PRESENTATION ABSTRACTS – JUNE 2017

How Material Selection Contributes to the Fulfilment of Production Requirements

I. Geyer [1] and H.-J. Schmidt [2]

[1] BMA Braunschweigische Maschinenbauanstalt AG, 38122 Braunschweig, Germany
[2] BMA America Inc., Greeley, CO 80631

For many years, the materials used for sugar production equipment have been selected on the basis of criteria such as material strength, corrosion resistance, availability and current prices. Today, additional requirements have to be considered, which are defined by the location at which the equipment is to be installed. Examples would be food safety (hygiene), operational reliability and maintainability.

Even a few decades ago, mild steel was the standard material choice for the production of white sugar based on sugar beet. Since then, the demands of this industry have shifted to equipment made from stainless steel, either completely or at least in sections that are in contact with the product. Nowadays, these requirements may even have to be accounted for in cane sugar production. To meet product quality specifications, stainless steel is therefore now included as a standard option in offers for vacuum pans and centrifugals.

Some examples are given to explain the selection of materials made in view of modern requirements. These include compliance with hygienic standards, such as the use of inert materials, non-breakability, low surface roughness, cleanability, low abrasion, detectability, and resistance, but also a long service life and ease of maintenance.

The Increasing Role of Automation in the Production of Raw Sugar

J.P. Camel

MA Patout and Sons Enterprise Facility
Jeanerette LA, 70394

The Enterprise sugar mill in Jeanerette has been automating and consolidating their process control system. This has facilitated the steady expansion of the plant without increases in labor or maintenance costs throughout the process. With annual expansion, the down time attributed to the Controls and Instrumentation Department has decreased while the overall production of the plant has increased. The mill originated with all hand power and moved up as automation

technology improved; through pneumatic controls to wizard boxes, then stand-alone controllers and finally the current setup, a mixture of PLC's and Hybrid controllers.

This philosophy has been chosen for two main purposes. The first is reliability; through consolidation Patout has reduced the number of potential failure points while simultaneously physically keeping them close together to reduce troubleshooting time. The second is cost; these PLC and Hybrid controllers have a cheaper per loop cost while also having a higher potential I/O capacity. On top of these two considerations the capability of programing in these controller softwares exceeds that which is possible in a stand-alone controller. While there are certain drawbacks to furthering automation the benefits far outweigh them and will continue to provide returns far into the future.

First Year in Operating a Mechanical Detrasher System at a Sugarcane Factory in Louisiana

G. Eggleston,[1*] C. Schudmak,[2] H. Birkett,[3] H. Waguespack, Jr.,[4] I. Lima [1] J. Gay,[5] A. Landry,[6] J. Stein,[3] E. St. Cyr,[1] A. Finger,[4] and R. Hulett[7]

[1]USDA-ARS-SRRC, New Orleans, LA 70124
[2]Cora Texas Manufacturing Co., White Castle, LA 70788; [3]Audubon Sugar Institute, LSU, St. Gabriel, LA 70776; [4]American Sugar Cane League, Thibodaux, LA 70301; [5]St. Louis Planting Inc., Plaquemine, LA 70764; [6]Alton Landry, Inc., Plaquemine, LA 70764
[7]American Biocarbon, White Castle, LA 70788
Corresponding author: gillian.eggleston@ars.usda.gov

Over the past 2 years, a new prototype mechanical detrasher system was built at a Louisiana sugarcane factory by American Biocarbon LLC. It was built to remove sugarcane trash (top stalks and leaves) before processing, and for the manufacture and sale of value-added-products from the removed trash, such as biochar. The first commissioning year of operation was in 2016, specifically from November until the end of the Louisiana grinding season. A large factory study was initiated in 2016 to (i) provide crucial knowledge on how efficient the detrasher system is at removing trash at the factory and (ii) evaluate the effect of the detrasher system on factory operations. Three trials were undertaken on Nov 9, Nov 18 and Dec 15 with the detrasher system off and on for comparison. Combine-harvested cane from one variety HoCP 96-540 was supplied for the studies, with enough to purge the factory's tandem mill of other cane and to process the selected cane for a total of ~30 min. Trash tissues (green leaves, brown leaves, top stalk or growing point region, soil and roots) and billet stalks were collected and analyzed, as well as prepared cane, bagasse, and mixed juice samples. At only 50-60 capacity, the detrasher was able to remove all different trash tissue types and up to 53% total trash. Furthermore, the detrasher system reduced the variation in trash values entering the factory which is important for engineering control. For every 1% decrease in trash there was a 3.4 to 4.0 tons/hr increase which translated into approximately 1 day less in grinding for every 1% decrease in total trash with associated dramatic savings in costs. The detrasher, generally, caused an improvement in most quality parameters in mixed juice but these were not always clear as the detrasher system only worked at ~60% capacity. More trials will be undertaken in 2017 to further evaluate the detrasher system at improved

capacity (up to 100%) across the whole grinding season, with different sugarcane varieties, and under different environmental conditions. Loose versus attached trash will also be examined, and the fuel values of the bagasse produced.

Old Sugar Mill Drives: Overhaul or Replacement by Planetary Gearbox?

M. Loewen and T. Youngblood

SEW-EORODRIVE, 148 Finch Road, Wellford, SC 29385
Corresponding author: mloewen@seweurodrive.com

The trend in refurbishing sugar cane grinding mills is beginning to shift from replacing and/or repairing the extremely large parallel shaft unit with like for like, to replacing them with more modern planetary gear reducers. These new reducers may be utilized between the smaller steam turbine driven parallel shaft units and the mill shafts, replacing the entire system with a large planetary gear unit or a planetary gear motor on each roll as a "booster gear unit. The technical aspects of overhauling old existing reducers and upgrading existing sugar mills will be discussed. The main technical aspects presented are:

- Planetary gearing technology compared with helical gearing design
- Design parameters and low speed shaft geometry
- Space and weight limitations
- Low speed couplings
- Foundation requirements
- Future upgrades from steam turbines to electrical motors

Chainless Diffusers, Mud Recycling and Press Water Clarification

Neil Du Plessis and Bruce Moore

Bosch Projects, 1 Holwood Park, 5 Canegate Rd, La Lucia Ridge Office Estate, PO Box 2009, Durban 4000, KZN, South Africa.

Many cane sugar industries have already converted from milling to diffuser extraction (the South African industry now has 17 diffusers and only two milling tandems). There are strong reasons for this change, including energy savings, capital, operational and maintenance cost savings. The introduction of a novel chainless diffuser has further enhanced the benefits. In this diffuser, the prepared cane is transported along by means of a "walking floor" that is operated by simple hydraulic cylinders. It has no chains and no gears. Because of its construction with no returning conveying equipment, it does not require the wide bridging structure of other diffusers. Single diffusers of this type are available to process more than 25 000 metric tons of cane per day at high extractions. Even greater benefits can be derived by recycling the clarifier mud to the diffuser. This virtually eliminates the filter loss, eliminates the high degradation losses that

typically occur in the filter station, avoids dilution by the filter wash water, saves the mud conditioning bagacillo for additional fuel (usually 2-5% additional fuel) and eliminates the entire filter station and filter cake disposal plant.

New Information on How to Reduce Sucrose Loss by Managing Microbial Contamination and in Louisiana Sugar Factories

Stephanie Boone, G. Eggleston[1], Belisario Montes, Luis Edgardo Mancias, John Sanders, Sam Ihli, Eldwin St. cyr[1], Larry Boihem and Maureen Wright[1]

[1]USDA-ARS-SRRC, New Orleans, LA 70124

Favorable conditions in temperature, juice pH, water activity, sugar and nutrient content promote microbial growth, resulting in sugar loss. Post-harvest sugar loss presents significant problems and causes profit loss for the sugar processor, refinery and grower. The majority of sugar destruction in sugarcane occurs shortly after harvest during storage in truck loads and in mill yards. Raw sugarcane factories apply biocides to last expressed juice, and during mill sanitation to reduce sucrose loss caused by microbial contamination. This presentation will focus on reducing sucrose loss by using effective biocides (Potassium Permanganate (Carusol™) and Hydrogen Peroxide), and managing biocide or enzyme application during factory processing.

Ammonium in Juice, Syrup and Sugar

Franz Ehrenhauser and Cy Gaudet

Audubon Sugar Institute, LSU AgCenter, St. Gabriel, LA 70776

Ammonium is an omnipresent impurity in sugar cane juice, syrup and sugar and can challenge processing. Unusual ammonia levels during the 2015 crop prompted the collection of mixed juice, clarified juice, syrup and sugar samples during the 2016 season in order to establish a baseline for a normal ammonium level. Samples from all eleven raw sugar mills in Louisiana were analyzed for their cations (sodium, ammonium, potassium, calcium and magnesium) via ion chromatography. Raw juice and syrup experienced a fairly constant level of 20-40 ppm/°Bx, whereas clarified juice experiences the highest level of up to 150 ppm/°Bx.

Clarifier Design and Operation

Maria del Carmen Perez

CBTR Clarifiers Corporation, Fort Lauderdale, FL 33323

The sugar cane juice clarification is an important operation on sugar production process. This is a complex system, with many chemical reactions involved, which are influenced by many factors. And where important variables and peripheral operations are implicated. The clarifier design and its operation between them. The clarifier should be understood as a technology, not as an individual equipment and customized for each sugar mill.

Lamella Clarifiers – Principle and Applications in the Sugar Industry

P. Rein, M. Getaz, S. Rosettenstein, and N. Du Plessis

Bosch Projects, Durban 4000, KZN, South Africa

Clarification of liquid flows is required at various stages of the sugar manufacturing process. In mixed juice, solids are separated by settling out of solids in multi-tray “subsiders” or in smaller “short retention clarifiers”. In higher density raw factory syrup or refinery liquors, air injection is used to float off the solids from the liquid surface. The equipment normally used for these functions is large and costly, with significant retention times during which sucrose degradation can occur.

Lamella clarification, which is well established technology in water clarification plants, has recently been adapted to meet the more challenging demands presented by the sugar factory flows. The equipment is compact and reduces retention times to well below half that of the conventional plant. Results are quoted that demonstrate the effectiveness of the equipment in these sugar processes. Other potential sugar factory applications for lamella clarifiers are discussed.

Effect of Feed Source and Pyrolysis Conditions on Sugarcane Bagasse Biochar

Amir Hass[1] and Isabel M. Lima[2]

[1]Agricultural and Environmental Research Station, Gus R. Douglass Land-Grant Institute, West Virginia State University, Institute, WV 25112; [2]USDA ARS SRRC, New Orleans LA 70124

Processing of sugarcane in sugar mills yield ca. 30% bagasse, a fibrous waste material composed mostly of crushed cane stalks. While 80-90% of the bagasse is used on site as fuel, the remaining portion can be converted into a value-added product. One such option is thermal conversion of bagasse into biochar, a solid, stable, carbon-rich product. Fresh and field-aged sugarcane bagasse and detrasher output material (leafy residues) were used in a slow-pyrolysis system to produce biochar. The effect of feed source material and pyrolysis conditions (peak-temperature [350 – 800 ^{0}C], steam activation [at 800 ^{0}C]) on biochar properties and efficiency as sorbent for heavy metals were determined. Biochar properties were feedstock and pyrolysis conditions dependent. Biochar of fresh bagasse had the highest fixed carbon and surface area, while detrasher and field-aged bagasse biochars had the highest ash content. While the field aged bagasse biochars showed the highest affinity and capacity for metal sorption, the biochars showed limited ability to remove Cu, Cd, and Pb from water. Detrasher output material and resulting biochars had the highest nitrogen content compare to the other feed sources and biochars.

Boiling Schemes for Very High Pol (VHP) Sugar from High Purity Syrups

Harold S. Birkett

Audubon Sugar Institute, St. Gabriel, Louisiana 70776
Email: hbirkett@agcenter.lsu.edu

Most Louisiana factories are currently using the double magma sugar boiling system to produce very high pol (VHP) sugar. Louisiana syrup purities have been increasing over the years and are currently in the 88-89 purity range. This combination makes achieving low purity final molasses challenging. Boiling scheme modifications to improve final molasses exhaustion are discussed.

The Use of On-line Video Based Colorimeter to Optimize the Process: A Case Study

Catherine Bouché

ITECA SOCADEI, 445 Rue Denis Papin, 13592 Aix-en-Provence, France

The priority for any factory operation is to produce sugar that meets its customer's specification while minimizing the financial impact of such compliance. To ensure low color sugar, the default position tends to be to over wash it, thus leading to substantial water volume and energy consumptions, with a high amount of remelted sugar which should instead be reduced.
The paper describes the installation of two online ITECA color camera systems at ERAWAN factory in Thailand and presents the experience feedback over a one year period. The equipments are installed above two vibrators conveyors and measure wet white sugar discharged from every batch of two sets of four centrifugals. The HD cameras send images and videos to a computer in control room that processes the images in real time. Based on the correlation with the laboratory measurements, ITECA software calculates the sugar color in ICUMSA units. The on-line measurement is used to optimize the individual centrifugal washing time and keep track of the

different massecuite qualities. The software automatically detects any non-conformity and trigger alarms to avoid contaminating the drier with out of spec products.
The paper shows how the factory rapidly and significantly stabilized the final sugar color production around the color set point of 30 IU. It also shows that a close monitoring of the sugar color brings a considerable improvement of the global operation efficiency, especially when comparing the on-line measurement to conventional laboratory sampling methods.

C-Sugar Crystal Size in Louisiana

Franz Ehrenhauser, Cy Gaudet, Iryna Tishechkina, Daira Aragon

Audubon Sugar Institute, LSU AgCenter, St. Gabriel, LA 70776

C-sugars have been continuously collected over the past three seasons in Louisiana from every raw sugar factory and were analyzed for their crystal size and distribution. An overview of the measurements is given and the potential impact on sugar recovery is discussed.

Continuous crystallisation of A and C product

A. Lehnberger, D. Laue and R. Hempelmann

BMA Braunschweigische Maschinenbauanstalt AG, 38122 Braunschweig, Germany

Changing market conditions are forcing cane sugar factories to find ways of improving the quality of the produced sugar and increasing the sugar output. Numerous process details from crystallisation, which are commonly applied in beet sugar factories, but not yet considered to be state of the art in the cane sugar industry, have in recent years been implemented in cane sugar factories. Continuous crystallisation of bold A sugar in a vertical continuous pan (VKT) was verified while working at very low temperature differences. Process automation together with far-sighted operation of the process produces A massecuite of a consistent quality. The use of 4th vapour for continuous crystallisation of a product contributes significantly to steam savings in the sugar production process. The yield improvement obtained by continuous cooling crystallisation of C product directly depends on the outlet temperature reached. The oscillating vertical cooling crystalliser (OVC) system achieves low molasses purities thanks to a final temperature of 40°C and the low percentage of fine crystals.

Quality Determination of Sugar inside Continuous Centrifugals

Tim Diringer, Bjarne Christian Nielsen, Neltec Denmark A/S

Vestergade 35, 6500 Vojens, Denmark, mail@neltec.dk

The performance of continuous sugar centrifugals and the quality of the delivered sugar is dependent on the massecuite quality, the steam addition and the water addition.
Until recently the impact of the combination of the above-mentioned parameters on the sugar quality in continuous centrifugals was not fully known. Usually the centrifugals are trimmed by the trial and error method. An inline colour measurement instrument has been developed and installed on top of continuous centrifugals, allowing real-time monitoring of the changes of the sugar colour inside the centrifugals. While monitoring the sugar quality online, it was observed that the sugar colour inside the centrifugals varies rapidly and with larger variations than expected. By optimizing the water addition, the centrifugals were trimmed to produce a more uniform sugar quality. The results showed that online monitoring of the sugar colour inside continuous centrifugals, will give the factories the possibility, to reach the required sugar colour with less sugar loss to molasses.

Evaporators for Large First and Second Effects

Bruce Moore, R. Ramaru, and S Rosettenstein

Bosch Projects, 1 Holwood Park, 5 Canegate Rd, La Lucia Ridge Office Estate, PO Box 2009, Durban 4000, KZN, South Africa.

Increasing factory sizes, higher imbibition rates, the need for energy efficiency and the development of continuous pans that can operate on low pressure vapour have all created a demand for large first and second evaporator effects – often with heating surfaces of 6,000 m2 to 20,000 m2 per effect. Potential solutions for providing this capacity are compared. The traditional solution has been to use multiple and large Robert type (short tube climbing film) vessels, but it has been shown that the long juice retention times in these at high temperatures results in large “unseen” sucrose losses by inversion. Recent reports are quoted that indicate losses as high as 1.5% of sugar production or more. Plate evaporators are not recommended for cane juice applications due to their propensity for serious, sometimes uncleanable, fouling. Falling film tubular evaporators have short retention times, but require additional pumping and careful control. They often have juice distribution problems. The recommended option is a novel long tube climbing film evaporator that reduces these losses by 80% to 90% and is as simple to operate as a Robert vessel. The design is an adaptation of the Kestner type. It has numerous other advantages and features, including the option to incorporate direct contact clear juice heating within the body of the vessel.

CVPs for good quality sugar, low energy and high availability

Bruce Moore and Neil Du Plessis

Bosch Projects, 1 Holwood Park, 5 Canegate Rd, La Lucia Ridge Office Estate, PO Box 2009, Durban 4000, KZN, South Africa.

Most of the advantages of continuous vacuum pans (CVPs) over batch pans are obvious and widely recognised: energy savings from continuous operation and use of low grade steam, simplicity of operation and control, small space requirements. However, some other significant benefits are not widely recognised and do not apply to all types of CVPs. Three of the most important of these are discussed in this paper:

- Sugar quality – the great importance of crystal size uniformity is explained, factors influencing this parameter are analysed and means to achieve uniformity are detailed

- Energy efficiency, including minimising reboiling

- Time availability – techniques and equipment to minimise time off line for cleaning in traditional CVPs are explained and a novel development that effectively eliminates lost production for cleaning is described.

FINAL MOLASSES EXHAUSTION BASED ON EXPERIMENTAL RESULTS AND SUGARS™ MODELING SOFTWARE.

Fikadu Beyene[1], Mike Comb[1], Antonio Avila[1] and Stuart L. Goudeau[2]

[1]LASUCA (Louisiana Sugar Cane Cooperative Inc.), St. Martinville, LA
[2]ASI (Audubon Sugar Institute), St. Gabriel, LA
*Email:fbeyene@lasuca.com

ABSTRACT

The main goals of a “raw” sugarcane factory are to have an efficient, profitable operation with required sugar quality and maximum sugar recovery. Based on Louisiana sugar mills’ manufacturing report, the loss of sugar in final molasses accounts for 35% - 52% (or on average 47%) of the total sugar losses. The loss of sugar in molasses is generally the largest loss suffered by sugar mills worldwide.

Based on Louisiana sugar mills 2016 crop year data, topics to be discussed include: A) the financial impact for rising of final molasses purity based on different syrup purities, B) examples of back boiling based on Sugars™ and Cobenze diagram for lowering final molasses purity and C) along with factory and experimental results, how cooling C-Massecuite is very important for exhaustion to the maximum viscosity handled by the crystallizers driving units.

The most important thing is to boil C-massecuite keeping the super saturation zone in between 1.0 to 1.25 at constant vacuum, because 75% exhaustion is done in the pan. As will be shown, the magma purity can be processed as low as 80 without any difficulty if the C-massecuite ranges from 49-52. To do this, the boiling scheme should be double magma. Double magma is the only way to lower B-molasses below 50 purity or around 50 purity without affecting sugar quality.

Potential Sugar Recovery by De-Ashing Molasses Streams

Daira Aragon and Franz Ehrenhauser

Audubon Sugar Institute, LSU AgCenter, 3845 Highway 75, St. Gabriel, LA

Ash is present in the sugar cane plant and in the soil picked up during harvesting. Some of these components, specially potassium, calcium, magnesium and sodium, are not removed during clarification and remain in the juice, where levels range between 2.5 and 4.5 %Brix. This ash not only causes scaling in the heaters and evaporators but also increases the target purity of final molasses, translating in less sugar recovery. This paper evaluates whether reducing ash in the boiling house makes a significant impact on sugar recovery and, if so, which molasses stream (A, B or double purge) should be de-ashed for each boiling scheme. Results show that removing 10% of ash recovers between 7,000 and 11,000 lb of sugar per day, representing a value close to $200,000 per season (raw sugar priced at $0.20 per pound). Higher recoveries are obtained by de-ashing A molasses in double magma, B molasses in three-boiling+double purge, and B molasses from three-boiling scheme. Other advantages of de-ashing molasses include an increase in C-pan capacity and a decrease of final molasses production.

Stopping Maillard Reaction in Molasses Storage Tank

Fikadu Beyene and Antonio Avila

Louisiana Sugar Cane Cooperative Inc. (LASUCA)
*Email:fbeyene@lasuca.com

The Maillard reaction was observed in a 2 million gallon capacity molasses storage tank at Louisiana Sugar Cane Cooperative Inc (LASUCA) near the end of the 2016 crushing season. The remedial action taken is detailed and successfully stopped the reaction before catastrophic damage could occur. Future solutions to prevent it from happening again are provided.

POSTER PRESENTATIONS

Development of an Industrial Method to Measure Total, Soluble, and Insoluble Starch in Sugarcane Products

Marsha R. Cole[1*] and Gillian Eggleston[1]

[*,1]USDA-ARS Southern Regional Research Center, 1100 Robert E. Lee Boulevard, New Orleans, LA, 70124, USA; marsha.cole@ars.usda.gov; +1 (504) 286-4437

An easy and inexpensive method was developed to measure total, soluble, and insoluble starch in products at the factory and refinery, using microwave-assisted neutralization chemistry. The method was optimized using the previously developed USDA Starch Research method as a reference. Optimal acid and base combinations and concentrations plus microwave time and power were determined to solubilize an insoluble corn starch reference. The final method solubilizes <4,000 ppm insoluble starch in 2 min, has acceptable precision (7% CV, coefficient of variation), accuracy (≥94%), uses a corn starch reference, and incorporates a color blank to remove contribution from natural colorants found in industrial samples. This method was validated using simulated (5%) and factory samples and found applicable to sugarcane crusher juice (8% CV), clarified juice (12% CV), massecuite (2% CV), molasses (4% CV), syrup (2% CV), and raw sugar (8% CV) with 98.4% satisfactory performance z-scores. Total starch values obtained with this method were significantly higher than those measured using other methods presently used by the global sugar industry. The USDA Starch Factory and Research methods were very similar with an overall mean difference of ~6-9%, depending on the sugar product analyzed.

Clarification of Energy Cane Juices

Franz Ehrenhauser[1], Peter Gaston[1], Stephanie Linares[1], Cy Gaudet[1], Everton Barreto[2], Michael Pontiff[2], Collins Kimbeng[2]

[1] Audubon Sugar Institute, LSU AgCenter, St. Gabriel, LA
[2] Sugar Research Station, LSU AgCenter, St. Gabriel, LA

With the current world-wide trend towards a transformation of the sugar industry to a sustainable energy, food, feed and chemical industry, energy cane as a high fiber crop is an interesting alternative to regular sugar cane. Some select (highest sugar/highest fiber) breeding candidates of energy cane were milled and the raw juice clarified in a small continuous clarifier. Performance of the clarifier, as well as juice and syrup quality obtained from energy cane juice compared to a commercial variety (L01-299) are presented and discussed.