



INGOLD

Leading Process Analytics

Durable pH System Ensures Whiteness of Sugar

Producing white sugar relies on control of pH, but process conditions are a challenge for measurement equipment. For India's leading sugar company, intelligent pH systems are helping them produce the highest quality products.

India's foremost sugar company

India is known as the home of the sugar industry. The process for creating sugar by pressing out the juice from sugarcane then boiling it down into crystals was developed there around 500 BC. Today, India is the largest single producer of traditional cane sugar sweeteners, equivalent to 26 million tons raw value. In respect of white crystal sugar production, India has ranked first in seven of the last ten years.

The history of the Indian sugar industry is closely linked with that of EID Parry (India) Ltd. In 1842, the company set up India's first sugar plant at Nellikuppam in Tamil Nadu. Parry now operates nine sugar plants spread across Southern India, and has a throughput capacity of 32,500 TCD metric tonnes of sugar cane per day.

The company is recognized as a pioneer in the manufacture of plantation white sugar from sugarcane.

Challenges in producing pure sugar

Like all sugar producers, one of the biggest challenges Parry faces is maintaining the whiteness of the final product. The clear sugar juice coming from the filter following second carbonation has a light straw color. Further heating has a tendency to react with residual amino acids, causing the juice to turn dark brown. To avoid this the juice usually undergoes sulfitation. Improper control of pH in the sulfitation process compromises the quality of the end product. At low pH the syrup reacts with nitrogen compounds and creates an undesirable color, and at high pH alkaline



METTLER TOLEDO



destruction of sucrose and monosaccharides occurs.

Temperatures during sulfitation are often as high as 70–100 °C, which creates difficulties in measuring pH accurately. Performance of the pH probes used for this process had been a great concern for Parry production engineers, until they began using a METTLER TOLEDO solution.

Reliable pH measurement

Our Bangalore office worked closely with Parry's sugar industry production team to offer them a reliable solution. At their plant in Haliyal, Karnataka state we installed a system comprising the InPro 4260 i pH electrode, M400 transmitter, InTrac 777 retractable housing and EasyClean 150 automated sensor cleaning system.

The InPro 4260 i probe is ideal for this application. It uses a solid polymer, Xerolyt Extra, rather than a liquid one, allowing the diaphragm found on most electrodes to be replaced by a hole in the probe's glass casing. This open junction means that the sugar liquor is in direct contact with the electrolyte material, allowing more precise measurement. Additionally, the open junction greatly reduces the risk of clogging. The InPro 4260 i is also very tolerant of the high acidity and temperatures present in sulfitation.

The InPro 4260 i is a member of METTLER TOLEDO's Intelligent Sensor Management (ISM) family of sensors. ISM reduces the maintenance requirement for pH systems by sending diagnostics data to the transmitter, informing the operator of required maintenance before measurement is affected.

Predictive diagnostics

The diagnostics information is displayed on the connected M400 transmitter as the Dynamic Lifetime Indicator (DLI). The DLI shows the remaining lifetime of the electrode based on the current and historical process conditions. The Adaptive Calibration Timer, also displayed on the M400, tells the user when calibration will next be required.

The design of the InTrac 777 e retractable housing incorporates a built-in flushing chamber in which the electrode can be cleaned and calibrated when required, without process interruption. The Easy-Clean 150 system attached to the housing and transmitter takes care of electrode cleaning, automatically.

Parry's production engineers are more than satisfied with the equipment's performance, and the confidence they now have in pH measurements is helping them produce sugar of consistent color and quality.

Partner for liquid analytics measurement

Impressed with the durability and reliability of the METTLER TOLEDO solution, our collaboration with Parry has grown as they have now installed METTLER TOLEDO conductivity systems in their co-generation plant and pH systems at their ethanol plant.

If you want to benefit from dependable analytical measurement systems, go to:

- www.mt.com/pro-sugar
- www.mt.com/ISM



InPro 4260 i
pH electrode

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Lower Measurement Point Costs With Automatic Sensor Cleaning

Process conditions in sugar, starch and yeast production are often demanding environments for process analytical sensors. EasyClean 350e is a robust and fully proven automated sensor cleaning and calibration system that helps keep sensors operating at their best and increase sensor lifetime by 30 %.

Longer sensor lifetime

For measurements in aggressive media at high pressures and temperatures, sensor life can be increased significantly through automatic cleaning and calibration. Furthermore, with an automatic system it is possible to insert the sensor into the process only when measurement is required. For the rest of the time the sensor can be stored securely in the flushing chamber of the housing.

Reduced maintenance costs

The EasyClean 350e cleaning and calibration system allows you to effectively reduce the maintenance costs of measurement points while also increasing operational safety. You therefore achieve a safer work environment and improve the effectiveness of measurement points. The unit's extremely compact and sturdy construction ensures safe application in the presence of aggressive cleaning chemicals and high temperatures. EasyClean 350e delivers longer sensor lifetime and more reliable measurement values, even in the most demanding applications.

Benefits of the EasyClean 350e

- Minimum maintenance costs through fully automatic cleaning and calibration of the sensor
- User-friendly operation of predefined flushing, cleaning, and calibration programs
- Program optimization via adjustable software parameters
- Easy installation thanks to compact design and simple integration into process control systems
- Extremely durable components ensure reliable operation in the most demanding applications

Find out more at:

► www.mt.com/EasyClean

EasyClean 350e
sensor cleaning and
calibration system



Robust pH Electrode Lasts Three Times Longer in Cane Sugar Refining

A common issue in sugar refining processes is frequent pH electrode replacement due to short sensor lifetime. One of Europe's largest sugar producers was looking for a sensor that could better tolerate the demanding process conditions. Compared with their previous probe, the solution from METTLER TOLEDO survives more than three times longer.

Major sugar refiner

UK sugar production is dominated by two companies. One of these concentrates on processing the country's entire sugar beet crop of around 9 million tons. The other company, with a more international commitment and a more diversified product portfolio, is one of the largest producers of cane sugar in Europe. Apart from white sugar, manufacture covers a wide variety of sugars, including the dark soft types much favored for baking purposes, as well as treacle and syrups.

High pH electrode consumption

During the refining process, pH electrodes have to endure extremely hostile environments, with temperatures over 90 °C and a high concentration of very abrasive solids. With the electrodes they were using, the company was experiencing unstable readings and high electrode consumption due to the conditions. pH electrodes typically lasted one week before requiring replacement. Production engineers at the company asked METTLER TOLEDO if we could supply a more robust solution.

Reliable sensor

METTLER TOLEDO's recommendation was to use the InPro 2000 i pH electrode with Friscolyt-B electrolyte, and M700 transmitters. The liquid-filled InPro 2000 i was selected due to its excellent tolerance of harsh operating conditions and for allowing the user to change overpressure (to maintain a steady out-

flow of electrolyte, ensuring reliable measurement) as well as a choice of reference electrolytes.

The M700 transmitter with its excellent communication features was suggested in order to provide signal output to a Distributed Control System. Additionally, the M700 offers a wide range of diagnostic features, providing technicians with valuable information on electrodes relative to lifetime and maintenance requirements.

Intelligent Sensor Management

The InPro 2000 i is one of METTLER TOLEDO's growing portfolio of Intelligent Sensor Management (ISM) probes. ISM reduces the maintenance costs of measurement points, while increasing the safety of the production process.

Benefits of ISM include:

- Pre-calibration – ISM technology allows sensors to be pre-calibrated in a convenient location away from the process and stored for future use
- Plug and Measure feature – Once a pre-calibrated sensor is connected to an ISM-compatible transmitter, calibration data is instantly up loaded, making measurement point start-up fast and reliable
- Digital signal – Measurements are calculated within the head of the sensor and sent digitally to the transmitter. The digital signal is unaffected by moisture or electrical interference,



ISM

InPro 2000 i
pH electrode



therefore measurements are reliable and robust

- **Dynamic Lifetime Indicator** – Sophisticated algorithms use current and historical process conditions to calculate a sensor's remaining lifetime. The chance of sensor failure during the process is almost eliminated, so process stability is greatly enhanced

Control of carbonation stage

The equipment is mainly being used on the carbonation step in the process where milk of lime is added to the sugar juice to promote precipitation of impurities. This step is controlled via monitoring of the pH value, the 4 – 20mA signal from the transmitter is fed into the DCS system to control lime dosing.

Longer sensor life

In contrast to the previously used electrodes, our customer reports that the InPro 2000 i lasts three to four weeks. The sensor also provides a more stable pH reading and consequently improves the reliability of this important control parameter. Cleaning and calibration is conducted on a weekly basis, which has been found to be sufficient for the electrode in this application.

Cost savings

The diagnostic capability of the M700 and ISM have been used by the customer to determine when electrode cleaning, calibration or replacement is required. Such information is important for maintenance planning and has led to improvements in

productivity. The reduced maintenance requirement of each measuring point and the lower consumption of electrodes are together substantial cost saving factors.

Discover more about METTLER TOLEDO's solutions for the sugar industry, at:

► www.mt.com/pro-sugar



Higher Output and Lower Production Costs in Juice Clarification

Tight process control during juice clarification is vital for preventing unwanted reactions in downstream processes. Fast response, in-line turbidity monitoring during the process enables precise feeding of flocculating agents and makes repeated lab analyses unnecessary, saving both time and money.

Brazilian market

Brazil is the world's leading sugar producer. Sugarcane fields cover 8 million hectares of the country, and in 2010 sugar production exceeded 36 million tons. There are approximately 380 sugar and/or alcohol plants in Brazil, and over 20 new ones under construction. Investment in the sector has been boosted by the bright outlook for sugar and alcohol exports and increased domestic consumption.

Juice clarification

Our customer operates a number of refineries throughout Brazil. They approached METTLER TOLEDO for a solution for improving juice clarification at one of their facilities. The clarification (or decanta-

tion) process, for removal of unwanted lime salts and impurities, is made faster by dosing polymer flocculating agents. Our customer was concerned that dosing was far from being optimal.

At our customer's refinery, the control over clarification was being carried out by manually adjusting the polymer flow to the decanter based on juice transmittance values produced by lab spectrophotometer analysis. The delay between taking grab samples, lab analysis and consequent adjustment of flocculant dosing, was leading to impaired stability of the suspended solid contents of the clarified juice, and periodic over-dosing of the flocculating agents.

Refinery engineers wanted to improve the process by automating dosing of flocculants in response to in-line analysis of the juice. METTLER TOLEDO recommended turbidity measurement to monitor the suspended solids content. Installation of an in-line sensor directly in the production line would provide continuous, real-time determination of juice turbidity from which corrective adjustments to flocculant dosing could be easily achieved.

Chosen METTLER TOLEDO solution

For this application, turbidity determination through the backscatter measurement principle is most suitable. METTLER TOLEDO recommended the following solution to set up a highly accurate and efficient measuring system:

InPro 8200 turbidity sensor

This is a dual optical fiber sensor designed for use where high resolution is required. Its scratch-resistant sapphire window repels fouling and therefore reduces the need for cleaning.

InTrac 779e retractable housing

With its integrated flushing chamber the InTrac 779e allows cleaning of sensors without process interruption. The Tri-Lock safety system prevents escape of clarified juice when the turbidity sensor is retracted.



Trb 8300 transmitter



Trb 8300 transmitter

The versatile, easy to use Trb 8300 transmitter offers multiple calibration options and a range of selectable measuring units, including FTU and NTU.

Benefits from implementation

Engineers at our customer's refinery are very pleased with the performance of the system and have noted the following:

- Tests have shown a fast measurement response to variations in flocculant dosing
- Excellent linearity of turbidity values has confirmed system efficiency
- Through automation of flocculant dosing, the targeted performance is achieved using a reduced quantity of the agent, lowering production costs
- Continuous monitoring of turbidity has also led to higher yield, since immediate action can be taken in the event of any process failure

If you need real-time turbidity measurements at your facility, go to:

► www.mt.com/turb



InTrac 779e
retractable housing



InPro 8200
turbidity sensor

No Sticky Solution Fast Moisture Determination in Sugar Syrup

Analyzing the moisture content of sugar syrups can be done quickly, easily and accurately with the HR83 Halogen Moisture Analyzer from METTLER TOLEDO. This was confirmed by a study carried out by the University of Hohenheim which compared different methods.



Matching the reference value

The determination of moisture content by differential weighing before and after drying is suitable for nearly all foods. The weight loss of heat sensitive sugars may be affected two fold during drying: Volatile decomposition products add to the weight loss, whereas the crust typically formed during heating of sugar may prevent complete moisture evaporation. A study at the University of Hohenheim has shown that weight loss of sugar and fructose syrups as measured with METTLER TOLEDO's HR83 Halogen Moisture Analyzer corresponds to the water content chemically determined by Karl Fischer titration. Three drying programs (gentle,

standard and rapid) on the HR83 were tested at different temperatures with varying sample sizes. All three methods demonstrated a good correlation to the reference value determined with KF Titration (Table 1).

Optimizing drying procedures

In tests with inverted sugar and fructose syrups, the German researchers found that the rapid drying program was not only the fastest but also the least sensitive against temperature and sample weight. The use of glass fiber pads optimized the drying procedures as they increased the surface area of the syrups and ensured complete and reproducible evaporation. Accuracy and repeatability were satisfying for most instrument settings tested as estimated by the relative standard deviations of the measurements. In general, the data shows that the HR83 heats the samples quickly and homogeneously and provides accurate and reproducible results for sugar and fructose syrups.

► www.mt.com/sugarMA

Table 1

Water content by Karl Fischer titration and mass loss of fructose syrup with relative standard deviation (rsd) using the HR83 halogen moisture analyzer from METTLER TOLEDO.

Water content by Karl Fischer titration 29.46 % \pm 0.12 %; rsd=0.42 %; 10 repetitions

Programme	Switch-off criteria	Mass loss (%) at 105°C	rsd	Analyzing time	Repetitions
Gentle drying	SW 3	29.46 \pm 0.21	0.70 %	7–8 min.	10
Standard drying	SW 3	29.30 \pm 0.14	0.84 %	6–8 min.	10
Rapid drying	SW 4	29.43 \pm 0.17	0.58 %	4–7 min.	10

Reference:

⁽¹⁾ Heinze P, Isengard H-D (2001). Determination of the water content in different sugar syrups by halogen drying. Food Control 12, 483-486.



Adsorbent glass fiber filters simplify testing of liquid and pasty substances and prevent film building.

The Information You Want is at www.mt.com/pro

The METTLER TOLEDO Process Analytics website contains a vast amount of up-to-date information on all our products and services.



Content is localized for your country and tailored to suit your selections. Simple layout allows you to quickly find the information and features you are looking for.

- Learn about our most recent product developments
- Request further information on products and services
- Obtain a quote quickly and easily
- Read case studies relevant to your industry
- Access buffer and electrolyte solution certificates
- and more ...

- Read the latest product news
- Access our newsletter archive
- Find out when our next trade show or exhibition is in your area
- Register for free webinars presented by our industry experts
- Download our white papers

Greater Process Reliability and Sensor Life Extended up to 30 %

Maintaining sensors at peak condition is important for performance reasons, and therefore process assurance. An automatic sensor cleaning and calibration unit frees maintenance staff for more important tasks. It can also significantly increase sensor life.

Keeping sensors in prime condition can extend their lifetime by 30 % and provides greater assurance of process reliability. Conditions in the sugar industry mean the time spent on measurement point maintenance can be extensive. With the EasyClean 400, thorough sensor cleaning and accurate calibration are completely automated.

Allowing the EasyClean 400 to dependably clean and calibrate pH electrodes frees maintenance staff to concentrate on more important and skill-intensive tasks.

Find out how EasyClean systems can help your operations – go to:

► www.mt.com/EasyClean

Your benefits



Completely unattended maintenance
Automatic cleaning and calibration of pH measurement points.



Greater production efficiency
Eliminates downtimes caused by insufficiently maintained sensors.



Configurable to your requirements
Time of calibration, and time and duration of cleaning are fully programmable.



EasyClean 400 automatic sensor
cleaning and calibration unit

Get in-line with METTLER TOLEDO

Heads – I use the sensor again,
tails – I don't.



Don't leave it to chance!

ISM – True Predictive Diagnostics



No more guessing if a sensor will survive through the next production run. Intelligent Sensor Management's predictive diagnostics analyze process conditions and sensor health to provide you with accurate information on when sensor replacement will be needed.

ISM Intelligent Sensor Management
from METTLER TOLEDO

► www.mt.com/ISM