

SHARKARA

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NATIONAL SUGAR INSTITUTE

DEPARTMENT OF FOOD & PUBLIC DISTRIBUTION

MINISTRY OF CONSUMER AFFAIRS, FOOD & PUBLIC DISTRIBUTION

GOVERNMENT OF INDIA

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IT CONTAINS.....

CONTENTS	PAGE
MESSAGE FROM DIRECTOR	03
OUR RESEARCH AREAS	04-06
OUR PROVISIONS	07 - 13
OUR ADVISORY	14 - 15
RESEARCH ARTICLE	16 - 24
HAPPENING IN THE SUGAR INDUSTRY	25 - 36
ABSTRACTS	37 - 45

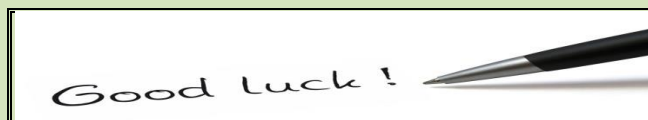
FROM DIRECTOR'S DESK.....



Sugar season 2017-18 has commenced with sugar production in the country soared 26% year-on-year or an increase of 21.35 lakh tonnes to 103.3 lakh tonnes between October and December 2017 on the back of good out put in key growing states of Uttar Pradesh and Maharashtra. Uttar Pradesh has reached 23% higher sugar production then the similar period of last crushing season producing 52.90 Lakh tonnes of sugar. ISMA has further revised its estimates of sugar production to 260 Lakh tonnes during 2017-18.

Uttar Pradesh again being comfortable with sugar recoveries although factories in the eastern part not doing so well. Considering a demand growth @2%, the sugar consumption in the country is expected to be approx. 250 lakh tonnes and thus the closing stocks shall be about 50 Lakh tonnes. However, the recent downward trend in the prices of sugar is a matter of concern for the sugar industry as a whole, while the factories in Uttar Pradesh suffering more on account of rock bottom prices of molasses.

With reports of India talking to neighboring countries viz. Bangladesh and Sri Lanka to seek lower import duties for its sugar exports to prevent a glut next season is a ray of hope for the sustainability of the sugar industry. I reiterate that sugar factories need to develop out of box thinking and developing innovative technologies in collaboration with technical institute for value addition and sustainability of the sugar industry.



(Narendra Mohan)
Director

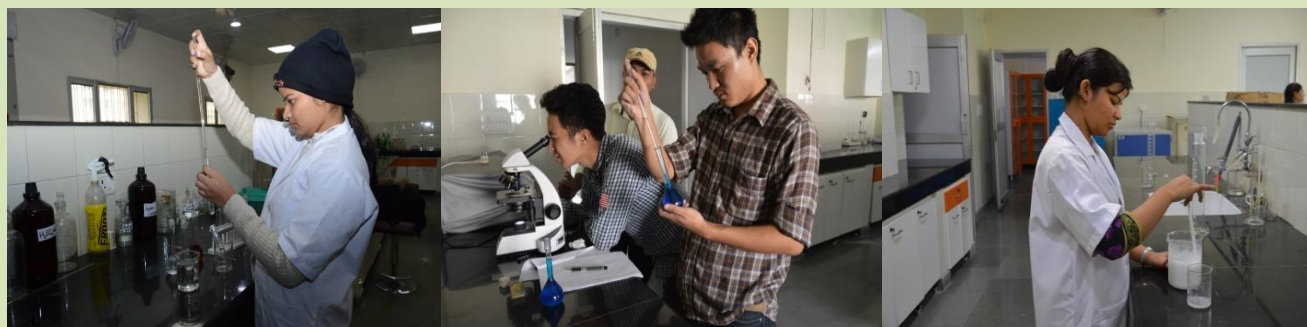
➤ OUR RESEARCH AREAS:

The Institute is actively involved in the collaborative endeavors with the sugar and allied industries for developing innovative techniques and technologies for improving the overall profitability of the sugar industry.

➤ RESEARCH:

The Institute during the period took up R&D work on the following:

1. Isolation and purification of yeast strains from saccharine materials and their performance for fermentative production of alcohol- The yeast strain isolated from spoiled sugar cane juice produced best results when diluted molasses was fermented by this strain with a fermentation value of 91.7% and ethanol yield of 218 liter/ton assessed. The yeast isolated from rotten grapes also produced good results. Three selected strains were tested for their efficiency on molasses medium. The same were repeated to validate the results. All the sets (ranging from 13-20% sugar content) were repeated for the assurance of fermentation efficiency.



2. Bio- CNG from Press Mud- With an aim to utilize the press mud for production of Bio-CNG, different combinations of press mud, farm yard manure and spent wash were tried on laboratory scale. Overall gas formation patterns in ten selected treatments were studied with the help of gas analyzer. Physico-chemical analysis of the slurry of combinations giving better results is in progress. Analysis of bio-manure residue obtained after the production of biogas for inorganic constituents, organic nitrogen and phosphorus has been completed. Further, pilot plant scale trials shall be taken up in the Experimental Sugar Factory of the Institute during the ensuing crushing season.



3. Studies on clarification of cane juice with bagasse derived bio-char- The study has been taken up with an aim to utilize the bagasse fly ash in combination with bio char to check its clarification efficiency on cane juice and other sugar liquors. In order to implement the bagasse fly ash as an adsorbent to clarify the sugarcane juice, the analysis of input parameters such as pol, brix, purity, conductivity ash, colour, turbidity, starch and dextran of sugarcane juice to be treated is under process for exploring further possible use. The proximate analysis [Moisture (%), Volatiles (%), Ash (%) and Fixed carbon (%) of bagasse fly ash received from three sugar factories has been carried out.



4. Mushroom Cultivation from different lignocellulosic substrates- To explore possibilities of utilization of bagasse as substrate for mushroom cultivation, studies have been taken up which shall be extended further using other lignocellulosic substrates. Sets with different combinations of lignocellulosic substrates were prepared viz. Bagasse, Bagacillo, Wheat straw for the production of *Pleurotus sp.* Standardization of the techniques has been done. Initial analysis of raw material completed and the sample analysis is in progress.

5. Studies on synthesis of glycosidic surfactants using by-product resources of sugar industry- Studies have been taken up further so as to enhance the yield of bagasse derived polypentosides based surfactant along with reducing the purification steps involved thereof. An experiment has been performed on 10 gm scale to synthesize the glycosidic surfactant. The purification and characterization of the product is under evaluation. Patent application on this topic has been filed. Experiments to synthesize bagasse derived glycosidic surfactant towards validating the method by procuring bagasse from various sugar factories were performed. The isolation and characterization of the product is under process.



6. Improvement in Sugar Quality by clarification of intermediate boiling house products- Experiments were carried out on laboratory scale with B & C-Double Cured Sugar melt using different doses of phosphoric acid and hydrogen peroxide. Centrifugation of melt was also carried out to remove suspended impurities & significant removal of colour and turbidity was achieved. Further experiments were also carried out on laboratory scale in a commercial sugar factory during the current crushing season and the results are encouraging.

7. Studies on Production/isolation of C5-Sugar Alcohol/Sugar using by-product resources of sugar industry- An up to date literature survey on the topic and procurement of the required chemicals/materials is under process. The study is aimed basically at deriving a low calorie sweetener from bagasse. Thus studying is also aimed at developing value added product from the by-product of the sugar industry. Such study is also aimed to developing a value added product from the by-product of sugar industry.

8. Settling test using Lamella Clarifier - The literature survey has been done and a Laboratory model for the experiment is under construction for the actual assessment of mud removal & quality parameters of clear juice. Lab trials on this new design of clarifier will be carried out during the present crushing season. It is envisaged that settling of juice shall take place within 6-10 minutes and will thus facilitate lower temperature drop, sugar loss & colour development.

➤ **RESEARCH PAPERS/ POSTER / PRESENTED / PUBLISHED/ SENT FOR PUBLICATION:**

2. “Diversification for Sustainability of the Sugar Industry” by Narendra Mohan presented during the 23rd Asia International Conference held on 2nd November, 2017 at Jakarta, Indonesia.

3. “Sugarcane bagasse as surrogate for production of surfactants (Bio-Detergent)” by Narendra Mohan, V.P. Srivastava & Anuska Agarwal sent for publication in 6th IAPSIT International Sugar Conference to be held in March, 2018 at Thailand.

4. “Implementation of Quality based Sugarcane Payment Scheme in India-A need of hour” by Narendra Mohan & Priyanka Singh sent for publication in 6th IAPSIT International Sugar Conference to be held in March, 2018 at Thailand.

5. “Green Energy for the Indian sugar Industry: A Sustainable Energy Future” by Narendra Mohan, D. Swain & A.K. Kanaujia sent for publication in 6th IAPSIT International Sugar Conference to be held in March, 2018 at Thailand.

➤ OUR PROVISIONS:

➤ BUREAU OF SUGAR STANDARDS:

The Institute on behalf of Bureau of Indian Standards prepares and issues Sugar Standard Grades to the entire Sugar Industry of the country for every sugar season. These Sugar Standard Grades are issued to facilitate quality control and to protect the interest of the common consumers. On the basis of these grades, sugar factories mark their produce accordingly.

On the basis of the approved Standards, Bureau of Sugar Standards Grades distribution commenced from 3rd October, 2017.

To facilitate grading and marketing of Plantation White Sugar, Bureau of Sugar Standards issued 1355 Sugar Standard Grades to 243 Sugar factories during the period October-December 2017 for the present crushing sugar season 2017-18.

Price schedule for the sugar season 2017-18:

1	Sugar Standard Grades to be issued	L-31, L-30, M31, M-30, S-31,S-30 & SS-31
2	Set of New Sugar Standard Grades containing 7 grades +3 empty glass bottles + 3 Velvet Cork in packing case	Rs.10000/= each set
3	Single Sugar Standard Grade	Rs.1260/= each
4	Empty Sugar Standard Glass Bottle	Rs.200/= each
5	Packing case	Rs.430/= each
6	Velvet Cork	Rs.50/= each
7	Postal expenses, forwarding charges, if any	Extra on actual basis
8	Demand Draft to be sent	In favour of Director, National Sugar Institute , payable at Kanpur
9	Delivery of Sugar Standard Grades	Monday to Friday (10.00 AM to 5.00 PM)
10	Taxes	GST extra as applicable

➤ SEMINAR/WORKSHOP/TRAINING PROGRAMMES:

➤ TRAINING PROGRAMME ORGANIZED:

One day workshop on "Upcoming technologies for effluent treatment in sugar industry" was organized at NSI, Kanpur on 24th October 2017. Shri D K Saxena, Chief Executive Officer, HPCL Biofuels graced the occasion as "Guest of Honour". Lively discussions were held on the technologies for treatment of spray pond overflow and condensate polishing units.



➤ SEMINARS/CONFERENCES:

1. Prof. Narendra Mohan, Director, attended 23rd Asia International Sugar Conference at Jakarta, Indonesia from 31st Oct. to 2nd Nov. 2017 along with Shri Brajesh Singh, Technical Officer (Instrumentation). Prof. Narendra Mohan also presented a paper during the conference on "Diversification for Sustainability of the Sugar Industry".

2. Prof. Narendra Mohan, Director, attended a short course on "Enhancing Nutrient Use Efficiency through Next Generation Fertilizers in Field Crops" on 21st November 2017 at IIPR, Kanpur as Chief Guest.

➤ DISTINGUISHED VISITORS:

1. Shri Anurag Goyal, an alumnus of the institute now working with ISGEC visited the institute and took keen interest in the institute activities, particularly, on production of Bio-CNG from press mud.



2. Shri K.J. Sharma, General Manager (Technical), Tikaula Sugar Mills Ltd., Distt-Muzaffarnagar, U.P.
3. Shri R.K. Singh, Chief General Manager, Simbhaoli Sugars, Distt-Panchsheel Nagar, U.P.
4. Shri Mahmud Ali, Managing Director, Sasa Musa Sugar Works (P) Ltd., Distt-Gopalganj, Bihar.
5. Dr. Ummed Singh, Senior Scientist (Agronomy), ICAR- Indian Institute of Pulses Research, Kanpur, U.P.
6. Shri Deepak Jindal, CEO, Jhanil Healthcare Pvt. Ltd., Sunam, Punjab.
7. Shri M.K. Kulshrestha, General Manager (Technical), U.P. Co-operative Sugar Factories Fed. Ltd., Lucknow, U.P.

➤ **NSI SIGNED MOU WITH INTEGRAL UNIVERSITY, LUCKNOW:**

NSI & Integral University, Lucknow signed a MOU on conducting research work for award of PhD in various disciplines. The two organizations also felicitated progressive farmers on the occasion of "Farmers day", 23rd December, 2017



➤ **NSI SIGNED MOU WITH CSA UNIVERSITY OF AGRICULTURE & TECHNOLOGY:**

Director, NSI and Vice Chancellor of CSA University of Agriculture & Technology principally agreed for collaborative work on improving soil health and production of bio-fertilizers. NSI & CSA University of Agriculture and Technology, Kanpur also signed a MOU on conducting research work for award of PhD in various disciplines.



➤ RECORD CAMPUS PLACEMENTS:

Record 191 placements were recorded through on and off campus interviews. All prominent sugar groups picked up students of various courses. M/s ISGEC, Uttam, DSCL, Dalmia, Balrampur, Wave, Dhampur, KM Sugar, Birla and SEDL were the prime takers.



➤ FAIRWELL OF FINAL YEAR STUDENTS:

Junior Students organized farewell party to the seniors. Scintillating dance, singing and mimicries performances were organized by the students on their own.



➤ AIMING AT SUGARCANE FARMERS:

As its commitment towards increasing sugarcane productivity by educating the farmers, three brochures in simple Hindi on "Pest", "Disease" and "Ratoon" Management published by the institute.



➤ NABL ACCREDITATION OF NSI ANALYTICAL LABORATORY:

Second and final audit of the NSI Analytical Laboratory was successfully carried out. The laboratory is expected to receive the certification in this regard shortly.

The NSI Analytical Laboratory has been equipped with most advanced and sophisticated instruments to facilitate analysis of sugar and other sugar house products as per ICUMSA prescribed and other standard protocols.



➤ ANALYTICAL SERVICES:

Analytical services were rendered to following:

1. Shree Ganesh Khand Udyog Sahkari Mandali Ltd., Bharuch, Gujarat.
2. JSR Insurance Surveyors & Loss Assessors, JVTs Garden, New Delhi.
3. Akbarpur Chini Mills, Mijhaura, Distt- Ambedkarnagar, U.P.

➤ एकता दिवस:

संस्थान में दिनांक 31-10-2017 को अधिकारियों, कर्मचारियों एवं छात्रों को सरदार बल्लभभाई पटेल के जयन्ती के उपलक्ष्य में एकता एवं अखण्डता की शपथ दिलाई गई।



➤ SAMVIDHAN DIWAS:

“Samvidhan Diwas” was celebrated on 27th November, 2017 at the institute. Prof. D. Swain, Prof. Sugar Engineering administered the oath to the staff and students of the Institute.

➤ सतर्कता जागरूकता सप्ताह:

संस्थान में दिनांक 30.10.2017 से 04.11.2017 तक सतर्कता जागरूकता सप्ताह-2017” का आयोजन किया गया तथा दिनांक 30.10.2017 को संस्थान कर्मियों को शपथ दिलाई गई। इस सप्ताह के दौरान संस्थान कर्मियों एवं छात्रों के लिए निबन्ध एवं व्याख्यान प्रतियोगिताएँ आयोजित की गयी।



➤ ISO SURVEILLANCE AUDIT:

Surveillance audit of the Institute for ISO 9001:2018 certification was conducted from 20th to 21st December, 2017 by QSI, (India) Pvt. Ltd. Jaipur and certificate has been issued.



➤ हिन्दी कार्यशाला:

सरकारी कामकाज में राजभाषा के रूप में हिन्दी के प्रति जागरूकता लाने तथा उसके उत्तरोत्तर विकास हेतु संस्थान में 27 दिसम्बर, 2017 को हिन्दी कार्यशाला का आयोजन किया गया, जिसमें संस्थान निदेशक ने सभी विभागाध्यक्षों को निर्देशित किया कि सभी अपने अधीनस्थ कर्मचारियों को हिन्दी में कार्य करने को प्रेरित करें जिससे कि राजभाषा विभाग के निर्देश का पालन सुनिश्चित किया जा सके।



➤ SWACHHTA PAKHWADA:

Swachhta Pakhwada was organized at the institute from 15th September to 2nd October 2017. Various events were organized to create awareness about swachhta viz. nukkad natak, painting competition, seminar, blood donation camp and cleanliness drive in the institute and in local primary school. Swachhta Shapath was also administered on "Swachhta. Biochemistry Department was awarded for being the most clean section.



➤ OUR ADVISORY:

Besides conducting teaching and training programmes, carrying out research in relevant field, another main function of the institute is:

1. To function as a “Think-tank” to sugar and allied industry for proposing modernization and trouble free functioning of the process on advisory basis / through Extension Services.
2. To formulate strategies and promotes measures for expansion of capacities, energy conservation, co-product utilization etc. for sugar and allied industries.
3. To assist Govt. of India through technical contribution in policy formulation and control of Sugar Industry.

➤ CONSULTANCY SERVICES:

During the period October to December, 2017 consultancy services were provided to the following:

➤ OVERSEAS:

M/s Tembo Sugar Mills Ltd., Kilfi County, Kenya.

➤ INDIA:

1.	M/s Nanglamal Sugar Complex, Distillery Unit of Mawana Sugar Ltd., Distt- Meerut, U.P.
2.	M/s Rajasthan State Ganganagar Sugar Mills Ltd., Distt- ShriGanganagar, Rajasthan.
3.	M/s The Karnal Co-op. Sugar Mills Ltd., Karnal, Haryana.
4.	M/s Triveni Engineering & Industries Ltd., Distillery unit, Distt- Muzaffarnagar, U.P.
5.	M/s K. M Sugar Mills Ltd., Distillery unit Motinagar, Distt- Faizabad, U.P.
6.	M/s DSM Sugar Mills Ltd., Unit-Mansoorpur, Distt- Muzaffarnagar, U.P.
7.	M/s Venus Sugar Ltd., Chandausi, Moradabad, U.P.
8.	M/s U.P. Co-op. Sugar Factories Federation Ltd., Lucknow, U.P.
9.	M/s U.P. State Sugar Corporation Ltd., Unit-Munderwa, Lunknow, U.P.

10.	M/s U.P. State Sugar Corporation Ltd., Unit-Pipraich, Lunknow, U.P.
11.	M/s Jubilant Life Sciences Bhartiagram, Gajraula, Amroha, U.P.
12.	M/s Coromandal Sugar Ltd., Makkaualli, Mandaya, Karnataka.
13.	M/s Simbhaoli Sugar Ltd., Simbhaoli, Distt-Ghaziabad, U.P.
14.	M/s Simbhaoli Sugar Ltd., Simbhaoli Distillery, Distt-Ghaziabad, U.P.
15.	M/s Simbhaoli Sugars Ltd., unit- Brijnathpur Sugar, U.P.
16.	M/s Simbhaoli Sugar Ltd., unit-Brijnathpur Distillery, Distt-Ghaziabad, U.P.
17.	M/s Daurala Sugar Works, Daurala, Distt-Meerut.
18.	M/s Kesar Enterprises Ltd., Baheri, Distt-Bareilly, U.P.
19.	M/s Oswal Overseas Ltd., Nawabganj, Bareilly, U.P.

➤ RESEARCH ARTICLE:

“INVERT SUGAR SYRUP FROM SUGARCANE JUICE-OPPORTUNITIES & CHALLENGES”

by

Vinitanjali Banerjee, Santosh Kumar and Narendra Mohan
National Sugar Institute
Kanpur

Invert Sugar or Sugar Syrup production is generally a two stage process. To economize, conversion of sugarcane juice directly into invert sugar syrup has been studied in which the sugarcane juice from two prominent sugarcane varieties Co 0238 and CoSe 1434 was clarified using natural clarificant Aloe vera. The clarified juice was subjected to inversion with citric acid. The results obtained were encouraging and showed inversion % of 96.6. The clarified juice was also inverted using cation/anion exchange resins and the data showed 98 % inversion. The syrups were chemically analyzed for various parameters and were comparable to those obtained for standard invert syrups. The invert sugar syrups so produced were quite stable when analyzed up to 3 months. Production of invert sugar syrup directly from sugarcane juice shall be cost effective by dispensing away of the necessity of producing sugar in the first stage and then dissolving the sugar to convert it into invert sugar syrup, requiring energy and other inputs at both stages. Last but not the least it would be a value added product from the sugar industry.

Key words: Sugar cane juice, Invert Sugar Syrup, Aloe-vera, Citric acid and Ion exchange resins.

➤ INTRODUCTION

For sustainability of the sugar industry, a continuous brainstorming is going on diversifications and production of value added items in the sugar industry. Sugar is the main sweetener being used world over in confectionery, soft drinks, pharmaceutical, ice-cream industry etc. and also for domestic consumption by individuals. It is mostly produced from sugarcane juice and part using sugar-beet. The consumption of sugar is increasing continuously globally while the production is stagnant from last 6-7 years. In our country too, the scenario is same wherein sugar production is constant in the range of 240-280 lakh tonnes since last many years (except for the current sugar season 2016-17) while the consumption is increasing mainly due to demographic changes, growth in income and increased share of consumption by urban population due to higher consumption of sugar in confectionery, soft drinks etc. The consumption of sugar showed an increase to 260 lakh tons in 2014 from 175 lakh tons in 2005, showing an annual increase of 3.4%. The per capita consumption has also increased up to 19.8 kg in 2015 from 16.3 kg in 2006.

➤ MATERIALS AND METHODS

Sugar cane

Two prominent sugarcane varieties of the subtropical region viz. Co 0238 and CoSe1434 were obtained from the farm attached to Institute. The raw sugarcane juice was analyzed for Brix, pH, TRS, Pol, Purity, Ash content and Colour as per standard Indian and ICUMSA methods.

Process for clarification

The raw sugarcane juice was heated to boiling with steam @1 kg/ sq cm g, 120°C from a baby boiler. Clarification was carried out with Aloe vera as a natural clarificant giving a retention time of around 30 minutes. Aloe vera was found to be very effective during earlier studies conducted at the Institute⁹. The clarified juice was centrifuged at 8000 rpm for 10 minutes so as to remove the suspended & precipitated impurities prior to subjecting it for inversion.

Inversion process

By Citric Acid (AR grade)

The clarified sugarcane juice was inverted and concentrated simultaneously by using citric acid (@1.5g/l). The concentration was carried out under vacuum of 450 mm Hg to obtain concentrated Invert syrup.

Inversion using Ion Exchange Resins

Cation exchange resin :FFIP225H

Anion exchange resin: NIP

In other set of experiments, clarified sugarcane juice was diluted 1.5 times and then inverted by passing through cation exchange resin followed by anion exchange resin column; and the resulting inverted solution was concentrated under vacuum of 450 mm Hg into Invert Syrup.

These process was repeated for both the varieties of sugarcane and the invert syrups prepared were analyzed for pH, Brix, Reducing and Total Reducing Sugars, Colour, % inversion, F/G ratio, Ash Content, Acidity, Specific Gravity and Fiehe's Test, a test for commercial invert sugar, appearance of cherry red colour¹⁰. The shelf life of the syrup was also checked by analyzing the same parameters time to time along with the total viable count.

The Reducing Sugars (RS) and Total Reducing Sugars (TRS) were determined by Lane and Eynon Method¹¹ while the other parameters were determined by using FSSAI methods for

honey analysis¹². The colour of the Invert syrup was measured at 400 nm on double beam UV-Vis Spectrophotometer, model Shimadzu UV 2600.

The clarification using steam prevents the charring of sugarcane juice whereas citric acid was chosen as it is a mild acid, an edible one, gives good results and is commercially used as preservative in squash, pickles etc. and in many food preparations. Ion exchange resins although are slightly costly but they can be reused again and again after regeneration and provide a means inversion as well as clarification and thus producing invert sugar syrup almost resembling honey.

➤ RESULTS AND DISCUSSION

The sugarcane juice of sugar cane varieties Co 0238 and CoSe 1434 was taken for this study in the months of January, February and March. In earlier study at the Institute, the juices have been clarified by using commercially available flocculent, FCS-2 and natural clarificants: Deola (*Hibiscus ficulneus*), *Hibiscus esculentus*, *Moringa olifera* and Aloe vera and best results had been obtained with Aloe vera. Hence the above juices were clarified with Aloe vera and then inverted with Citric Acid and Ion Exchange Resins. The results obtained are presented in tables 1, 2 and figures 1A, 1B, 2A, 2B.

It is seen from table 1 and fig.1 A and 1 B, that the final pH of the inverted syrup using citric acid ranged from 3.5-4.2 in both of the above varieties when the juice was taken in the months of January, February and March. The inversion % varied from 22-96, the best inversion of 96.6% was seen in the sugar cane variety CoSe1434 when the juice of sugar cane harvested in March was taken. The inversion percent with sugar cane variety Co 0238 was comparatively less and was around 60% in the juice of the sugar cane harvested in March. The results for inversion% for the months of January and February ranged from 22 – 49%.

The colour reduction ranged from 51-81 % in all the cases the best results were seen with variety CoSe 1434 harvested in February. The F/G ratio varied from 1.62-9.36, acidity of the syrups was nearly 0.2-0.6 % having specific gravity around 1.3 and ash content 0.01-0.02 g/100g. The syrups gave a positive Fiehe's Test, a test for commercial invert sugar. It was seen that colour reduction showed a high value in all the cases and considerable inversion was seen in all the juices with a final value of 96.6%. Thus, sugar cane juice after clarification can be inverted by the above procedure in order to produce invert sugar syrup of good quality directly from sugar cane juice.

The results of invert syrup obtained from sugar cane juice followed by clarification and then treatment with Ion Exchange Resin for inversion are presented in table 2, fig. 2A and 2B. It is seen from the table that the pH of syrups ranged from 4.5-8.0 and the percent inversion varied between 24-98 %, the maximum inversion was seen with variety CoSe1434. The sugar cane harvested in the month of January showed 98% inversion with

70% colour reduction and 91.5% inversion with 92.64 %reduction in colour in the sugar cane harvested in February. The results were not encouraging with the sugar cane harvested in March. The inversion percent ranged from 25 -34% in the sugar cane variety Co 0238 harvested in the months of January, February and March.

The colour reduction in all the cases ranged from 70 -92% (with the exception of variety Co 0238 and the sugar cane harvested in January where it was only 48%). The F/G ratio varied from 2.72-7.05, acidity in the syrups ranged from 0.019 - 0.43% with specific gravity of 1.3 and ash content 0.5-0.18 mg/100g. It was seen that ash content was very low when the juice was inverted with Ion Exchange Resins as a result of removal of inorganic impurities. Such syrup shall be of superior quality since presence of excess salts is undesirable in edible food items. Ion Exchange Resins thus resulted in the production of syrup with high inversion percent, more reduction in colour and a very sweet taste similar to honey. The syrups also produced positive Fiehe's Test. The invert syrup thus when stored was stable up to 3 months and the analytical parameters did not change to any significant extent.

➤ CONCLUSION

The syrups so produced exhibited excellent quality characteristic and also showed stability as analytical parameters did not change during storage for a period more than six months. Further studies on stability of the stored invert syrup and improving the quality characteristics, primarily, colour, being still in progress with re-validation of experiments and extending studies further on other sugarcane varieties.

➤ ACKNOWLEDGEMENT

We express our sincere thanks to the staff and scholars of Biochemistry Division for their cooperation during the course of present investigation.



Concentrated Invert Syrups

Table-1 : Analysis of Invert Syrup after Citric Acid inversion (Jan.- March 2017)

Month	Variety	Parameters (Citric Acid Inversion)								
		pH	Brix	% Invert	% Colour Red.	F/G Ratio	Acidity	Specific Gravity	Ash	Fiehe's Test
Jan.	CO 0238	3.5	75	49.20	70.00	3.99	0.6063	1.398	0.0145	Cherry Red colour
	CoSe 1434	3.5	66	24.16	51.90	1.62	0.4477	1.341	0.0204	Cherry Red colour
Feb.	CO 0238	3.8	69	22.14	80.22	2.05	0.2845	1.352	0.0155	Cherry Red colour
	CoSe 1434	3.8	69	35.09	81.76	9.36	0.6388	1.365	0.0160	Cherry Red colour
Mar.	CO 0238	3.8	70	61.60	81.39	7.79	0.2258	1.388	0.0125	Cherry Red colour
	CoSe 1434	4.2	75	96.60	60.30	3.46	0.5750	1.340	0.0146	Cherry Red colour

Table-2 : Analysis of Invert Syrup after Ion Exchange resin inversion (Jan.- March 2017)

Month	Variety	Parameters (Ion Exchange Resin Inversion)								
		pH	Brix	% Invert	% Colour Red.	F/G Ratio	Acidity	Specific Gravity	Ash	Fiehe's Test
Jan.	CO 0238	5.5	72	34.36	48.19	3.27	0.0814	1.321	0.0009	Cherry Red colour
	CoSe 1434	4.5	67	98.00	70.00	4.58	0.4299	1.407	0.0016	Cherry Red colour
Feb.	CO 0238	5.3	68	25.42	89.58	6.51	0.0185	1.387	0.0010	Cherry Red colour
	CoSe 1434	4.5	68	91.50	92.64	6.80	0.1064	1.377	0.0005	Cherry Red colour

Mar.	CO 0238	8.0	68	24.90	77.67	7.05	0.0216	1.362	0.0018	Cherry Red colour
	CoSe 1434	5.5	71	34.30	82.50	2.72	0.0446	1.344	0.0014	Cherry Red colour

Figure 1 A: Showing the variation of Inversion and colour reduction (Citric acid)

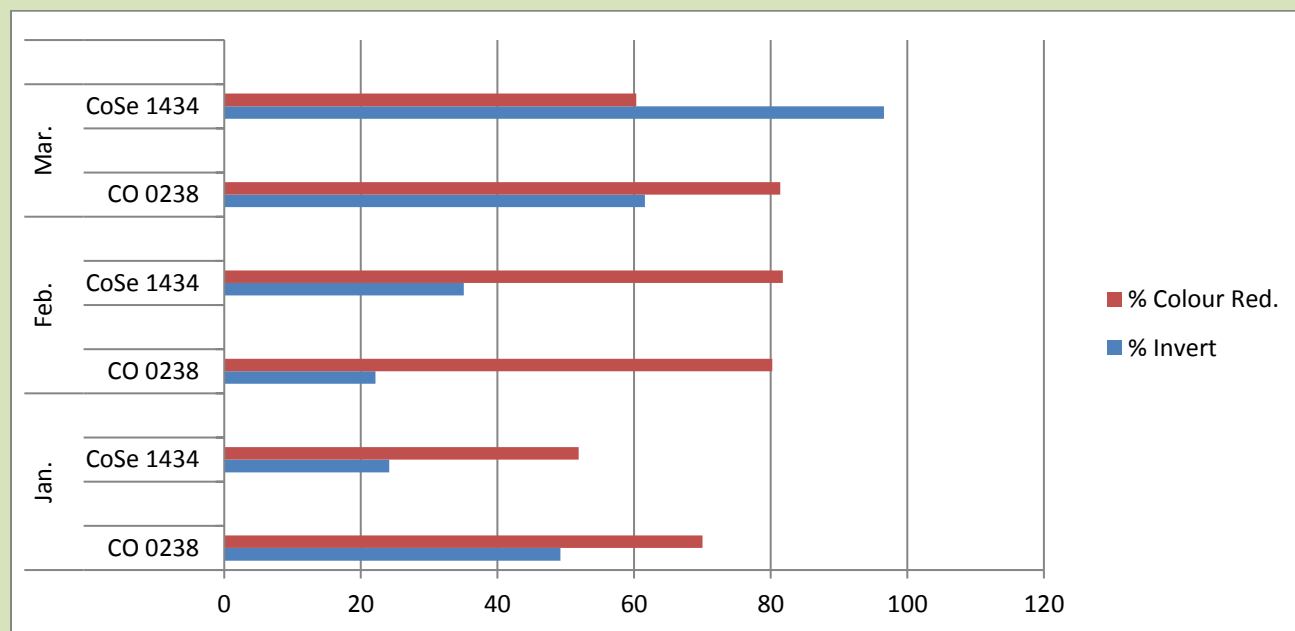


Figure 1 B: Showing the variation of pH, F/G ratio, acidity and ash (Citric acid)

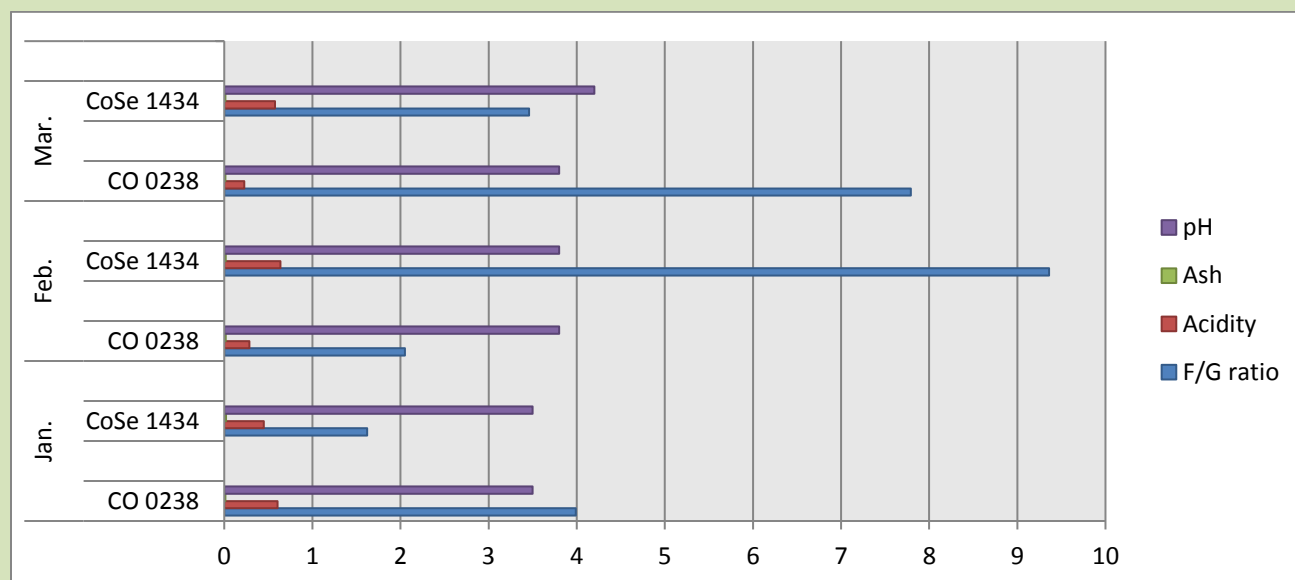


Figure 2 A: Showing the variation of Inversion and colour reduction (Ion exchange resin)

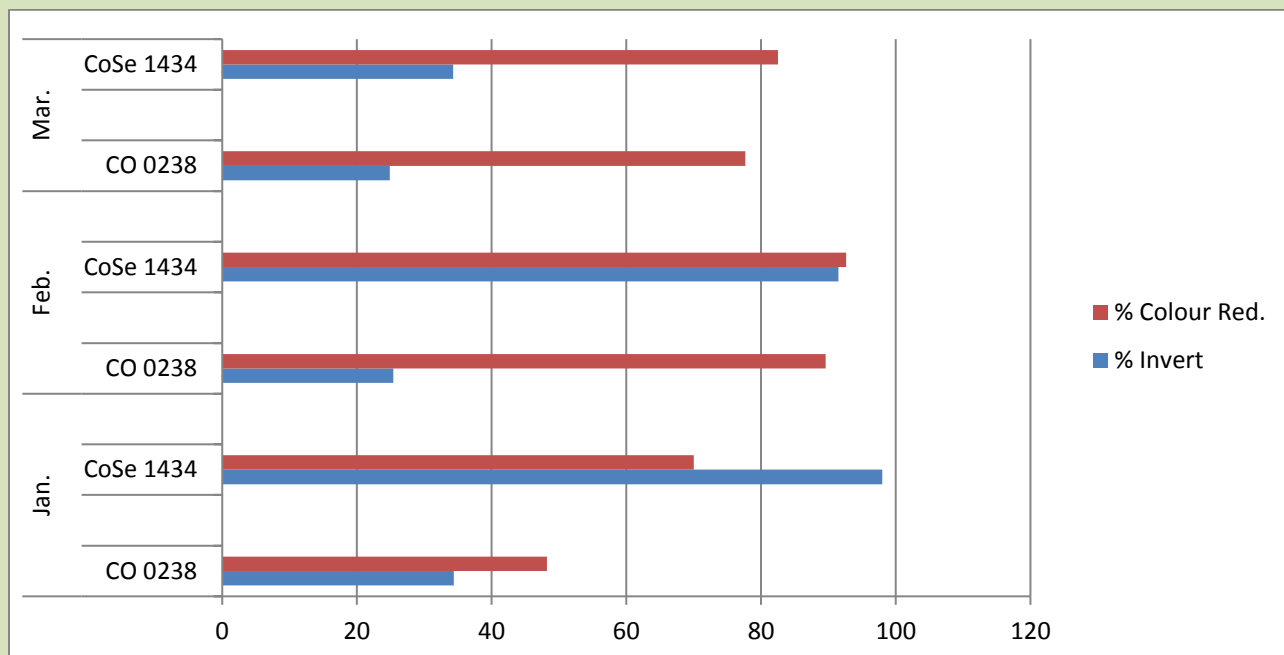
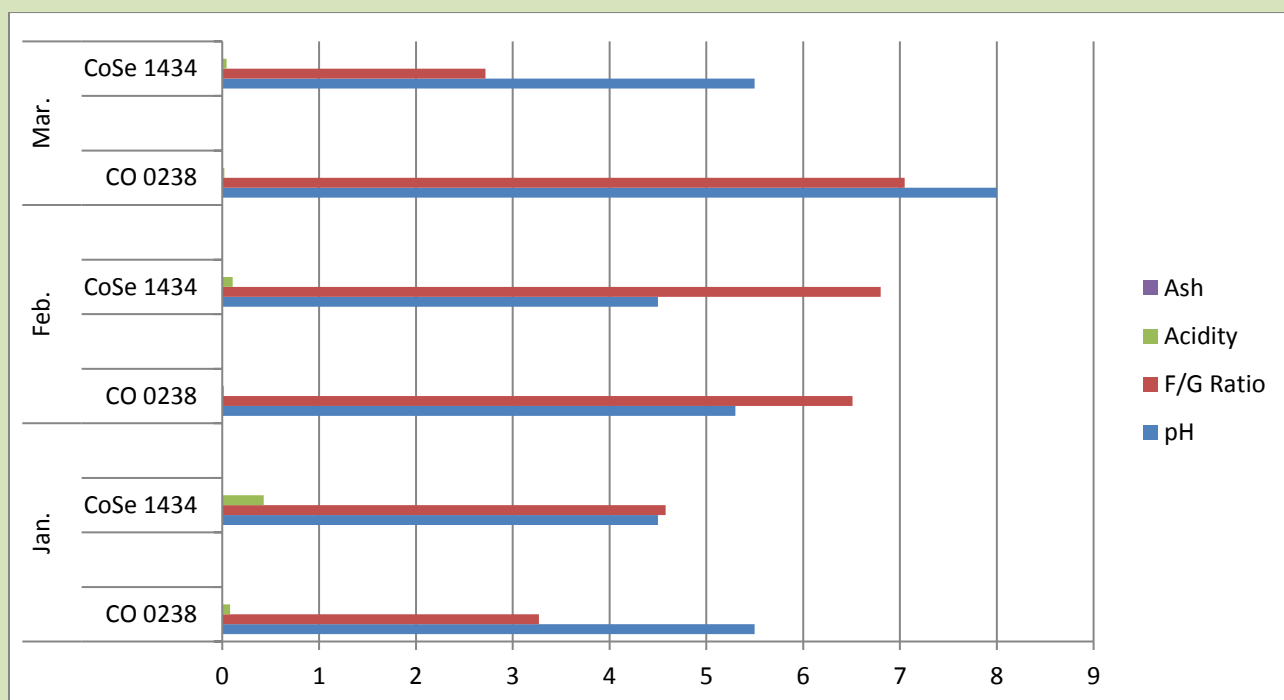


Figure 2 B: Showing the variation of pH, F/G ratio, acidity and ash (Ion exchange resin)



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➤ **HAPPENING IN THE SUGAR INDUSTRY:**

Spray buttermilk to save cane crop from Pokka Boeng disease.

Buttermilk or 'mattha' to save sugarcane crop? Farmers who have sown 0238 variety of cane are increasingly facing problems caused by Pokka Boeng disease and that too when the crushing season is due to begin by October-end. At this stage, use of pesticide is ruled out.

A 50 year old cane order enforced in UP; Maharashtra millers mum.

Even as sugar mills from Uttar Pradesh have paid Rs 342 crore as interest on delayed cane payment in 2016-17, their counterparts in Maharashtra will have to pay interest on delayed cane payment from the 2017-18 crushing season.

Brazil – Insolvency in the sugar-ethanol sector continues.

Bankruptcies in the sugar-ethanol sector sparked by credit crunch nearly ten years ago do not seem to have ebbed, according to a survey conducted by RPA Consultoria.

Gevo to supply jet fuel to Virgin Australia.

The biotech start-up Gevo recently announced that it expects to supply its renewable alcohol-to-jet fuel (ATJ) to the Virgin Australia Group. The Group will be responsible for coordinating the purchase, supply and blending of the ATJ into the fuel supply system at Brisbane Airport in Queensland, Australia.

USA – Hurricane Irma's damage to Florida's sugar industry estimated at US\$383 million.

Damage from Hurricane Irma will cost the state of Florida's sugarcane industry an estimated US\$383 million, the state agriculture commissioner Adam Putnam said on 4th October.

Tanzania – Two pension funds invest in new sugar production project.

Two pension schemes in Tanzania are partnering to produce sugar via investing in the construction of a new sugar factory and cane plantation to address the current shortage of sugar in the country, according to local press reports.

Plasma catalysis process facilitates conversion of CO₂ and CH₄ into fuels and chemicals.

Researchers from the University of Liverpool have made a significant breakthrough in the direct conversion of carbon dioxide (CO₂) and methane (CH₄) into liquid fuels and chemicals.

Guatemala triples exports of sugar to Canada.

Between 2015 and 2016 the export value of raw sugar from Guatemala fell by 4%, falling from US\$ 849 million in 2015 to US\$ 814 million in 2016. The volume sold decreased by 3% from 2.1 million of tons in 2015 to 2 million tons in 2016.

Advanced technologies to overcome stagnancy in sugarcane cultivation.

Acreage under sugarcane has remained more or less stagnant for the past many years causing concern to different agriculture stakeholders. Better yield To overcome the barriers and enthuse the farmers to take up the cultivation over a larger area.

Zambia – New US\$200 million sugar project awaiting planning approval.

The Indian company Nava Bharat, through its local subsidiary, Kawambwa Sugar Limited (KSL), recently submitted an environmental impact assessment (EIA) report to the Zambia Environmental Management Authority to pave way for the development 10,000 hectares integrated sugar estate in Kawambwa.

Australia – SRA invests bulk of its budget on plant breeding programme to drive cane productivity.

Cane growers and the industry will be the beneficiaries of Sugar Research Australia (SRA) led plant breeding program aiming to improve productivity growth by 2% from the newly developed cultivars.

Novel fertilizer tablets created for slow release of plant nutrients.

Researchers at the Siberian Federal University and Krasnoyarsk scientific centre (KSC) of SB RAS have developed a ‘smart fertiliser’ tablet by combining a traditional fertiliser with a biodegradable polymer.

Modus operandi of hydrolytic enzymes offer clues to producing cellulosic biofuels cheaply.

The holy grail of producing cellulosic biofuels cost effectively is the efficient breakdown of cellulosic feedstock into sugars. Researchers at the Graz University of Technology have found that hydrolytic enzymes are effective at breaking down cellulose than previously perceived, paving the way to competitive biofuels.

Germany – Weed control in organic sugar beet costs well over €1500/ha.

For farmers growing organic sugar beet for Nordzucker to be processed at the Schladen factory, weed control has been found to be fairly cost prohibitive, reports Land & Forst.

Jaggery producers to compete with sugar mills to buy early cane.

Encouraged by a sharp increase in realisation through last year, jaggery manufacturing units (termed kolhus) say they're equipped for a price battle with sugar mills on sugarcane purchase.

In big relief for farmers, Centre may hike ethanol price by 5 pct for supplies to OMCs for petrol blending.

The government is likely to raise the price of ethanol by around 5% for supplies to oil-marketing companies for blending with petrol in the next marketing year through November 2018, sources told FE. The Cabinet Committee on Economic Affairs would soon take up a proposal to increase the ethanol price to around Rs 41 per litre for the 2017-18 marketing year from Rs 39 this year.

Sugar eases on subdued demand.

Prices of both the varieties of sugar eased at the Vashi wholesale market here today due to subdued demand from stockists and bulk consumers. Small sugar (S-30) slid by Rs 6 per quintal to Rs 3,670/3,756 from Tuesday's close at Rs 3,676/3,756. Medium sugar (M-30) also moved down by Rs 10 per quintal to Rs 3,762/3,932 as against Rs 3,762/3,942.

Toxic gas case: sugar mill owner booked.

The police has booked the owner and management of a sugar mill here which emitted noxious fumes yesterday, causing scores of school children to fall ill. A biogas plant at the mill, from where the gas had originated, was also sealed by pollution department officials.

Brazil – Renuka do Brasil fires 900 workers from its two mills.

Renuka do Brasil, a subsidiary of India's sugar maker Shree Renuka Sugars, has fired around 900 people from its two sugar mills in Brazil and returned to owners most of the land it used to lease to plant cane, reports Reuters.

Russia – Sugar exports encouraged by Prime Minister Medvedev.

The Prime Minister Dmitry Medvedev told Ministry of Agriculture and the Ministry of Economic Development should develop measures to expand sugar exports from Russia by December 5 this year, according to local press reports.

Turkey – 2017/18 sugar output forecast at 2.5 million tonnes by USDA.

Turkey is forecast to produce 2.5 million tonnes of sugar in 2017/18 according to the recent report from USDA.

South Africa – 2017/18 sugar output 27% up from previous year.

The 2017/18 sugar output in South Africa is forecast to increase to 1.97 million tonnes, up by 27% from the previous year, according to the latest report from USDA.

India – Sugar mills in the southern states surrender import quota.

On September 7, the government had allowed import of 3,00,000 tonnes of raw sugar at a concessional 25% import duty to boost supply in southern India. The import quota was allocated to only southern mills. However, a significant portion of the raw sugar import quota allowed to South Indian sugar mills are being surrendered as imports are unviable and the deadline not practical, according to local press reports.

Converting lignin into plastics in one-step process.

Untangling the complex chains of lignin polymers into components, which can be useful plastics, has presented an ongoing challenge to science and industry. Researchers at the U.S. Department of Energy's Ames Laboratory have devised a new method to process lignin into useful components.

Brazil – Seven Alagoas Cooperative mills file for bankruptcy.

Seven sugarcane mills linked to the Alagoas Regional Cooperative of Sugar and Ethanol Producers (CRPAAA) filed for bankruptcy protection against creditors on 25th October, reported Valor Economico.

Dwarikesh Sugar expects 12-15% increase in crushing & production numbers: Banka.

With the festive season upon us and as the new crushing season begins later this month, the sugar stocks are in focus. Vijay Banka, Wholetime Director & CFO, Dwarikesh Sugar said Diwali looks good because the sugar sales have been good in month of October as well as the earlier months.

Karnataka: Angry cane farmers interrupt Madhwaraj's speech at KrishiMela.

Angry farmers interrupted Minister for Fisheries, Youth Empowerment and Sports PramodMadhwaraj's speech during the inauguration of the two-day KrishiMela at the Zonal Agricultural and Horticultural Research Station here on Saturday.

UP Govt. to set up new sugar mills, modernise older ones: Adityanath.

Uttar Pradesh Chief Minister Yogi Adityanath on Monday said that new sugar mills will soon be set up and the present ones will be revamped and modernised to help the sugarcane farmers in the state.

Rs10 per quintal increase in cane prices on cards.

In a bid to appease farmers, the state government plans to increase the state-agreed price (SAP) for sugarcane by Rs10 per quintal. With this, the early yielding variety of cane could

fetch Rs310 per quintal, mid-yielding variety Rs300 and late-yielding variety Rs295. The SAP will be increased after two years.

Maharashtra farmer bodies want 'better price' for sugarcane.

The start to Maharashtra's cane crushing season of 2017-8 promises to be stormy. Farmer organisations including the SwabhimaniShetkariSanghatana (SSS) have urged farmers to practice restraint and not part with their cane in haste unless a decision is taken on the first cane installment to be given to farmers.

Farmers block tractors to demand better price for sugarcane.

Farmers blocked tractors and deflated tyres of another set of such vehicles during separate protests held to demand higher purchase price for sugarcane. A group of farmers in Kolhapur halted tractors supplying harvested sugarcane to a mill, while another group of cultivators deflated tyres of tractors in Solapur district.

Farmers burn cane at collectorate to protest against Rs 10 hike in sugarcane price.

Hundreds of farmers arrived at the collectorate here on Saturday and burnt their sugarcane crop to protest against the marginal increase in the state advised price (SAP) of cane.

CACP proposes Rs 20 per quintal hike in sugarcane FRP for next season.

The Commission for Agricultural Costs and Prices (CACP) has recommended Rs 20 per quintal hike in the fair and remunerative price of sugarcane at Rs 275 per quintal for next season, a government official said. The fair and remunerative price (FRP), the minimum price sugar mills have to pay to farmers, has been fixed at Rs 255 per quintal for the 2017-18 season that starts from this month.

After sugar price hike, farmers seek disbursal of Rs 1600 crore dues.

Following the announcement of increasing the price of sugar supplied through ration shops across the state to Rs 25 from Rs 13.50 with effect from November 1, the sugarcane growers have demanded the state government to clear the dues.

Sugarcane growers plan protest at SuvarnaSoudha in Belagavi.

Sugarcane growers of Belagavi, Bagalkot, Vijayapura and other districts of North Karnataka have decided to lock sugar factories in the state and hold a day-and-night protest in front of the SuvarnaVidhanaSoudha in Belagavi during the assembly session from November 13, to press for their demands. "

First lifting of sugarcane will be as per MSP.

The first lifting of sugarcane in the upcoming crushing season in Maharashtra will be in accordance with the Minimum Support Price (MSP), state Cooperation Minister

SubhashDeshmukh said here today. "The cooperative sector needs to be more efficient in the state. Cooperative sugar factories are of farmers.

Only 10 safety officials to inspect 3,000 boilers in state.

The boiler explosion at an Uttar Pradesh thermal power plant which left 30 people dead and many others injured, brings a sharp focus on industrial safety in Karnataka. There is an acute shortage of inspectors in the state to check the safety of steam generators, also known as boilers, said sources.

TN: Sugar cane workers' meeting begins.

The two day 48th meeting of the sugar cane research and development workers of Tamil Nadu and Puducherry which commenced here on Wednesday focussed on the problems of the sugar cane farmers and sugar industry for evolving appropriate strategies to improve the sugar cane productivity in the state.

India eyes record sugar output in 2018-19.

Though these are early days, yet there is a section within the Indian sugar industry that has already started talking of a record sugar production of almost 29-30 million tonnes in the 2018-19 crop marketing year that will start from October next year.

Hafed would purchase the entire bonded sugarcane crop of farmers of Assandh.

Haryana Minister of State for Cooperation, Mr. Manish Kumar Grover said that Hafed would purchase the entire bonded sugarcane crop of the farmers of the Assandh area and the Sugar Mill Assandh would be operated till the availability of sugarcane.

Ukraine - Astarta secures US\$25 mln loan from EBRD for its sugar and grain business.

The Ukraine-based agri-industrial Astarta Group has secured a US\$25 million loan from the European Bank for Reconstruction and Development (EBRD) to finance development of its grain and sugar infrastructure.

India - New cogen units in Maharashtra may not be able to sell power.

When the 2017/18 campaign starts on December 1, sugar mills in Maharashtra with new cogeneration plants may not be able to sell surplus power to the grid because the state utility has not signed agreements to buy the power, according to local press reports.

France - New sugar silo at the Le Havre port inaugurated.

Sucre Oceane, a subsidiary of SHGT (a wholly-owned subsidiary of Sogena) and Euroports, inaugurated its new sugar silo in Le Havre (Seine-Maritime) on 31 October.

New process conversion technology for jet fuel production from lignocellulosic feedstock.

Researchers at the University of Delaware have developed new catalysts which could help in converting lignocellulosic feedstock into jet fuel.

Romania – Clariant to build 50,000 t capacity cellulosic ethanol plant.

Clariant has secured an approval from its board of directors to invest in a new commercial scale plant in south-west Romania to produce cellulosic ethanol.

Pairing bacterial strains *Synechococcus elongates* and *Halomonas boliviensis* supports efficient production of PHB.

By combining two kinds of bacteria and sunlight, researchers at the Michigan State University have devised a new way to efficiently produce biodegradable plastics.

Belgium – Euroports expands, upgrades sugar shipping terminal at Antwerp.

Netherlands-based port terminal operator Euroports has finished the renovation of its dedicated sugar terminal in Antwerp, Belgium, just in time for the first delivery trains of the 2017-2018 sugar season, the company said in a September 21 statement.

Brazil – Project to build 3 new ethanol plants in Mato Grosso revived.

Halted due to the economic crisis, the planned project to build three new ethanol plants in Mato Grosso will be resumed later this year, according to local press reports. One significant.

Pakistan – NEPRA grants licenses to 3 sugar mills to sell surplus power.

In a drive towards energy security, which includes renewable energy mix, the National Electric Power Regulatory Authority (NEPRA) recently granted licenses to three sugar mills to cogenerate power with the view of selling surplus power to the national grid, according to local press reports.

China – State company to build 600,000-tonne ethanol plant in Heilongjiang.

China's State Development & Investment Corporation (SDIC) signed a framework agreement to build a 600,000-tonne ethanol plant in northeastern Heilongjiang province, state media said on 7th November, according to Reuters.

Kenya – Sugar industry in disarray as imports rise four-fold.

Kenya's sugar imports increased by nearly 400% in the first nine months of this year, according to the latest figures from the Kenya National Bureau of Statistic (KNBS). This is mirrored by cane production falling to nine-year low.

Leaf Resources secures license for lignin-based biodegradable coating.

Leaf Resources has secured a license for an innovative biodegradable coating product for the packaging market. The product is based on lignin and also utilizes glycerol, two of the products that Leaf's Glycell™ process will produce.

USA – Sugar program under threat from bipartisan bill.

A bipartisan group of lawmakers on 7th November introduced legislation in the House and Senate that would overhaul the U.S. sugar program.

Braskem and Haldor Topsoe partner to produce monoethylene glycol from sugar.

The Brazilian and Danish companies Braskem and Haldor Topsoe A/S's, respectively, are partnering to develop a pioneering route to produce monoethylene glycol (MEG) from sugar.

Philippines commences sugar exports to China first time ever.

The Philippines is exporting US\$8 million worth of sugar to China after some local investors were able to get an allocation from the latter in what seemed to be the result of the warming relationship between Manila and Beijing.

Integrated sugar mills to benefit from 5% rise in ethanol procurement price for 2017-18: ICRA.

The Cabinet Committee on Economic Affairs (CCEA), in a recent announcement, has increased the basic price of ethanol by 5% amounting to Rs 1.88/litre for the procurement season 2017-18. According to an ICRA BSE -0.91 %note, this increase in ethanol price by the Central Government for the procurement season 2017-18 (starting December 2017) to Rs 40.85 per litre for the OMCs might result in an increase in the total contribution margin by around Rs 200 per tonne of sugar produced for fully integrated sugar mills.

DCM Shriram to invest Rs 838 cr on expansion projects.

DCM Shriram will invest Rs 838 crore for expansion of its sugar and chemical business, according to the company's quarterly report. Already, the company is implementing projects involving investments of Rs 350 crore for setting up of a distillery and aluminium chloride units besides expansion of its chlor-alkali unit.

Despite Haryana govt order, private sugar mills fail to advance crushing.

Private sugar mills in the state have not followed the state government's guidelines to advance crushing operations to the first week of November, creating problem for thousands of sugarcane growers. The cooperative sugar mills, however, have started crushing as per the schedule on November 7.

India Sugar Output Seen Rebounding From 7-Year Low on Good Rain.

Sugar production in India is set to bounce back from a seven-year low as the area planted to cane increases and rain boosts yields in the world's top consumer. Production may total 25.886 million metric tons in the crop year that began on Oct. 1.

Cancel contract of company running Daulat sugar factory, farmers tell KDCC.

The farmers are demanding cancellation of the contract between the KDCC and a private company through which the former has leased the latter the functioning of Daulat Co-operative Sugar Factory in Halkarni.

Mills to buy sugar cane at higher prices this season.

The state government, in consultation with the representatives of Bihar Sugar Mills' Association (BSMA), has decided to give increased returns to farmers on three varieties of sugar cane that sugar mills will purchase from them at their gates this season.

Surplus sugarcane crop sends molasses price crashing in UP.

With over two million tonnes of surplus molasses, Sugar mills in Uttar Pradesh are looking at non-traditional markets for remunerative disposal. Mills in UP are looking at non-traditional but high demand markets of Andhra Pradesh and Tamil Nadu for selling molasses; distilleries there needs raw material to produce potable alcohol.

Sugar factories owe 74.25 crore to farmers, says Shettar.

Leader of the Opposition in the Assembly Jagadish Shettar on Wednesday alleged that sugar factories in the State were yet to pay dues of ₹74.25 crore to farmers towards sugarcane supplied by them.

AP Officials want to sweeten the deal for sugarcane farmers.

Adoption of new technology and sowing of new varieties of seeds have been identified as need of the hour to improve sugarcane production in Vizianagaram and Srikakulam districts. Although many farmers have been depending on sugarcane production, they are unable to get decent returns on their investment with the yielding confining to 50 tonnes. quintal of sugarcane by 81 sugar mills including that of 67 in the private sector and 14 in the cooperative with a record recovery of 9.54 per cent by November 17 last.

Effluent treatment plant commissioned at Salem Co-operative Sugar Mills.

The Hindu - 18 November 2017: A modern two-tier reverse osmosis distillery effluent treatment plant set up at a cost of 8.50 crore was commissioned at the Salem Cooperative Sugar Mills in Mohanur near here on Saturday. This is the maiden two-tier RO effluent treatment plant to be set up in Tamil Nadu, said M. C. Sampath, State Industries Minister.

Farmers oppose move to merge Sugarcane Breeding Institute.

The Farmers' Association on Monday petitioned the district collector, T N Hariharan, not to allow the merger of Sugarcane Breeding Institute (SBI) with the Indian Institute of Sugarcane Research, Lucknow.

China aims to fully mechanize cane and beet production.

China will boost mechanization of cane and beet production over the next five years as part of a broader plan to upgrade domestic production.

Iraq – Etihad buys more raw sugar for its refinery from Alvean.

Etihad Food Industries has bought six cargoes, each of 42,000 tonnes, of raw Brazilian sugar from Geneva-based Alvean as it continues to negotiate for a new long-term contract, a senior executive at the Iraqi company said.

Canada – Rogers Sugar acquires maple syrup processor Decacer.

Canada's Rogers Sugar has paid CAD40mln (US\$31.3mln) to acquire Decacer, a Québec-based distributor of branded and private label maple syrup products.

Pakistan – Prime Minister approves exports of 1.5 mln t sugar.

Prime Minister Shahid Khaqan Abbasi on 28th November allowed the export of 1.5 million tonnes of sugar, according to local press reports.

EU to offer Mercosur group 100,000 tonne sugar quota at import duty of €98/tonne.

The European Union has prepared a new farm offer to Mercosur, which this time includes a sugar quota, but not a better access to beef and ethanol from the Southern bloc, according to Valor Economico.

Sugarcane control order puts cottage industry jaggery makers in a spot.

Sugarcane farmers making jaggery in their farms as cottage industry are in a spot, as provisions of the sugarcane control order, 1966 have come to haunt them.

Sugarcane farmers protest 'revenue sharing formula'.

Any attempt to implement 'revenue sharing formula' between sugar mills and sugarcane farmers would spell doom not only for the farmers but also for sugar production as farmers would give up cane cultivation, said Tamil Nadu Farmers' Association general secretary P. Shanmugam.

Tirupati: Sugarcane cultivation drops to just 50,000 acres.

The Government in Chittoor district had reportedly shut down sugar factories over huge losses and now the common sugarcane farmer is burdened over getting as much as the minimum prices for their fixed crop from the private sugar factories who are not willing to pay the minimum prices even.

Sugar mill modernisation project to be taken up.

Deputy Commissioner (DC) Varinder Kumar Sharma today said concerted efforts would be made to get the project of modernisation of Bhogpur Sugar Mill cleared from the state government at the earliest.

Fish kill after sugar factories release chemical effluents to Doodhganga river.

Thousands of fish have died in the Doodhganga river in the past week due to the release of chemical effluents by sugar factories in Maharashtra. Small and big fish are washing up on the bridge-cum-barrage on the river at Karadaga village, Chikkodi taluk.

Unease over cane price: Distress sale by Maharashtra millers fuels worries.

A month after sugarcane crushing season started in Maharashtra, millers in some parts of the state are worried about the momentary slide in sugar prices, which they say might affect their ability to pay growers.

Traders want import duty at 60% to counter cheap sugar from Pakistan.

Traders have requested the food ministry to increase the sugar import duty from 50 per cent to 60 per cent as the drop in local prices coupled with the influx of cheap sugar from neighbouring Pakistan is spoiling the party for farmers here.

Mah minister announces Rs six lakh compensation for Vaijnath Sugar Factory employees.

Maharashtra state rural development minister Pankaj Munde-Palve on Saturday announced Rs six lakh compensation to the three employees of Vaijnath Sugar Factory at Pangari in Beed district, who died during the treatment in hospital due to tank blast occurred Friday.

3 die as hot cane juice scalds them in factory.

Sugar unit linked to Pankaja Munde Three workers were killed and 13 injured, four of them critical, in a mishap at a sugar factory associated with Rural Development Minister Pankaja Munde on Friday.

This man grew 100 tonnes sugarcane in one acre of land, made lakhs in profit.

Suresh's father, Appaso Kabade, owned 30 acres of ancestral land. There was a local sugar mill which offered a good price for sugarcane. Thus, Appaso decided to begin sugarcane farming, and grew around 25-30 tonnes of sugarcane in one acre of land.

Sugar mills to supply 140 crore litres of ethanol.

Sugar mills and ethanol manufacturers have entered into an agreement with oil marketing companies to supply a record 140 crore litres of ethanol for blending during the year, starting last October.

Bihar: Boiler blast in sugar factory kills 4, 9 injured

Four persons lost their lives and 9 were injured when a boiler at a sugar factory in Gopalganj district in Bihar exploded last night. The incident happened at around 11:30 PM on Wednesday at the Sasmusa sugar factory in Gopalganj, approximately 170 kms from Patna.

ISMA: Highest ever ethanol offers accepted/finalized by OMCs; says ISMA.

After two rounds of offers, counter-offers and negotiations between sugar factories/ethanol manufacturers and oil marketing companies, against the first tender invited in November 2017, 140 crore litres of ethanol supplies have been finalized for the supply period 2017-18 (December - November).

➤ ABSTRACTS:

Don't sweat the sweet stuff: how to manage in the new sugar order by Colin Cooper published in International Sugar Journal October, 2017.

On October 1, 2017, the EU's 50-year old sugar quota production system will come to an end, introducing a new dynamic between the European and global sugar markets. Currently, producers and consumers are insulated from the significant price fluctuations in the global market. The end of the quota system exposes every aspect of the sugar value chain to these global headwinds, while simultaneously increasing the level of volatility seen, for at least the short term. This article explores the potential impacts of the end of the sugar quota system on European and international markets for both sugar and isoglucose.

Soil biological health—what is it and how can we improve it? by Richard Brackin, Susanne Schmidt, David Walter, Shamsul Bhuiyan, Scott Buckley & Jay Anderson published in International Sugar Journal October, 2017.

Soil biological health is a topic of great interest to sugarcane growers, although there is confusion as to what constitutes soil health. Many growers and consultants are unaware that beneficial organisms, rather than pathogens and pests, dominate the biological community in a healthy soil. Considering the vast diversity of soil organisms and their complex interactions, it is unsurprising that there is limited knowledge about how

farming practices precisely impact on soil biological health, and how biological health can be achieved. The former Sugar Yield Decline Joint Venture (SYDJV) and subsequent activities have demonstrated that soil biological health represents a significant production constraint. The modern farming system (MFS), with controlled traffic, permanent beds, minimum tillage, legume break crops and crop residue retention, aims to overcome soil constraints, including soil biological health, by minimising problems arising from soil compaction, continuous monoculture and low levels of soil organic matter. In this paper we discuss key organisms that inhabit soils under sugarcane production and how soil biology responds to management practices. We highlight biological indicators of soil health, and their usefulness to growers for quantifying soil responses to changed farming practices. We outline research needs to advance the industry's ability to manipulate soil biological health.

Generation of a 345K sugarcane SNP chip by KS Aitken, A Farmer, P Berkman, C Muller, X Wei, E Demano, PA Jackson, M Magwire, B Dietrich & R Kotap published in International Sugar Journal October, 2017.

DNA markers can enhance rates of genetic gain in breeding programs and are currently being applied in many animal and crop species. The very large sugarcane genome means that many current 'best bet' markers associated with agronomic traits of interest are probably not in very close linkage with underlying causal genes. This will limit gains from future applications of markers in sugarcane breeding. The development of

single nucleotide polymorphism markers (SNPs) in sugarcane can overcome the current limitations as large numbers throughout the genome can be easily screened across many genotypes. To generate a SNP chip for sugarcane with

Today's production requirements – how material selection and innovative design contribute to their fulfillment by Irma Geyer&Andreas Lehnbergerpublished in International Sugar JournalOctober,2017.

For many years, the materials used for sugar production equipment were selected based on criteria such as material strength, corrosion resistance, availability and current prices. Today, additional requirements have to be considered, which are defined by the location where the equipment is to be installed. Examples include food safety (hygiene), operational reliability and maintainability. Material selection enhanced by innovative design allows meeting the highest requirements regarding process optimisation and productivity while also ensuring low wear and tear of the components, low maintenance, and a long service life.

Mechanical properties of lightweight concrete blocks containing bagasse ash by Piyanat To-on,Savalee Uttra&Arjaree Saengsathienpublished in International Sugar JournalOctober,2017.

Limited availability of natural resources, pollution from the production of conventional building materials, and accumulation of unmanaged agro-waste have motivated the

development of new technologies to recycle and convert waste materials into reusable ones. This study aimed to investigate the mechanical properties of bagasse-ash lightweight concrete blocks. The bagasse ash, obtained from the sugar industry, was used as a major raw material for the production of lightweight concrete blocks. It was found that sugarcane bagasse ash is a pozzolanic material combining of silica and alumina that helps strengthen the concrete.

The content of nitrates and nitrites in the semi-products in the final stages of white sugar production process by Paulina Bąk, Aneta Antczak-Chrobot&Maciej Wojtczakpublished in International Sugar Journal November,2017.

Neither nitrates nor nitrites can be removed during purification process and therefore they are encountered in all steps of white sugar production. This is undesirable because the nitrites can react with sulfur dioxide, that leads to an increase in ash content in white sugar, and also causes a significant reduction in sulfitation efficiency and a substantial increase in the color of sugar juices. The nitrites and nitrates also adversely affect the quality of molasses used as feed materials.

Detection, breeding and selection of durable resistance to brown rust in sugarcane by JW Hoy, N Baisakh, MC Avellaneda, CA Kimbeng&AL Halepublished in International Sugar Journal November, 2017.

Brown rust, caused by *Puccinia melanocephala*, is an important disease of sugarcane in Louisiana. The adaptability of the pathogen has repeatedly resulted in

resistant cultivars becoming susceptible once they are widely grown. The frequency of the brown rust resistance gene Bru1 was low in the breeding and selection populations in Louisiana. Through markers-assisted screening and selection, the frequency of Bru1 is increasing in the breeding populations being developed for gene introgression. Bru1 has provided resistance in diverse germplasm across widespread regions. However, over reliance on one resistance source is inadvisable.

Sugarcane outgrower schemes in Mozambique: Findings from the field by JGDB Leite, MRLV Leal&FM Langapublished in International Sugar JournalNovember,2017.

Agro-industries have been widely acknowledged as a way to kick-start agricultural development in developing regions. A number of pro-poor organizations promote production models that include the engagement of smallholder farmers as potential enablers for employment generation, economic development and livelihood improvements. Initiatives such as this appear in Sub-Saharan Africa with a focus on food and bioenergy crops. However, the large-scale production of cash crops, such as sugarcane, also raises concerns. A critical aspect is the impact of land-use on food security, particularly if local communities are constrained in cultivating traditional crops. In this paper, we explore the relationship between

Pan life cycle management by Robert Iturbepublished in International Sugar JournalNovember,2017.

Mackay Sugar Limited routinely carries out pan vessel inspections and non-destructive thickness testing as part of a pan's life cycle management system. This paper details the previous thickness testing regime and how, due to inconsistent readings and recording, a new approach to thickness testing was required and how this was achieved. In addition, the paper provides details as to how and why the new testing method was adopted and how the information is tabulated. It also describes how the measurements are used to determine the inspection intervals and the pan vessel life.

Results from the commercial operation of a fractal shallow-bed ion exchange decolorizer by S.D. Peacock,O. Tzschaetzsch,B.-C.Schulze&V.

Kocherginpublished in International Sugar JournalNovember,2017.

The use of relatively shallow resin beds, in conjunction with efficient fractal fluid distribution, has been shown to reduce both the capital and operating costs of ion exchange systems. The use of highly efficient fractal distributors reduces the amount of waste regenerant produced and minimizes process dilution, which are critical factors in a successful sugar refining application. Regenerant use can further be optimized by means of partial recycle and the membrane filtration of regenerant waste (either using nanofiltration or high pressure reverse osmosis) for brine recovery.

DECIPESTS, a decision-support system for pest management in sugarcane by Pierre Martin&Francois-Regis Goebelpublished in International Sugar Journal December,2017.

Integrated Pest Management requires consideration of multiple interrelated and interdependent factors that influence pest infestations and population dynamics. Finding the reasons behind damage and the resulting crop loss is a key element to identifying and implementing an effective and sustainable solution with a minimum cost. To this end, DECIPESTS, a DECISION support system for PEST management in Sugarcane, was developed using Cogui software. As a first step, interactions regarding food webs of different insect communities (Lepidoptera, Coleoptera, Hemiptera, etc.) and the impact of major agricultural practices (insecticides, soil preparation, variety, irrigation, fertilization, etc.) in the agro-system were implemented.

Diversity of *Colletotrichum falcatum* population in India: Comparative virulence at two different agro-climatic regions by R. Viswanathan, P. Malathi, A. Ramesh Sundar, K. Kaverinathan, M.L. Chhabra, B. Parameswari & R. Jothi published in International Sugar Journal December, 2017.

The fungal pathogen *Colletotrichum falcatum* causing red rot in sugarcane exhibits enormous variation in pathogenicity. Detailed studies were conducted to assess comparative virulence of about 117 *C. falcatum* isolates collected from different states in India at two different climatic conditions viz., tropical (Coimbatore) and sub-tropical (Karnal) conditions for five years under field conditions on a highly susceptible cv CoC 671. Pathogenic reactions of the isolates were categorized into highly virulent (HV), virulent (V), moderately virulent (MV),

less virulent (LV) and least virulent (LeV) based on disease reactions in the stalks.

An investigation into the viscosity of C-massecuite using a pipeline viscometer by S. Shah, D Lokhat & S.D Peacock published in International Sugar Journal December, 2017.

Most product streams within the sugar process have physical properties that are well defined. However, upon crystallisation, the behaviour of the two-phase product becomes more complex. The physical properties of massecuite affect the design of all equipment and piping in the back-end of a sugar factory, however, the performance of equipment is only as reliable as the data on which the design is based. The massecuite viscosities used within the South African sugar industry were determined over 20 years ago using a rotating viscometer, however, this instrument is believed to be unsuitable for the application due to the heterogeneous...

The need of bagacillo in processing? by F Plaza, CH Bakir & DW Rackemann published in International Sugar Journal December, 2017.

The historical use of rotary vacuum filters in the Australian sugar industry to recover sugar from the clarifier mud has dictated that some bagacillo is allowed to flow through juice screens and subsequently into the clarifier mud stream to improve the porosity of the mud cake that develops on the rotary vacuum filter screen and hence improve washing efficiency and juice drainage. In some cases, particularly at times of high soil loading in the cane supply, additional bagacillo is added at the mud mingler. This bagacillo is usually removed from bagasse by the use of a pneumatic separator and

Effects of Maltodextrin Powder Addition on the Rheological and Thermal Properties of Molasses by Yong Wang, Tuyen Truong, Bao Wang, Sangeeta Prakash & Bhesh Bhandari published in Sugar Tech November, 2017.

Molasses is a highly viscous liquid that causes difficulty in transportation and other applications. Conversion of molasses into free-flowing powder can be an economic way to resolve this challenge and broaden its end-use. Maltodextrin is typically used as an effective carrier for drying of viscous liquid. The objective of this study was to investigate the rheological properties of molasses as affected by the addition of maltodextrin (DE 12) powder at various levels (10–40% w/w). The apparent viscosity and dynamic moduli of both pure molasses and molasses–maltodextrin mixtures were characterized and modeled using power law at various temperatures. In general, the results showed that the addition of maltodextrin significantly increased the viscosity, storage modulus and loss modulus of the molasses, as well as the activation energy derived from viscosity versus temperature curves. The addition of maltodextrin increased glass transition temperature (T_g) of the mixture solid. Such results are useful for further investigations on the direct mixing method using maltodextrin as an aid for the manufacturing process of dried molasses.

Use of secA Gene for Characterization of Phytoplasmas Associated with Sugarcane Grassy Shoot Disease in India by Shailender Kumar, Vikas Singh Jadon & G. P. Rao published in Sugar Tech December, 2017.

Surveys of commercial sugarcane varieties were conducted to the phytoplasma disease incidence in eight major sugarcane growing states of India (Uttarakhand, Uttar Pradesh, Maharashtra, Bihar, Assam, Chhattisgarh, Haryana and Tamil Nadu) during 2014–2015. Leaves from 24 symptomatic sugarcane plants of eight varieties showing grassy shoot and chlorosis symptoms, and of 8 non-symptomatic plants were collected and analyzed for phytoplasma presence using 16S rRNA and secA gene-specific primers. Amplification of 1.8- and 1.2-kb products using nested primers (P1/P7 and R16F2n/R16R2) of 16S rRNA gene and 880- and 480-bp products using secA gene-specific primer pairs (SecAfor1/SecArev3 and SecAfor2/SecArev3) was obtained for all the 24 symptomatic sugarcane samples. Pairwise sequence comparison, phylogenetic and in silico RFLP analysis of partial 16S rRNA and secA gene sequences of eight strains of sugarcane grassy shoot phytoplasma representative of the eight states confirmed the association of 'Candidatus phytoplasma oryzae'-related strains (16SrXI-B) with symptomatic sugarcane varieties. The study confirmed that secA gene-specific primers could be employed for molecular characterization of phytoplasmas associated with sugarcane grassy shoot phytoplasmas belonging to 16SrXI group.

Epidemiology of Fusarium Diseases in Sugarcane: A New Discovery of Application of Enzymes & Sugar Process Chemicals by S.M. Chavan & D.M. Raskar published in the proceedings of Annual Convention of STAI 2017.

The Application of specific formulated enzymes in double sulphitation process has been introduced in Indian sugar industry in contest of reduction of process chemicals consumption during sugar processing as well as improvement in quality of sugar in terms of reduction in starch and dextran concentrations and also on the improved exhaustibility of C-masseccuite by improvement in R.S. / ash ratio and final molasses purity.

Boiling Mechanism in Rising Film Vertical Tube Evaporator by O.P. Thaval, R. Broadfoot & G.A. Kent² published in the proceedings of Annual Convention of STAI 2017.

This paper presents the results from a PhD study undertaken to investigate the heat transfer coefficient of vertical tubes of different lengths and diameters over a wide range of operating conditions. Condensate rates were measured along four equidistant lengths of a single tube. Six boiling patterns were identified of which four boiling patterns were significant in terms of percentage of results. The effect of tube dimensions and operating conditions on the boiling patterns were investigated. A boiling mechanism was proposed wherein "Annular flow" does not exist in sugar mill evaporators. Two boiling patterns were identified to be the preferred boiling patterns in the tube. Operating the evaporator close to the optimum conditions might result in formation of these boiling patterns and good heat transfer performance can be achieved.

Fully Automated back end Sugar Refinery with Decanter Technology for Scum

Desweetening by Sanjay Awasthi, Anurag Goyal, Gaurav Awasthi & Nitesh Kumar published in the proceedings of Annual Convention of STAI 2017.

This paper reviews application of automation in sugar refinery for job simplification besides improving efficiency. The back end sugar refinery was commissioned by ISGEC in existing raw sugar plant at Mexico in year 2017, to produce pharmaceutical grade sugar of less than 25 IU. Three stage scum de-sweetening or other such systems are generally used for scum de-sweetening but here Decanter technology is first time used for desweetening of scum with good results.

Improved Design of a Falling-Film Tubular Evaporator with a Maintenance-Friendly Novel Juice Distributor by Anurag Goyal, Gaurav Awasthi & Deepti Mishra published in the proceedings of Annual Convention of STAI 2017.

Several variants of falling-film tubular evaporators (FFTE) are in use in cane sugar industry. Most of these suffer from two main drawbacks: (i) occasional tube chokes due to uneven distribution of juice, (ii) absence of headroom between the top tube sheet and juice distributor necessitating its dismantling for mechanical de-scaling of tubes.

A new design of juice distributor has been developed. It comprises an inlet weir box and a five-stage cascading system that forms a uniform shower of juice across the entire cross-section. It is installed at 1.8 m above the top tube sheet to facilitate easy access to various tubes for inspection or mechanical de-scaling without its dismantling. A segmented tray plate bolted to the top tube

sheet and having an individual tripod-type umbrella structure located over each tube ensures equal wetting of each and every tube, making the system failsafe.

Iron-Chlorogenic Acid Interaction and Development of Colour during Sugar Processing by Kaman Singh & Ajay Kumar published in the proceedings of Annual Convention of STAI 2017.

Colour formation study of the complexation of chlorogenic acid with ferric chloride was performed using UV-Vis absorption spectroscopy. The colour complexation reaction was found to be a first-order with rate constants for k_1 (formation) $2.4 \times 10^{-2} \text{ min}^{-1}$ for chlorogenic acid. The effect of concentration and temperature on the complexation reaction was also investigated. The apparent activation energy of the complexation reaction was evaluated to be 0.085 eV.

Performance of spray continuous pan at a glance by Vivek Verma, Ashok Kumar Nanda & Dinesh Kumar Saini published in the proceedings of Annual Convention of STAI 2017.

Energy in production unit always remained as the major concern for profitability of that unit. In sugar factories thermal energy consumption contribute the major role in the revenue of the factory. Thermal energy i.e. steam is consumed directly or indirectly majorly in two areas of the sugar processing i.e. evaporation and crystallization.

Evaporation has been made less energy intensive by increasing more no. of effect, but least has been done for crystallization even

crystallization consumes major portion of steam energy in a sugar manufacturing. Spray Continuous Pan (SCP®) is one such effort in the field of continuous crystallization. This technology which is developed for optimizing crystallization of sugar solutions in sugar factories is now increasingly accepted by sugar technologists.

Continuous operation without any compromise on the process parameters is the specialty of SCP®. SCP® is multi-chambered mechanically stirred vertical structure with many distinct features along with ease of operation and installation flexibility too. This paper presents the results and performance achieved in one of the installation of the vertical spray continuous pan in a sugar factory located in Northern region of India where juice purities is less comparatively to other region.

The result shows a unique heat economy & product quality along with substantial reductions of primary energy consumption in that plant

Plate Falling Film Evaporator – An Efficient Evaporation Technology by Vivek Verma & Dinesh Kumar Saini published in the proceedings of Annual Convention of STAI 2017.

Evaporation is the most energy intensive unit operation in the sugar industry because it involves change in phase from liquid to vapours. Separation of water from juice by evaporation & condensation is done to make the juice close to supersaturation so as to get the dissolved sucrose crystallized out. A major amount of thermal energy is consumed in this unit operation. The energy

consumption of the total system can be optimized by best thermal configurations of the evaporation plant.

Plate Falling Film Evaporator (PFFE) is efficiently developed for optimizing evaporation of sugar solutions. High efficiency evaporation without any compromise on the process parameters is the specialty of PFFE. Because of the very high heat transfer rate of these evaporators, evaporation from a sugar solution at very low ΔT can be easily accomplished. This paper presents the technological development of the PFFE in the evaporation which allowed a unique heat economy due to lowest ΔT operation in the sugar house, along with substantial reductions of energy consumption.

Reduced Preparation Index as a Means of Comparing Efficiency of Cane Preparatory Devices by K. Jagadeesh published in the proceedings of Annual Convention of STAI 2017.

There are two methods to determine the degree of cane preparation. Australian Sugar Industry adopts "Pol Percentage Open Cells (PPOC)" method & South African sugar industry prefers "Preparation Index (PI)" method. ICUMSA had adopted PI method as followed by South Africa, with modifications.

There is no consensus as yet on the superiority of one over other hence results of both these methods are reported. So, necessity arises to critically analyse and understand the fundamental differences between these two methods to arrive at a

rational opinion on their adaptability in Industry. The PI method is simply the ratio of concentration of dissolved solids in the extracts on leaching and disintegration of prepared cane samples for a pre set time with equal cane to water ratios for both the determinations. PPOC method is based on an entirely different concept as compared to PI method. Analysis and interpretation of its concept indicates that it may be aimed for arriving at reduced PI value of prepared cane, taking into consideration a constant value of Fibre% cane.

Its critical analysis by the author in this technical paper concludes that PPOC formula can hardly be relied upon as a dependable indicator of PI as neither a pure Preparation nor a Reduced Preparation Indicator.

The present study concludes that the assumptions considered by original author of PPOC (ISSCT 1962 and QSSCT 1971) with respect to hygroscopic water and fibre looked in it needs for suitable corrections and thus a revision in its formula is necessary. A revised formula for measuring the degree of cane preparation, by considering relevant concepts from both methods, is proposed in this paper. Unlike other reduced formulae for mill extraction and boiling house extraction, at present there is no such formula for measuring reduced Preparation Index.

So, a new formula, termed as Reduced Preparation Index, (RPI) has also been derived and proposed by the author. Such a formula will be useful for a meaningful comparison of efficiencies of different cane preparation devices, their power consumption, milling performance etc.

Reducing Steam Consumption at M/S Maa Rewa Sugar by Akhilesh Kumar Goyal, Sudhir Kumar & M.B. Londhe published in the

proceedings of Annual Convention of STAI 2017.

Sugar industry is striving to reduce steam consumption. M/s MAA REWA Sugar has achieved a considerable success to reduce steam consumption producing sugar. The various steps taken to bring down steam consumption to 36- 37 % cane have been described in the article.

Screening of Hot Raw Juice using Rotary Juice Screen by Chaitanya S. Joshi published in STAI 2017.

The article describes the details of hot juice rotary screen installed at few sugar mills along with data collected which shows hot juice quality improves by further screening of hot raw juice. Single stage screening which is universally carried out has the following limitations: 1. Very fine cane preparation has increased fine particles of bagacillo in the juice which is not satisfactorily removed by 500 micron screen in Single stage. 2. These fine particles interfere with clarification process besides choking juice pipes and pumps, plate heat exchange opening. 3. Particles have also been observed floating in clear juice.

Hence it was thought to provide further screening of heated raw juice using a finer mesh at the rotary screen. The results were quite interesting and encouraging. The Sugar colour improved making sugar easily acceptable to the beverage industry.

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