Sugar Industry Technologists, Inc. 2020 Daily Program

Seventy Ninth Annual Technical Meeting New Orleans, Louisiana, 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.

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SUGAR INDUSTRY TECHNOLOGISTS, INC.

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S.I.T. 2020
Daily Program

New Orleans
Louisiana, U.S.A.

Saturday, May 2, 2020

12 Noon - 4:00 pm	S.I.T. Hospitality Edgar Aguirre - Suite

Sunday, May 3, 2020

9:00 am - 5:00 pm	Registration Ile de France Foyer I 3rd Floor
9:00 am - 2:30 pm	Presenters Rehearsal Maurepas 3rd Floor
2:00 pm – 10:00 pm	Exhibitors Set Up Ile de France Foyer II and III 3rd Floor
3:30 pm - 5:30 pm	S.I.T. Directors Meeting Maurepas 3rd Floor
6:30 pm - 8:00 pm	S.I.T. Mixer Reception Ile de France I 3rd Floor

Monday, May 4, 2020

8:00 am - 5:00 pm	Registration – Ile de France Foyer I, 3rd Floor
8:00 am – 10:00 pm	Exhibitors Presentation - Ile de France Foyer II and III, 3rd Floor
8:45 am - 4:00 pm	Spousal/Guest Program - Departure from Hotel Lobby at 9:00 am

FIRST TECHNICAL SESSION

Ile de France II and III, 3rd Floor

	Jack Thompson - Presiding Louisiana Sugar Refining, LLC
8:30 am	Address of Welcome: Jack Thompson, President - Sugar Industry Technologists
8:40 am	#1220 - Keynote Speaker: Courtney Gaine, PhD, RD - President & Chief Executive Officer, The Sugar Association.
9:00 am	#1221 - "Energy Efficiency Concepts in Sugar House Operation – What is Old, What is New?" Hempelmann, Reinhold; Laue, Deike; BMA AG.
9:30 am	#1222 – "Cane Molasses; Beet Molasses". Barbara Muir – Tereos R&D: New Product and Process Development.
10:00 am	Coffee Service – Poster viewing. Ile de France Foyer II & III
10:30 am	#1223– "Increase of White Sugar Yield by the Development and Implementation of an Automated 4th Boiling Program". Harshadkumar Patel – ASR Group – Redpath Sugar
11:00 am	#1224 – "Industry 4.0, Facts and Vision, A Project Example for a Full Digital Plant Experience, Providing Online Performance Data as well as Plant Optimization, Using Statistical Process Control Features". Bernd Langhans - Siemens.
11:30 am	#1225 – "Xylooligosaccharides from Bagasse as a Source of Prebiotics". Giovanna M Aita, Young Hwan Moon, Chardcie Verret and Tyrenee Foster - Audubon Sugar Institute, Louisiana State University Agricultural Center.
12:00 pm	Annual General Meeting of the Corporation of Sugar Industry Technologists, Inc., Election of Board of Directors.
12:10 pm	New Board of Directors Meeting
12:20 pm	Lunch, Ile de France I. Sponsored by Jord International, Australia

SECOND TECHNICAL SESSION

Ile de France II and III, 3rd Floor

Michael Burchell – Presiding
ASR Group, C&H Sugar Company.

1:45 pm — #1226 - "Learning from the Implementation of Refinery Production Short Interval Control Meetings at Redpath Sugar". George Carter – ASR Group – Redpath Sugar.

2:15 pm — #1227 - "Sugar Beet Leaves as a Source of Functional Protein". Olaf Van Baal, Paulus Kosters, and Marlies Geerts - Suiker Unie

2:45 pm — #1228 – "Indication of Solubility Conditions after Seeding of a Technical Solution under Technical Conditions". Bjarne Christian Nielsen, Neltec Denmark; Thomas Frankenfeld, Swiss Sugar, Aarberg

3:15 pm — Coffee Service – Poster viewing. Ile de France Foyer II & III

3:45 pm — #1229 – "Duplicity, Hypocrisy and Resorting to WTO". Arvind Chudasama – International Sugar Journal

4:15 pm — #1230 - 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
Kristin Odörfer, BMA AG
Danish Mansoor, ASR-Group

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Tuesday, May 5, 2020

8:00 am - 5:00 pm	Registration – Ile de France Foyer I, 3rd Floor
8:00 am – 4:00 pm	Exhibitors Presentation - Ile de France Foyer II and III, 3rd Floor
9:45 am - 4:00 pm	Spousal/Guest Program - Departure from Hotel Lobby at 10:00 am

THIRD TECHNICAL SESSION

Ile de France II and III, 3rd Floor

Janet Harriman - Presiding
United Sugars Corporation.

8:30 am	#1231 - "After Four Decades: A New Look at Ion-Exchange Resin at the Tongaat Hulett Refinery". M. Moodley, J. Hardwick, C. Mbanjwa, and Dr. Nadja Hermsdorf.
9:00 am	#1232 – "The Use of Structural Modelling Software for Resolving Chronic Reliability Issues". Austin Fletcher – Louisiana Sugar Refining, LLC.
9:30 am	#1233 – "Enhancement in Sugar Production Capacity along with High Bagasse Saving by Modified Bleeding Scheme of Boiling House". Vinod Kumar, Kavita Sharma, Rajeev Nath Tiwari - Spray Engineering Devices Limited.
10:00 am	Coffee Service – Poster viewing. Ile de France Foyer II & III
10:30 am	#1234– "Prediction of Sugar Caking, Using Dynamic Vapor Sorption Isotherms". Wakana Ota – Mitsui Sugar.
11:00 am	#1235 - "Simultaneous Removal of Multiple Impurities from a Refinery Syrup Using Powdered Activated Carbon in a Pilot Plant". Isabel Lima - USDA.
11:30 am	#1236 – "Low Colour Direct White Sugar Production at a Cane Sugar Plant". Narendranath Mullapudi - The Andhra Sugars Limited, India.
12:00 pm	Lunch – On your Own

FOURTH TECHNICAL SESSION

Ile de France II and III, 3rd Floor

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

2:00 pm — #1237 - "The Changing Sugars Market and How Natural Sugarcane Products Compare". Gillian Eggleston, Giovanna Aita, Alexa Triplett, and Eldwin St. Cyr - Audubon Sugar Institute, Louisiana State University Agricultural Center

2:30 pm — #1238 - "Modernization of Resin Decolorization Systems to Adapt to New Conditions in Sugar Refineries". Anne-Sophie Faurot, Maxime Gallot - Novasep Process SAS

3:00 pm — Coffee Service – Poster viewing. Ile de France Foyer II & III

3:30 pm — #1239 - SYMPOSIUM B

"Value-Adding Analysis: What is best practice now.. and what does the future hold?"

Chairman and Moderator:
John Kerr, ASR-Group – Tate & Lyle Sugars.

Panelists:

Bjarne Christian Nielsen, Neltec Denmark.
Shannon Conrad, Bruker
Tod Canty Jr., J.M. Canty
Adrian Charlton, Fera Science Ltd.

5:00 pm — Invitation to Dubai

5:10 pm — President's Closing Remarks

7:00 pm — Reception. Ile de France Foyer I, II & III

8:00 pm — Awards Banquet
Ile de France I & II

10:00 pm — Entertainment
Ile de France I & II

POSTERS: **Ile de France II and III, 3rd Floor**

#1240 – "Operation of a Scaled-up Filtration Pilot Plant for Removal of Sugar Beet Extract Colorants". Isabel M. Lima, Charles Clayton, Annie Tir, Craig Parker, Emmanuel Sarir and Gillian Eggleston

#1241 – "How Denatured Dextranase and Amylase Proteins Contribute to Floc Formation in Alcohol Beverages Sweetened with Refined Cane Sugars". Alexa Triplett and Gillian Eggleston

#1242 – "How Sugarcane Vinegars Physically and Chemically Compare to Other Commercial Vinegars". Alexa Triplett, Giovanna Aita, Vitor Teixeira, Eldwin St. Cyr, and Gillian Eggleston

Wednesday, May 6, 2020

8:00 am	Buses leave for Refinery Tour
12:00 pm	Lunch at the refinery
2:00 pm	Buses return to the JW Marriott Hotel

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FUTURE MEETINGS

2021 **April 4-7, Dubai, U.A.E.**

2022 **May 1-4, Vancouver, CANADA**

2023 **TBD, Casablanca, MOROCCO**

ABSTRACTS

KEYNOTE SPEAKER PRESENTATION

Courtney Gaine, PhD, RD - President & Chief Executive Officer - The Sugar Association.

#1220

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

#1221

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.

CANE MOLASSES; BEET MOLASSES

#1222

Muir, Barbara M., Tereos R&D: New Product and Process Development, Burchtstraat 10, 9340 - Aalst, Belgium. barbara.muir@tereos.com

Crystallisation is a purification process in which one or more substances in solution can be separated from the others often in very pure crystalline form. In sugar factories this process is invariably used for final purification of sucrose and also for subsequent exhaustion of the mother liquor. After exhaustion, the final molasses then becomes a secondary product with enough sugars left over for valorisation. Plenty of good research and development work has been done over the years to either recover or further convert the remaining substances in molasses.

Final molasses from cane and beet may seem similar, but it is not. Where cane molasses has a pleasant odour and taste, making it ideal as a sweetener in the food industry, beet molasses does not; in some parts of the world it has application in the feed industry. Both products are widely used in bioconversion fermentations. In addition, both are highly desirable not only for innovative applications but also to find a worthy spot within the proposed circular economy in a future world free from dependency on fossil fuels and similar sources of energy, minerals and chemical building blocks.

INCREASE OF WHITE SUGAR YIELD BY THE DEVELOPMENT AND IMPLEMENTATION OF AN AUTOMATED 4TH BOILING PROGRAM

#1223

Harshadkumar Patel – ASR Group – Redpath Sugar Ltd. Toronto, Ontario, Canada

In 2019 a project to utilize 4th boiling sugar into the 45 ICU white sugar finished product steam was successfully implemented at the Redpath Sugar Refinery in Toronto. This paper describes how a unique equation to calculate the sugar colour was developed based on the pan's massecuite colour, crystal MA and CV. Following this a description is included of how this was integrated into an automated pan boiling program that was implemented to control the massecuite and finished sugar colour maximizing the use of higher colour run-off syrups.

INDUSTRY 4.0, FACTS AND VISION, A PROJECT EXAMPLE FOR A FULL DIGITAL PLANT EXPERIENCE, PROVIDING ONLINE PERFORMANCE DATA AS WELL AS PLANT

OPTIMIZATION, USING STATISTICAL PROCESS CONTROL FEATURES

#1224

Bernd Langhans – Siemens

With "digitalization" being a topic every day in discussions all around the industrial world, it becomes clear that the pure availability of data has no added value. Thus, it becomes difficult to justify investment beyond the "want-to-have" argument. Therefore, it is essential that a professional assessment combined with a clear target setting is the key to a winning strategy. With the complete plant fully automated, and a full integration of laboratory and energy production data, a good example for this strategy is the professional usage of the available data can be found in several sugar factories in Europe. Data availability throughout the production process on a secure and reliable basis is the key for all further analytics. Not only for visualization of KPI but moreover for a dedicated process optimization. This can be achieved by well known principles like statistical process control, which can today be implemented into digitalization packages. This paper will present the approach from assessment to optimization as executed in several sugar plants globally and will give some arguments for the essential return on investment.

XYLOOLIGOSACCHARIDES FROM BAGASSE AS A SOURCE OF PREBIOTICS

#1225

Giovanna M Aita*, Young Hwan Moon, Chardcie Verret and Tyrenee Foster. Audubon Sugar Institute, Louisiana State University Agricultural Center, St. Gabriel, LA 70776, USA; *gaita@agcenter.lsu.edu

Prebiotics can be grouped into established prebiotics (inulin, fructooligosaccharides, galacto-oligosaccharides, lactulose, polydextrose) or emerging prebiotics (isomaltooligosaccharides, xylooligosaccharides (XOS), lactitol). XOS are non-toxic, stable at acidic pH, heat resistant, and can achieve positive biological effects at low daily doses and low caloric content, properties that are the same or more desirable than the already established prebiotics. XOS are present in plants in very low amounts so there is a great opportunity to isolate XOS with varying degrees of polymerization from the hemicellulose fraction of lignocellulosic materials (e.g. bagasse), a source that

offers both economic and environmental advantages. The production of XOS by dilute acid hydrolysis of energy cane bagasse was evaluated. Chromatographic analysis of hydrolysates revealed increased XOS production with time;

however, prolonged incubation with sulfuric acid at elevated temperatures resulted in higher amounts of xylose and non-sugar compounds. The strategy for producing XOS from bagasse or any agricultural residue should be designed for not only the removal of these non-sugar compounds from the hydrolysate, but their recovery as potential value-added products. These compounds were successfully removed (>90%) by activated carbon and the combined used of polar solvents resulting in fractions containing up to 95% XOS. In-vitro studies were carried out to evaluate the prebiotic potency of the recovered XOS using the beneficial gut bacteria Bifidobacterium adolescentis. The strong prebiotic effects of XOS observed on Bifidobacterium adolescentis were comparable to commercially available prebiotics.

LEARNING FROM THE IMPLEMENTATION OF REFINERY PRODUCTION SHORT INTERVAL CONTROL MEETINGS AT REDPATH SUGAR

#1226

George Carter – ASR Group – Redpath Sugar Ltd. Toronto, Ontario, Canada

In 2019 short interval control-style meetings were implemented to increase production at the Redpath Sugar Refinery in Toronto. The meetings highlighted opportunities to increase the refinery performance which were implemented over a short time scale. This paper describes the meeting structure, the input data, the key findings and the subsequent implementation of improvements in practices and control systems to increase the production rate.

SUGAR BEET LEAVES AS A SOURCE OF FUNCTIONAL PROTEIN

#1227

Olaf van Baal, Paulus Kosters and Marlies Geerts. Suiker Unie

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.

INDICATION OF SOLUBILITY CONDITIONS AFTER SEEDING OF A TECHNICAL SOLUTION UNDER TECHNICAL CONDITIONS

#1228

Bjarne Christian Nielsen, Neltec Denmark; Thomas Frankenfeld, Swiss Sugar, Aarberg

A new instrument and presentation of results has been developed and tested on technical solutions in technical environments. The instrument is located outside the crystalliser measuring through a standard sight glass. The measurements give information on the state of supersaturation early in the crystallisation process. Application in a beet sugar factory cooling crystalliser has indicated the tool may give trends useful in monitoring and controlling the crystallisation. Results are reported, followed by suggestions for their practical implementation in the crystallisation work

DUPLICITY, HYPOCRISY AND RESORTING TO WTO

#1229

Arvind Chudasama - International Sugar Journal, London, UK

The top sugar producer, Brazil, has, in the recent past made formal complaints to the World Trade Organization against Thailand, China and India for various kinds of support to their sugar industries – whether through subsidies or tariffs. It's a fact that the global sugar industry is not informed by a level playing field when it comes to the global market place. Structural sugar exporters like Brazil, Australia and Thailand are particularly vulnerable to market volatility. When residual dump exporters like India add to the global surplus and drive down prices, while at the same time get government subsidies to export, there is invariably an outcry and formal complaint to WTO is the ultimate resort to curb such actions in the future. However, Brazil whose industry has been built through government policy and cross-subsidy has little moral superiority when it resorts to WTO. This paper describes and discusses the
relative growth and support of top sugar players and exposes certain duplicity and hypocrisy that comes with the holier than thou attitude.

SYMPOSIUM A

INDUSTRY 4.0 – WHAT DOES THIS MEAN TO DIFFERENT REFINERIES?

#1230

AFTER FOUR DECADES-A NEW LOOK AT ION-EXCHANGE RESIN AT THE TONGAAT-HULETT REFINERY IN DURBAN

#1231

1M Moodley and J Hardwick, 2C Mbanjwa, 3Dr.Nadja Hermsdorf - 1Cwenga Technologies, 28 Boeing Road East, Dunvegan, 1609; 2Tongaat-Hulett Sugar-Refinery, P.O. Box 1501, Durban 4000; 3 Lanxess Deutschland GmbH, Kennedyplatz, D-50679 Koln

In November 1978 the bone char decolourisation plant at Tongaat-Hulett Refinery (Hulref) was replaced with four

ion-exchange columns. This change had major benefits for the refinery in terms of chemical and energy costs, and refined sugar quality. In order to improve the liquor decolourisation, a further 5 secondary stage resin columns were installed in 1987. This improved the overall decolourisation from 60 to 70%. Since 1978 the resin plant has been using the same macroporous strong base anion acrylic resin. Having a single supplier of resin for the refinery has been identified as a risk. In view of this it was decided by the refinery management to evaluate resin from other suppliers.

In the paper the work done to evaluate an alternate resin supplier over a period of three years will be discussed. The paper will cover the following areas:-

- Technical performance of the resin at various cycle times
- Commercial evaluation of the resin
- Technical support from the suppliers
- Resin lifetime prediction based on analysis
- Some problems encountered during the trail

The trial has also allowed the refinery to re-evaluate process conditions and the lessons learnt from the exercise are expected to benefit the refinery in the long run

THE USE OF STRUCTURAL MODELLING SOFTWARE FOR RESOLVING CHRONIC RELIABILITY ISSUES

#1232

Austin Fletcher - Louisiana Sugar Refining, LLC

This paper describes how LSR utilizes Solid Works, a structural modelling program, to diagnose and resolve chronic reliability issues in a wide variety of mechanical equipment. Solid works provides structural analysis utilizing Finite Element Analysis to predict and replicate physical behavior by virtually testing CAD models. It provides static linear stress, time-based motion, and high cycle fatigue simulations. Several examples are presented on how Solid Works is used by the LSR Reliability Team to predict component failure points and simulate the effect of various repair methods and/or design changes to increase equipment reliability.

The models are generated by replicating current in service equipment. This includes measuring the actual equipment dimensions and displacements in the area of interest. Running the simulations involves calculating the forces and displacements during normal and extreme operation (starting, stopping, high loading).

ENHANCEMENT IN SUGAR PRODUCTION CAPACITY ALONG WITH HIGH BAGASSE SAVING BY MODIFIED BLEEDING SCHEME OF BOILING HOUSE

#1233

Vinod Kumar, Kavita Sharma and Rajeev Nath Tiwari - Spray Engineering Devices Limited, India

In the last two decades sugar mills are focused on reduction in steam consumption and plant capacity enhancement with high bagasse saving and high yield. One's thrust should be on minimization of the steam requirement for sugar processing through efficient vapour bleeding scheme by most suitable selection of boiling house equipment. Authors through this paper explained how to enhance the plant capacity with reduction in steam consumption by changing the vapour bleeding scheme with addition of 4 nos. of tubular falling film evaporators, 1 no. of vertical spray continuous pan (SCP(R)) along with other heating media using innovative approach and efficient technologies and give true example through Dewan Sugar Ltd, Moradabad, U.P., India which is one of its kinds of plant that was designed much efficiently. The installed tubular falling film evaporators of total heating surface area was 14,000 m2 and a vertical spray
continuous pan of five chambers and each chamber having heating surface area 265 m2 for B-massecuite boiling with maximum capacity of 55 T/hr and operational capacity 40 T/hr. The plant of capacity 3500 TCD with steam consumption 48% on cane is now performing at the plant capacity 5600 TCD with steam consumption below 32.5% on cane along with net bagasse saving of 12.0% on cane in

current season without any addition in milling capacity and steam/power generation units.

PREDICTION OF SUGAR CAKING, USING DYNAMIC VAPOR SORPTION ISOTHERMS

#1234

Wakana Ota - Research Section, Research & Development Division, Mitsui Sugar Co., Ltd. 36-2, Nihonbashi-Hakozakicho, Chuo-ku, Tokyo 103-8423, Japan

In some countries, where humidity is high throughout the year, the caking of sugar is an important problem, and customers often complain about the caking of sugar, especially granulated sugar and soft sugar. The caking is generally due to the dissolution and recrystallization of the crystal surface and the subsequent mutual adhesion of crystals, but the factors are diverse and complex.

Therefore, hardly any methods have been established to predict the cause of sugar caking beforehand.

The purpose of this research was to establish a method to easily evaluate the degree of caking on the basis of the numerical information, with the aim of predicting sugar caking beforehand. Grain size, powder characteristics, dynamic vapor sorption/desorption (DVS), and, as an indicator of caking degree, breaking strength of different granulated sugar samples collected from respective companies and regions in Japan were measured, and the correlations between their values were analyzed.

In conclusion, this research demonstrated that DVS measurement may be an effective method to predict the degree of caking (or ease of caking). This research is the first step to establishing a method to predict sugar caking beforehand. Going forward, further studies are necessary to implement these evaluation methods in the field.

SIMULTANEOUS REMOVAL OF MULTIPLE IMPURITIES FROM A REFINERY SYRUP USING POWDERED ACTIVATED CARBON IN A PILOT PLANT

#1235

Isabel M. Lima[a], Ana Maria Jimenez[b], Gillian Eggleston[a, c], Benhur Pabon[b], Emmanuel Sarir[b], Jack Thompson[d]

[a] **USDA-ARS Southern Regional Research Center, Commodity Utilization Research Unit, 1100 Robert E Lee Blvd, New Orleans, LA, 70124, USA**
[b] **CarboUA International, Los Angeles, CA, USA**
[c] **Audubon Sugar Institute, St. Gabriel, LA, USA**
[d] **LSR, Louisiana Sugar Refining, Gramercy, LA, USA**

Scaled up pilot plant studies were carried out on the ability of powder activated carbon (PAC) to remove multiple impurities from sugarcane refinery streams and confirm prior laboratory results. Clarified refined syrup, at 75 or 80°C was spiked with either 0.5 or 1 ppm of high temperature stable α-amylase and treated with PAC at doses of 250, 500, or 750 ppm on a Brix basis. The effectiveness of PAC was monitored over 45 min residence time to determine best performance conditions on the simultaneous removal of colorant compounds, soluble and insoluble starch, and residual amylase from refinery liquors (syrups). Amylase (protein) removal improved with
PAC application rate, with an overall amylase percent removal (across residence times and amylase doses) of 81.8%, 84.8%, and 94.0% respectively for 250, 500, and 750 ppm of PAC at 75°C. Highest percent color removal of 37.9%, 42.5% and 55.1%, respectively for color compounds measured at pH 4, 7, and 9, occurred for 750 ppm PAC and 45 min residence time, across both syrup temperatures and amylase doses. A concomitant decrease in the indicator value (I.V.) of up to 21% at the 750 ppm PAC dose, was also observed. PAC was also able to decrease turbidity by 42% on average. The small-scale pilot plant unit can bridge laboratory data to larger scale studies and report valuable information prior to large-scale industrial trials.
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LOW COLOUR DIRECT WHITE SUGAR PRODUCTION AT A CANE SUGAR PLANT

#1236

Narendranath Mullapudi - The Andhra Sugars Limited, India.

With the selection of available ideal process equipment and practicing best operating conditions, good quality low colour sugar can be produced at a direct white plantation sugar plant. The Andhra Sugars Limited (India) has 3 cane sugar plants, producing direct white plantation sugar of

below 50 ICUMSA colour without a backend refinery.

At the juice extraction stage, Cane Diffusers are being used which are energy efficient and produce cane juice with low suspended matter. Apart from low maintenance cost, Cane Diffusion has less sugar loss in bagasse, low inversion loss

as extraction is at 80+0C maintained. Vacuum filter station has been totally eliminated by sending the clarifier underflow into the diffuser.

The Double Sulphitation process is followed using ejector system to get a better colour and turbidity removal. High efficiency, low residence time and low turbulence settling clarifier is being used for juice clarification. Syrup clarification is also used to polish the syrup further without using any colour precipitants.

A 3½ Massecuite boiling process is used for crystallization to prepare a high purity seed massecuite with B Seed, syrup and melt. Seed obtained from this massecuite is used as footing for A-Massecuite. Purity of A-Massecuite is maintained around 90 producing a sugar of below 50 ICUMSA colour with 70% medium grade sugar crystal of 1200 – 1700 micron size.

There is a perception in the sugar industry that residual SO2 level in sugar produced using the sulphitation process

is high. Our experience over decades is that with proper operation controls, good quality sugar meeting EC-2 & US FDA requirements can be produced at a cane sugar plant without a backend refinery or an expensive and sophisticated filtration system.

THE CHANGING SUGARS MARKET AND HOW NATURAL SUGARCANE PRODUCTS COMPARE

#1237

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

Consumers in the USA and around the world are increasingly demanding more natural and healthy foodstuffs including sweeteners. Currently there is no single description of "natural" but consumers expect natural foods and beverages to contain (i) no preservatives, (ii) no hormones or antibiotics, (iii) no pesticide residues, and to a lesser extent be (iv) fresh, (v) organic, and (vi) have few added ingredients. Natural sweeteners that are

the least processed, are also increasingly in demand and include stevia, monk fruit, honey, agave syrup, maple syrup, palm sugar, date sugar, sorghum syrups, and rice syrups. These are produced from saps, syrups, extracts,
and nectars found in nature, and they often contain a range of other nutrients including vitamins, minerals, and antioxidants but some contain added chemicals. Brown cane sugars, either centrifuged or non-centrifuged, are also considered natural sweeteners. Brown cane sugars are a rich

source of natural phenolic antioxidants but the sugar industry is currently failing to market this advantage, while some artificial sweeteners are being enriched with chemical antioxidants. Consumers prefer antioxidants from natural extracts over "chemically-sounding antioxidant names." Both physical and chemical attributes of commercial maple, honey, coconut, palm, and date (solid) sugars were compared to centrifuged cane sugars (white refined, organic, light brown, dark brown) and non-centrifuged cane sugars (piloncillo and panela). The results highlight the competitive advantages of cane sugars compared to alternative "natural" sugars in the US market.

MODERNIZATION OF RESIN DECOLORIZATION SYSTEMS TO ADAPT TO NEW CONDITIONS IN SUGAR REFINERIES

#1238

Anne-Sophie Faurot and Maxime Gallot - Novasep Process SAS

Ion exchange and activated carbon are the major technologies used for sugar decolorization in refineries. Ion exchange is generally preferred as it requires lower capital investment and it offers higher decolorization performance in a robust and reliable manner. Improvements in raw sugar quality, and particularly reduction in color, raised multiple opportunities to upgrade existing resin decolorization systems to these news conditions. Two different cases of modernization are presented, resulting in increasing plant capacity for the same amount of installed resin, improving flexibility to multiple production conditions, decreasing water and regeneration brine to lowest levels, while keeping operating costs minimal. A detailed description of the performances before-and-after modernization is presented, as well as the appropriate strategy, to ensure investment low and to shorten the production stop during implementation.

SYMPOSIUM B

#1239

VALUE-ADDING ANALYSIS: WHAT IS BEST PRACTICE NOW.. AND WHAT DOES THE FUTURE HOLD?

POSTERS

OPERATION OF A SCALED-UP FILTRATION PILOT PLANT FOR REMOVAL OF SUGAR BEET EXTRACT COLORANTS

#1240

Isabel M. Lima[a], Charles Clayton[a], Annie Tir[a], Craig Parker[b], Emmanuel Sarir[c], Gillian Eggleston[d]

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[b] **British Sugar, Sugar Way, Peterborough PE2 9AY**

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During sugar beet processing, molasses is subjected to slow moving bed chromatography to extract high value betaine and recover more sucrose. The result is a high color sugar beet extract (SBE). Sucrose recovery can be increased by recycling this extract from the chromatography system back into the crystallization unit. However, this is only economically viable after it undergoes color reduction. Feasibility pilot plant studies were undertaken on the use of a high surface area powdered activated carbon (PAC) and diatomaceous earth (DE) to adsorb color compounds from SBE. Color compounds associated with beet extract are either, generated during processing or naturally occurring. Experiments were performed using a batch decolorization process to maximize color removal and determine an optimal distribution of PAC either as a body feed or a pre-coat in a filter. With initial colors at 4,275±114, 4,256±223 and 4,774±157 ICU for color measured at pH4, 7 and 9, respectively, a target of 50% color removal was achieved using 4,000 ppm of PAC with a recommended distribution of 75% as pre-coat in the filter and 25% as body feed in the process feed tank. A 50/50 distribution of PAC also produced consistent rate of color removal. PAC performance was slightly better for native colorants to sugar beet than factory colorants. Addition of PAC did not lead to sucrose loss neither had any negative effect on the pH of SBE.

HOW DENATURED DEXTRANASE AND AMYLASE PROTEINS CONTRIBUTE TO FLOC FORMATION IN ALCOHOL BEVERAGES SWEETENED WITH REFINED CANE SUGARS

#1241

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The gradual appearance of floc in alcohol beverages sweetened with refined, white cane sugar remains a technical problem, albeit sporadic, for sugar refiners and beverage manufacturers. When cane (refined) invert sugars which cause flocs were mixed with 60% pure alcohol and water, light scattering increased by up to ~1000-fold. A tentative mechanism for floc formation has been advanced which incorporates protein binding with phenolic compounds (indirectly indicated by the color indicator value I.V. which is color measured at 420 nm pH 9.0/color at pH 4.0) via hydrophobic and hydrogen bonding sites on the protein. Alpha amylase and dextranase enzyme proteins, applied as processing aids during sugar manufacture, both formed flocs with haze active polyphenol. This was not surprising since both these industrial enzymes contain proline, a key amino acid component of floc forming proteins, as well as arginine that can also interact with phenolic compounds although to a lesser extent than proline. Denaturing of dextranase and intermediate temperature (IT) stable amylase proteins at 80 °C, a temperature prevalent at the cane sugar refinery, increased floc formation due to further exposure of polyphenol/flavonoid binding sites on the denatured protein. In comparison, heating dextranase, IT and HT (high temperature stable) amylases to 100 °C damaged the protein and reduced floc formation. Thus, it is important that sugar refiners remove or minimize any residuals of these enzyme proteins. Powdered activated carbon is known to be able to remove both protein and phenolic colorants. Identification of individual phenolic compounds involved in alcohol floc formation by a high performance liquid chromatography method is also discussed.

HOW SUGARCANE VINEGARS PHYSICALLY AND CHEMICALLY COMPARE TO OTHER COMMERCIAL VINEGARS

#1242

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Many types of commercial vinegars (aqueous solution of mild acetic acid) are now available including food vinegars, specialty (gourmet) vinegars, cleaning vinegars (produced in large volume), and even flavored drinking vinegars which are growing fast in popularity. 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, then (2) ethanol conversion to acetic acid by *Acetobacter*. Distilled vinegars (e.g., wine, sherry, and cider) are manufactured directly from potable alcohols. Vinegars used in the culinary arts are flavorful, cooking ingredients that can act as food preservatives (e.g., pickling) due to their acidic nature. For the industrial manufacture of vinegar in the USA, an industrial fermentation license is required and vinegar sold at the retail level should be at least 4% acidity as mandated by the Food and Drug Agency of the U.S. Government. Vinegar production from sugarcane sugar is very popular in the Philippines and also occurs in Brazil, India, France, USA, and Colombia, to name just a few. Cane sugar rejects and by-products including molasses and bagasse make these co-products further attractive. The way commercial sugarcane vinegars physically and chemically compare to other popular vinegars will facilitate their marketing. In this study, Brix, density, acidity, pH, turbidity, color, total phenolic content, and antioxidant capacities were measured in commercial red wine, prosecco wine, apple cider, balsamic, rice, malt, and sweet sorghum vinegars and compared to commercial sugarcane vinegars.

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Finnsugar Ltd. - Sune Berghall

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