Energy Requirements for Shredding Cane and Grassy Biomass

B. Eiland and S. Clarke

Florida Crystals Corporation, P.O. Box 86, South Bay, FL 33493 USA

The impact of fiber content of cane varieties on the power requirements for cane preparation is generally understood and appreciated. Florida cane varieties are usually low in fiber (~10%) but one variety has significantly higher fiber (~12%) and this had an impact on milling operations. This prompted the evaluation of shredding energy requirements of different varieties of cane (and other grasses) using a pilot scale shredder and data logging the power required. Reproducible data for power requirements per unit weight of cane were obtained and these will be presented, along with data for potential grassy biomass crops. This technique could be useful for early evaluation of varieties, especially the higher fiber content materials proposed for energy production.

Bagasse Deterioration on Storage

C-H. Chung, D.F. Day, G. De Queiroz, and B. Stradi

Audubon Sugar Institute, Louisiana State University AgCenter
3845 Highway 75, St. Gabriel, LA 70776 USA

Hefty changes in natural gas prices have increased the fuel value of sugarcane bagasse in the sugar industry. Generally, bagasse is stored as a pile in the open at sugar mills. The bagasse deteriorates with time due to the composting action of microorganisms which decreases the amount of sugar present and combustibility of the material. This study quantifies the loss of the major components of bagasse stored in the open for one year with and without aeration. Changes in temperature, humidity and calorific value were monitored.

Integration of Plate Falling Film Technology into Multiple-Effect Evaporator Stations in the Cane Sugar Industry

J.R. Braasch and P. Toebe

GEA Ecoflex GmbH, Schifferstraße 20-22, 47059 Duisburg, Germany

Modern cane sugar factories have managed to increase profitability by increasing production and reducing production costs. Any thorough economical analysis nowadays should not only consider quantitative growth but also qualitative change as principal modification of any hardware. This paper deals with the integration of a proven, reliable

and sophisticated technology for the evaporation process, plate falling film evaporators which does provide technical aimed at optimizing steam consumption. Furthermore it also increases product yield by reducing sugar losses due to sucrose inversion.

Plate falling film evaporation technology has shown significant advantages in terms of shorter retention time, smaller effective temperature differences and higher overall heat transfer coefficients than conventional evaporator designs. Operation data from current references endorse the repute of a sugar process enhancing technology.

The possibility of retrofit existing, individual evaporator bodies within a multi-effect evaporator station with plate pack systems simplifies the urge of technological driven advancements by reducing the initial capital costs. References in distinguished destinations of cane sugar processing industries substantiate the effectiveness, efficiency and feasibility of this technology that conquered the beet sugar industry already and is ready to provide equivalent advantages to the cane sugar industry also.

Influence of Crystal Size Distribution on Sugar Mill Performance

V. Kochergin

Audubon Sugar Institute, Louisiana State University AgCenter,
3845 Highway 75, St. Gabriel, LA 70776 USA

The uniformity of sugar crystals throughout a sugar mill influences all areas of boiling house operation, such as seeding and graining operations, magma production for A and B sugar boiling, centrifuging and the storability of final raw sugar. Procedures for crystal size analysis are reviewed. It appears that particle size analyzers provide more accurate characterization of crystal population than optical methods, especially for very small particle range, such as seed slurries. Various seed preparation procedures will be discussed. Data on crystal size distribution at multiple stages of graining and C sugar boiling will be presented. Effect of particle size distribution on the color of product raw sugar will be illustrated.

Scale in the Sugar Industry

M. McKee, M.A. Godshall, R. Triche, and C. Richard

Sugar Processing Research Institute, Inc., Southern Region Research Center,
1100 Robert E. Lee Blvd., New Orleans, LA 70124 USA

Two types of scale plague the sugar industry world wide. Scale is responsible for lowering heat transfer coefficients, causing decay in evaporators and heaters, and ultimately increasing the time and money costs of raw sugar manufacture. In this paper

we will examine several scale samples from both juice heaters and evaporators focusing on the physical and chemical properties of each scale type.

Iron as a Decolorizer for Raw Cane Juice

L.R. Madsen II and D.F. Day

Audubon Sugar Institute, Louisiana State University AgCenter,
3845 Highway 75, St. Gabriel, LA 70776 USA

A double clarification process for raw cane juice was developed. At bench scale, up to 70% of colorant materials can be removed from juice using this method. This clarification mechanism requires that four components; protein, phenolic compounds, carboxylic acid salts, and iron be present.

The process involves the treatment of juice with iron and a cationic flocculent (cationic polyamine, 10-15 mg/L, active ingredient) at ambient temperature. The floc formed is allowed to settle. The juice is then decanted and cold-limed (hot-liming led to a rapid increase in both residual iron and color).

Decolorization increases with increasing iron concentration but, the settling rates decrease. Iron dosing at 150-200 mg/L gave a reasonable compromise between decolorization (50% removal) and settling rate. The method was reproducible for mixed juices acquired from three Louisiana mills and the dose-response was consistent from batch-to-batch.

The process was pilot-tested at Raceland Raw Sugar Corp. during the 2007 season using a 40 gallon clarifier, operated both batch and continuously (~ 2 gpm). The process scaled well, yielding results similar to those observed at bench scale.

Production and Storage of High Quality Raw Sugar

V. Kochergin and M. Saska

Audubon Sugar Institute, Louisiana State University AgCenter,
3845 Highway 75, St. Gabriel, LA 70776 USA

Existing contracts do not provide strong incentives for raw sugar producers to manufacture very high pol (VHP) or very low color (VLC) sugar. Increased energy cost and potential competition with imported sugars for domestic refinery markets drive the quality requirements for US raw sugar producers. Relatively long storage periods (from 6 to 10 months) are specific for both Louisiana and Florida industries. It is not uncommon to observe color increase up to 200-300 %, especially towards the end of storage. To investigate the effects of sugar storage on color, purity and other parameters of VHP sugar large scale tests were initiated. Experimental sugar piles were monitored in two

sugar mills with different crystallization sequences (conventional and double magma). To gain more understanding of the fundamentals of changes due to storage and to obtain fast response to alternative ways of sugar treatments, a laboratory accelerated aging procedure has been devised. The results will be discussed along with the proposed treatment procedures that are expected to improve storage by changing its pH.

Two aspects of production of VLC / VHP sugar that do not require substantial capital expenditures on the part of the raw sugar mills are briefly discussed, that is increased washing of the sugar in the centrifugals, and the effects of particle size distribution in massecuite on whole sugar color.

Microwave Measuring Technology for the Sugar Industry

U. Klute[1] and D. Dykes[2]

[1]Berthold Technologies Gmbh & Co KG, Bad Wildbad, Germany
[2]Berthold Technologies, USA, LLC, Oak Ridge, TN USA

Nowadays the dry substance of sugar syrup and massecuite is measured online using the most advanced microwave measuring technology. The correlations for water content and dry substance allow for accurate control of concentration, Brix content and density in all areas of sugar production. This permits a continuous measurement during the complete crystallization process, both in the solution and the magma phase. This report explains the measuring effect and signal analysis of microwave measurement systems and illustrates the user benefits, resulting in very good process control. Solutions are proposed for typical application problems such as incrustation, abrasion, purity dependencies and the recognition of breaks between crystallization processes using the Micro-Polar Brix measurement system. Results acquired with different sensors in various processes and applications are presented. Besides the accurate and reliable measurement of all products from sugar beet or sugarcane, a high value is placed on simplicity, low maintenance and easy calibration to ensure optimized process control and cost. The automatic calibration feature, which requires no additional PC, is demonstrated.

New Insights on Hard-to-Boil Massecuites in the Sugarcane Industry

A. Antoine and G. Eggleston

USDA-ARS-SRRC, 1100 Robert E. Lee Blvd., New Orleans, LA 70124 USA

Hard-to-boil (HTB) massecuites with markedly lower heat transfer coefficients are a sporadic but continuing problem in U.S. sugarcane factories. It has been observed that after delivery of severely deteriorated sugarcane and trash (brown and green leaves) to the factory that unwanted HTB massecuites sometimes occur, but the specific cause of

this phenomenon is still unknown. At the end of the 2006 processing season HTB and normal massecuites were collected and analyzed from U.S. factories. New insights have been gained by using sophisticated techniques, including oscillatory deformation rheology.

Final Recommendations for the Improved Application of α-Amylase in Raw Sugar Manufacture

G. Eggleston[1], A. Antoine[1], B. Montes[2], and D. Stewart[2]

[1]USDA-ARS-SRRC, 1100 Robert E. Lee Blvd., New Orleans, LA 70124 USA
[2]Alma Plantation LLC, Lakeland, LA 70752 USA

In recent years there have been warnings by some U.S. refineries that there may be a penalty for high starch concentrations in raw sugar if starch control is not improved. Most commercial α-amylases used by the U.S. sugar industry to control starch have intermediate temperature (IT) stability (up to 185 ^{o}F with an optimum ~158 ^{o}F) and are produced from *Bacillus subtilis*. Amylases have been typically applied to the last evaporators of U.S. factories where starch is solubilized, syrup temperatures are ~140-149 ^{o}F, and ~18 min retention time (R_t) is available. As IT stable amylases from *Bacillus subtilis* are effective up to 185 ^{o}F they could be more effective and economical if applied to next-to-the-last evaporators where syrup temperatures are ~170 ^{o}F and more R_t would be available for the amylase to break down starch. Large factory trials conducted in 2006 and 2007 at a LA factory have now conclusively shown that adding a working solution (diluted 3-fold in tap water at the factory) of high activity amylase (*B. subtilis*) to the next-to-the-last evaporator gives greater total starch breakdown (up to 74% at a 5 ppm dosage) than adding it to the last evaporator alone (up to 56% at a 5 ppm dosage). Also, it is more difficult to break down starch with amylase at the factory when starch levels are low, i.e., ≤1000 ppm/Brix, because of lower contact between the starch and amylase. Therefore, it is recommended that amylase dosage is not decreased when starch levels entering the factory are lower. However, lower starch levels may not be causing any processing problems and factory staff have to decide whether to discontinue amylase addition altogether to save costs.