OPTICAUST-2100

OptiCaust-2100 combined with Duralyzer

DURALYZER-NIR

The heart of the control strategy is the installation of a state-of-the art automated sampling analyzer to monitor liquor properties throughout the recausticizing process. Samples are analyzed using near infrared (NIR) technology to determine liquor strength. These measurements are passed to the Customer's existing DCS system via a dedicated serial link (4-20 mA also available). The sampling sequence is optimized in order of importance from the control point of view, while at the same time taking into account the process delays.

DELTAV CONTROL COMPUTER

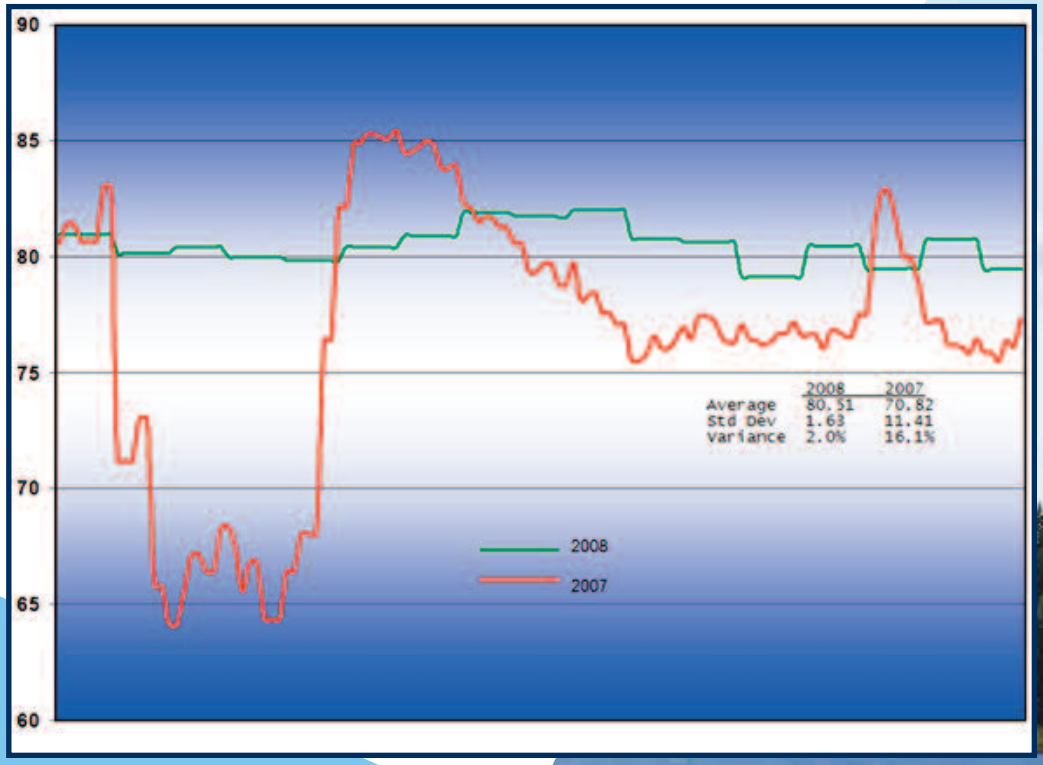
This information is transferred to the DeltaV Control Computer via an OPC link, where sorting logic is used to update the data values into modules used to track each sampling point. Additional calculated values are created and the results are read back into the DCS for operator display, again via OPC.

GREEN LIQUOR TTA CONTROL

Weak Wash and post-dilution green liquor properties (TTA) are used to adjust Weak Wash dilution flow to the green liquor line(s). This will reduce the variability in green liquor TTA to the slaker(s), resulting in more uniform EA (AA) out of the last causticizer(s). This control resides in the existing DCS.

OPTICAUST-2100: General

Causticizing controls are implemented in the DeltaV Control Computer. The unknown variables are Lime Reactivity (LR) and Lime Availability (LA) that the System must be able to adjust to. Refering to the attached Control Scheme, intermediate reaction progress is measured at the first causticizer with final causticizing adjustments based on data from the final causticizer. The sole causticizing control adjustment to the field is the lime feed rate, which is based on theoretical lime required for the desired reaction of carbonate as a direct Feed-forward control at the slaker. This control is then trimmed by the output of a Model Predictive Controller (MPC) module. The MPC module is then trimmed by a final Statistical Process Control (SPC) module based upon samples at the final causticizer.



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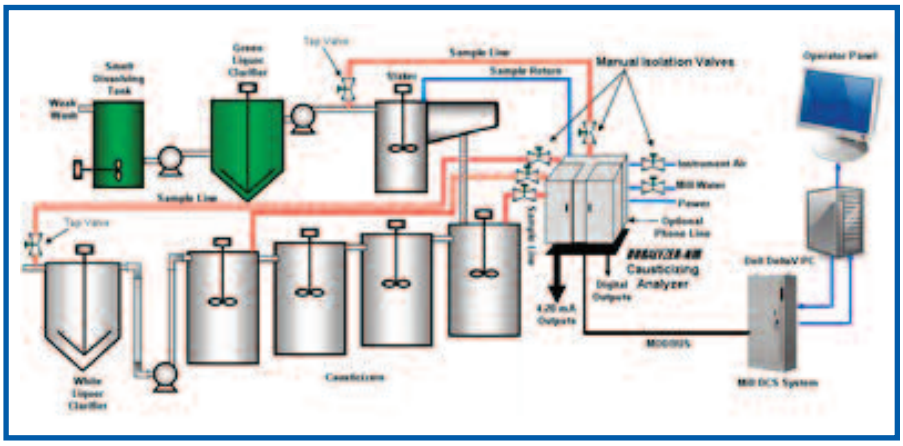
The overall controls are based upon Causticity (C%) expressed in percent at the outlet of the final causticizer. This number is converted and the actual controls are based upon the Reaction of Carbonate (ROC) number. As the ROC (can also be characterized as Causticizing Efficiency), is limited by the Goodwin's curve, empirically determined as a function of green liquor TTA and Sulphidity (S%), the OptiCaust-2100 will continually optimize the C% setpoint based on the incoming green liquor properties. The end control result is maximum NaOH production, regardless of lime quality or green liquor strength.

OPTICAUST-2100: Feed-forward Lime Screw SP Control

This is by far the most important control function. The ROC target is calculated based on the incoming green liquor properties and the desired C% setpoint (or optimized automatically by the System under "Advanced" control). This is then converted to Lime SP using the stoichiometric chemistry that applies to this particular process.

OPTICAUST-2100: First Causticizer Model Predictive Control

The Lime Reactivity (LR) is given as the ratio between the ROC at the first and final causticizer, typically between 90-97%. The intermediate ROC target is calculated in the Feed-forward controls and the GL values are time shifted by the process delay at this point. When a new measurement is available at the first causticizer, this is used to update the Actual intermediate ROC. This value is then used as the manipulated variable for the MPC controller. The output of the MPC controller is then scaled to provide a minor adjustment to the lime screw speed control as described above.



OPTICAUST-2100: Final Causticizer C% Control

The final trimming controls back to the MPC are based upon the results on a Statistical Process Controller (SPC) at the final causticizer. The C% target, with process delay, becomes the target used by the SPC controller and the actual C% is used as the process variable. When new sample values are available, they will be scrutinized by the following statistical rules: Exceeding 1 sigma, 2 sigma, 3 sigma, on the same side of C% target or change in the same direction.

OPTICAUST-2100: Additional Features

Lime Availability

The Lime Availability, although not used for control, is estimated by a continuous calculation by the system between lab tests.

C& SP Bias

As it is not advisable to run the process at Goodwin's theoretical value due to highly increased lime demand and a risk of overliming, a good starting point in a normal run is 95%. This bias is operator adjustable and can be increased during periods of well reacting lime. Lime settling rate, based on periodic lab analysis, can be entered for display and further used by the operator/supervision to determine the optimum bias.

Safeties

Certain safeties are built into the overall control scheme. These are temperature override based on slaker temperature, also a limit on maximum lime feed in order to prevent slaker boilovers.

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