

**Sugar Industry
Technologists, Inc.
2022
Daily Program**



**Eighty First Annual
Technical Meeting
Orlando,
Florida, U.S.A.**

**PURPOSE OF
SUGAR INDUSTRY TECHNOLOGISTS,
INC.**

Sugar Industry Technologists, Inc. was established in 1941 to serve the professional interests of its members by providing a forum for the exchange of scientific information and other technical aspects of sugar refining, by encouraging original research in sugar technology, by promoting broader acquaintance among its members, and by cooperating with other engineering, technical and scientific societies.

We are indebted to the several Committees and their Chairmen whose collective participation contributed greatly to the development of this Annual Meeting.

**SUGAR INDUSTRY TECHNOLOGISTS,
INC.**

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Monday, April 18, 2022

- 8:00 am - 5:00 pm Registration – Convention Level
Windsong Prefunction 9-12
- 8:00 am – 10:00 pm Exhibitors Presentation – Convention Level
Windsong Prefunction 9-12
- 8:45 am - 4:00 pm Spousal/Guest Program – On their own

FIRST TECHNICAL SESSION

Convention Level – Windsong 9-12

Michael Burchell- Presiding
ASR Group – C&H Sugar Company

- 8:30 am Address of Welcome: John Kerr, President
Sugar Industry Technologists
- 8:40 am #1220 – “Implementing Process Simulation
Technology to Optimize Sugar Refinery
Vacuum Pan Boiling Sequences”, Eleanor
McFeaters & Camille Smith – Louisiana
Sugar Refining, LLC , Stephania Imbachi-
Ordonez & Dr. Gillian Eggleston, Audubon
Sugar Institute
- :
- 9:10 am #1221 – “Differences in Commercial Filter
Aids Used for Polarimetry Measurements of
Cane Products Including Sugars”, Maria del
Carmen Perez, Gillian Eggleston, Stephania
Imbachi-Ordonez, Peter Gaston, Alexa
Triplet, Chardcie Verret, Greg Brown -
Audubon Sugar Institute
- 9:40 am #1222 –” Advanced mixing, optimizing
Batch pan efficiency”, C. Castro and R.
Acosta - MCI Ingenieria y Aplicaciones
S.A. de C.V.
- 10:10 am Coffee Service – Poster viewing, Windsong
Prefunction 9-12
- 10:40 am #1223– “Digitalisation in sugar production
– from vision to reality. Chances of
integrated thinking”, Bernd Langhans,
Siemens AG
- 11:10 am #1224 – “Use of Highly Efficient 2-Stage
Adsorbent Treatment with Re-Use Allows
The Elimination of Clarification by
Phosphation at la Union Refinery in
Guatemala”, Mario Canales, Idalberto
Delgado, Francisco González, Roberto
Medina. Graver Technologies LLC.
Glasgow, DE, USA & Maynor Cupertino
Mejías, Juan Pedro Quiñones - Ingenio La
Union, Escuintla, Guatemala
- 11:40 am #1225 – “Duplicity, hypocrisy, resorting to
WTO”, Arvind Chudasama – International
Sugar Journal.
- 12:10 pm Lunch at Four Flamingos Restaurant

SECOND TECHNICAL SESSION

Convention Level – Windsong 9-12

Janet Harriman - Presiding
United Sugars Corporation

- 2:00 pm #1226 - “Technical and practical look for waste heat and powdered activated carbon recovery from GAC regeneration kiln flue gas used in a sugar factory”, Nour Tharwat, Savola Sugar
- 2:30 pm #1227 – “Energy efficiency concepts in sugar house operation – what is old, what is new?”, Hempelmann, Reinhold; Laue, Deike; BMA AG
- 3:00 pm #1228 – “Optimizing sugar plants with direct-excited screening machines”, Camille Smith – LSR, LLC & Dominik Stappert - RHEWUM America Inc.
- 3:30 pm Coffee Service – Poster viewing, Windsong Prefunction 9-12.
- 4:00 pm #1229 - SYMPOSIUM A
- “Industry 4.0 – What does this mean to different Refineries”
- Chairman and Moderator: John Kerr
ASR Group – Tate & Lyle Sugars
- Panelists:
Bernd Langhans, Siemens AG
Kristin Odörfer, BMA AG
Danish Mansoor, ASG Group-Baltimore Refinery

Tuesday, April 19, 2022

- 8:00 am - 5:00 pm Registration – Convention Level
Windsong Prefunction 9-12
- 8:00 am – 4:30 pm Exhibitors Presentation – Convention Level
Windsong Prefunction 9-12
- 8:45 am - 4:00 pm Spousal/Guest Program – On their own

THIRD TECHNICAL SESSION

Convention Level – Windsong 9-12

Thomas Rathke- Presiding
Imperial Sugar Co

- 8:30 am #1230 – Keynote Speaker: Dr. Courtney Gaine, President and CEO, Sugar Association, Washington, D.C
- 9:15 am #1231 – “Sugar beet leaves as a source of functional protein”, Olaf Van Baal – Cosun Beet Company.
- 9:45 am #1232 – “Microbiome and nutrient quality of sugarcane mill/press mud as bio-fertilizer and bio-stimulant”. Sophie Minori Uchimiya – USDA - ARS, Southern Regional Research Center
- 10:15 am Coffee Service – Poster viewing, Windsong Prefunction 9-12
- 10:45 am #1233 – “Use of Adsorbents to Improve the Phosphatation Process, Increase Yields, and Reduce Cost per Ton of Refined Sugar Produced - Commercial Results”, Jerry Lengen, Idalberto Delgado, Francisco Gonzalez, Mario Canales & Roberto Medina - Graver Technologies
- 11:15 am #1234 – ” The Fractal Pack: New Equipment for Ion Exchange. Operations in the Sugar Industry”, Steve D. Peacock & V. Kochergin - Amalgamated Research LLC
- 11:45 pm Annual General Meeting of the Corporation of Sugar Industry Technologists, Inc., Election of Board of Directors.
- 12:05 pm New Board of Directors Meeting
- 12:15 pm Lunch – On your Own

FOURTH TECHNICAL SESSION

Convention Level – Windsong 9-12

John Kerr – Presiding
ASR-Group – Tate & Lyle Sugars

- 2:00 pm #1235 – “Natural, Nutritious, and Functional Unrefined Sweeteners from Sugarcane That Meet New Consumer Demands”, Gillian Eggleston, Giovanna Aita, & Alexa Triplett - Audubon Sugar Institute,
- 2:30pm #1236 - “Automated Factory Exception Reporting Using Sugars™ Mass and Energy Balance Software”, Scott M. Kahre - Sugars International LLC
- 3:00 pm #1237– “The new Putsch® MFP filter press series for large refineries: results on direct filtration duty at Al Khaleej refinery in Dubai”, Martin Herrmann, Putsch GmbH & Co. KG
- 3:30 pm Coffee Service – Poster viewing, Windsong Prefunction 9-12.
- 4:00 pm #1238 - SYMPOSIUM B
- “Value-Adding Analysis: What is best practice now.... and what is going to be in the future”
- Chairman and Moderator:
John Kerr, ASR-Group – Tate & Lyle Sugars.
- Panelists:
Bjarne Nielsen, Neltec
Tod Canty, Jr., J.M. Canty
Shannon Conrad, Bruker Optics, Applied Spectroscopy Division
- 5:00 pm Invitation to New Orleans
- 5:10 pm President’s Closing Remarks
- 7:00 pm Reception. Convention Level
Windsong Prefunction 9-12
- 8:00 pm Awards Banquet. Convention Level
Windsong 9-12
- 10:00 pm Entertainment

**POSTERS: Convention Level – Windsong
Prefunction 9-12**

#1239 – ”Comparative Study of Evaporator Cleaning Practices at Louisiana Factories”, Stephanie Imbachi-Ordonez - Audubon Sugar Institute, LSU AgCenter.

#1240 – “How the Composition and Health Benefits of Sugarcane Vinegars Compare to Other Commercial Vinegars”, Gillian Eggleston, Alexa Triplett, Giovanna Aita, Chardcie Verret, Eldwin St. Cyr, & Tyrennee Foster - Audubon Sugar Institute, Vitor Teixeira - Department of Technology, FCAV/UNESP Jaboticabal, Brazil

Wednesday, April 20, 2022

8:00 am On your own

FUTURE MEETINGS

2023 May 7-10, New Orleans, U.S.A.

2024 April 28 - May 1, Vancouver, CANADA

2025 TBD, Dubai, U.A.E.

ABSTRACTS

IMPLEMENTING PROCESS SIMULATION TECHNOLOGY TO OPTIMIZE SUGAR REFINERY VACUUM PAN BOILING SEQUENCES

#1220

Eleanor McFeaters & Camille Smith - Louisiana Sugar Refining, LLC
Stephania Imbachi-Ordonez & Dr. Gillian Eggleston - Audubon Sugar Institute

One of the remaining horizons in optimizing the sugar refining process is the automation of the crystallization sequence. High concentration sucrose solutions behave non-linearly which makes performing engineering calculations on the sequence complicated. New developments in process simulation software make developing and optimizing the crystallization step more attainable, with engineers able to incorporate process knowledge and data into a simulated model. The future of modelling software could also include a direct communication from the modelling software straight to a refinery's DCS.

This report outlines the findings of preliminary optimization calculations of the crystallization sequence, using SysCAD, a modelling software that has valuable and specific sugar unit operations. A model of Louisiana Sugar Refining's plant operations was created in the software using available plant data and correlations developed by the modelling team. Different strike parameters were input to the model, along with cost and profit parameters, and the financial results were recorded for each scenario.

Initial results indicate large cost savings associated with better valve tuning, improved insulation, enhanced pan control towards the end of a strike, high inlet liquor brix, and shifting focus to reducing strike times rather than strike cost. Furthermore, the results justify the continued investment and expansion for the project to identify more cost savings and improve accuracy. These scenarios will be tested and translated into refinery boiling sequence improvements, via LSR's Siemens automation system, that have the potential for large cost savings in the refinery. The project also demonstrates the future potential of artificial intelligence and reduction of the human factor in sugar crystallization.

DIFFERENCES IN COMMERCIAL FILTER AIDS USED FOR POLARIMETRY MEASUREMENTS OF CANE PRODUCTS INCLUDING SUGARS

#1221

Maria del Carmen Perez, Gillian Eggleston, Stephania Imbachi-Ordonez, Peter Gaston, Alexa Triplet, Chardcie Verret, Greg Brown - Audubon Sugar Institute, LSU AgCenter, St. Gabriel, LA 70776, USA

The use of filter aids for polarimetry (apparent content of sucrose) measurements of multiple cane products at the factory and refinery is currently an acute problem in many countries due to various reasons, including (i) toxicity and environmental concerns of lead acetate in some countries, (ii) availability of other non-lead filter aids, and (iii) concerns with any metal salts advocated as lead acetate substitutes. For many years, Louisiana sugarcane factories have used Octapol® non-lead, proprietary filter aid but, recently, its availability became an issue as well as the quality control of batches. Furthermore, having a “back-up” filter aid will always be of benefit to the industry. Clearpol® filter aid was recently marketed and is now being used in multiple countries including the USA. The aim of this study was to systematically compare these two filter aids for their effect on accuracy, precision, and how they compare to HPLC (high performance liquid chromatography) true sucrose purities. Since Clearpol® was less ($P < 0.05$) dense (0.440 g/mL) than Octapol® (0.615 g/mL), more is needed to filter juices; exact amounts needed vary from factory to factory and depend on the quality of the juice. Although acceptable filter aids should remain inert, it was repeatedly observed that increased amounts of Octapol® (one to four level tablespoons or ~9 to 40 g) caused an increase in the filtrate Brix which decreased pol and sucrose values. This phenomenon also occurred for Clearpol® but to a much lesser extent, indicating Clearpol® was more stable. This Brix increase was because of salts (particularly calcium, potassium, and sodium salts in Octapol®) dissolving in the filtrate. Constituent analyses of the filter aids (both proprietary products) showed that Octapol® contained up to quadruple (~20%) the amount of total salts than Clearpol® (~5%). Moreover, differences between Clearpol® batches were small, with major constituents (total salts, moisture, calcium carbonate equivalents, calcium, magnesium, and sodium) only varying 1 to 12.5% whereas differences between the Octapol® batches were 0 to 457%. Precision. Studies are ongoing with other factory cane products.

ADVANCED MIXING, OPTIMIZING BATCH PAN EFFICIENCY

#1222

C. Castro and R. Acosta - MCI Ingenieria y Aplicaciones S.A. de C.V. Kepler 72, Anzures, CDMX, 11590, Mexico

Pan Stirrers can significantly improve the performance of a batch pan by improving circulation, heat transfer with a lower temperature difference, decreasing strike times and thus increasing output rate or allowing for the use of lower pressure vapors. At the same time, they can improve the quality of sugar by reducing the creation of conglomerates and reducing the generation of color.

While the benefits of Pan stirrers on batch pans may already be common knowledge in the industry, the importance of good design, manufacturing practices, quality of materials and correct sizing of all the components of a Stirrer can play a big part on ROI, TCO and the degree to which the Stirrer will bring improvement to the Batch pan efficiency.

Process Mixing Solutions is a French designer and manufacturer of mechanical Stirrers and mixers that specializes in developing solutions tailored to the application, for the sugar industry with installations and experience of over 40 years, PMS produces some of the best Stirrers with the focus on:

- Energy efficiency
- Operational reliability
- Low maintenance
- Improving sugar quality

With decades of experience and the use of CFD simulation technology PMS further improved their proven designs to offer mixers with higher hydrotechnical specifications, lower turn speeds, no internal bearings inside the batch pans and lower energy consumption.

DIGITALISATION IN SUGAR PRODUCTION – FROM VISION TO REALITY. CHANCES OF INTEGRATED THINKING

#1223

Bernd Langhans, Siemens AG, Germany

Sugar production facilities are facing an ever increasing demand for optimized and efficient performance. State of the art systems are providing the factories with all needed data and in some cases even with the tools to interpret them in real time. However, only a very small percentage of sugar plants globally are really thinking and working to utilize the chance out of the potential which the already available data are providing for daily business. Adding the simple basics,

that data which are not measured are not available or data which are measured and not verified must be considered invalid, and one can easily see that digitalization and the trend towards an industrial (r)evolution need further innovative thinking. This paper shall provide some ideas and shall be seen as a wakeup call to start thinking integrated instead of compartmentalized. With properly implemented digitalization concepts, a one-setpoint factory becomes possible.

**USE OF HIGHLY EFFICIENT 2-STAGE
ADSORBENT TREATMENT WITH RE-USE
ALLOWS THE ELIMINATION OF
CLARIFICATION BY PHOSPHATION AT LA
UNION REFINERY IN GUATEMALA**

#1224

**Mario Canales, Idalberto Delgado, Francisco González,
Roberto Medina - Sugar Segment. Graver Technologies
LLC. Glasgow, DE, USA & Maynor Cupertino Mejías,
Juan Pedro Quiñones - Ingenio La Union, Escuintla,
Guatemala.**

La Union is an attached refinery that processes 1,200 t/day of very high pol raw sugar having a color ranging from 550 to 600 IU. After phosphatation, its primary decolorization technology uses the non-regenerable adsorbent Ecosorb® S-505 in a two-stage treatment that reuses the partially spent Ecosorb cake from the second stage in the first stage treatment. Ecosorb® S-451 had been successfully used in the past as a supplement in the phosphatation clarification process with removal in the clarifier scums. However, its excellent filtration properties and higher color removal capability firstly, suggested switching from S-505 to S-451 as the primary decolorizing adsorbent, and secondly, that removing the phospho-flotation process entirely might be possible. The successful new strategy resulted in a more straightforward, flexible, and adaptable process particularly well suited to handle the upsets typical when operating an attached refinery. The usual losses associated with shutting down and re-starting a phosphatation process were eliminated. When compared, both approaches achieved similar efficiencies at the refinery, 88.1% vs. 88.0% yield, but the new approach resulted in a 10% increase in refined sugar production. In addition to the savings on the chemicals when working without clarification (about \$0.70/t of refined sugar), this change made it possible to operate the refinery at a significantly higher melted sugar Brix (68.5 vs. 63.7), reducing the refinery steam consumption by 18% and increasing the pan capacity significantly. Total savings in direct costs from this process simplification was estimated at \$1.30/t of refined sugar, or \$260,000 for the crop season.

DUPLICITY, HYPOCRISY, RESORTING TO WTO

#1225

**Arvind Chudasama – International Sugar Journal,
London, UK**

The thrust of this paper is that the holier than thou attitude is somehow allowed to prevail in the rule based system that WTO supports at the expense of certain sophistry by players who seek to invoke it but can claim no superior moral claim if their past actions are dredged up. Brazil has actively pursued foul play amongst top players in the global industry, namely Thailand, China and India who have invariably damaged its interests. The presentation will critically scrutinise issues that betray certain level of hypocrisy by those pursuing the dispute at the WTO.

**TECHNICAL AND PRACTICAL LOOK FOR
WASTE HEAT AND POWDERED ACTIVATED
CARBON RECOVERY FROM GAC
REGENERATION KILN FLUE GAS USED IN A
SUGAR FACTORY**

#1226

Nour Tharwat – Savola Sugar

Spent granular activated carbon (GAC) is widely reactivated thermally in sugar industry using specialized furnaces which is operated mainly by fuels like diesel and/or natural gas. This process is well known to recover most of the adsorptive capacity especially towards macro molecules thus reduce the need for exploiting more quantities of fresh GAC which is very costly and environmentally unfriendly.

Over years, many technologies are invented that can be used to make the GAC regeneration process even more environmentally friendly and more cost-effective

**ENERGY EFFICIENCY CONCEPTS IN SUGAR
HOUSE OPERATION – WHAT IS OLD, WHAT IS
NEW?**

1227

**Hempelmann, Reinhold; Laue, Deike; BMA
Braunschweigische Maschinenbauanstalt AG, P.O. Box
3225, 38022 Braunschweig, Germany**

Energy efficiency is a key performance indicator for the efficient operation of a sugar refinery. It is to a large extent determined by the reduction of energy use in crystallisation and the separation of crystals and syrup, both in the refinery and in recovery. Water intake via the fine liquor and the amount of wash water used in centrifugals are crucial indicators for steam consumption. Usually the wash water

intake can only be reduced up to a point if product quality requirements are to be met.

A range of concepts have for several decades been used in crystallisation to automate the process, thus making it to a large extent reproducible. Depending on the crystal size aimed for, one- or two-stage seeding processes are often used. They serve primarily to ensure that the feed liquor used has the maximum dry substance content. Thanks to the process design, water intake and thus steam consumption are reduced to a minimum.

Additional water intake, namely the wash water applied in the centrifugals, is always kept to a minimum. In many cases it can be significantly reduced even further with the use of syrup washing. Successful application depends partly on whether or not the raw material is of a consistently high crystal quality. The seeding systems mentioned earlier are therefore usually a prerequisite for successful application.

This paper describes the principles of the process steps mentioned and their importance for refinery and recovery in a sugar refinery. It also addresses the reasons why use of these process steps is time and again called into question. On this basis, the paper presents opportunities that can result from a reassessment of precisely these process steps, taking into account state-of-the-art process monitoring methods.

OPTIMIZING SUGAR PLANTS WITH DIRECT-EXCITED SCREENING MACHINES

#1228

Camille Smith - Louisiana Sugar Refining, LLC & Dominik Stappert - RHEWUM America Inc.

In times of increasing energy costs and stringent environmental regulations, the optimization of sugar factories with clean and efficient processes is an important factor to stay profitable and sustain an eco-friendly image at the same time. Choosing efficient production equipment is a key factor to increase productivity while lowering power consumption and emissions. Another factor that must be taken into consideration when it comes to classifying sugar is the fact that traditionally used screeners are swinging machines that lead to high wear in the building or the supporting structure due to the transported dynamic forces.

Direct-excited screening machines combine a variety of benefits which make them highly efficient. Due to the direct excitation of the screen cloths, a high-frequency

vibration leads to high acceleration of the feed material to segregate it fast while the low amplitude allows a sharp separation. Aided by gravity the specific mass flow is very high, allowing increased capacities while the static housing keeps the dynamic mass low. Thus, energy consumption and

transmission of vibration into the supporting steel structure is at a minimum. Furthermore, the possibility to set individual amplitudes for all screen decks with different cut sizes leads to highly efficient screening for every screening task. An implemented self-cleaning cycle ensures that the screen meshes stay entirely free, thus keeping the production output and quality high, while lowering maintenance downtime and costs.

In this joined paper Louisiana Sugar Refining, LLC will elaborate their desire for improvement and why a direct-excited screening machine was the right machine for them. RHEWUM America Inc. will present the expected cost saving potential and quality improvement of the direct-excited screening machines compared to conventional gyratory screening machines.

SYMPOSIUM A

INDUSTRY 4.0 – WHAT DOES THIS MEAN TO DIFFERENT REFINERIES

#1229

KEYNOTE SPEAKER PRESENTATION

#1230

Dr. Courtney Gaine, President and CEO, Sugar Association, Washington, D.C

SUGAR BEET LEAVES AS A SOURCE OF FUNCTIONAL PROTEIN

#1231

Olaf Van Baal – Cosun Beet Company

In current sugar beet cultivation, the leaves of the sugar beet are left on the field as a source of minerals. These leaves, about 15 tons per acre, also contain about 1-3% protein, of which RuBisCo protein is of specific interest because of its technical functionality in food products. It is a technical challenge to obtain this protein from sugar beet leaves, but it fits the current market trend towards more plant based protein and sustainable sourcing. In this paper the extraction process is described as well as the functionality of the protein, especially gelation. The excellent gelation properties of this protein make it a very suitable ingredient for binding of meat replacers for example or as an egg-white replacer in other applications.

MICROBIOME AND NUTRIENT QUALITY OF SUGARCANE MILL/PRESS MUD AS BIO-FERTILIZER AND BIO-STIMULANT

#1232

Sophie Minori Uchimiya - U.S. Department of Agriculture, Agricultural Research Service, Southern Regional Research Center, 1100 Robert E. Lee Blvd., New Orleans, Louisiana 70124

Bio-fertilizer and bio-stimulant could be developed from sugarcane mill mud/filter cake to provide (1) carbon source for natural micro-organisms to promote soil health and (2) controlled-release of nitrogen, potassium, phosphorus, and other essential plant nutrients to reduce the cost to purchase imported inorganic fertilizers. In Louisiana, waste management for muds became expensive at mills, as on-site waste piling space is becoming exhausted. Research is needed to identify the quality of organic carbon and microbiome in mill mud. This study used bioinformatics to statistically evaluate complex microbial community in mill mud, and to understand their environmental fate. Fresh mill mud was enriched with heat- and drought-tolerant microbiota, which became depleted after prolonged environmental exposure (soil amendment, composting). The rate of environmental transformation is the key to fertilizer value, as chemical and microbial aging occurs concurrently. In addition, biochemical, thermal, and electrochemical augmentation approaches can be used to add values to biostimulants from mill mud. Organic waste-to-biofertilizer concept of mill muds offers a real world message, beyond United Nation's Sustainable Development Goals, to diversifying, sustainability-conscious consumers. Those approaches also address U.S. Department of Agriculture's Agricultural Innovation Agenda to "increase the productivity of U.S. agriculture by 40%, while cutting the environmental footprint of U.S. agriculture in half by 2050".

USE OF ADSORBENTS TO IMPROVE THE PHOSPHATATION PROCESS, INCREASE YIELDS, AND REDUCE COST PER TON OF REFINED SUGAR PRODUCED - COMMERCIAL RESULTS

#1233

Jerry Lengen, Idalberto Delgado, Francisco Gonzalez, Mario Canales & Roberto Medina - Graver Technologies

Refining sugar requires the removal of color, turbidity, ash and other impurities from the raw sugar. Each processing step has limitations on the degree of purification that can be achieved in a cost-effective manner. Use of Ecosorb® S-451 in the clarifier (removed with the clarification scums) significantly increases the amount of decolorization achieved in the clarifier. This reduced color can be used to reduce the degree of affination required upstream to meet the required color to feed the IER or GAC columns. Or it can be used in conjunction with reduced washing in the white centrifugals to significantly reduce the amount of

runoff sent to the recovery house while still sending the same clarified liquor color to the IER or GAC columns. Either approach reduces the volume sent to the recovery house significantly, resulting in lower sugar losses. Additional benefits include extending the filter cycle life of deep bed and/or polish filters and a significant decrease in steam consumption in the recovery house (due to the decreased volume of run-off sent to the recovery house).

Additionally, use of S-451 allows the effective treatment of high color raw sugar without overloading the recovery house, with no reduction in daily production capacity.

THE FRACTAL PACK: NEW EQUIPMENT FOR ION EXCHANGE. OPERATIONS IN THE SUGAR INDUSTRY

#1234

**Steve D. Peacock & V. Kochergin - Amalgamated
Research LLC, 2531 Orchard Drive East, Twin Falls,
Idaho 83301, USA**

High efficiency fractal fluid distribution has been used in ion exchange and chromatographic applications in the sugar industry for over 30 years. It offers a number of benefits for industrial ion exchange operations that include reduced capital and operating costs, as well as the potential to use very shallow resin bed depths of more kinetically-efficient resins of a smaller average size, without incurring an excessive pressure drop across the bed. The fractal pack is a new patented ion exchange configuration that is conceptually similar to a plate and frame filter press and contains a number of ion exchange plates held within a frame. With bed depths as shallow as three to 24 inches, this arrangement results in a substantial reduction in capital cost for an ion exchange system and is modular, allowing the capacity of the unit to be expanded by simply adding additional plates to the existing frame. The plates are manufactured from corrosion resistant materials, making it possible to use aggressive resin regeneration chemicals if necessary. Testing has been carried out on both a small pilot / bench scale as well as a large pilot scale for several potential applications across a range of industries. In the sugar industry, successful performance has been demonstrated in decolorization and softening of juice and syrups. Experimental work at various scales has confirmed that performance is maintained on scale-up to fractal pack plates of full industrial size.

NATURAL, NUTRITIOUS, AND FUNCTIONAL UNREFINED SWEETENERS FROM SUGARCANE THAT MEET NEW CONSUMER DEMANDS

#1235

**Gillian Eggleston, Giovanna Aita, & Alexa Triplett -
Audubon Sugar Institute, 3845 Highway 75, St.
Gabriel, LA 70776, USA**

Sucrose has been greatly scrutinized in the past decade mainly for its calories, even though sales have increased globally and it still remains the gold standard of sweeteners as well as the most widely used sweetener. Ironically, the present and accelerating consumer-driven trend toward healthier, sustainably manufactured, and more natural foods, beverages, and ingredients has started to further redeem sucrose and less refined sugars from sugarcane as natural sweeteners. Natural sweeteners, as compared to artificial and highly processed caloric sweeteners, are the least processed and contain a greater range and higher quantity of nutrients, including antioxidants, minerals, and vitamins. Unrefined, brown sugars from sugarcane are having a huge growth as natural sweeteners. They include centrifuged and non-centrifuged cane sugars that are markedly less expensive yet equally if not more nutritious than other natural sweeteners, including solid sugars from coconut palm, honey, maple, date, stevia, and monk fruit. The global sugar industry needs to consider an educational or marketing campaign to educate consumers on these antioxidant rich, unrefined sugars.

**AUTOMATED FACTORY EXCEPTION
REPORTING USING SUGARS™ MASS AND
ENERGY BALANCE SOFTWARE.**

#1236

**Scott M. Kahre - Sugars International LLC, 305
Inverness Way South Unit 204, Englewood, CO 80112.**

Sugar factory performance is often compared to a set of “standards” that are set at the beginning of each processing season based on anticipated average beet, cane, or raw sugar quality parameters. However, as feedstock quality and processing rates change, even the most optimized factory’s results will vary. It is more beneficial to compare the actual factory operating data to an accurate mass and energy balance that accounts for the actual throughput and raw material supply conditions. The latest major release of Sugars™ (version 4.3) includes a new feature that builds upon the existing XML Data Import/Export functions to automate model balances and results publishing. Factory personnel can now program their daily or weekly reporting system to generate a Sugars™ XML input file and schedule an automatic data import, balance, and results export within Sugars™. The exported model results can then be included in a periodic comparison report showing differences between actual factory performance and Sugars™ mass and energy balance predictions. Parameters with large deviations may direct factory staff’s attention to opportunities for process improvement and/or measurement errors.

**THE NEW PUTSCH® MFP FILTER PRESS SERIES
FOR LARGE REFINERIES: RESULTS ON DIRECT
FILTRATION DUTY AT AL KHALEEJ REFINERY
IN DUBAI**

#1237

Martin Herrmann - Putsch GmbH & Co. KG

With refinery throughputs ever increasing and direct filtration being the preferred state-of-the-art solution, especially for new carbonation refineries being built around the world, the need for cost efficient filter press systems exists. Considering these trends over the last years, Putsch® developed a new filter press series for refinery applications with high throughput. The innovative Putsch MFP Membrane Filter Presses can be designed specifically for each refinery – there are no fixed sizes! This paper discusses the Putsch® MFP Membrane Filter Press series and the results achieved at Dubai's Al Khaleej refinery.

SYMPOSIUM B

**VALUE-ADDING ANALYSIS: WHAT IS BEST PRACTICE
NOW.... AND WHAT IS GOING TO BE IN THE FUTURE**

#1238

**COMPARATIVE STUDY OF EVAPORATOR
CLEANING PRACTICES AT LOUISIANA
FACTORIES**

#1239

**Stephania Imbachi-Ordonez - Audubon Sugar
Institute, LSU AgCenter, St. Gabriel, LA 70776, USA**

Multiple-effect evaporation is the key to the energy efficiency of a sugarcane factory and refinery. However, the heat transfer rate can decrease due to the accumulation of unwanted material on the heat transfer surfaces, which is named scaling or fouling. Evaporator cleaning to remove the scale has been an ongoing problem in the Louisiana (LA) sugar industry and the methods to remove it are all chemical, relatively rapid, and do not require skilled labor or specialized equipment. The aim of this study was to characterize the evaporator scale from LA factories and evaluate the performance of the LA evaporator cleaning practices as well as their relationship with the scale characteristics. Information about evaporator cleaning practices was collected from 10 LA Factories during the 2020 LA processing season. The cleaning procedure followed by most LA factories includes a soda boiling step, followed by an acid boiling step with a water rinse between them (spraying 1-4 times or filling up 10-15 min), and at the end of the cleaning. The most common caustic soda dosage

concentration is 20-25%. The acid dosage concentration is variable, mostly 1-3% for hydrochloric (HCl), sulfamic, and phosphoric acid, and between 3-17% for EDTA. Scale samples from the evaporator calandria tubes from 8 factories were characterized by X-ray fluorescence (XRF) and X-ray diffraction (XRD) and scale from the pre, third, and fourth evaporator vessels of different LA factories were subjected to dissolution tests to compare cleaning practices. Different concentrations, boiling times, and chemicals (caustic soda and acids) were evaluated. Scales from the LA sugar factories were mainly composed of CaO, SiO₂, and P₂O₅ (0.2% to 66.0%), with small quantities of Na₂O, MgO, MnO, and other oxides (0.01% to 12.3%). Approximately 60% of the inorganic components was amorphous silica, which increased from vessel No. 1 to No. 4. The LA factories with the highest consumption of chemicals had the highest contents of CaO and Na₂O (present in the form of oxalates and carbonates). Neither of these two compounds were broken down by caustic soda, instead, both were broken down by EDTA, and only the carbonates were readily broken down by acid. Scale dissolution tests showed that scale of a heterogeneous inorganic composition (silica, hydroxyapatite, carbonates, and amorphous components) was mostly broken down by acids, especially HCl at high concentration and partially broken down by EDTA. Another scale with a high content of calcium oxalates was mostly broken down by EDTA at a high concentration and partially attacked by HCl. Unexpectedly, a third scale sample with a high concentration of amorphous silica was readily broken down by caustic soda, which suggested interactions among scale components can interfere with the cleaning process. More studies are warranted to evaluate such interactions that may affect scale removal by altering the structure and strength of the scale.

HOW THE COMPOSITION AND HEALTH BENEFITS OF SUGARCANE VINEGARS COMPARE TO OTHER COMMERCIAL VINEGARS

#1240

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Many types of commercial vinegars (aqueous solution of mild acetic acid) are now available, including food, specialty (gourmet), and cleaning (produced in large volume) vinegars and even flavored drinking vinegars which are growing fast in popularity. This has set the stage for the greater production and marketing of sugarcane vinegars. Vinegar can be easily and relatively inexpensively manufactured from sugarcane and other sources of sugar by a two-step fermentation process: (1) ethanol production with yeast, and (2) conversion of ethanol to acetic acid by bacteria (*Acetobacter*). Vinegar manufacture from sugarcane (mainly juice and diluted syrups) is very popular in the Philippines and also occurs in Brazil, India, France, United States, and Colombia, among other countries. Since sugarcane vinegars can also be made from sugarcane rejects and by-products including bagasse and molasses, this makes them further attractive. How commercial sugarcane vinegars compare in composition and nutritional benefits to other popular vinegars will facilitate their utilization and marketing. Eighteen commercial sugarcane, red wine, white wine, apple cider, balsamic, rice, malt, and sweet sorghum vinegars were analyzed for phenolic compounds with high performance liquid chromatograph with diode array detection, total phenolic and acid contents, antioxidant activity, organic acid and anion contents, color, Brix, density, and turbidity. There was a large variation in Brix (3.3 to 28.6%) among all the vinegars and cane vinegars (four) ranged from 2.2 to 11.6%. Color indicator values (I.V.) were not an indication of phenolic colorants in the vinegars. The cane vinegars exhibited the lowest pH values (2.49 to 2.83) which may impart greater preservation ability. Cane vinegars manufactured from cane juice had higher turbidity values compared to cane vinegars from cane syrups. Overall, vinegars from cane juice had higher nutritional value than vinegars from syrups and white wine and were in the same range as red wine and cider vinegars.

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