Acetic Acid in Vinegar

PROZESS TECHNOLOGIE

APPLICATION NOTES

Analyte: Acetic Acid CH_3COOH

Detector: Reveal XNIR process analyzer (Extended Near Infrared spectrometer 1100−2100 nm)

HIGHLIGHTS

- Millisecond measurement times
- Internal referencing, wavelength and linearity validation for stable, continuous operation
- WiFi, Ethernet, OPC, ModBus, Ethernet/IP communications standard
- Hazardous area enclosure options
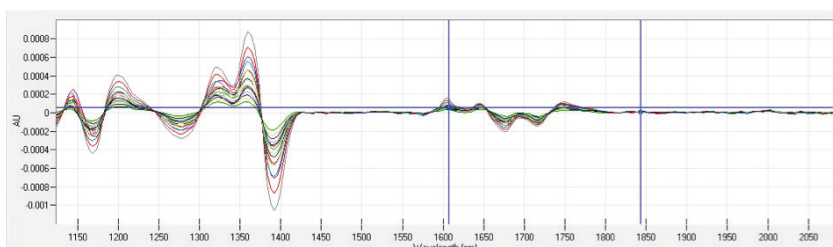- Various sampling options

REGRESSION ANALYSIS

Figure 1: Example of spectral data collected using the Prozess Reveal NIR instrument, on dilutions of production vinegar samples showing several distinct features (1100−1350 nm range, 1600−1775 peaks).

Summary

The ability to measure analytes, like acetic acid in vinegar, in real-time offers significant advantages compared to offline analyses, including savings in time, money, and resources. Manufacturers need not wait until the end of a process to acquire data from an off-line testing lab to determine the quality of their product, which can cause delays in bringing that product to market.

Acetic Acid

The power of the Reveal XNIR to monitor products in real-time was exemplified by the analysis of acetic acid concentration in various vinegar samples. *Figure 1* shows the NIR spectra of production vinegar samples with varying amounts of acetic acid, which produce several distinct special features corresponding to the acid content. Analysis of the vibrational modes corresponding to C-H and O-H stretching in the first and second overtone regions can be utilized to design predictive, multivariate analysis models.

In order to effectively monitor the acetic acid concentration in vinegar in real-time, a partial least squares regression model was generated (*Figure 2*). These models revealed strong correlation, with R^2 values > 0.99, and standard errors of prediction of ±0.1%.
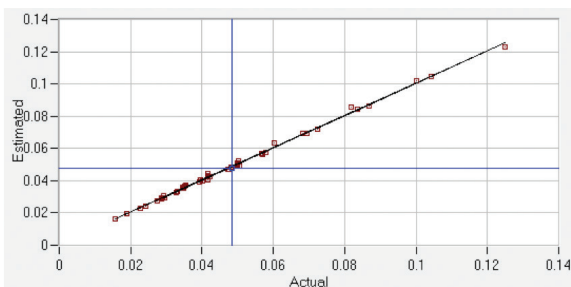

Figure 2: Partial least squares regression indicates strong correlation (R^2>0.99) to reported acetic acid concentration in vinegar samples with a standard predictive error of ±0.1%.

Reveal

The Prozess Technologie Reveal XNIR instrument provides millisecond measurements, a variety of sample interfaces, and rugged system designs for the manufacturing environment, enabling users to acquire data in real-time, and make modifications during their process to ensure proper quality control and efficiency.

The Reveal contains integrated light sources and dispersive spectrometers utilizing linear diode array detectors, with no moving parts for high throughput and maximum stability. The Reveal contains automated internal hardware for lamp referencing and for wavelength and photometric linearity validation, all of which can be performed at user-defined intervals.

Standard communications in the system include WiFi, Ethernet, OPC, ModBus and Ethernet/IP for upstream and downstream interface with distributed control systems, computers, or tablets. Sampling options range from flow cells with selectable path lengths, to measuring heads that mate to sight glasses in vessels, to fiber probes for contact or non-contact measurement in various insertion points.

Prozess provides a myriad of engineering solutions to integrate into customers' process streams. Hazardous area enclosures, additional analog and digital inputs and outputs, and sample head integration are just a few of Prozess' competencies to ensure a turnkey and trouble-free implementation. With high stability and genuine real-time measurement, the Reveal is a dependable device for monitoring moisture content in both continuous and batch processes.

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