MANUFACTURING ABSTRACTS

The Florida Sugar Industry: Trends and Technologies

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The Florida Sugar Industry has been consistently improving the operation and efficiency of several sugar mills. The trends in operation and efficiency are first discussed followed by a survey of technologies and applications that cumulatively have contributed to these improvements in operation. The Florida Sugar Industry has consistently increased the processing rate while at the same time improving the overall recovery of sugar. No attempt is made to formulate cause and effect of the technologies, but general comments are made on the experience of some of the technologies and the possible trends that these technologies may take the industry in the future. The technologies covered are in the areas of milling, processing, and the power plant as well as quality control and information technology. The industry has benefited by borrowing and implementing technologies from other industries as well as from other sugarcane growing areas such as Australia and South Africa. The technologies involved range from computational fluid dynamics, new materials, digital and electronic devices and equipment, larger and more efficient sugar processing equipment, computer automation and information technologies. Technologies that are being developed that may change the sugar process are still years away from commercial implementation. The economic pressure of globalization will continue to force the Florida sugar industry to continue the technological trend.

Versatility of the Antibody Dextran Test Method

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The monoclonal antibody test (Sucrotest™, Midland Research Labs, Inc.) has proven be a versatile means of determining dextran. It can handle any dextran containing liquid sample and give a value in about one minute. It correlates very well with the Haze test. Samples ranging from the raw factory, to the refinery, to white sugar can be rapidly analyzed. The source of the sample is not important, whether it is from Mauritius or Louisiana this test produces reliable information. The test is being used in both raw factories and refineries world wide. Results showing the scope of uses, and correlations with existing methods will be presented.

Evaluation of a Near Infrared Spectrometer for the Direct Analysis of Sugar Cane

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A Foss InfraCana Near Infrared (NIR) spectrometer was installed at Cinclare mill in Louisiana for the 2001/02 crushing season, to assess its suitability for direct analysis of cane delivered to the mill. The system prepared core-sampled cane in a Jeffco shredder and measured reflectance over a range of wavelengths. Analyses of cane by wet disintegration and by the existing core press method were used as the primary measurements. Calibration equations for pol, brix, fiber, moisture and ash in cane were produced. Values of standard errors were excellent, and prospects for the use of such an instrument for accurate direct analysis of cane look promising.

Effect of pH and Time Between Wash-outs on the Performance of Evaporators

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Factory staff must consider all costs to make good economic decisions on how to improve the performance of evaporators. These include knowing optimum pH levels to minimize sucrose losses, and knowing when to wash-out evaporators to reduce the impact of scaling on sucrose losses. A comprehensive study was conducted at a factory during the 2001 grinding season, to determine the effects of time between evaporator wash-outs and pH on sucrose losses and overall evaporator performance. The factory operated Robert's Type calandria evaporators, with two (30,000 and 25,000 ft^2, respectively) pre-evaporators in parallel and three sets of triple-effect evaporators in series. In this investigation the second set of triple-effect evaporators was studied and each body was 12,500ft^2. Retention times were 11.4 and 9.5 mins in the two pre-evaporators, respectively, and increased from 10.0 to 21.8 mins across the triple-effect evaporators. Gas chromatography was used to determine glucose, fructose, and sucrose concentrations in and out of the evaporators. Changes in Brix adjusted pH, Brix, color and turbidity, as well as chemical analyses of condensates were monitored. Most sucrose losses to inversion occurred in the pre-evaporators and were more a function of temperature, heating surface, and pH than retention time. Sucrose inversion occurred in the first and second evaporator bodies only when scale had built up ~3-4 days after a wash-out and, generally became worse until the next wash-out. Although color formed in the pre-evaporators, it was relatively less than what occurred in the first and second evaporators. Increasing the factory target pH of the clarified juice (CJ) or final evaporator syrup (FES) systematically reduced losses of sucrose and a target FES pH of ~6.3-6.4 is recommended. A target CJ pH of 6.7, giving an equivalent FES target pH of 5.9, caused approximately 1.97-3.05 lbs sucrose lost/ton of cane in the pre-

evaporators from mid to late season, whereas a target CJ pH of ~7.1 and FES pH of 6.3 reduces this loss to 1.46-2.28 lbs sucrose lost/ton of cane. More sucrose losses occur at the beginning of the season. Further recommendations are discussed.

Maximize Throughput in a Sugar Milling Operation using a Computerized Maintenance Management System (CMMS)

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The sugar industry relies on expensive mechanical plant for sugar production. Loss of production during the crushing season due to downtime means huge revenue losses. Excessive downtime and high maintenance costs can be avoided if a throughput focused CMMS Software system is implemented. The CMMS provides valuable information to base decisions on, but also enables valuable operational tools to ensure an optimized availability and sustained throughput.

This paper presents a success story about a CMMS implementation at 14 sugar mills in Southern Africa, for a leading, global, low cost sugar producer and a significant manufacturer of high-value downstream products. The group has extensive agricultural and manufacturing operations in Southern Africa. Group sugar production of almost 2.0 million tons of sugar derives from South Africa at 1.25 million tons, Malawi 240 000 tons, Swaziland 220 000 tons, Zambia 205 000 tons and Tanzania 75 000 tons.

By implementing a focused and effective Maintenance Management System, the Group was able to ensure operational reliability during the crushing season, and improved uptime, without sacrificing maintenance expenditure. The paper highlights the challenges that the business faced, provides a roadmap to the implementation, as well as the realized benefits as a result of the implementation.

The steps to adopting a philosophy of Scientific Maintenance Management and Total Quality Management (TQM) for the two distinct phases of Plant Maintenance namely, Production Season and Off-crop, demand the following key elements that will direct Maintenance in the business:

- Taking a life cycle long term view.
- Defining key performance indicators that are measurable.
- Ensuring Quality at the source of work execution.
- Basing decisions first on factual information and cross checking it with historical information.
- Challenge past maintenance practices.
- Focusing on prevention rather than cure.

All maintenance work done in both the crushing season and the off-crop, have as its primary objective the reduction of Lost Time Available during season and effective planning and management of off-crop maintenance, to reduce maintenance spend. This paper is based on the experience gained by the author and his associates from CMMS implementations over a period of 15 years.

Experiences with the First Full Scale Plate Evaporator in the North American Cane Sugar Industry

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An Alfa Laval EC 700 plate evaporator was installed at Raceland Raw Sugar Corp during the 2001 crop. The evaporator was installed as a second effect booster. The unit ran for the last 34 days of the 2001 crop with excellent results. On average 1500 TCD more was ground after the evaporator had been installed compared with the previous period. Steam economy improved by up to 130 pounds steam per ton cane. A heat transfer coefficient of around 390 BTU/ft^2/F °(2.2 W/m^2/C °) was achieved on average for the operating period.

Organic Acids in the Sugar Factory Environment

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Volatile and non-volatile organic acids (ranging from acetic, through lactic to higher acids) can be found in raw sugar process streams. They are products both of microbial degradation and decomposition of cane waxes. The concentrations increase from the primary juice to significant levels by the end of the separation process. The specific sources of some of these acids are traced and implications of their presence on corrosion and sugar recovery are highlighted.

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Experiences with Unwashed Cane at Raceland

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Cane washing was stopped on the fifth day of grinding and remained off for around 70% of grinding. The performance of the plant in the extraction, steam generation and clarification various areas was monitored in order to assess the impact of this modus operandi. Overall sugar recovery was enhanced by 13 pounds of sugar per ton cane whilst operational difficulties in the extraction and steam generation areas were minimal. Clarification of juice improved during periods of no washing whilst increased mud quantities experienced during this period could be handled if anticipated in good time. Attempts have been made to estimate the effect on recovery by comparing results during periods of washing and no washing. Work done by Birkett and Stein during 2000 suggests that the value of additional sugar to the industry by not washing cane is USD 18 million or USD 1.2 per ton. This provides sufficient incentive to both growers and millers to work together to ensure that this practice remains sustainable.