Application

ABB Analytical – pH Measurement
Sugar Mill Sulfitation Process

Industry: Sugar refining

Controlling sugar color

The clear sugar juice coming from the filter following the second carbonation has a light straw color. Further heating has a tendency to react with residual amino acids, causing the juice to assume a dark brown color. To avoid this, the juice usually undergoes a process called sulfitation which whitens the sugar. The plant adds sulfur dioxide gas to the juice at a level of about 120 to 200 pounds per million pounds of juice. The gas rapidly dissolves in the juice.

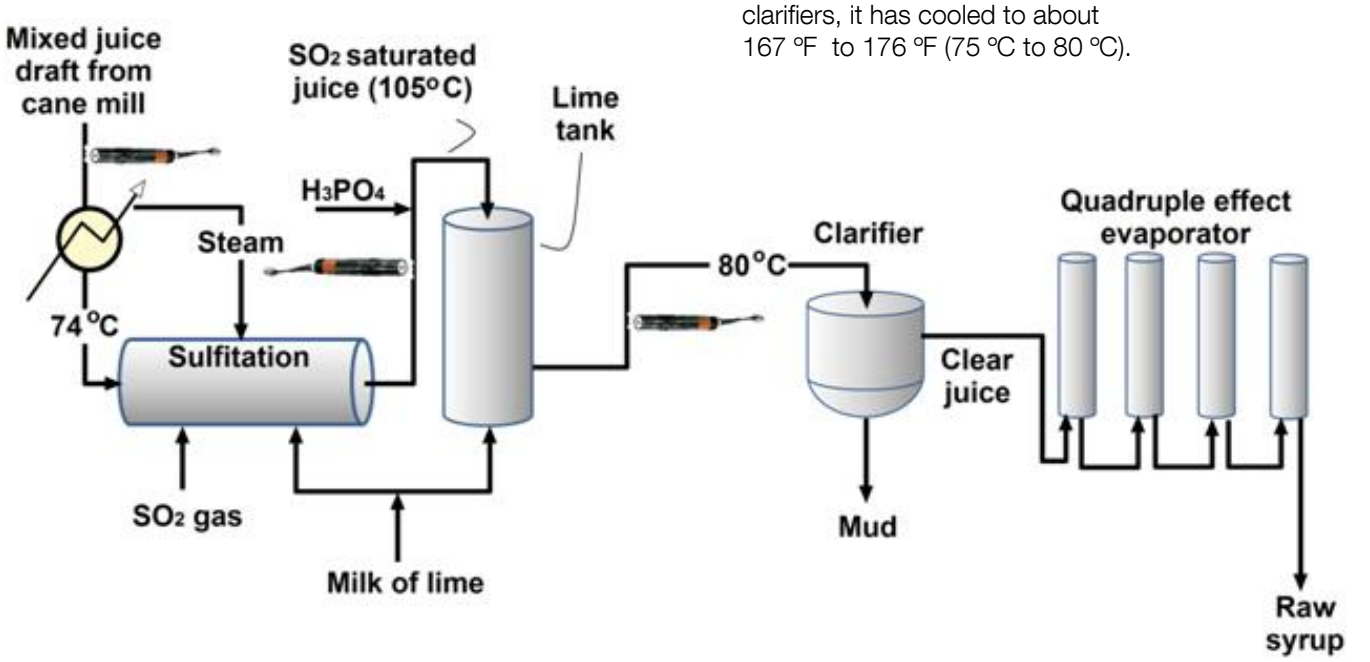
The sulfitation process has three benefits:

- it slows the browning process during the subsequent concentration and crystallization processes allowing white sugar to be produced.
- it keeps the juice from becoming too alkaline, which would cause the sugar crystals to stick together and acquire an undesirable taste
- it acts as a biocide to sanitize the sugar prior to evaporation.

Adding sulfur dioxide gas

In the sulfitation process shown in the diagram, the plant first heats the mixed juice draft to 165 °F (74 °C). It then enters the sulfitation tank where both and sulfur dioxide gas and milk of lime are introduced. The juice, saturated with sulfur dioxide, exits the sulfitation section at temperatures as high as 221 °F (105 °C) with a pH about 7.0 to 7.5.

At this point the juice receives an injection of phosphoric acid (H_3PO_4). Next the liming tank slightly elevates the juice to 7.5 to 7.8 pH before it enters the clarifier. By the time the saturated juice reaches the clarifiers, it has cooled to about
167 °F to 176 °F (75 °C to 80 °C).



Further processing with sulfur dioxide gas and a centrifuge (not shown) produces the white sugar product. The residual sulfur dioxide remaining in the final white sugar is below 10 ppm.

Following clarification, quadruple effect evaporators concentrate the clarified thin juice into raw syrup. In these evaporators the vapor given off by the boiling juice in the first or previous evaporator is the heat source for the next evaporator. The evaporators increase the solids content to 60 to 70%.

The ABB Solution: TB551 and TBX587

Most sugar mills will operate through a growing season (referred to as a “campaign”). The campaign will be three to six months, depending if beet or cane sugar is being refined. Mills that produce “plantation white sugar” will have sulfitation as part of their process. If the pH sensor can last through the entire campaign in the sulfitation process, it is considered a success

Sulfitation is the final measurement to get the pH right. Improper control of pH compromises the quality of the end product--"white sugar." At low pH, the syrup reacts with nitrogen compounds to form undesirable color, and at high pH alkaline destruction of sucrose and monosaccharides occur. Temperatures are often as high as 212 ºF (100 ºC), so this can be challenging pH application.

For these applications ABB’s Twist Lock TB(X)551 are ideal for sample line installations. The bayonet style mounting simplifies sensor removal for cleaning and calibration. If the pH sensor is inserted directly into the process, ABB recommends a retractable sensor with an extraction housing. The extraction housing has flushing ports which can be used to loosen congealed sugar.

The TB(X)587 or TB(X)557 are good examples of retractable sensors that work in these processes. For all carbonation applications the coat resistant “J” Glass electrodes should be specified. The Wood Next Step Reference should be used for Sulfitation processes.

The TB(X)551 can be mounted into 1” tees in sample line installations

The TB(X)587 includes an extraction housing with flushing ports

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