Corn Syrup Production

On-Line Measurement of Color and Clarity in Process Liquor for Production and Quality Control

There are several points in the process where measurements are made:

- Downstream of the filter presses to determine the load on the color removal stage. Typical ranges are 0 to 5000 or 0 to 12500 color units.
- Downstream of the color removal stage for quality control or as a way of determining when to take the color removal column off-line for regeneration instead of uneconomical time based sequencing. In this latter application there is usually one analyzer per bed. Typical ranges are 0 to 500 or 1000 color units.
- On the HFCS product line for quality assurance purposes. Typical ranges are 0 to 50 color units.
- Downstream of the decolorization stage to detect organic material. By monitoring in the UV region of the spectrum, organic materials can be detected which will ultimately result in color formation, but they can be detected with much higher sensitivity. This measurement can then be used to switch decolorizing columns rather than either waiting for color breakthrough or switching beds on a timed basis. This yields a lower cost, higher quality operation.
- Monitoring for "brilliance" of final product.

Product clarity measurement is important downstream of the filter presses to ensure proper filter operation and catch breakthrough before contaminating the char beds. It has been shown that although on a time-averaged basis the filtered liquor may only show a particulate level of 10 - 20 ppm, there are periods at start-up and break-through of individual presses when the levels are as high as 500 ppm.

Color Analyzer

The AMETEK Model 4000 color and turbidity analyzer is based on a rugged photometric analyzer which has been used for continuous on-line analysis in the petroleum refining, chemical processing, petro-chemical, pulp and paper, and food industries for more than 30 years.

This unit uses the split beam technique for high reliability. Light passes through a sample cell which is physically separated from the lamp and detector. The transmitted light is split into two beams by a semi-transparent mirror. One beam passes through an optical filter to isolate a "measuring" wavelength. The other beam passes through an optical filter which isolates a wavelength where the color forming products do not absorb light or "reference" wavelength. The difference between these two beams, after logarithmic conversion, is directly and linearly proportional to absorbance at the measuring wavelength; and the analyzer is calibrated directly in CRA color units. Particulate matter in the sample stream, such as filter breakthrough, affects both beams equally. Since the difference is used to determine the color, the measurement is not affected by either particulate or bubbles. Analyzer stability and reliability are extremely high since there are no moving parts. Maintenance is usually confined to zero and calibration checks during plant shut-downs. For ease of use, an optical calibration filter is built into the unit for use at any time by unskilled personnel.

Note that this technique gives direct color analysis without requiring the liquor to be filtered. (An exception to this statement is the application prior to the filter presses where coarse filtration is required to remove "rocks" which would otherwise plug the sample lines. A suitable self-cleaning filter eliminates maintenance.)

When product clarity measurement is required combined with color measurement, then a second output is provided. This signal is based on the amount

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of light absorbance taking place at the reference wavelength which is solely due to particulate and independent of color. This provides a highly cost-effective solution for two measurements, since not only the cost of a second analyzer is avoided, but also the installation costs.

For organic, color-forming measurements, the same type of analyzer is used but the measuring wavelength is changed to 365nm where the color formers are strong UV absorbers. All other aspects of analyzer operation are the same.

Measurement of "brilliance" is defined as the transmittance wavelength of 546nm. (Both measuring and reference wavelengths are emission lines from a mercury vapor lamp which are highly intense, extremely stable and highly accurate. This results in higher accuracy, higher linearity, and lower drift than a broad-band source/interference filter combination.) By taking a signal directly from the reference detector, a measurement of "brilliance" is provided from the same analyzer that measures product color. This is a significant reduction in purchase and installation costs. Further, the output is continuous and does not need to wait for laboratory analysis.

AMETEK®
PROCESS INSTRUMENTS

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REGISTERED ISO 9001 MANAGEMENT SYSTEM

Corn Syrup Production (06/07/07)

Specifications subject to change without notice.

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