

MANUFACTURING ABSTRACTS

The Freeze of 2001-A “New Book is Written”

John A. Fanjul

Atlantic Sugar Associations, Inc.
Belle Glade, Florida

Atlantic Sugar Associations, Inc. developed an organizational plan, which involved pooling its R&D/Harvesting, Operations/Mill, and Cane Bank, to handle the freeze in 2001. Atlantic Sugar Associations, Inc. had successful and record-breaking results across the board.

The Breakage in Sugarcane Mill Rolls

Jorge Okhuysen

Mexico

The causes of failure involving the design, materials selection, methods of manufacturing, and the influence of operating conditions in sugarcane mill rolls will be discussed.

Material Balance and Equipment Requirements of a Typical Sugar Mill

Eduardo Samour, P.E. and William Easdale

United States Sugar Corporation
Clewiston, FL

Traditionally, to reduce production costs or for other reasons, most sugar mills have increased their grinding rate over the years, after they were designed and built for certain capacity, and conditions. When an expansion project is conceived in a sugar mill, the focus generally is, on cane grinding capacity and steam production. Even though these are extremely important factors, a proper evaluation of the rest of the equipment in the factory is often neglected. This, bring about unnecessary bottlenecks that will defeat the purpose of the expansion, or even worse, a reduction of efficiency. With a properly conducted survey of equipment capacities, an engineer can determine, with the new operating conditions, the proper capacity required in each station of the process.

This paper describes, calculations of material and steam balance performed for a typical sugar mill. It is based on a grinding rate of 1000 tons of cane per day, using the double magma system, and quadruple effect evaporation, with first effect vapor bleeding for secondary heaters and clarified juice heaters and second effect vapor bleeding for primary heaters and vacuum pans.

The results are presented in various charts. These were developed, to illustrate different volumes of materials that can be expected in the boiling house, under different cane quality conditions. Other charts are also presented such as: heating surface required for Juice heaters on the various stages, evaporation rates necessary to satisfy the demands of vacuum pans, and heaters. These figures are useful for sizing the proper equipment required under different conditions and grinding rate.

Properly planning an expansion project, after evaluating all the areas of the mill, will help mill managers spend their investment dollars in the areas where equipment is most needed. A properly balanced factory, provides a smooth operation that enable the mill engineers to focus their attention on increasing efficiency, rather than coping with the added material they have to process.

Reducing Equipment Cost/Best Equipment Management Practices

Neal Hahn

Nortrax Equipment Company - South
Baton Rouge, Louisiana

The owning and operating cost of mobile equipment can have an adverse effect on a mill's profitability. Cost control is important. The core business of the mill is grinding cane, rather than mobile equipment management. Many managers do not take the time to consider this key area of operation. The productivity of equipment is directly proportional to the effectiveness of an equipment management strategy. Equipment that stays idle during productive times is a substantial cost to the mill. Utilization tracking can be used to determine if added equipment is required. Downtime can be an indicator both of equipment and maintenance problems. A good program of maintenance for high-tech equipment must include oil sampling, repair option management, preventative maintenance, and life cycle planning. A good record keeping system should also include an effort to make historical comparisons of cost per hour. The equipment division of each mill should also have a Standard Operating Procedures guide, which would address the key areas of equipment operation and maintenance. This paper will provide ideas on better equipment management and review specific examples key to lowering the operating cost of equipment.

What You Should Learn from Your Chemical Supplier

Stephen J. Clarke

Florida Crystals Corporation

This paper surveys the issues of selection, use and fate of chemicals used as processing aids in sugar production and in equipment cleaning. The chemical sales business is extremely competitive and it is essential that the sugar technologist (chemical user) be aware of the benefits, costs, and possible unforeseen consequences of each chemical used. The chemical supplier who should be familiar with the scientific basis for the application must provide this information – there is no magic in this business. Chemical use should be minimal but is

unavoidable, and factory personnel must have the information required to avoid unnecessary use. Examples of cases where problems and new consumer issues have arisen will be presented, along with some suggestions of new chemical applications.

The Effect of Two Louisiana Soils on Cane Juice Quality

Mary An Godshall

Sugar Processing Research Institute
New Orleans, LA.

Scott S. Spear

University of Alabama
Center for Green Manufacturing
Tuscaloosa, AL

Richard M Johnson

Southern Regional Research Center, ARS, USDA
New Orleans, LA

As part of a large-scale investigation on the effect of various field practices on the quality of cane juice in Louisiana, it was noted that when soil was added to the cane juice to assess the effect of soil on cane juice quality, the juice color lightened. In a study during the 1998/99 crop in Louisiana, with addition of 5% and 10% soil, it was noted that polysaccharide was also removed, the first time this had been reported. These observations run contrary to expectations that soil would degrade the quality of cane juice. Two soils from the Louisiana cane growing area, Sharkey clay and Norwood silty clay loam from Bunkie, were tested on raw juice from green cane, topped, with side leaves, at a 10% add-on to juice. The juice was treated for 30 minutes in a shaker either at room temperature (25°C) or heated (80°C). Changes in pH, color, and total polysaccharide, ash and filtration rate were noted. Both soils caused significant decreases in color and total polysaccharide and increased the filtration rate. Ash and pH were not significantly changed.

Mill House Operation: Composition of Juice from Individual Mills

Khalid Iqbal, Mary An Godshall, and Linda Andrews

Sugar Processing Research Institute
New Orleans, LA.

Although a lot of work has been done to study and improve sucrose extraction by individual mills in the factory, little information is available about the nature and composition of the juice exiting each mill. The type and concentration of the impurities entering into the process with the extra sucrose may affect processing and the quality of sugar, a subject that has not been addressed to the fullest extent. From a processing point of view, it is useful to have detailed knowledge of every sugar-bearing stream within a sugar factory. Samples of individual mill juices were collected from mills at a local factory during the 2000 grinding season. Juice

samples were analyzed for purity, invert, color, total polysaccharides, conductivity ash, cations, anions, and nitrogen content. The level of extraction of non-sucrose components generally increased across the mills, while the sucrose content decreased. Purity drop was in the range of 3 to 10 degrees while color, total polysaccharides and nitrogen content increased 2 to 4 times from mill #1 to #6. Among cations, sodium and potassium increased, phosphate plateaued at mill #3 or #4, and chloride did not change very much. Potential application of this information will be discussed.

A New Polarimetric Method for the Analysis of Dextran and Sucrose

Victoria Singleton

Optical Activity Ltd.
Cambridgeshire, England.

A new method for dextran quantification has been developed and field-trialled in Jamaica, in association with the Sugar Industry Research Institute. The method uses a near infrared (NIR) polarimeter and a specific dextranase. The dextranase selectively breaks-down the dextran into sugars of lesser specific rotations without affecting any other substance present in the juice. The initial dextran concentration is derived from the calibration curve of the change in observed optical rotation (OR) due to enzymatic hydrolysis and outputted automatically by the polarimeter. Readings are not affected by the molecular weight of the dextrans, the entire procedure takes less than 10 minutes to perform and it is semi-automated. Use of a NIR polarimeter negates the need for lead clarification. The method is suitable for both juice and raw sugar samples.

Comparative Performance of Hot, Cold, and Intermediate Lime Clarification at Cora Texas Factory

Gillian Eggleston and Blaine E. Ogier

USDA-ARS-Southern Regional Research Center
1100 Robert E. Lee Blvd
New Orleans, LA 70124

Adrian Monge

Cora Texas Manufacturing Co.
Res. 32540 B Texas Rd
White Castle, LA 70788

Since 1996, Cora Texas factory in Louisiana has been operating intermediate lime clarification and was, therefore, one of the few U.S. factories that did not operate cold lime clarification. In an attempt to further improve clarification performance, the factory made the decision to convert to hot lime clarification during the 2000-grinding season. This comparative investigation of hot versus intermediate and cold lime clarification was undertaken to quantitative performance. In cold liming, mixed juice (MJ) was incubated and then limed in a lime tank (4min), both at ambient temperature (~105°F). For intermediate liming, 50% of the

MJ was heated (180-200°F) before incubation, then limed in a lime tank (4min) at ~150°F. Hot liming was configured very similar to intermediate liming except that lime was added immediately after flash heating (215°F; 30sec). Hourly samples across each of the three processes were collected over a six-hour sampling period, on three consecutive days respectively, and these were repeated three times across the 2000-grinding season. For most clarification parameters investigated, both hot and intermediate liming performed much better than cold liming, and hot liming offered some extra advantages over intermediate liming. Markedly less sucrose was lost to inversion reactions across both hot (season av. 0.79%) and intermediate (0.97%) lime processes than across cold liming (1.48%). Increasing the factory target pH of the final evaporator syrup (FES) from ~6.0 to 6.3, in sampling period 3, caused a marked reduction in sucrose inversion losses in both hot and intermediate liming. Less lime was added in hot liming compared to either cold or intermediate liming, with the factory consuming, on season average, only 1.01 lbs lime/ton cane compared to 1.28 for the 1999-grinding season when intermediate rather than hot liming was operated. Pre-heating 50% of the MJ in both intermediate and hot liming markedly removed color, dextran, and starch. Approximately 2.1% (season av.) more turbidity removal (MJ to CJ) occurred in intermediate and hot liming compared to cold liming, with better CJ turbidity control. Subsequent FES turbidity values and control were better in hot liming. Significantly less color (~2.5%) formed on hot liming because of the alkaline degradation of invert compared to ~17% color formation in cold and intermediate lime clarification. Dextran removal was best across hot liming and, as expected, dextran formed in the cold lime tanks.

Advanced Report on the Use of Lime Saccharate in the Alkalinization of Sugarcane Juices

Miguel Lama, Jr. and Raul O. Rodriguez

Atlantic Sugar Associations, Inc.

Belle Glade, Florida

A factory scale trail on the use of lime “Saccharate” at Atlantic Sugar Association in Florida is described. The methods of application, using existing equipment and facilities, are shown, and some modifications proposed. Results obtained are discussed, within possibilities, and proposals formulated for a continuance of the study.

The Re-introduction of Formal Sugar Engineering Courses at LSU

Peter W Rein

Audubon Sugar Institute

LSU Agricultural Center

Baton Rouge, Louisiana

The need for adequately trained people in the sugar industry is discussed. In response to the need for better-qualified people in the Louisiana sugar mills, it has been decided to introduce formal courses in Sugar Process Engineering and Sugar Factory Design, in the Department of Biological Engineering. These courses will form part of the curriculum of students studying Chemical, Mechanical or Biological Engineering who wish to earn a Minor in Sugar

Engineering. In addition, options for Masters students in engineering to take the sugar courses exist, aimed at producing graduate students with a comprehensive knowledge of sugar. The benefits to the industry, to Audubon Sugar Institute, and the University are highlighted.

SAT Process for Production of White Sugar from Sugar Mills

Chung Chi Chou
Chou Technologies, Inc.
New Orleans, LA

Due to the uncertainty in the government's sugar program and the threat of global competition, the US domestic sugar industry is under pressure to develop a new strategy for the new millennium. One of the potential solution is to produce white sugar directly from sugar mills with minimal / nominal capital cost. With this vision in mind, the SAT process was developed at Sugar Processing Research Institute under the direction of its former managing director, Dr. Chung Chi Chou and is the subject of this paper.

For the cane sugar industry, sugar is extracted from sugar cane, processed to produce raw sugar in a sugar factory and then further purified to refined white sugar in a sugar refinery. However, beet sugar does not require a two-stage process to achieve white sugar in a beet sugar factory. By studying the basic differences in the nature of colorants and various composition of sugar streams from both sugar cane and sugar beet, the SAT process is developed successfully to produce white sugar using clarified juice from sugar mills with color ranging from 80 to 150 ICUMSA. In this paper, the SAT process itself and its benefit to sugar mills will be presented.

The Biorefinery Concept

Willem H. Kampen and Henry Njapau
Audubon Sugar Institute
LSU Agricultural Center
Baton Rouge, Louisiana

In response to the present energy problems, global warming and the lack of a national energy policy, US Government agencies as USDA, EPA, DOE and others are presently preparing a strategic plan entitled: "Fostering The Biology Revolution...In Biobased Products and Biobased Energy". The national goal is to triple the U.S. use of biobased products and bioenergy by 2010. The biorefinery concept is based upon (cheap) sugars from which a diverse and flexible mix of energy, fuel, chemical and material products from biomass resources is produced; sugarcane should play a major role.

R&D to reduce the cost of the sugar cane crop has to be part of this effort. It already has been demonstrated that betaine can improve the sucrose yield in Louisiana. Most of the blackstrap molasses produced in Louisiana is leaving the state. With a large biorefinery we can produce from molasses and waste sugars (as an example): bioethanol, carbon dioxide, inositol, glycerine, itaconic acid and succinic acid. Other value-added or co-products such as lactic acid

and thietins could be recovered as well. An example of a biorefinery with a modern waste treatment system based upon incineration and heat recovery is presented. These biorefineries can have much higher Return On Investments than (raw) sugar factories.

Evaporator Scale-Minimization with Electro-Coagulation and Improved Cleaning with Chelates

Henry Njapau and Willem H. Kampen

Audubon Sugar Institute
LSU Agricultural Center
Baton Rouge, Louisiana

Electro-coagulation of clarified juice resulted in the removal of essentially all the silicon dioxide & silicates plus from 10 to 40% of calcium, magnesium and (inorganic) phosphate. This may reduce scaling by up to 50%. Preliminary work on mixed juice indicates that it is likely that electro-coagulation can be effective before clarification also.

The removal of scale is typically accomplished by boiling with an alkaline solution, a water wash and an acid solution. A new acid is being tested, which shows promise as a cleaning agent. However, in testing several BASF-chelate solutions we have identified two types of chelate solutions that show much improved cleaning over the standard method(s) and in a matter of two hours of boiling time. These chelates most likely can replace both the alkaline and acid boils, will be cost effective and save on downtime.

Evaporator Performance During Crop 2000-2001 at Cajun Sugar Factory

Walter Hauck

Cajun Sugar Cooperative, INC.
New Iberia, Louisiana

During the crop 2000-2001 we tried at Cajun Sugar Cooperative a scale inhibitor. We could extend our grinding between the clean outs from 50,000 TC to 110,000 TC. We also used products in the cleaning solutions. To our caustic soda of 25 Be we added 5% of soda ash together with an activator and a dispersant. We observed that the juice heaters after the crop were cleaner than before we started the crop. In our acid boiling we used 1.5% HCl together with 3% ammonium bifluoride % diluted muriatic acid. We also used a new inhibitor, which allows us to boil the acid for 1.5 hours. The total cleaning cycle was done in approximately 10 hours including a calandria test in 3 evaporators. The cleaning solutions we used helped us to obtain perfectly cleaned heating surfaces. In the original paper I will include more detailed facts and analysis from the scaling we could remove or not.

Mixed Juice Clarifier Distribution at Clewiston

Mike Damms and Carlos Bernhardt

United States Sugar Corporation
Clewiston Sugar Mill

For the 2000/2001 crushing season, it was necessary to install a new mixed juice flash tank at the Clewiston milling facility. Along with the flash tank installation, a new mixed juice distribution system, feeding the clarifiers, was also commissioned. The distribution system is fully automatic and has several novel features that enhance the operation.

This paper discusses the installation and its benefits as well as limitations after one season of operation. Overall the project was very successful and will lead the way to a reduction in the high retention times currently being experienced in the mixed juice clarifiers. Plans for the future are also listed.

Goats, Mice, and Dextran, the Road to a Monoclonal Antibody Test Kit

Don F. Day and D. Sarkar

Audubon Sugar Institute
LSU Agricultural Center
Baton Rouge, Louisiana

J. Rauh

Midland Research Laboratories, Inc.
Lenexa, Kansas

For several years we have been pursuing the development and commercialization of a rapid antibody-based kit for the quantitation of dextran in a diverse range of sugar streams. The report will detail the development process that finally resulted in the a rapid test for dextran.

Comparing the Effects of Sulphur Dioxide on Model Sucrose and Cane Juice Systems

L.S. Andrews and M.A. Godshall

Sugar Processing Research Institute, Inc.
1100 Robert E. Lee Blvd
New Orleans, LA

Sulphur dioxide (SO₂) has been used for centuries to minimize color in food processing and fruit and vegetable storage. In the sugar industry, sugar beet processors to reduce and prevent color formation in white refined sugar use it routinely. Sugarcane processors throughout the world use SO₂ to produce plantation white sugars. This study was undertaken to determine the effect of SO₂ on pure sucrose solutions in comparison to real factory sugarcane juice streams. Sugar systems included 15 brix pure sucrose, clarified juice and mixed juice from a Louisiana sugarcane mill. A pH of 8.0 was obtained by adding milk of lime then lowered to

approximately pH 5.0 with either SO₂ or HCl as the control. Several samples ranging from pH 5 to 8 were processed at 0-120 min at 85⁰ C. Analyses included pH, SO₂, color, calcium, and invert (as a measure of sucrose loss). Results indicated that the model system was much more sensitive to small levels of SO₂ than real juice samples. The pH levels dropped rapidly and invert levels increased with time. There was 1.6 % loss of sucrose in the SO₂ trial as compared with no sucrose loss with HCl. Clarified juice resisted changes in pH with both SO₂ and HCl. Sucrose loss at 120 min of processing and a pH of 5.0 was only 0.88 %. There was a maximum color reduction of 10-15 % in the SO₂ trial, whereas no color reduction or sucrose loss was observed in the HCl trial. The mixed juice was very resistant to pH changes, and a minimum pH of 6.0 was achieved with 4800 ppm SO₂. No sucrose loss was observed in either trial with mixed juice, and color reduction was the same in both the SO₂ and HCl trials. In real juice streams, SO₂ reduced color by 10-15 % more than clarification alone but also induced some sucrose loss (0.88%) after a lengthy time.

Advances in Technology of Boiler Treatment in Louisiana Sugarcane Mills

Brent Weber, Brian Cochran, and Brian Kitchen

ONDEO Nalco

During the 2000 crop, two new technologies were introduced to improve boiler water treatment and control at a number of Louisiana sugar cane mills. This paper discusses these technologies, their application and overall improvements documented at these mills. Also reviewed are possible opportunities to utilize these technologies to improve overall mill operations and efficiencies in the future.

The basis of these technologies is the adaptation of fluorescing bodies, detected via a fluorometer, and read as distinct wavelengths of light. These identifiable wavelengths of light are the core of our ability to control chemical feed and perform diagnostic control studies, which can dramatically improve the performance and reliability of mill steam generating equipment.

Technology #1 is the introduction of a new internal treatment program for steam generating equipment. It is the first new product for this purpose introduced by the industry in over 15 years. It incorporates the fluorescing technology described previously and has been successfully utilized by several Louisiana mills during the 2000 grind.

Technology #2 builds upon our knowledge of fluorescence by identifying the presence of sugar in return bodies such as pan and evaporative condensate. This is made possible by the detection of fluorescing bodies associated with the sucrose molecule. This technology was successfully evaluated during the 2000 grind at mills in both Florida and Louisiana for boiler, cooling water and once through waters.

Heat Transfer Devices

Nell Swift

Alfa Laval Inc.
5400 International Drive
Richmond, Virginia

In the past 2 decades, great advances have been made in the use of lower cost and more efficient heat transfer devices. In the presentation, we will look at how the sugarcane industry in the USA can best take advantage of this technology. We will examine the origins of the plate heat exchanger and the latest developments up to the present day where we have plate evaporators playing an ever-larger role in sugar processing. We will cover the 4 major areas in which plates can be beneficial, namely raw juice heaters, clarified juice heaters, evaporators, and molasses coolers.

Special attention will be paid to the installation and operation of plates with regard to the sugarcane process and its particular fouling issues. We will discuss key design points that should be taken into account before a plate heater or evaporator is installed and the importance of venting non condensable gases and maintaining minimum flows. All of these factors need to be taken into account by the plant engineer or designer when he/she is looking to use plate heat exchanger technology.