Reduced maintenance and increased accuracy through automated pH measurement with cleaning and calibration

Customer

Azucarera is the leading sugar company in Iberia, with sugar beet sourced from a few thousand growers in Spain to the production sites in La Bañeza, Toro, Miranda de Ebro and Jerez de la Frontera.

Azucarera, part of the Sugar division of group of business AB Sugar.

A successful cooperation for more than 10 years

In 2013, the Spanish company Azucarera was looking for an innovative solution for a particularly difficult measuring point in sugar production and found it in the fully automatic sensor cleaning and maintenance system cCare from Knick.
The beet sugar production is an industrial process which starts by the beet washing that becomes raw juice. In its purification process there are two highly challenging points; the first and second carbonatation.

The measuring system, which reliably provides accurate pH readings even under the adverse conditions of lime scale and high temperature, saves costs for lime, energy, manual maintenance and sensors.

After a very successful validation phase, Azucarera installed the first two systems in 2014, which have now been running for 10 years without any problems.

THE ART
OF MEASURING

Knick

The challenge of pH measurement at 1st and 2nd carbonatations in sugar production

The purpose of 1st carbonatation is to introduce carbon dioxide and lime which causes lime to bind which removes impurities with precipitation. During this step, the pH value is kept between 10 and 11. To do so, carbon dioxide (from the lime kiln process) is introduced at approx. 70 °C so that the lime precipitates together with the impurities. However, the filter cake from this first carbonatation still contains considerable amounts of sugar and is therefore washed. The sugary wash water is returned to the first stage of the process together with the filtrate, but it still contains undesired calcium hydroxide.

The Ceramat retractable fittings in the 1st (left) and 2nd (right) carbonatation have been in use since 2013.

2nd carbonatation is used to remove any remaining lime before moving to the evaporators in the thickening stage. The measurement of pH is critical to ensure the purification of the carbonatation juice. The remaining lime is precipitated at 90–95 °C in a second carbonatation process. If the pH value decreases too much due to the introduced carbon dioxide (carbonic acid in water), the lime decomposes to form hydrogen carbonate. If the value remains too alkaline, the precipitation is incomplete.

The efficiency of the carbonatation process strongly depends on the pH value at a temperature around 90 °C, with the formation of deposits due to lime, non-sugar particles and sticky syrup. The life of the electrodes is shortened by abrasion and blocking of the reference system.

Therefore, the measuring points must be checked several times a day and the pH sensors must be cleaned frequently with an acidic cleaning agent, such as amidosulfonic acid.

Sugar market

Sugar is produced in over 100 countries around the world from either cane or beet, with eight countries which produce sugar from both cane and beet.

The global sugar consumption was over 183 million tonnes in 2020/21, driven by a long-term growth of around 2 % annually which is expected to continue in the future. Approximately two-thirds is met by local regional production. Sugar is used by two main food sectors; food and beverage manufacturing, the biggest one with different functionalities, and retail.

Good to know:

The pH value is temperature dependent, and transmitters use to perform the temperature compensation based on a generic table. In this case Protos allows the introduction of a specific table for this process and consequently the pH value is calculated with the highest accuracy.

It is possible to obtain pH values from the inline measuring system, which can be compared directly with the pH values of the reference samples in the laboratory.

If this temperature compensation was not used, pH values of different temperatures would be compared, which would lead to misinterpretations and errors.

Tips

A proper temperature compensation factor is important to ensure the highest accuracy when measuring pH at high temperatures

A proper (manual or automatic) cleaning and calibration of the pH sensor ensures a high accuracy and repeatability at the same time that increases its lifetime.

Solution and customer benefit – Substantial saving costs for maintenance, sensors, lime, and energy

Until the installation of the automatic measuring point, the customer took a sample every hour for 3–4 months during the sugar campaign and brought it to the laboratory for checking. This was very time consuming and also inaccurate, because the effects of the temperature compensation could not be considered properly and the response time was too long.

cCare – Fully Automated Sensor Maintenance System

With the cCare system, the pH sensor is cleaned every 8 hours in the 1st carbonatation, every 2 hours in the 2nd carbonation, and calibrated 3 times per week. Everything is fully automatic, and no manual intervention is required.
Personnel resources (maintenance costs) are minimized and the Memosens pH sensor is now working for at least one beet sugar campaign of 3–4 months. Reliability and robustness of the system is really proofed.

The increased accuracy leads to great savings in production. This is possible thanks to the cleaning and calibration on site and the use of the temperature compensation table for this particular medium.

- Cleaning
- Calibration
- Conservation

cCare System

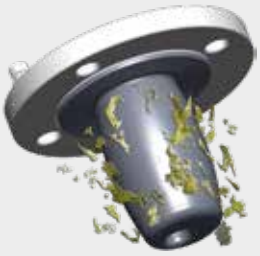
cCare is a sensor maintenance system that cleans and calibrates pH sensors fully automatically without interrupting the process. It ensures more accurate measurement values, lower maintenance costs and longer service life of pH sensors, especially with aggressive, viscous and abrasive media. Also in hazardous areas.

As an autonomous measuring system, cCare supplies reliable values directly to the process control systems. In this way, cCare not only contributes to process optimization, product quality, and the safety of people and the environment, but also to end-to-end digitalization in the process industry.

Ceramat

Ceramat is an compressed air-driven retractable fitting with ceramic sealing, superior to conventional O-ring seals in demanding measurement environments.

Ceramat is extremely resistant to chemical, thermal, and mechanical influences. It has a patented cyclone rinsing for optimal cleaning and is designed for highly corrosive media and processes with depositing, abrasive, and encrusting solid particles.



The optional deposit remover function uses compressed air to break and remove solid particles around the PEEK sensor protection.

MEMOSENS

Memosens is the waterproof and interference-free sensor coupling for liquid analysis that digitizes measurement data and stores calibration data.

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