro4XXX (pdf)
- FM approval certificate pH electrodes and O2 sensors (pdf)
- CE pH electrode InPro4800 (pdf)
- More

Low to medium turbidity measurement when clarity matters most in industrial process control

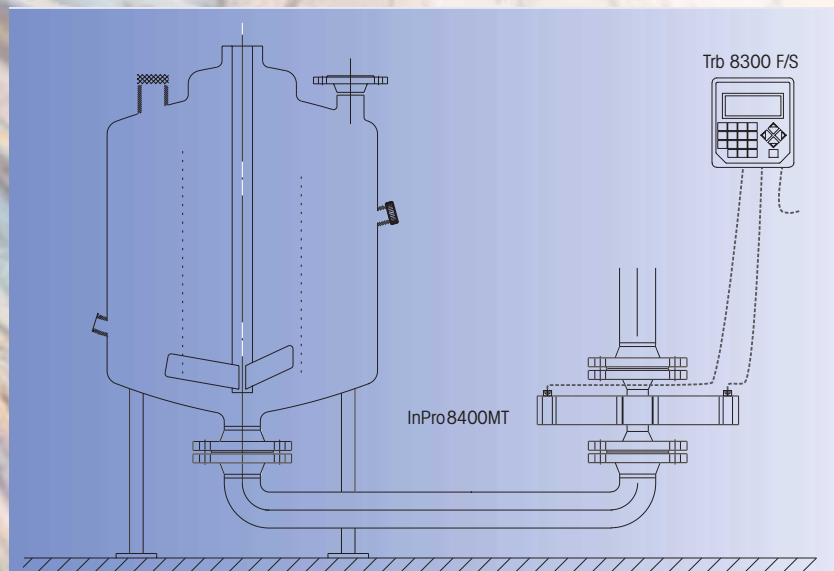
METTLER TOLEDO introduces a system for the measurement of turbidity in process liquids. This optical system for extremely low concentrations perfectly completes the existing product offering for mid to high turbidity ranges. The system consists of the Trb 8300 F/S transmitter and the InPro 8400 sensor series. This system is well suited for optimizing separation processes in the sugar industry.

The forward scattered light technique of the InPro 8400 sensor series enables measurements even in liquids which seem to be clear to the human eye. This requirement for reliable detection of particles in liquid streams for advanced process control and improved quality assurance measurements. Filter performance and particle concentration measurements are typical measuring tasks for the InPro 8400 sensor. This flow-through sensor can be easily installed in main pipes or in a bypass. The rugged sensor design allows installations even in harsh process conditions. The Trb 8300 F/S transmitter enables quick start-up and operation with a full text menu guide in three selectable

languages. Sensor diagnostic features provide information on sensor performance and consequently reduces maintenance time. METTLER TOLEDO also provides an outstanding MaxCert™ documentation program with the system. Depending on specifications sensors are provided with application relevant certificates like, 3.1B, PED, 3A, ATEX and factory calibration certificates to satisfy safety requirements and to guarantee traceability.



Transmitter: Trb 8300 F/S.



Background image:
Sugar crystal.

Comprehensive Product Catalog for 2005

The new 2005 Mettler-Toledo Ingold product catalog is a comprehensive guide for products, markets and services in the INGOLD product portfolio. All product pages have full color photos along with detailed specifications and ordering information. The process solutions catalog offers the end user the opportunity to quickly and easily choose the proper product solution for their demanding process analytic requirements.

Six parameter sections including:

- pH
- Dissolved Oxygen
- Dissolved CO₂
- Conductivity
- Turbidity
- Automation

Dissolved Oxygen Sensors

InPro® 6800 12mm Dissolved Oxygen Sensors



The InPro 6800 dissolved oxygen sensor with 12 mm diameter body provides maximum accuracy and ultimate reliability for vessels with limited space or in containers with smaller volumes. The sensor is available with the side-of-the-head MP connector or TSC connector in straight or angled versions. A durable 316L stainless steel construction allows for CIP, steam sterilization or autoclaving in place, and the high carbon finish virtually eliminates contamination of the process. INGOLD's Teflon-membrane membranes have been designed with an internal dead mesh that reduces the membrane mess-rag and dramatically increases membrane life.

Specifications	
Performance	
Operating range:	0 up to saturation
Accuracy:	±0.4% FSO
Response time at 25 °C:	90% of final value in < 90s
Span:	0 to 10.0 mg/L
Reactor signal in oxygen-free media:	< 0.1% of the signal in oxygen at 0.5%.
Construction	
Measuring principle:	Paramagnetic Clark electrode
Cell construction:	Ø 12 mm
Connector design:	Straight or angled
Material body:	316L stainless steel
Electronics system:	Microprocessor-based (optional with InPro 6800)
Surface treatment of metal parts:	Highly polished
Cable material:	Shielded, PVC (optional)
Cable diameter:	12 mm
Working Conditions	
Temperature compensation:	Automatic
Measuring temperature range:	0 to 60 °C
Maximum pressure range:	4 to 100 psi (absolute and relative)
Accuracy/pressure resistance:	0.2% FSO (0.4 to 10 psi absolute)
Maximum pressure resistance:	maximum 1.2 MP (174 psi absolute)

Features Overview:

- Automatically repeat calibration without the need for a solution
- Detector shut down in 0.5 g/s
- Intrinsic measurement and spike response
- Long lasting and easy to maintain membrane
- PTFE gaskets avoid leakage of water/steam
- Ruggedly polished carbon-steel or 316L (optional)
- IP65 certified for readability and 3A compliance
- Autocalibration and clean membrane

Other highlights:


- 12 mm diameter allows versatile space
- ISO 15.5 threads for standard ISO fittings
- Comes with other material of construction or TSC connector
- Angled connector available also for easy removal from fermenter and reduces mess in vessel
- Variety of sensor lengths available

Mettler-Toledo Ingold • 800 352 8763 • www.inpro.com

INGOLD
Leading Process Analytics

- Pharmaceutical Industry
- Chemical Industry
- Food & Beverage Industry
- Wastewater Treatment

pH • Dissolved Oxygen • CO₂ • Conductivity • Turbidity



Process Measurement Solutions Catalog
U.S. and Canada 2005

METTLER TOLEDO

To order the 2005 Process Measurement Solutions Catalog please either email us at mtpro@mt.com or call us at 1-866-621-2999

Mettler-Toledo Ingold, Inc.
36 Middlesex Turnpike
Bedford, MA 01730 USA

Main Number: 1 781 301 8800
Customer Service: 1 800 352 8763 (US and Canada only)
Order Fax Line: 1 781 271 0681

INGOLD
Leading Process Analytics

www.mtpro.com

METTLER TOLEDO