Maintaining an accurate pH value during the first stages of ethanol production ensures product quality.

Customer profile
An ethanol producer in Wisconsin uses Endress+Hauser memosens technology to monitor pH values during ammonia and water addition before the fermentation process. The corn mash slurry is high in solids content.

Application description
Corn is delivered by truck or rail where it is loaded into storage bins. The grain is screened and ground into course flour. During cooking, the starch in the flour is prepared for fermentation. Milled grain is mixed with process water and the pH is adjusted to approximately 5.8.

The ethanol plant began experiencing problems with pH measurement in corn mash when they increased production (flow) by 50%. When first installed, pH sensors read correctly but after 24 hours, the pH reading drifted down before stabilizing. The readings were 2.00 pH different from grab samples. Fouling of the sensor was not evident and improper calibration was not evident. Removing the sensor from the process and measuring a grab sample matched the lab readings. Ground loop interference was not considered since Memosens technology has no direct electrical contact between the sensor and transmitter.

Process temperature was 184°F (84°C) and the mix had a solids content of approximately 32%.

Application challenges
pH measurement accuracy is vital in meeting the strict requirements of corn mash slurry. The pH sensor must measure accurately and see a representable sample of the process under high temperatures and high solids concentration.

Ammonia was added too close to the pH sensor and impaired the sensors measuring capability by causing large errors in the reference junction.

Solution
Using the CPS91D, and adding ammonia in a water tank/line prior to the slurry tank, allowed the ammonia more reaction time and better mixing. This avoided the swings in the pH reading and added stability to the measurement and ultimately automatic control of the pH via the ammonia addition.

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CPS 91 in pH Measurement and Control in Ethanol- Renewable Fuels
Avoiding pH errors in hot corn mash slurry in first stage of ethanol production with CPS 91 D, CPA 450 and CM 42

Instrument used
pH sensor: CPS91D
pH analyzer: Liquiline CM42
(or Liquisys M CPM223/253)
Holder assembly: CPA450
See back page for additional information.

Measurement results
Significant increases in both operational run time (time between cleaning and calibration) and stability in overall measurement values, leading to automated control of a critical process control point.
Product information

Memosens sensor technology from Endress+Hauser is revolutionizing analytical measurement technology. Measurement parameters now exist for the measurement of pH, dissolved oxygen, and conductivity. In particular for pH measurement technology, Endress+Hauser supplies all sensor types which ensure accurate operation of customer processes systems. The user can choose the most suitable sensor for a process from a wide range of sensors with liquid, gel or polymer electrolyte and with different junction types, such as ceramic, Teflon or open junctions. ISFET sensors complete the range. This means that the ideal pH sensor can be selected for each application.

Measuring principle

The latest advancement in pH measuring technology is Memosens based measurement and signal processing. A crucial factor in Memosens technology is that the digitalization of the analog measurement signal takes place directly in the sensor and that, in addition to the transmission of current measurement data, all quality-related data, such as temperature, calibration/adjustment values, location, total operating hours and operating times can be stored in extreme process conditions. This allows an optimal evaluation of measuring points to be carried out independently of location. In addition, the pH measurement is completely free of the interferences which present difficulties for classical, analog technology, such as high impedance connections, moisture and costly cables. The availability of sensor data at each location makes a change in maintenance strategy possible. This results in considerable cost reductions when compared to the previous mode of operation.