SHARKARA

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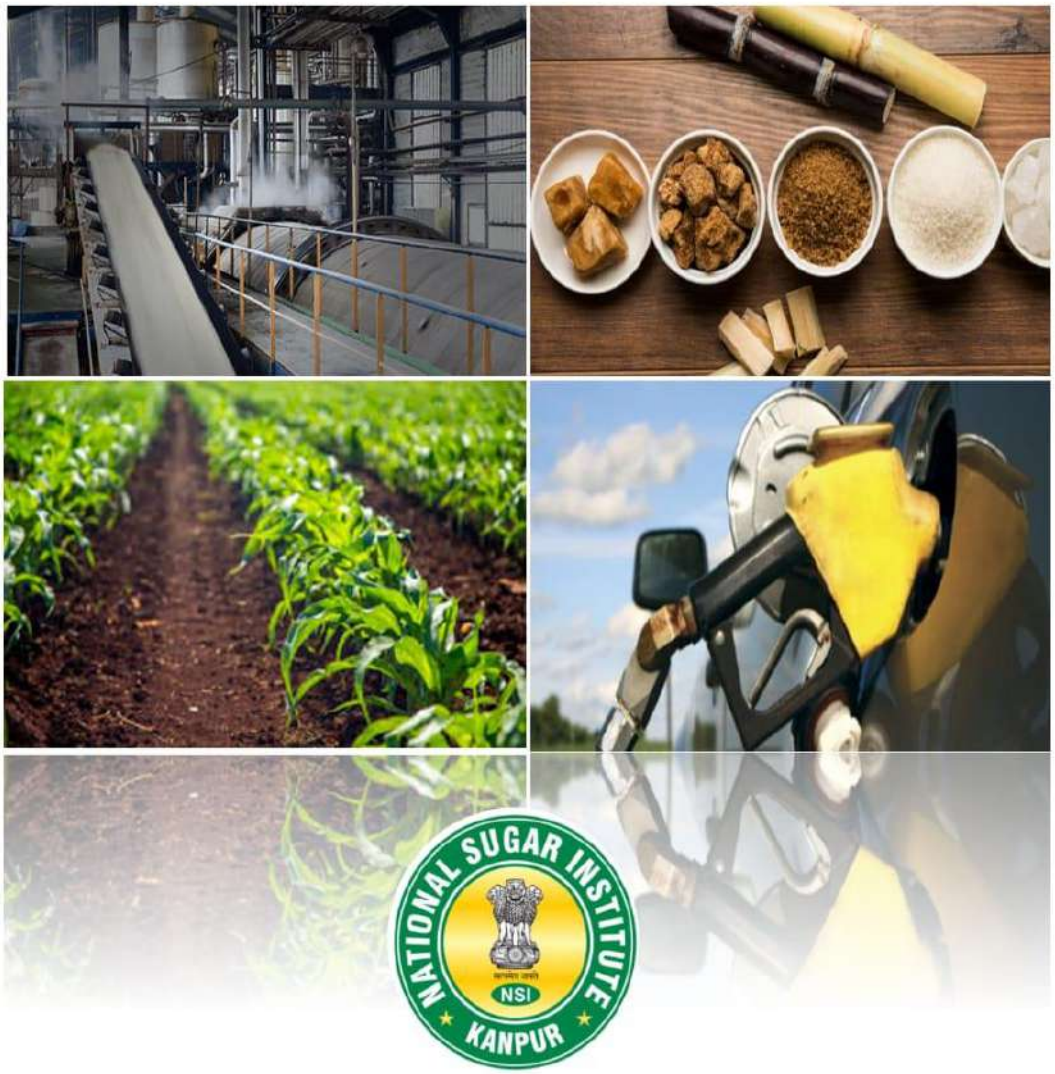

NATIONAL SUGAR INSTITUTE

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It contains……

From Director's Desk...

During the period, efforts to take institute activities to other countries continued and yield results as well. The institute signed a MoU with Great Lakes University of Kisumu, Kenya for conducting training programmes for technical personnel from Kenyan sugar factories, developing infrastructural facilities at University of academic and research activities and miscellaneous other technical matters. Process for signing of MoU's with organizations from Cuba and Fiji has also been taken up for similar objectives. Institute also received request from Bangladesh Food and Sugar Industries Corporation for rendering training and extension services.

As regards domestic sugar industry, as per the revised estimates, the sugar production in the country during the sugar season 2022-23 is likely to be about 32.7 MMT and thus after considering exports to the extent of 6.0 MMT, the sugar availability in the domestic market shall be just adequate to meet the requirement. On the ethanol front, all out efforts shall be required to cope with 12% blending during ethanol supply year 2022-23.

While greater diversion of juice or syrup for ethanol production shall be required for higher blending targets in future, it would be essential to improve the sugarcane productivity on pan India basis. Newer sugarcane varieties are desperately required in the state of Uttar Pradesh where the dominating sugarcane variety has shown deterioration. Climate resilient, high yielding & high sugared varieties requiring lower irrigation water are to be developed.

Institute continued its endeavor to bring forth newer processing techniques viz. production of refined sugar using carbon dioxide from distillery fermenters, water purification technique based on phytoremediation and developing various value added products from sweet sorghum bagasse. In addition to it, laboratory scale trials continued for production of low glycemic index sugar and on production of bio-ethanol from sugar beet.

In order to disseminate knowledge, the institute organized training programme on behalf of Central Pollution Control Board besides conducting workshops on "Efficient water management & ETP operation" and "Intellectual Property Rights" with CPCB and NRDC respectively. Institute has planned many activities in coming months too e.g. Executive Development Programme and International Conference where active participation of all stake holders is solicited. The new academic session 2023-24 to commence from July 2023 and for admission to various courses, online examination was conducted at twelve center's in various sugar producing states of the country.

(Narendra Mohan)
Director

❖ OUR PROVISIONS

❖ NSI AWARED BY SECOND PRIZE FOR SWACHHATA PAKHWADA:

National Sugar Institute, Kanpur was ranked second amongst all the organizations of Department of Food & Public Distribution, Ministry of Consumer Affairs, Food & Public Distribution, Government of India for the exemplary cleanliness drive taken up during the **"Swachhata Pakhwada's"** for the two consecutive years 2022 and 2023. Shri Sanjiv Chopra, Secretary (Food & Public Distribution), Government of India gave away the awards to Director, National Sugar Institute in a ceremony held at Krishi Bhawan, New Delhi on 6th April 2023.

❖ NATIONAL SEMINAR ORGANIZED:

One day National Seminar on **"Water & Effluent Management in Sugar Industry- Emerging Challenges"** was jointly organized by National Sugar Institute and Central Pollution Control Board (CPCB) on 10th May 2023 at NSI, Kanpur. It was attended by large no. of delegates from Haryana, Bihar, Uttar Pradesh, Uttarakhand, Madhya Pradesh, Maharashtra and Karnataka.

Mrs. Reena Satawan, Additional Director, Central Pollution Control Board, New Delhi in her address stressed upon adoption of best available technologies and standard operating procedures for reducing the quantity of effluent discharge.

Shri Narendra Mohan, Director, National Sugar Institute, Kanpur in his address suggested that instead of insisting on quantity of effluent discharge, the norms should stress on fresh water intake and quality of discharge, which may be made more stringent.

❖ TRAINING PROGRAMME ORGANIZED:

i. National Sugar Institute, Kanpur organized training programme on **"Quality Control"** at the institute from 15th May 2023. Technical personnel from 21 sugar factories of Uttar Pradesh Cooperative Sugar Federation participated in two weeks long programme in similar lines various other training programme were conducted on the topics related to **''Efficient Ethanol Production"**, **''Cogeneration''** and **''Sugar crystallization,** wherein the participants were imparted knowledge about the latest technological developments, standard operating procedures and various do's and don'ts.

ii. Three days training programme on **"Advanced Treatment Technology of Waste Water with Respect to Recycle/ Reuse of Treated Water"** was organized at National Sugar Institute, Kanpur 29th–31st May 2023. The programme was attended by officers of Central & State Pollution Control Boards (CPCB). Institute faculty and experts from other organizations deliverd lectures on subject related to techniques for minimizing fresh water consumption, maintaining discharges as per CPCB norms and about technologies for implementation in future.

❖ INAUGURATION OF SPORT STADIUM:

"N.A. Ramaiah Sports Stadium" was inaugurated by Sadhvi Niranjan Jyoti, Hon'ble Minister of State, Ministry of Consumer Affairs, Food & Public Distribution & Rural Development, Government of India on 18th May 2023 at National Sugar Institute, Kanpur. The stadium is equipped with a visitor gallery, dug outs, changing room will be used for athletic, cricket and other outdoor sports.

❖ WORKSHOP ORGANIZED:

National sugar institute, Kanpur organized workshop jointly with Bharatiya Sugar at Kolhapur on 23rd-24th June 2023. Director NSI, Kanpur addressed the participants on the matters related to modelling of sugar industry. Highlighted newer environment friendly processes to produce sugar quality as per market requirement, producing value added products, side by side boosting ethanol production.

❖ INAUGURATION OF CHILDREN PARK & OPEN GYM:

A **"Children Park & Open Gym"** was inaugurated on 7th June 2023 by Mrs Pramila Pandey, Mayor, Kanpur at National Sugar Institute, Kanpur. The park on the one hand has swings, slides and sea-saw etc. for children, it also has sky walker, chest & shoulder press, hand rotator and pull up bars etc. in the open gym.

❖ RESEARCH WORK:

1. **Studies on Sweet Sorghum bagasse value addition:** The Experiments (two batches-10 gm bagasse each) related to fractionation of individual component of the Sweet Sorghum Bagasse (cellulose, hemicellulose, lignin) have been completed. Observation on cellulose content in bagasse were not found in conformity with the literature values. Thus, reanalysis of cellulose content is currently ongoing. Along with the experimental work, literature survey related to Chloro Methyl Furfural (SSB) has also been taken up.

2. **Cane juice syrup study for shelf-life and production of alcohol:** Syrup Samples collected from three factories viz; M/s Dalmia Bharat Sugar & Ind. Ltd., Unit – Jawaharpur, M/s Dalmia Bharat Sugar & Ind. Ltd. Unit - Nigohi, & M/s DCM Shriram Unit - Ajbapur after recording initial parameters like ^{o}brix, Pol, purity, TRS etc. were kept at room temperature in Biochemistry laboratory to assess the shelf life of the syrup. It has been observed that no detoriation was seen in sample having high brix for about four months of storage. However, microbial contamination was observed in some samples, reasons for which are being investigated. The study shall now be taken up in collaboration with commercial sugar factories during the forthcoming crushing season.

3. **Study of Sugar beet lines for ethanol production:** Six sugar beet germplasm lines, viz., IISR Comp 1, LS 6, LKC HB, LKC 2020, LKC LB, LKC 2006 were sown by agriculture chemistry division and varieties were harvested in the month of April & May first week. Out of three varieties only LS-6, IISR Comp and LKC2020 germinated and harvested. The yield of sugar beet per hectare and ethanol yield from the same has been evaluated. High temperatures during March and April 2023 appear to have adversely affected the cultivation in general and three varieties, as referred, in specific.

4. **Comparative study on polarization by using lead, non-lead, clarificants and NIR polarimetry:** Samples of B heavy molasses were used for the purpose & polarization was made at 589.9 nm & 880 nm by using lead & Carrez reagent as clarificants. A decrease in Pol % & Purity to the extent of 0.4 & 3.68 unit was observed at 880 nm, in case of samples clarified with Carrez reagent. However, the polarization was out of range at 589.9 nm by using Carrez reagent. As regards, colour (IU) of B heavy molasses, it was also observed that the colour reduction was 56.1% in case sample clarified with lead subacetate while it was only 19.10% in case of Carrez reagent. The results were discussed during the 33rd session of ICUMSA held at Vienna, Austria and further studies shall be taken up as per the deliberations.

5. **Production of Invert syrup directly from sugarcane juice and Raw sugar:** Two batches of medium invert sugar were prepared from raw sugar solution (271 IU, as per ICUMSA METHOD GS 10) using membrane filtration. One batch was dosed with Monk fruit extract (98% pure) while the other batch was dosed with Stevia extract (99 % pure). Quarterly analysis of parameters such as brix, pol, purity, RS, TRS, colour was carried out. The medium invert liquid sugar samples exhibited good keeping quality with no microbial growth. The liquid sugar samples were kept at 3 different temperatures (@ 15 ^{0}C, 32 ^{0}C and 36 ^{0}C) to observe changes such as microbial growth, crystal formation etc. No marked changes were seen in the samples kept at different temperatures in second month also. No microbial growth or any type of crystal formation is observed however,

the stevia sample of liquid sugar kept at 15 ^{0}C formed a cloudy mass, which upon reheating disappeared.

6. **Comparative study of activated biochar from sugarcane and sweet sorghum bagasse in decolourization of sugar melt:** Characterization and data interpretation of prepared biochars producted from two different sources was carried out. Manuscript of a paper based on comparative study of the efficiency of biochars prepared from sweet sorghum bagasse and sugarcane bagasse for decolourization of 65° brix of sugar melt liquor has been sent for publication. The studies shall be further extended to assess efficiency of such activated bio-char for tertiary treatment of the effluents from the sugar industry.

7. **Conversion of Wastewater into Potable water through Bioremediation technique:** Further trials with effluent for different retention time in primary and secondary stages of treatment were carried out. For the purpose an innovative Bio-filter was developed for primary treatment, while secondary treatment was carried out on the principle of Phytoremediation using water hyacinths. Analysis of physiochemical parameters of the waste water samples before and after treatment indicate satisfactory performance of the system and to convert it into potable quality water.

Further studies shall be taken up to validate the system efficiency and also to work out cost economics. Pilot plant trials are proposed to be taken at the site of two commercial sugar factories.

8. **Shelf life study of press mud:** Samples of press mud from UP, Bihar, Haryana and Chhattisgarh were collected and stored at the institute. 10 blant + 10 treated samples (enzyme provided by M/s Praj Industries Ltd.) of each factory are being analysed for parameters such as pH, total solids (moisture content), ash content, total volatile solids (TVS), lignin and total convertible volatile solids (TCVS) on monthly basis to observe the degradation in both blank as well as treated press mud samples.

9. **Utilisation of Sweet Sorghum bagasse as Dietary Fibre:** Microwave-aided alkali treatment and autoclave-aided alkali treatment was given to sweet sorghum bagasse. Treated samples have been analysed for physicochemical properties and structural characterization of sweet sample was done by Fourier Transform Infrared Spectroscopy (FTIR). Further experimental work is in progress.

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❖ RESEARCH PAPERS:

1. A research paper entitled **"Melt Carbonation – A Different Approach & its Comparison with Phosphatation"** by Narendra Mohan & Mahendra Yadav, sent for publication to the Deccan Sugar Technologists Association (DSTA).

2. A research paper entitled **"Silica Nanoparticles from Sugarcane Bagasse Fly Ash: Converting Waste to Wealth"** by Shalini Kumari, Vishnu Prabhakar Srivastava & Narendra Mohan sent for publication to the International Journal of Science and Research (IJSR) Volume 12, Issue 4, April-2023.

3. A research paper entitled **"Ethanol from Maize: A Potential Feed Stock"**by Narendra Mohan sent for publication inthe convention of Sugar Technologists' Association of India (STAI).

4. A research paper entitled **"Performance of Grossly Polluting Industries-Sugar & Distillery Units Located in River Ganga Basin"** by Narendra Mohan & Anoop Kannaujia, published in the National Seminar on "Water & Effluent Management in Sugar Industry-Emerging Challenges" organized at National Sugar Institute, Kanpur.

5. A research paper entitled **"A Sustainable Indian Sugar Industry Through Efficient Exploitation of Sugarcane By-Products"** by Narendra Mohan & Anoop Kanaujia published in sugar journal Sharkara.

6. A research paper entitled **"Sweet Sorghum: A Wonder Crop"** by Shalini Kumari, Mamta Shukla, Shruti Shukla and Himanshu Mishra has been sent to the convention of Sugar Technologists' Association of India (STAI).

7. A research paper entitled **"Comparative Study of Activated Biochar from Sugarcane Bagasse and Sweet Sorghum Bagasse in Dec-colorisation of Sugar Melt"** by Shalini Kumari, Sudhanshu Mohan and Narendra Mohan, has been sent to the convention of Sugar Technologists' Association of India (STAI).

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❖ MoU SIGNED:

1. National Sugar Institute, Kanpur signed Memorandum of Understanding with ICAR- Indian Institute of Maize Research, Ludhiana on 10th April 2023. The MoU focusses on development of new maize hybrids suitable for different agro-climatic zones and evaluation of performance with respect to ethanol production potential. Maize is considered as "Queen of Cereals" and the crop offers many benefits over other crops being used for ethanol production particularly in respect of duration and water requirements, said Shri Narendra Mohan, Director, NSI, Kanpur. Dr. H.S. Jat, Director, ICAR-IIMR stressed on bridging the gap between productivities of rabi and kharif crop and to attain a benchmark productivity.

2. National Sugar Institute, Kanpur signed Memorandum of Understanding with Great Lakes University of Kisumu, Kenya on virtual platform on 19th May 2023, for conducting teaching & training in the area of sugar processing. Prof. Hazel, Vice Chancellor, Great Lakes University of Kisumu expressed his confidence that with this collaboration it would be possible to fulfill the requirement of technical manpower needs of the East Kenyan sugar factories.

National Sugar Institute, Kanpur shall also extend its expertise to Great Lakes University of Kisumu for developing teaching and training facilities in sugar processing discipline and training of the faculty.

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❖ OUR ADVISORY:

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

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.
4. To render assistance to various government organizations in implementation of policies, validations and on associated matters.
5. To extend human resource management services to various government and private organizations.

❖ CONSULTANCY:

Requests for availing consultancy services of the institute were received and also provided to various sugar factories ethanol & other allied units on various technical matters relating to diversion of B Heavy molasses/syrup, validation of ETP's, preparation of DPR's, validation of no increase in pollution loads in ethanol units upon enhancement in capacity and to conduct technical audit etc.

Sr. No.	Factory Name
1	M/s Magadh Sugar and Energy Ltd., (Unit - Bharat sugar Mills), Gopalganj, Bihar.
2	M/s KM Sugar Mills Ltd., Ayodhya, U.P.
3	M/s PBS Food (Sugar) Pvt., Ltd., Bijnor, U.P.
4	M/s Wave Industries Pvt. Ltd., Bulandshahar, U.P.
5	M/s Balrampur Chini Mills Ltd., Chemical Division –Balrampur, U.P.
6	M/s Triveni Engineering & Industries Ltd., Unit – Raninangal, Moradabad, U.P.
7	M/s The Amaravathi Co-operative Sugar Mills, Tirupur, Tamil Nadu
8	M/s Bajaj Hindusthan Sugar Mills Ltd., Unit- Kinauni, Meerut, U.P.
9	M/s UP Co-operative Sugar Factories Federation Ltd., Lucknow, U.P.
10	M/s Dhampur Sugar Mills Ltd., Chemical Division, Bijnor, U.P.
11	M/s Ganga Kisan Sahkari Chini Mills Ltd., Unit- Morna, Muzaffarnagar, U.P.
12	M/s E.I.D. Parry (India) Ltd., Sankil, Vazianagaram, Andhra Pradesh
13	M/s Nirani Sugar Mills Ltd., (Sugar Division), Mudhol, Bagalkote, Karnataka
14	M/s MRN Cane power India Ltd. (Sugar Division), Bagalkote, Karnataka

15	M/s DCM Shriram Ltd., Unit- Hariawan, Hardoi, U.P.
16	M/s LH Sugar Factories Ltd., Distillery Division, Pilibhit, U.P.
17	M/s Dhampur Sugar Mills Ltd., Unit – Dhampur, Bijnor, U.P.
18	M/s The Shahabad Cooperative Sugar Mills Ltd., Shahabad, Kurukshetra, Haryana
19	M/s Dalmia Bharat Sugar & Industries Ltd., Unit – Ramgarh, Sitapur, U.P.
20	M/s Balrampur Chini Mills Ltd., Unit – Balrampur, U.P.
21	M/s Shri Sai Priya Sugar Ltd., Bagalkot, Karnataka.
22	M/s Bajaj Hindusthan Sugar Ltd., Unit – Kundarkhi, U.P.
23	M/s Dalmia Bharat Sugar & Industries Ltd., Unit – Nigohi, Shahjahanpur, U.P.
24	M/s Piccadily Agro Industries Ltd., Karnal, Haryana.
25	M/s Shravasti Kisan Sahkari Chini Mills Ltd., Nandra, Bahraich, U.P.
26	M/s SBEC Sugar Ltd., Malakpur, Baraut, Bagpat, U.P.
27	M/s Aarti Distilleries Pvt. Ltd., Kanpur Dehat, U.P.

❖ ANALYTICAL SERVICES:

Besides analysis of sugar & sugar house products, ethanol and effluents etc., Institute offers testing of Ethyl Alcohol based Sanitizer in its sophisticated, most modern NABL accredited analytical laboratory and other laboratories of the institute. Testing of bagasse for determination of GCV and lime for various constituents also taken up during the period. Analytical services were rendered to following:

Sr. No.	***Factory Name***
1	*M/s Triveni Engineering & Ind. Ltd., Sugar Unit- Chandanpur, Amroha U.P.*
2	*M/s Balrampur Chini Mills Ltd., Unit – Balrampur, U.P.*
3	*M/s Triveni Engineering & Ind. Ltd., Sugar Unit- Rani Nangal, Moradabad, U.P.*
4	*M/s Rana Sugars Ltd., Moradabad, U.P.*
5	*M/s Shree Dwarikadheesh Sugar Industry, Lakhimpur Kheri, U.P.*
6	*M/s Triveni Engineering & Ind. Ltd., Sugar Unit- Khatauli, Muzaffarnagar, U.P.*

7	*M/s Dhampur Bio Organic Ltd., Unit – Meerganj, Bareilly, U.P.*
8	*M/s Dhampur Bio Organic Ltd., unit – Mansurpur, Muzaffarnagar, U.P.*
9	*M/s Dhampur Bio Organic Ltd., unit – Asmoli, Sambhal, U.P.*
10	*M/s Balrampur Chini Mills Ltd., unit – Akbarpur, Ambedkar Nagar, U.P.*
12	*M/s Govind Sugar Mills, unit – Aira, Lakhimpur Kheri, U.P.*
13	*M/s Avadh Sugar & Energy Ltd., unit – Seohara, Bijnor, U.P.*
14	*M/s Maa Mahamaya Sahkari Shakkar Karkhana Maryadit, Ambikapur, Chattisgarh*
15	*M/s Rudra-Bilas KisanSahkari Chini Mills, Bilaspur, Rampur, U.P.*
16	*M/s L.H. Sugar Factories Ltd., Pilibhit, U.P.*
17	*M/s Lakshmi Sugar Mills Company Ltd, Roorkee, U.K.*
18	*M/s Magadh Sugar & Energy Ltd. Unit – Narkatiaganj, Bihar*
19	*M/s Kisan Sahkari Chini Mills, Budaun, U.P.*
20	*M/s Kisan Sahkari Chini Mills Ltd., Puranpur, Pilibhit, U.P.*
21	*M/s Kisan Sahkari Chini mills Ltd., Gajraula, Amroha, U.P.*
22	*M/s Sarjoo Sahkari Chini Mills, Belrayan, Lakhimpur Kheri, U.P.*
23	*M/s Balrampur Chini Mills Ltd., Unit – Kumbhi, Lakhimpur, U.P.*
24	*M/s Kisan Sahkari Chini mills Ltd., Bijnor, U.P.*
25	*M/s Kisan Sahkari Chini mills Ltd, Kaimganj, Farrukhabad, U.P.*
26	*M/s Magadh Sugar & Energy Ltd., Unit – Bharat Sugar Mill, Gopalganj, Bihar*
27	*M/s Avadh Sugar & Energy Ltd., Ltd. Unit- Seohara, Bijnor, U.P.*

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❖ OUR OTHER ACTIVITIES:

1. Director (Sugar), Directorate of Sugar & Vegetable Oils (Department of Food and Public Distribution Ministry of Consumer Affairs, Food and Public Distribution Department of Food & PD Krishi Bhawan, New Delhi) visited Ethanol Unit, Special Sugar Division and other facilities at National Sugar Institute, Kanpur on 17th April 2023.


2. Students of B. Tech. (Chemical Engineering) CSJM University, Kanpur visited National Sugar Institute, Kanpur on their study tour to understand unit operations in sugar and ethanol units on 17th April 2023.

3. National Sugar Institute in its endeavor to produce healthier and nutritive sugars, got success in producing **"Super Sugar"** containing carbohydrates, protein, essential fatty acids, vitamins, dietary fibre and minerals.


The product has been developed by Shri Rajesh Singh, Deputy General Manager (Quality Control), Triveni Sugar & Industries Ltd. while pursuing his Fellowship in Sugar Technology under the supervision of Director, National Sugar Institute, Kanpur. The **"Super Sugar"** has been produced by blending the **"Natural Cane Sugar"** with Spirulina and Basil under controlled conditions.

4. **"World Earth Day"** celebrated at NSI, Kanpur on 23rd April 2023 by taking a pledge for planting more trees, saving water, reducing and recycling waste.


5. Director, National Sugar Institute, Kanpur Attended "**Chintan Shivir**" of the Department of Food & Public Distribution at Surajkund, Faridabad on 27th-28th April 2023. S/Shri R. S. Sodhi, Sh. Ashok Gulati, Sh. S Shivakumar who are experts in the field of Agriculture, Food management, PDS chain etc. shared their ideas on how to fulfill the Vision of the #DFPD and on realignment of #PDS System with expectations of its beneficiaries. Shri Shiv Khera, Author of some best sellers, also delivered a motivational talk.


6. Director, National Sugar Institute, Kanpur attended National Seminar on "**Maize to Ethanol**" organized by Department of Food & Public Distribution at Vanijya Bhawan on 2nd May 2023 & Chaired session on "**Maximizing Ethanol Production by Improving Technical Efficiency and Reducing Cost of Production through Optimizing Inputs and Value Addition**".

7. Faculty & Students of Biotechnology discipline of Axis College of Engineering, Kanpur visited National Sugar Institute, Kanpur on their study tour to visit the institute on 9th May 2023. They were Imparted knowledge about process of industrial fermentation and role of biotechnology in distillation sector.


8. Students of M.Sc. (Life Science) and B.Sc. (Biotechnology) of KIET, Kanpur undertook study tour of the institute on 23rd May 2023. Information provided to them about courses conducted by the institute and also about the Indian Sugar Industry.

9. National Sugar Institute, Kanpur in pursuit of developing alternate feed stocks for production of ethanol joined hands with leading sugar groups, M/s Balrampur Chini Mills Ltd. and M/s Dalmia Bharat Sugar Mills Ltd. to undertake trials for intercropping of sweet sorghum with sugarcane at Maizapur and Nigohi respectively. Sweet Sorghum and Sugar Beet also being grown at institute to assess ethanol production potential.


10. Director, NSI, Kanpur addressed the seminar at National Chemical Laboratory, Pune on the topic "**Sugar Industry- An Industry of Enormous Possibilities**" on 26th May 2023. He discussed the strategy about producing many value added products from the by-products and waste of the sugar industry having out of shelf technology and good market demand. We have to look beyond sugar and bio-energy and for converting the sugar units to bio-refinery for having many bio-products. Sugar industry has to explore possibilities of producing healthier sugars which may be readily acceptable to common person, he said.

11. Director, National Sugar Institute, Kanpur Attended 16th Convocation of Jagran Institute of Management as Chief Guest on 31st May 2023. He delivered Convocation Address and distributed degrees and awards to the students.



12. During the **"Environment Week"**, a poster making competition was organized at the institute on 3rd June 2023, for different categories on the topics "Save Trees for Better Earth", "Save Water to Save Environment" & "Protecting Environment through Efficient Plastic & e-Waste Management". The winners were awarded by the Director, NSI.


13. Director, NSI, Kanpur & Assistant Professor Sugar Technology, attended the 33rd session of International Commission for Sugar Standards (ICUMSA) at Vienna, Austria on 14th June 2023. Director, NSI, Kanpur deliberated on analysis of sugar for Sulphur content and on use of non-lead clarifying agents during polarimetry.


14. राजभाषा सलाहकार समिति, राष्ट्रीय शर्करा संस्थान, कानपुर की त्रैमासिक बैठक दिनांक २० जून २०२३ को संपन्न हुयी और **"शर्करा भारती"** नामक पत्रिका प्रकाशित करने का निर्णय लिया गया ।

15. राष्ट्रीय शर्करा संस्थान द्वारा दिनांक २१ जून २०२३ को **"अंतरराष्ट्रीय योग दिवस – 2023"** का आयोजन किया गया जिसमें संस्थान के अधिकारियों एवं कर्मचारियों ने बढ़-चढ़ कर भाग लिया ।


16. "Online Entrance Examination-2023" for admission to various courses was conducted on 25th June 2023 by National Sugar Institute, Kanpur at various centers across the country.

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❖ HAPPENING IN THE SUGAR INDUSTRY:

UP Government decides to set up Modern Integrated Sugar Complex in place of old sugar mill-
By fulfilling the years-old demand of sugarcane farmers of Gajraula (Amroha) mill area, the State Government has decided to set up a Modern Integrated Sugar Complex in place of the old Sugar mill at Gajraula, in the interest of cane farmers. Under Modern Sugar Complex, it was decided that to double the sugarcane crushing capacity of Gajraula Sugar Mill from 2500 T.C.D. By setting up an Integrated Sugar complex at Gajraula, along with production of refined sugar, a distillery for production of one lakh liters of ethanol per day from cane juice/C-heavy/B-heavy and a compressed biogas plant from press mud will also be established. The mill will earn profit by creating an additional source of income and there will be ease in paying the sugarcane price. By making better use of by-products molasses, bagasse, and press mud in the sugar mill.

Central govt working to bring farmer-centric agricultural policies: Uttarakhand CM Dhami-
Roorkee (Uttarakhand) [India], April 9 (ANI): Uttarakhand Chief Minister Pushkar Singh Dhami on Sunday said that the Central government is working to improve the condition of farmers and make agricultural policies farmer-centric. "The central and state governments under the leadership of Prime Minister Narendra Modi have always been farmer-friendly. The extent of empowerment of the farmers is unprecedented. The Prime Minister is of the opinion that the confidence of the farmers of the country is the biggest strength of the country. The central government is working to improve the condition of farmers and to make agricultural policies farmer-centric", CM Dhami said.

तमिलनाडु: राज्य सरकार की एथेनॉल नीति चीनी उद्योग के लिए फायदेमंद

चेनई: तमिलनाडु आखिरकार एक ऐसी नीति लेकर आया है, जो किसानों और चीनी मिलों के लिए फायदेमंद साबित हो सकती है। तमिलनाडु एथेनॉल सम्मिश्रण नीति 2023 का प्राथमिक लक्ष्य मोलासेस/अनाज आधारित एथेनॉल उत्पादन के लिए 5,000 करोड़ रूपये के निवेश को आकर्षित करना और राज्य को 130 करोड़ लीटर की अनुमानित वार्षिक आवश्यकता को पूरा करने में आत्मनिर्भर बनाना है। दुनिया भर में, चीनी उद्योग का भविष्य एथेनॉल में निहित है। दुनिया के सबसे बड़े चीनी उत्पादक ब्राजील में, केवल 40-45% गन्ना चीनी उत्पादन में जाता है। आधी फसल सीधे एथेनॉल उत्पादन के लिए उपयोग की जाती है। लगभग 20 वर्षों की बातचीत और 5-6 वर्षों के वास्तविक प्रयास के बाद, भारत ने 10% एथेनॉल मिश्रण हासिल कर लिया है और 2025 तक इसे 20% तक ले जाने के लिए तैयार है।

India will achieve target of 20 per cent ethanol blending next year: Union Minister Hardeep Puri-
New Delhi [India], April 17 (ANI): Minister of Petroleum and Natural Gas Hardeep Singh Puri on Monday said in the area of biofuel, "we had a target of 20 per cent (petrol mixed with ethanol) biofuel mixing by 2030 but PM Modi has changed the target to 2025 and we will achieve it within the next year". During the global conference on compressed biogas under the theme — Towards Progressive Policy Framework for a Robust CBG Foundation and Growth, the minister said, "We also reached our biofuel target of 2022, five months before the target."

गन्ने की खेती के लिए सस्ते किराए पर मिलेंगे जरूरी कृषि यंत्र-

सहारनपुर: उत्तर प्रदेश सरकार किसानों की आय बढ़ाने की लगातार कोशिश कर रही है, अब इसी कड़ी में आगे सरकार द्वारा किसानों को सस्ते किराए पर जरूरी कृषि यंत्र मिल देने की योजना बनाई गई है। गन्ने के लघु और सीमांत किसानों के लिए मंडल की 15 गन्ना विकास समितियों ने कृषि यंत्रों के साथ ही ट्रैक्टर भी खरीद लिए हैं। अमर उजाला में प्रकाशित खबर के मुताबिक, मंडल में करीब 5.50 लाख किसान गन्ने की खेती से जुड़े हैं। किसानों को खेती के लिए कृषि यंत्रों की आवश्यकता होती है। किसान उपकरण किराए पर लेते हैं। किराया अधिक होने के चलते खेती की लागत बढ़ जाती है, और यही लागत कम करने के लिए गन्ना समितियों ने फार्म मशीनरी बैंक योजना के तहत कृषि यंत्र खरीदे हैं। इनमें मल्चर, ओपनर, छिड़काव के लिए स्प्रेयर टैंकर और पेड़ी प्रबंधन के लिए रैटून मैनेजमेंट डिवाइस आदि यंत्र शामिल है। इन कृषि यंत्रों को सस्ते किराए पर किसानों को दिया जाएगा।

Food ministry notifies sugar mills on strict compliance to package sugar in jute packaging material-

In a notification issued on the 24th day of April 2023, the Department of Food & Public Distribution (DFPD) stated that sugar mills shall strictly comply with 20% packaging of the total production of sugar in jute packaging material. Recently, the Central Government has issued orders under the provision of Jute Packaging Material (Compulsory use in Packaging use in packaging commodities) Act, 1987, specifying 20% of the total production of sugar to be mandatorily packed in the jute packaging material.

Govt. fixes 24 LMT monthly sugar quota for domestic sale in May 2023-

ChiniMandi, New Delhi: In a notification issued on 26th day of April 2023, the food ministry has allocated 24 LMT monthly sugar quota for May 2023 to 558 sugar mills which is 1.5 LMT higher than the quantity allocated in May 2022. According to marketmen, "The announced quota for May 2023 has exceeded expectations. Last year, with a quota of 22.5 LMT prices had remained stable. However, this year, the Government has increased the quota by an additional 1.5 LMT indicating its efforts to prevent any further rise in prices."

आबकारी विभाग एथेनॉल के उत्पादन को बढ़ावा देकर राज्य के समग्र औद्योगिक विकास में महत्वपूर्ण भूमिका निभा रहा-

लखनऊ : उत्तर प्रदेश आबकारी विभाग ने हाल ही में समाप्त हुए वित्तीय वर्ष 2022-23 के दौरान 41,252 करोड़ रुपये का रिकॉर्ड राजस्व अर्जित किया। पिछले वित्त वर्ष के दौरान, 2021-22 में 36,321 करोड़ रुपये के राजस्व की तुलना में राजस्व में 4,931 करोड़ रुपये या 13.58 प्रतिशत की वृद्धि हुई। अपर मुख्य सचिव संजय भूसरेड्डी ने बताया कि, वर्ष 2022-23 में अवैध व नकली शराब से जनहानि की कोई घटना नहीं हुई है। भूसरेड्डी ने कहा कि, राज्य के खजाने के लिए रिकॉर्ड राजस्व अर्जित करने के अलावा, आबकारी विभाग एथेनॉल के उत्पादन को बढ़ावा देकर राज्य के समग्र औद्योगिक विकास में महत्वपूर्ण भू□□□□ निभा रहा है।

Our govt set up new sugar mill in Basti: Yogi Adityanath-

Basti: Uttar Pradesh chief minister Yogi Adityanath said that his government has worked for the welfare of the sugarcane farmers and established new sugar mills, reports UniIndia. Addressing a public meeting in support of the BJP candidate in the second phase of urban local body polls, he said that when the previous government opened fire at farmers at Munderwa, our government has set up a new sugar mill here. This mill has become the identity of this place.

Sharad Pawar inaugurates bio-CNG project at Vitthal Cooperative sugar mill-

Solapur: Nationalist Congress Party chief Sharad Pawar inaugurated the Bio-CNG project at the Vitthal cooperative sugar mill. Addressing the gathering, Pawar said that the Vitthal sugar mill has paid the first instalment of Rs 2300 per tonne to the cane farmers for the ongoing crushing season. The mill will be providing an additional instalment of Rs 200 to the farmers and with this, the mill is likely to be one of the highest payers to the farmers in the district, he said.

उत्तराखंड में पानी की किल्लत से गन्ने की फसल प्रभावित

हरिद्वार : उत्तराखंड के कुछ इलाकों में पानी की कमी से किसानों को अपनी फसल बर्बाद होते देखना पड़ रहा है। पानी के बिना गन्ने की फसल सूख रही है। गंगनहर से पानी नहीं मिलने से धान की पौध की बुआई में भी किसानों को देरी हो रही है।पथरी क्षेत्र में इन दिनों गन्ने की फसल को पानी की काफी जरूरत है। फसल पानी नहीं मिलने के कारण पीली हो रही है।उत्तर प्रदेश सिंचाई विभाग की और से अभी तक गंगनहर से भरपूर पानी नहीं छोड़ा गया है।इससे किसानों को नुकसान हो रहा है।

Corn to ethanol: Experts suggest increased acreage to achieve 20 per cent blending target-

New Delhi: According to the news report published in The Hindu BusinessLine, experts have emphasized the need for increased acreage dedicated to corn cultivation in order to achieve the ambitious target of blending 20 percent ethanol with petrol by 2025. The Federation of Seed Industry of India (FSII) has suggested expanding the area of corn cultivation as the most viable solution.

Gyanendra Shukla, head of the committee on corn at FSII, emphasized the necessity of implementing a comprehensive policy on corn in medium to long term.

Bihar: MLA demands to revive Riga sugar mill-

Sitamarhi: Mithilesh Kumar, MLA from Nagar, has urged the chief minister, sugarcane development minister and Industry minister to revive the Riga sugar mill in the interest of the farmers, reports Dainik Bhaskar. He said that the agricultural land in the Sitamarhi is favourable to grow sugarcane crops and once the mill starts operations, it will be beneficial for farmers as well as for the economic development of the region.

किसान ड्रोन के साथ कीटनाशकों के प्रयोग के लिए फसल विशिष्ट एसओपी जारी-

केंद्रीय कृषि एवं किसान कल्याण मंत्री श्री नरेंद्र सिंह तोमर ने कल किसानों और अन्य हितधारकों के मार्गदर्शन के लिए सार्वजनिक डोमेन में फसल विशिष्ट "ड्रोन के साथ कीटनाशकों के अनुप्रयोग के लिए मानक प्रचालन प्रक्रियाएं (एसओपी)" जारी की। श्री तोमर ने "मिलेट उत्पादन, प्रसंस्करण और मूल्यवर्धन के लिए मशीनरी" नामक एक पुस्तिका का भी विमोचन किया। इस अवसर पर श्री तोमर ने कहा कि कृषि हमारी प्रधानता है, इसलिए चाहे रिसर्च का काम हो या योजनाएं सृजन का, सरकार की पहली प्राथमिकता कृषि को बढ़ावा देने व किसानों की माली हालत में सुधार की रहती है। आज कृषि क्षेत्र में अनेक चुनौतियां है। किसानों को खेती में रोकना, नई पीढ़ी को भी आकर्षित करना व उत्पादन लागत कम करते किसानों का मुनाफा बढ़ाना है। इनके लिए कृषि क्षेत्र में तकनीक का समर्थन बहुत जरूरी है, सरकार इस दिशा में सतत प्रयासरत है।

Fiji: Lot of money and time needed to fix years of mismanagement in sugar sector, says Finance Minister-

inance Minister Professor Biman Prasad said that there is a need for lots of money and time to fix the damage done to the sugar sector due to years of mismanagement and neglect, reports Fbcnews. He was speaking during a budget consultation at Vunimoli Primary School when he was asked about the plans to fix the railway network to assist cane farmers.

मुंडेरवा चीनी मिल यहां की पहचान बन रही है: मुख्यमंत्री योगी आदित्यनाथ-

बस्ती : शहरी स्थानीय निकाय चुनाव के दूसरे चरण में भारतीय जनता पार्टी (भाजपा) के उम्मीदवारों के समर्थन में एक जनसभा को संबोधित करते हुए मुख्यमंत्री योगी आदित्यनाथ ने कहा, एक समय था जब मुंडेरवा में पिछली सरकार ने किसानों पर गोलियां चलायी थी, लेकिन हमारी सरकार ने यहां नई चीनी मिल स्थापित की है। आज यह चीनी मिल यहां की पहचान बन रही है। इस मिल के कारण सेकड़ों लोगों को रोजगार के अवसर और हजारों किसानों को बड़ी राहत मिली है।

Our policies have transformed lives of sugarcane farmers: CM Yogi Adityanath-

Lucknow: Our government's policies have helped in transforming the lives of sugarcane farmers in the last six years, said Chief Minister Yogi Adityanath, reports Live Hindustan. He was speaking at a programme organised in Lucknow to felicitate sugarcane farmers. Addressing the gathering, CM said, "Six years ago sugarcane sector was facing several problems like delay in pending cane dues, stealing of receipts and cheating farmers by using false weighing machines. Farmers had no option but to burn their cane crop in the fields but now they are happy as our government has succeeded in implementing several reforms."

विठ्ठल सहकारी चीनी मिल की बायो सीएनजी परियोजना का उद्घाटन शरद पवार ने किया-

सोलापुर : विठ्ठल सहकारी चीनी मिल की बायो सीएनजी परियोजना का उद्घाटन NCP के अध्यक्ष शरद पवार ने किया। पवार ने कहा कि, पूर्व मुख्यमंत्री वसंतदादा पाटिल, औदुम्बरअन्ना पाटिल ने नई चीनी मिलें शुरू की, लेकिन अभिजीत पाटिल ने बंद पड़ी चीनी मिलों को शुरू करने की शैली विकसित की है। वे सिर्फ बंद पड़ी इन मिलों को केवल शुरू नहीं कर रहे है, बल्कि उन्हें अन्य मिलों की तरह फायदे में लाने की कोशिश भी कर रहे है।

Richa Sharma appointed as Additional Secretary, Department of Food and Public Distribution-

New Delhi: Richa Sharma, the additional secretary of the Ministry of Environment, Forest, and Climate Change, has been appointed as the additional secretary of the Department of Food and Public Distribution, Ministry of Consumer Affairs, replacing Subodh Kumar Singh. Richa Sharma belongs to

the 1994 batch of the Chhattisgarh cadre of the Indian Administrative Service (IAS). On the other hand, Subodh Kumar Singh (1997 batch) IAS officer of Chhatisgarh cadre, has been appointed as the Director General (DG) of the National Testing Agency (NTA) following a bureaucratic reshuffle by the Centre.

ओडिशा के गन्ना किसान चाहते है राज्य सरकार से मदद-

नयागढ़: जिले में पारंपरिक तरीकों से उत्पादित गुड़ की मांग दिन-ब-दिन बढ़ रही है क्योंकि यहां के गन्ने में सुक्रोज (मिठास) का प्रतिशत अधिक होता है और यह देश और राज्य के अन्य हिस्सों में उत्पादित फसलों की तुलना में अधिक रेशेदार होता है। हालांकि, सरकार से मदद की कमी, मूल्य निर्धारण और नयागढ़ चीनी मिल के बंद होने से गन्ना खेती प्रभावित हुई है।
फिर भी, कुछ किसान अभी भी गन्ने की खेती कर रहे हैं और बिना रसायनों के उपयोग के पारंपरिक तरीकों का उपयोग करके गुड़ का उत्पादन जारी रखा हैं। गन्ने की खेती में मंदी के बावजूद, केक और विभिन्न खाद्य पदार्थों की तैयारी में इसके उपयोग के कारण लोगों के बीच चीनी के बजाय गुड़ की मांग बढ़ी है।

Odisha: Farmers in Kendrapara shy away from cane cultivation-

Kendrapara: According to a report by Orissa Post, farmers in the Kendrapara region are avoiding cultivating cash crops such as sugarcane due to several factors, including inadequate irrigation facilities and the shutdown of sugar mills in the district. In the past, the area dedicated to sugarcane cultivation was approximately 15,000 hectares. However, it has now been significantly reduced to just 1,000 hectares. Farmers were actively involved in cane cultivation when the sugar mills were operational, but since their closure, they have halted the cultivation of sugarcane, except for specific festival seasons.

Kenya: Sugarcane farmers demand new crop pricing committee-

Sugarcane farmers have demanded the government set up a new pricing committee to help them earn profits from increases in sugar prices, reports Business Daily Africa. The term of the previous committee expired in December and the delay in setting up a committee has led us to leave at the mercy of millers, said farmers.

चीनी उद्योग के विकास में योगदान देने की पुरजोर कोशिश: चीनी आयुक्त शेखर गायकवाड़

पुणे: राज्य चीनी आयुक्त शेखर गायकवाड ने कहा कि, चीनी आयुक्त के नाते प्रदेश के गन्ना किसान और चीनी उद्योग की प्रगति करने का मौका मिला और मेरे लिए यह सबसे बड़ी उपलब्धियों में से एक है। उन्होनें कहा, किसानों का हित और चीनी उद्योग के विकास में योगदान देने के लिए पुरजोर कोशिश की। भूमाता परिवार, छत्रपति उदयनराजे भोसले महाराज फाउंडेशन और शुगर टुडे मैगज़ीन द्वारा शेखर गायकवाड़ के सरकारी सेवा से सेवानिवृत्ति के अवसर पर सम्मान समारोह का आयोजन किया गया था। पुणे के कृषि महाविद्यालय हुए इस समारोह में डॉ. बुधाजीराव मुळीक की अध्यक्षता में गायकवाड़ का सम्मान किया गया। इस अवसर पर 'शुगर टुडे' पत्रिका ने गायकवाड़ पर एक विशेष अंक प्रकाशित किया। पूर्व मुख्यमंत्री पृथ्वीराज चव्हाण ने वीडियो संदेश के माध्यम से गायकवाड़ के कार्यों की प्रशंसा की।

Sugar mill to implement sugarcane development scheme-

Amrutnagar, Maharashtra: Sahkarmaharshi Bhausaheb Thorat sugar mill has decided to implement a sugarcane development scheme for the farmers associated with the mill from 1 June 2023, said the chairman of the mill Prataprao Ohol, reports Agrowan. He said that the decision in this regard has been taken by the director body of the sugar mill.

After hike in FRP, sugar industry demands hike in MSP-

New Delhi: The central government announced an increase in the Fair and Remunerative Price (FRP) for sugarcane, a decision that is set to benefit sugarcane farmers across the country. The move has now prompted the sugar industry to demand hike in the Minimum Support Price (MSP) for sugar. In June 2018, the Indian government fixed the MSP of sugar, for first time, at Rs. 29 per kg when the FRP of sugarcane was Rs. 2550 per ton. However, the FRP has been steadily increasing, while the MSP of sugar has remained unchanged since February 2019.

केआरएस बांध का जलस्तर घट रहा है, गन्ने की खेती करने वाले किसान चिंतित

मांड्या : हजारों किसानों की गन्ना खेती जिस जलाशय पर निर्भर है, उस कृष्णराजस (केआरएस) जलाशय में जल स्तर 82.94 फीट दर्ज किया गया है। पिछले साल इसी अवधि के दौरान जल स्तर 104.58 फीट था। द टाइम्स ऑफ इंडिया में प्रकाशित खबर के मुताबिक, केआरएस को 388 क्यूसेक पानी मिल रहा है जबकि मंगलवार को 4,002 क्यूसेक पानी बांध से छोड़ा जा रहा है। जैसे जैसे बांध में जल स्तर गिर रहा है, बेंगलुरु और मैसूर के पीने के पानी की आपूर्ति पर ज्यादा ध्यान दिया जा रहा है।

अध्ययन के मुताबिक मध्य महाराष्ट्र में कृषि उत्पादकता पर पड़ सकता है प्रतिकूल प्रभाव-

मुंबई: बारामती में विद्या प्रतिष्ठान के कला, विज्ञान और वाणिज्य कॉलेज में भूगोल विभाग द्वारा किए गए एक नए अध्ययन के अनुसार, घटते जल स्तर, बढ़ते तापमान और बदलते फसल पैटर्न जैसे कारक मध्य महाराष्ट्र (Central Maharashtra) के कृषि उत्पादकता पर प्रतिकूल प्रभाव डालने वाला है। हिंदुस्तान टाइम्स में प्रकाशित खबर के मुताबिक, यह अध्ययन राज्य के सात सबसे सूखे जिलों- पुणे, सांगली, उस्मानाबाद, बीड, सतारा, सोलापुर और अहमदनगर के आंकड़ों के विश्लेषण पर आधारित है, जहां औसत वार्षिक वर्षा 700 मिमी से कम है।

ई-बाय शुगर के संस्थापक और सीईओ उप्पल शाह, एमडी हेमंत शाह 'बिजनेस टाइटन्स ऑफ इंडिया' पुरस्कार से सम्मानित-

मुंबई : चीनी ट्रेडिंग का देश का अग्रणी ऑनलाइन प्लेटफॉर्म ई-बाय शुगर (eBuySugar.com) के फाउंडर और सीईओ श्री. उप्पल शाह और एमडी श्री. हेमंत शाह को जागरण ग्रुप – रेडियो सिटी द्वारा इस वर्ष के 'बिजनेस टाइटन्स ऑफ इंडिया' अंतर्राष्ट्रीय पुरस्कार से सम्मानित किया गया। ई-बाय शुगर को देश के सबसे बड़े 'बी2बी' (B2B) चीनी बिक्री प्लेटफॉर्म के रूप में चुना गया।इस शानदार अवॉर्ड समारोह का आयोजन 10 जून 2023 को दुबई में किया गया था।

बांग्लादेश में ईद के बाद फिर बढ़ेंगे चीनी के दाम-

बांग्लादेश के वाणिज्य मंत्री टीपू मुंशी ने कहा है कि अंतरराष्ट्रीय बाजार में ऊंची कीमत के कारण ईद-उल-फितर के बाद चीनी की कीमत बढ़ सकती है। वाणिज्य मंत्री ने गुरुवार (22 जून) को सचिवालय में आयुर्वेदिक चिकित्सा पर एक राष्ट्रीय सेमिनार में यह बात कही। अंतरराष्ट्रीय बाजार में चीनी की कीमत बढ़ती जा रही है। देश की मांग को पूरा करने के लिए बांग्लादेश चीनी आयात पर निर्भर है।

एफआरपी 'अस्वीकार्य' है, इसमें उच्च उत्पादन लागत को ध्यान में नहीं रखा गया: तमिलनाडु के गन्ना किसानों का दावा-

तंजावुर: राज्य के किसानों ने गन्ने के लिए आर्थिक मामलों की कैबिनेट समिति (सीसीईए) द्वारा घोषित उचित और लाभकारी मूल्य (एफआरपी) को "अस्वीकार्य" बताया है, जिसमें 10 रुपये प्रति क्विंटल की बढ़ोतरी की गई है जो 10.25% की बेसिक रिकवरी के लिए है। किसानों ने एफआरपी में हुई बढ़ोतरी इसकी उच्च उत्पादन लागत के अनुरूप नहीं होने की शिकायत की और बताया कि केवल कुछ चीनी मिलें 10% और उससे अधिक की रिकवरी दर हासिल कर पाती हैं। सीसीईए ने बुधवार को इस साल अक्टूबर से शुरू होने वाले गन्ना पेराई सत्र 2023-24 के लिए एफआरपी के रूप में 315 रुपये प्रति क्विंटल को मंजूरी दी थी, जो मिलों द्वारा किसानों को दी जाने वाली न्यूनतम कीमत है। जो 3,150 रुपये प्रति टन होती है, और यह कीमत 10.25% की रिकवरी दर के लिए लागू है।

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❖ **RESEARCH ARTICLE:**

A Sustainable Indian Sugar Industry Through Efficient Exploitation of Sugarcane By-Products

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Abstract— With a bumper sugar production India has left behind Brazil to become the top producer and second largest exporter of the sweetener during season 2021-2022. India produced about 35.9 million metric tons of sugar after considering diversion of about 3.6 million metric tons of sugar equivalent for producing ethanol during the sugar season 2021-2022. During the current sugar season 2022-23, the sugar production is likely to 32.7 million metric tons after diversion of about 4.5 million metric tons of sugar for ethanol production. The future of the sugar industry, lies in development of Agri-business Complexes or to Bio-refineries producing bio-electricity, bio-ethanol, bio-gas/bio-CNG, bio-manure, bio-degradable cutlery/tableware, bagasse based particle board, green hydrogen and bio-food *etc.* and in nutshell about adopting a self-sustainable model.

Keywords- *Bagasse, Molasses, Press Mud, Bio-ethanol, Bio-electricity, Bio-gas/Bio-CNG.*

Introduction

Conventional sugar factories process sugarcane to obtain crystal sugar but considering the importance of utilization of by-products & process intermediate feedstocks for enhancing revenue streams, there is growing trend for utilizing them for obtaining value added products. At present, only about 50% of the Indian sugar factories are carrying out power export to national grid, whereas, the number of ethanol units attached to sugar factories is higher and is increasing because of the economics involved in production of ethanol compared to sugar. Utilization of by-products even in the most generalized manner, thus, can not only perk up the financial health of the sugar industry but also in meeting the scarcity of power and ethanol for EBP programme, the bio-energy in either case. Similar is the case of production of CBG from filter cake.

Moving further, a bio-refinery includes the sustainable processing of sugarcane into range of valuable products (including food, feed, bio-degradable cutlery/tableware, bagasse based particle board, green hydrogen and chemicals) and energy (including bio-electricity, bio-ethanol and bio-gas/bio-CNG) and thus, offers great potential for improving profitability and sustainability of the Indian sugar industry [1].

The sugar industry across the globe is also required to work on the mandate developing “Wealth from Waste” or converting “Waste to Resource” utilizing anything which is available with sugarcane or is generated in one or other form of processing. Thus, for sustainability of the Indian sugar industry or sugar industry as a whole, it includes improvement in the sugarcane and sugar productivities, conversion from single-product to multi-product factory, optimizing cost of sugarcane processing, integration with food processing industry, utilization of huge infrastructure during off-season, adoption of hybrid system for power generation *i.e.* biomass: solar: wind power and finally conversion of existing sugar factories to bio-refineries. (Fig.1)

It is being observed that in many cases there is a mismatch in the capacities of sugar & attached ethanol units, due to which adequate raw material is not ensured for ethanol units besides having issues in availability of desired quantities of fuel *i.e.* bagasse. A "Sustainable Model" for a complex having sugar-electricity-ethanol production facilities has also been developed ensuring working of ethanol unit almost round the year on feed and fuel from sugar factory [2]. In terms of bio-energy, the major sugarcane energy chains/ sources are;

- Bagasse for heat & bio-electricity generation.
- Molasses for conversion to bio-ethanol.
- Press mud and spent wash for conversion bio-gas.

Bagasse based tableware and particle board are also gaining tremendous market growth in the past few years. With great concerns of consumers towards environment, there has been a shift in the use of disposables and non-plastic materials for packaging that are bio-degradable, low cost incurred for their manufacturing. This trend has led an altogether different sector for efficient utilization of bagasse. Present times have shown various manufacturers jumping into the production of disposables, tableware's, bottling, packaging materials *etc.* that are processed using bagasse. India uses nearly 10,000 tonnes of single use plastic every day including plastic bags, multilayer laminates and disposable cutlery. Imminent ban on single use plastic is likely to create huge demand for alternatives that can replace such products [3].

The continuous increase in global human population resulted in the continuous increase in consumption of resources raising concerns on the ability of the future generation to meet their own needs in the years to come. The solution is the principle of sustainable development. Another way to achieve sustainable development is by recycle of the waste in a way that can be useful to the economic, social and environmental goals to divert the surplus bagasse for products such as particle board. Now-a-days there are so many hard board industry have set-up to utilize bagasse to manufacture hard board, insulation board and particle board *etc.* [4]

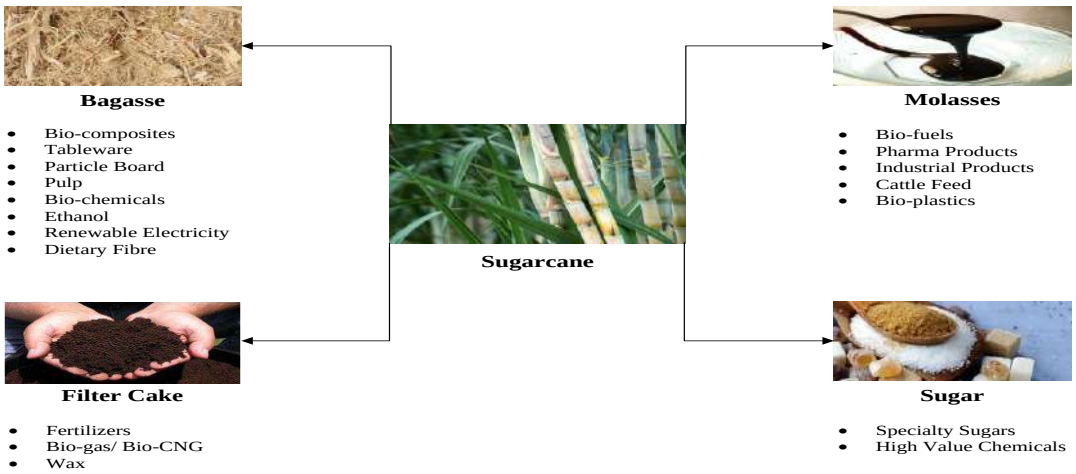


Fig.1 Bio-Refinery Concept

Bio-Electricity

Sugarcane is one of the most promising agricultural sources of biomass energy in India and elsewhere. In sugarcane plant the overall % by weight of dry matter and the energy content is given in Table no. 1.

Table 1 Dry Matter in Sugarcane Plant

S. No.	Part of the Sugarcane Plant	Dry Matter by Weight %	% Energy Content
1	Roots	2	1.23
2	Stalk	58	62.63
3	Leaves	14	24
4	Top	26	12.14

At present, only sugarcane stalk is processed to extract juice and bagasse, the fibrous residue left over after the milling. The balance 37.37 % of energy of the sugarcane plant remains unutilized. This energy needs to be used efficiently. It is fact that for the soil conditioning and its fertility improvement, part of the Sugarcane Plant Residue (SPR) should be used in mulching. Even, if 50% of the SPR is left for mulching, the balance 50% of SPR is a huge source of bio-energy and efficient utilization of the same may enhance the revenue of the sugar industry to a greater extent. It also provides clean energy because of neutral emission of carbon dioxide. The revenue generation for a 5000 TCD Plant in respect to utilization of 50 % SPR is given in **Error! Reference source not found.**.

Table 2 Revenue from SPR

S.No.	Particulars	Unit	Quantity
1	Cane crushed per day	TCD	5000
2	Season Days	Days	160
3	SPR (dry)	MT	196960
4	50% SPR (dry)	MT	98480
5	Steam Produced at 125 ata /540 deg	MT	364376
6	Power Produced	Lakh Units	958.9
7	Sale Price @ Rs 5/- per unit	Lakh ₹	4794.4

8	Cost of SPR (dry)	Lakh ₹	2462
9	Cost of Conversion	Lakh ₹	1438.3
10	Net saving	Lakh ₹	894.1
11	Sugar Production at 10 % Recovery	MT	80000
12	Revenue/ MT sugarcane	₹/MT Cane	111.8

Bagasse is usually combusted in boiler furnaces to produce steam for power generation but now is also being considered as an emerging and attractive feedstock for 2G bio-ethanol production. It is also utilized as the raw material for production of paper, particle board and tableware *etc.*

Bagasse based co-generation is one of the most attractive and successful power projects that have already been implemented in many of sugar factories in India. Combined heat and power from sugarcane in the form of power generation offers renewable energy options that promote sustainable development, take advantage of domestic resources, increase profitability and competitiveness in the industry, cost-effectively address climate mitigation and other environmental goals. However, there are certain challenges now with respect to power tariff's in some of the states which has made bagasse based co-generation to take a back seat.

Most of the sugar factories in India, cogeneration units work at very low cycle efficiency. For 67 ata and 87 ata pressure, the cycle efficiency is as low as 15 to 18% only whereas it is between 21 to 25% for 110 ata and 125 ata pressure. Power plants operate at cycle efficiencies as high as 35 to 45%. To improve upon, the working pressure and temperature needs to increase up to 140 ata and 560 deg C so as it may reach up to 35% of the efficiency. Another factor which needs to be improved for increasing the pressure and temperature is the moisture content of bagasse. Moisture of bagasse is to be brought down to as low as possible by use of waste heat going out of chimney.

Advantages of Bio-Electricity

Generating bio-electricity offers numerous benefits as;

1. A rich & renewable source and of high potential to substitute fossil fuels to meet energy demands of the country. It is also less expensive than fossil fuels.
2. It provides clean and green energy because of neutral emission of carbon dioxide (CO2) [5].
3. Decentralized power generation results minimal transmission and distribution costs [6].
4. It enables diversification in electricity generation, thus, increasing energy security.
5. Significant reduction of environmental pollution in relation to use of fossil fuels [6].
6. It helps sugar mills to meet 100% of their energy needs and drastically reduce their operational costs. Furthermore, the opportunity to sell surplus electricity to electric power grid.
7. Additional revenue generation through sale of carbon credits in terms of Clean Development Mechanism (CDM).

8. Assists in modernizing the rural areas by promoting sustainable rural growth.

Indian Electricity Sector Scenario

The utility electricity sector in India had an installed capacity of about 412.0 GW as on January 2023. Renewable power plants constitute 112.5 GW *i.e.* about 30% of total installed capacity, out of which, contribution of biomass based cogenerated power is about 11.0 GW *i.e.* 9.0% of total installed Renewable Energy Sources (RES) capacity. RES includes Small Hydro Projects, Biomass Power, Urban & Industrial Waste Power, Solar and Wind Energy. (Fig. 2)

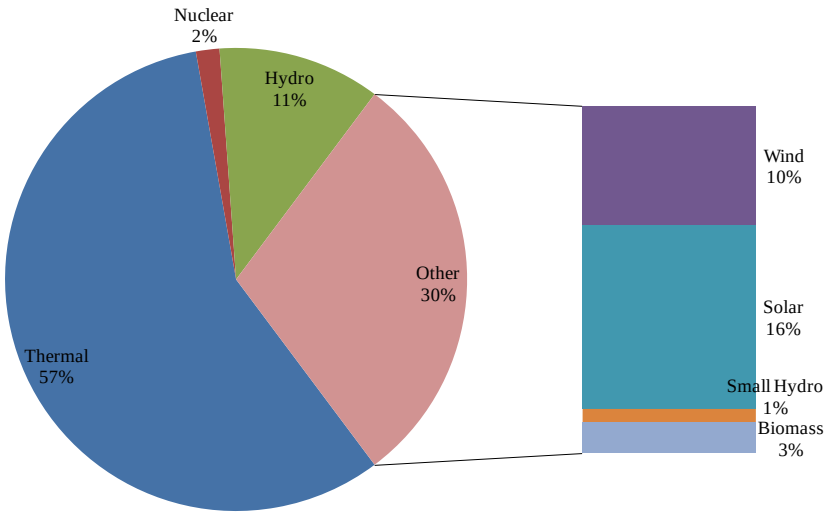


Fig. 2 Installed Power Generation Capacity in India as on January, 2023

Source: Central Electricity Authority (India)

The current installed co-generation capacity from excess bagasse in sugar factories is about 7500 MW, which is about 2.0% of the national electricity generation, with only part of the sugar factories undertaking power export and also as only about one-third sugar factories out of 275 co-generating sugar factories have high pressure co-generation system. With the availability of advanced co-generation technologies, sugar factories can harness the onsite bagasse resource to go beyond meeting their own energy requirements and produce more surplus electricity for sale to the national electric power grid. However, there are certain challenges now with respect to power tariff's in some of the states which has made bagasse based co-generation to take a back seat.

Potential of Power Export from Sugar Industry

Keeping in view the average cane crush of 350 MMT during a crushing season, the potential of the sugarcane industry nationwide is estimated as around 14.0 GW that can be exported to the grid on the basis of power generation @ around 150 kWh per tonne of cane processed using the latest commercially proven co-generation technologies (

Table 3). New technologies like steam parameters with extra high pressure and temperature configuration, modified design of fuel handling system and furnaces, higher blending of other biomass along with bagasse, improvements in pollution control devices and water treatment plants

etc. have to be made to increase the potential to this level. The exportable power potential may be further increased by around 15% *i.e.* to 16.0 GW after installation of bagasse drying system [7].

Table 3 Power Export Potential in Different Models of Co-Generation

Pressure (ata)	Cane Crushed (MMT)	Bagasse Available (MMT)	Exportable Power (MW)	Power from Cane Trash (MW)	Total Exportable Power (MW)
67	350	101.5	5941	800	6741
125	350	101.5	12963	1500	14463

MMT Million metric tonnes

Presently direct-combustion technology to generate steam for production of electricity through condensing-extraction steam turbine (CEST) system is dominant, but the future is focused on the introduction of high-efficiency gasification combined-cycle systems [8]. In this system gas turbines fuelled by gas produced by thermo-chemical conversion of biomass. The exhaust is used to raise steam in heat recovery systems used in expanding through a steam turbine to boost power output and efficiency in a gas turbine/steam turbine combined cycle (GTCC). Gas turbines, unlike steam turbines, are characterized by lower unit capital costs at modest scale, and the most efficient cycles are considerably more efficient than comparably sized steam turbines. (
Fig. 3)

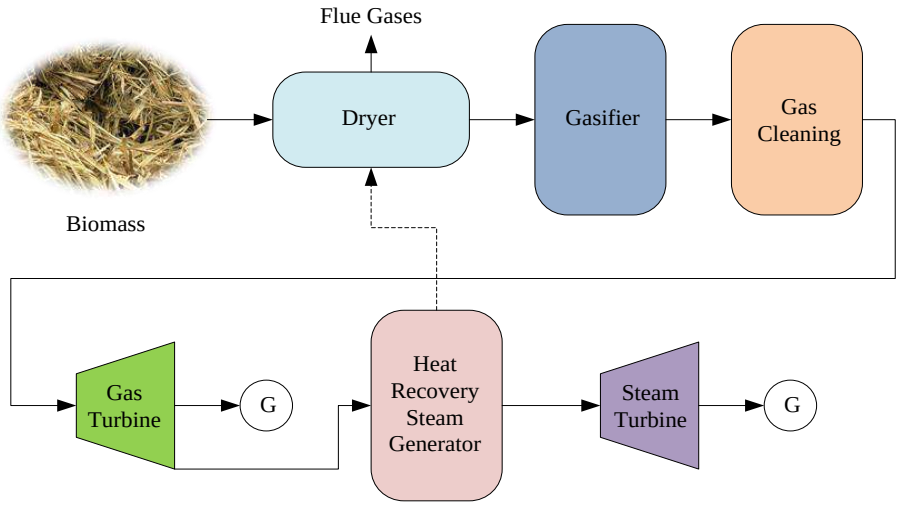


Fig. 3 Schematic of a Biomass Integrated- Gasifier/ Gas Turbine Combined Cycle (BIG/GTCC) System

The potential of power generation in such case may as high as 225-250 kWh per tonne of cane as compared to 120-150 kWh through condensing-extraction steam turbine CEST model.

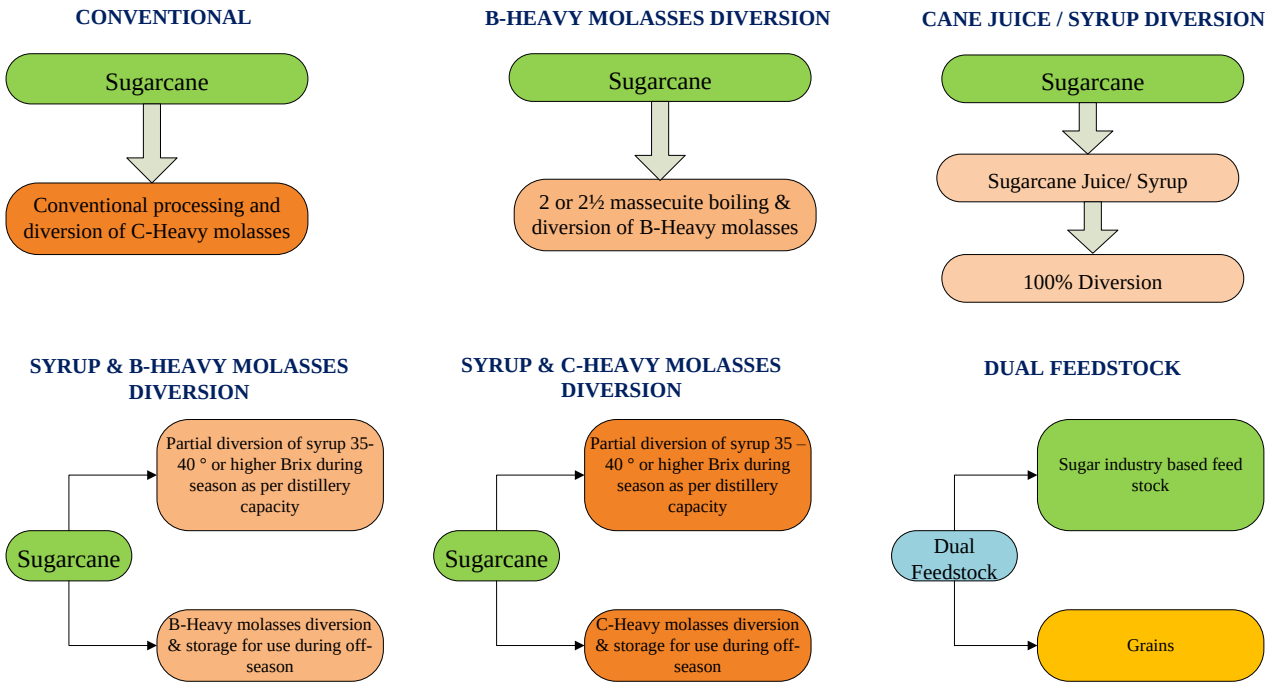


Fig. 4 Diversification of Sugar for Ethanol

Bio-Ethanol

Achieving energy security and the transitioning to a thriving low carbon economy is critical for a growing nation like India. Blending indigenously produced ethanol with petrol is to help India strengthen its energy security, enable local enterprises and growers to participate in the energy economy and reduce vehicular emissions. The Government of India notified the National Policy on Biofuels-2018 (NPB–2018) on 04.06.2018 wherein, under the Ethanol Blended Petrol (EBP) Programme, an indicative target of 20% blending of ethanol in petrol by 2030 was laid out. Further, the Government of India has set the revised target to achieve 20% blending of ethanol in petrol by Ethanol Supply Year (ESY) 2025-26 only.

U.S. Environmental Protection Agency (EPA) also classified that sugarcane ethanol as capable of reducing green house gas (GHG) emissions by at least 50% compared to gasoline Roughly, one ton of sugarcane biomass based on sugar, bagasse and ethanol output has an energy content equivalent to one & half barrel of crude oil [9].

Ethanol Blendig Programme in India

India is a fast-growing economy and is facing the challenge of increasing energy demand which is usually met by fossil fuels. India's domestic production of crude oil since been inadequate to cope up the requirement, this huge gap between demand and supply is met by imports at the cost of foreign exchange draining out.

Government of India has allowed ethanol production/procurement from sugarcane-based raw materials *viz.* C Heavy molasses & B Heavy molasses, sugarcane juice/ sugar/sugar syrup, surplus rice with Food Corporation of India (FCI) and Maize for boosting ethanol production to achieve the targeted ethanol blending programme @20% by ESY 2025-26. (Fig. 4) The raw material wise conversion efficiency (Litre Ethanol per MT of feedstock) and Ethanol price is tabulated in Table 4.

Table 4 Ethanol Yield & Price with Different Feedstock

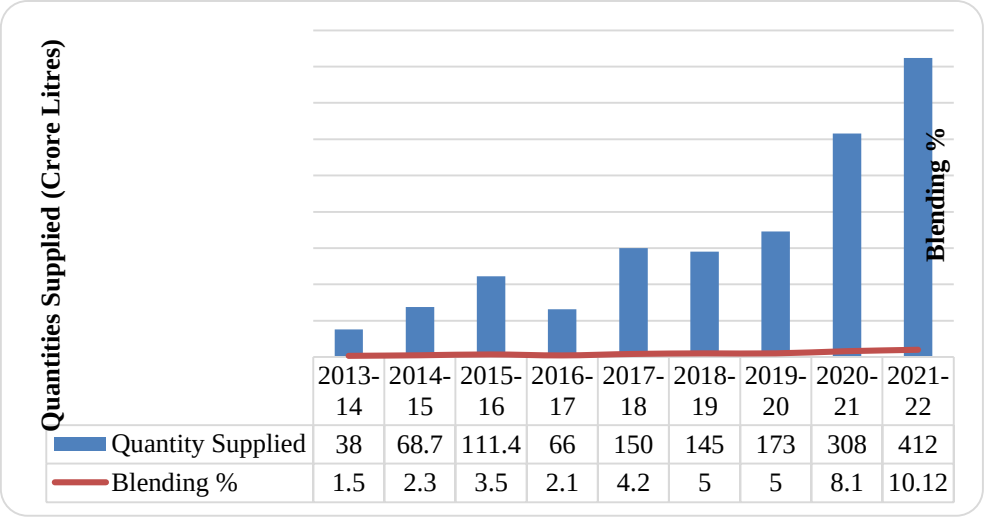
Feedstock	**Quantity of Ethanol per MT Feedstock (Litres/MT)**	**Ethanol Price (Rs/Litre)**
C-Heavy Molasses	225-235	49.41
B-Heavy Molasses	300-330	60.73
Sugar Syrup/ Sugar/ Sugarcane Juice	70-80	65.61
Broken Rice	420-440	51.55
Surplus Rice available with FCI	450-470	56.87
Maize	370-380	51.55

From the inception of the EBP Programme, various pricing models have been adopted by the Government of India which were based on the prevailing macro-economic situation of the sugar industry and the oil sector. Prices of ethanol produced from sugarcane sources are approved by the Cabinet Committee on Economic Affairs (CCEA), while that from food grains is decided by OMCs. Since ESY 2018-19, Government of India has introduced a differential pricing policy wherein higher rates were offered to sugar mills for production of ethanol from B Heavy molasses and sugarcane juice/ sugar syrup. Further in ESY 2022-23, even higher prices were offered for conversion of B-Heavy molasses and sugar/sugarcane juice to ethanol.

Ethanol distillation capacity of molasses-based distilleries was only 2150 million litres prior to 2014. However, in past 8 years due to the policy changes made by the Government, the capacity of molasses-based distilleries have increased by two and a half times and are currently at about 5550 million litres. Capacity of grain-based distilleries which were 2060 million litres in 2013 increased to 2800 million litres. Thus, the total ethanol production capacity in the country has reached to 8350 million liters by March 2022. However, ethanol production capacities are required to be enhanced to about 17000 million litres to achieve 20% blending by ESY 2025-26 and also to meet alcohol requirements of other sectors *viz.* potable liquor and chemical *etc.*

Till year 2013, supply of ethanol to Oil Marketing Companies (OMCs) was only 380 million litres with blending levels of only 1.53 % in ethanol supply year (ESY) 2013-14. Production of fuel grade ethanol and its supply to OMCs has increased by 8 times from 2013-14 to 2021-22. In ESY 2021-22, India touched a historically high figure of about 4124 million litres thereby achieving 10.12% blending. In

the current ESY 2022-23, Government of India (GOI) has planned to achieve ethanol blending in petrol @+12%, which is due to greater diversion of sugar. An overview of ethanol blending is shown in Fig. 5.



	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
Quantity Supplied	38	68.7	111.4	66	150	145	173	308	412
Blending %	1.5	2.3	3.5	2.1	4.2	5	5	8.1	10.12

Fig. 5 Ethanol Supply & Blending Achieved

Supply Projections of Fuel Ethanol in India

To produce 684 crore litres of ethanol by the sugar industry by 2025-26, sugarcane equivalent to 60 LMT of surplus sugar would have to be diverted to ethanol. During the last sugar season 2021-22 more than 36 LMT of sugar was diverted for producing ethanol to achieve blending @+10%. To produce 666 crore litres of ethanol/ alcohol from food grains by 2025-26, about 165 LMT of food grains is expected to be utilized. At present damaged food grain availability is around 40 lakh ton in the country. In 2020-21 approximately 20 lakh ton maize is surplus; FCI Rice is also sufficient in stock (266 LMT) and it will continue to remain robust as procurement of paddy/rice at MSP continues at expected levels. The country is producing sufficient food grains and sugar to meet the requirement of ethanol.

Molasses-based distilleries have also been offered interest subvention to convert them to dual feed, to convert both food-grains & molasses into ethanol. Thus, it is expected that there would be sufficient ethanol distillation capacity to achieve blending targets ([10]). Ethanol supply year wise ethanol projections with different feedstock are given in **Error! Reference source not found.**.

Hence, the market for ethanol would increase with the increase in blending percentage, blending units and number of vehicles. In India, Ethanol is mainly produced from final molasses and other intermediate feedstocks *viz.* B-Heavy molasses, syrup of the sugar industry. Hence, it is necessary to understand the sugar industry situation in India as the ethanol scenario is dependent on molasses unlike the US and Europe where it is mainly based on grains, especially corn.

Subsequent to opening up of alternate route *i.e.* Second Generation (2G) route for ethanol production, Public Sector Oil Marketing Companies under the administrative control of Ministry of Petroleum and Natural Gas are in the process of setting up 12, 2G bio-refineries with an investment of Rs.14,000 crore.

Table 5 Ethanol Projections with Different Feedstocks

ESY	Blending	For Blending (Crore Ltrs)			For Other Uses (Crore Ltrs)			Total (Crore Ltrs)		
	(%)	Sugar	Grain	Total	Sugar	Grain	Total	Sugar	Grain	Total
2019-20	5	157	16	173	100	150	250	257	166	423
2020-21	8.5	290	42	332	110	150	260	400	192	592
2021-22	10	330	107	437	110	160	270	440	267	707
2022-23	12	425	123	542	110	170	280	535	293	828
2023-24	15	490	208	698	110	180	290	600	388	988
2024-25	20	550	423	988	110	190	300	660	628	1288
2025-26	20	550	466	1016	134	200	334	684	666	1350

Bio-Gas and Bio-CNG

Conventionally, handling of the filter cake in the sugar industry is considered to be a troublesome area and whatever utilization is made is in making the bio-compost. However, in pursuit of generating higher revenues, the unharnessed potential of filter cake has been exploited by utilizing for generating bio-gas or bio-CNG/ CBG. Filter cake contains appreciable proportion of bi-degradable organic matter which has very good potential for the production of bio-gas from it. Bio-gas from filter cake can be produced by anaerobic digestion which is a biochemical degradation process wherein organic matter is decomposed by bacteria in the absence of oxygen [11]. The anaerobic digestion is low-cost method and the byproducts of this process are methane, CO_2 and H_2S. It is a complex process and divided into four categories: Hydrolysis, Acidogenesis, Acetogenesis or dehydrogenation and methanation. (Fig. 6) The use of bio-gas or compressed biogas/bio CNG will not only help to preserve the non-renewable energy resources but will also decrease dependence on scarce fossil resources and will also lead to decrease in green house emission and earning additional revenue in case of sugar factories.

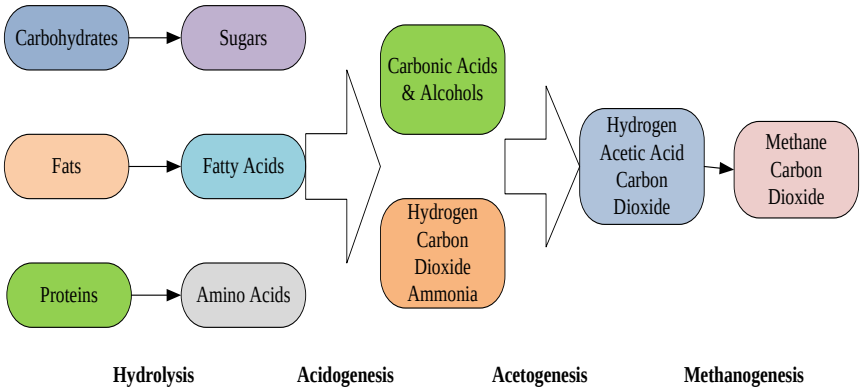


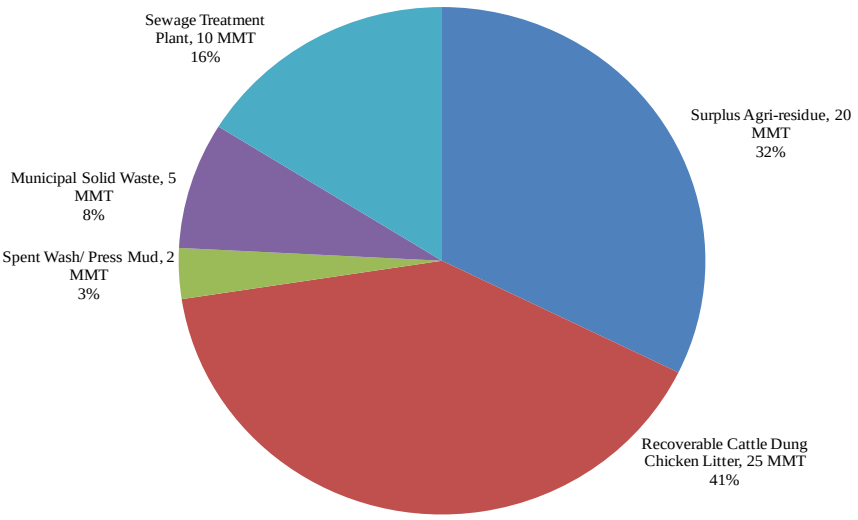
Fig. 6 Anaerobic Digestion Process

It has been estimated that 1 tonne of press mud generates between 85 to 120 m^3 of bio-gas *i.e.* 25-30 kgs of filter cake yields about 1 kg of bio-CNG and thus looking to the prices of filter cake and bio-CNG being about ₹ 250 per MT and about ₹ 54 per kg respectively, utilization of filter cake in such a manner appears lucrative for value addition and for providing bio-energy.

In this regard, 'SATAT' (Sustainable Alternative Towards Affordable Transportation) scheme on Compressed Bio Gas (CBG) was launched GOI on 01.10.2018 to promote bio-CNG production. Under SATAT scheme, entrepreneurs may set up CBG plants, produce & supply CBG to OMCs for sale as automotive & industrial fuels. The initiative aims to produce compressed biogas (CBG) from Waste and Bio-mass sources like agricultural residue, cattle dung, sugarcane press mud, Municipal Solid Waste (MSW) and sewage treatment plant waste.

Potent**ial of Compressed Bio-Gas (CBG) from Indian Sugar Inductry**

The graphical presentation shown subsequently**Error! Reference source not found.** provides an idea of total compressed bio-gas potential in the country estimated to be about 62 million metric tonnes per annum out of which spent wash/ filter cake (press mud) can contribute to the extent of about 2 million metric tonnes.



Bio-Energy from Spent Wash

It is pertinent to mention that spent wash, the effluent of ethanol production may turn out to be a key source of bio-energy either by transforming it into biogas (methane), which can be used as boiler fuel or after concentrating it in multiple effect evaporators (MEE) and then to incinerate along with bagasse/coal/other bio-mass in an incineration boiler integrated with turbine to produce the bio-electricity [12].

Potential of Bio-Energy from Spent Wash

Keeping in view the average alcohol production of 3000 million liters during an alcohol year, the potential of the alcohol industry nationwide is estimated around 500 MW power as reflected in Table 6, that can be utilized for own process uses and surplus energy may be exported to the national grid, using the latest commercially proven incineration technologies.

Table 6 Power Generation Potential using Spent Wash

Pressure (ata)	Alcohol Production (Million Liters)	Spent Wash Available (Million Liters)	SW to Supplement Fuel Ratio	Steam Generation Potential (MT)	Power Generation Potential (MW)
45	4000	32000	60:40	4900	580

Discussion

The optimal utilization of resources with exploring new horizons besides facilitating bio-energy in the form of bio-mass power, bio-ethanol and bio-gas/bio-CNG shall also help in maintaining the health of the sugar industry even under adverse sugar-sugarcane price scenario, thus, making possible in time payments for the sugarcane prices to the 50 million sugarcane farmers and others directly or indirectly associated with the Indian sugar industry, which has frequently remained a volatile issue for the Indian sugar industry.

The judicious utilization of the vital by-products *i.e.* bagasse for bio-electricity & 2G bio-ethanol, molasses & process intermediate feedstocks *viz.* B-Heavy molasses for bio-ethanol and press mud for bio-gas/bio-CNG can bring a turn around the situation as reflected from Table 7 and Table 8 respectively as besides rendering bio-energy, it renders the most desired value addition by the most convenient route. The potential of bio-ethanol shall be further increased by diversion of sugarcane juice or sugar syrup considering the relative economics of ethanol.

Table 7 Revenue through Sale of Primary By-product (Standalone Sugar Units- Conventional Route)

By-product	Quantity (ton)	Rate (₹ per ton)	Revenue (₹)
Bagasse saved @ 7.0% on cane*	0.070	2200	154
Molasses @ 4.5% on cane	0.045	6000	270
Press Mud @ 3.5% on cane	0.035	250	8.75

Total Revenue = ₹ 432.75 per ton of sugarcane

*Average bagasse % cane- 30 and considering installation of low to medium pressure boilers of 32 kg/cm^2 g to 45 kg/cm^2 g working pressure having bagasse: steam generation ratio as 2.2 to 2.3 only.

Table 8 Revenue through Value Addition (Integrated Sugar Complexes considering high pressure Co-Generation)

By-product	Quantity (ton)	Value Added Product	Rate (₹)	Revenue (₹)	Addl. Cost of Conversion	Net Revenue (₹)
Bagasse saved @ 9.0% on cane	0.090	Power: 47.8 units*	5 per unit	239	₹ 1.5 per unit *i.e.* ₹ 71.7	167
B-Heavy Molasses @ 7% on cane	0.07	Ethanol: 22.4 litres**	60.7per liter	1360	₹ 15 per liter *i.e.* ₹ 336	1024
Press Mud @ 3.5% on cane	0.035	Bio-CNG: 0.001 ton***	54000 per ton	54	₹ 17 per kg *i.e.* ₹ 17	37

Total Revenue = ₹ 1228 per ton of sugarcane

*Average bagasse % cane - 30 and considering installation of high-pressure boilers of 87 kg/cm^2 g to 110 kg/cm^2 g working pressure having bagasse: steam generation ratio as 2.5 to 2.6 only. Power

generation through Condensing/ Condensation-Extraction or in combination with back pressure turbines to meet sugar plant requirements and surplus for sale to national grid.
**Considering an average yield of 320 litres of ethanol per ton of B-Heavy molasses.
***Considering 25-30 kgs of filter cake yields about 1 kg of bio-CNG.

Conclusion

Production of bio-energy is one of the most proficient ways to achieve sustainable development. Increasing its share in the world vide matrix will not only help prolong the existence of fossil fuel reserves, address the threats posed by climate change, but also enable better security of the energy supply on a global scale. Most of the "new renewable energy sources" are still undergoing large-scale commercial development, but some technologies are already well established. These include bio-electricity, bio-ethanol and bio-gas/bio-CNG, in particular, which, is a global energy commodity that is fully competitive with motor gasoline and appropriate for replication in many countries.

In the near future, the bio-energy concept of complete utilization of sugarcane biomass, molasses and press mud will become a pivotal element for a sustainable sugarcane industry. An industry that produces bio-electricity, bio-ethanol and bio-gas/bio-CNG fuels from a renewable source should be considered a fascinating vision.
From the perspective of sustainable energy development, renewables are widely available, ensuring greater security of the energy supply and reducing dependence on oil imports from politically unstable regions. Renewable are less polluting, both in terms of local emissions (such as particulates, sulphur and lead) and green house gases (carbon dioxide and methane) that cause global warming.

Hence, there is abundant opportunity for the wider use of bagasse/spent wash for generation of bio-electricity, molasses for production of bio-ethanol and press mud for production of bio-gas/bio-CNG in sugarcane producing countries. Even, this potential remains by and large unexploited.

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ABSTRACTS

Financial impact of extraneous matter on supply of sugarcane to mills by B.K. Yadav, Chief General Manager – Balrampur Chini Mills Ltd., Unit-Haidergarh, Distt.-Barabanki (U.P.), Indian Sugar, April, 2023

Sugarcane is a perishable raw material for sugar industry and highly susceptible to microbial contamination, it's quality start deteriorating quickly after it is harvest in the field resulting in substantial rise of dextran and gums which are harmful from process point of view. Cane juice is also an ideal media for growth of micro-organisms at atmospheric temperature. The extraneous matter reduces the crushing capacity, sucrose content and interferes with the processing of sugar factory. The level of extraneous matter depends on the cane harvesting system, geographical area and sugarcane variety. This study elucidates that on an average of 4.663% extraneous matter accompanied with sugarcane is supplied to mill against the permissible limit of one percent deduction. Sizes of cane bundles also affect the cane quality. Type of binding material and its financial impact was worked-out and it was revealed from the data that paddy straw and grass if used as binding material are economical as compared to others.

Stakeholder Perspectives on Sensors and Automation in the Louisiana Sugarcane Industry, by Anurag Mandalika, Sugar Tech-April, 2023

The sugarcane processing industry in the U.S. state of Louisiana is on the verge of a transformation toward increased automation and real-time data analytics through the adoption of sensor networks. As part of this transition, it was imperative to obtain the current insight and feedback on sensors, automation, and data analytics from sugarcane processors. A short survey was circulated to assess the perspectives of industry stakeholders and seek their feedback on the prime needs for sensors, challenges in incorporating these, and outlook on real-time data analytics and predictive models in processing. Compilation of responses is presented, along with examples of industrially relevant projects that involve sensor networks, real-time data analytics, and artificial intelligence.

A Simplified Isothermal Recombinase Polymerase Amplification Assay for Detection of *Sugarcane bacilliform virus* Infection, by S. K. Sharma, L. Karthikaiselvi, Baby Wangkhem, K. Nithya, R. Viswanathan, G. P. Rao, V. Celia Chalam & K. Anitha, Sugar Tech-April, 2023

Sugarcane bacilliform virus (SCBV), a circular double stranded DNA genome, is considered as one of the economically important pathogens of sugarcane, limiting the sugarcane production worldwide. Establishment of highly sensitive, quick, simple and cost-effective nucleic acid detection method is essential for its timely detection and management. Present study reports an isothermal recombinase polymerase amplification (RPA) assay for detection of SCBV employing the primers targeting RT/RNase H region of viral genome. The developed RPA assay could detect the virus infection up to 10^{-10} dilution of crude sap (original sap prepared by lysis of 100 mg plant tissues in 1 ml of extraction buffer) thus exhibiting sufficient sensitivity. The developed RPA could detect the SCBV infection in to 10 ag μl^{-1} DNA of SCBV infected plant and plasmid DNA containing viral gene inserts, which was equivalent to the limit of detection of PCR assay in respective templates. The study

therefore reports a sensitive yet low-cost RPA based detection for SCBV diagnosis which can be used in laboratories of low resource settings. The developed RPA assay is versatile and can be applied for rapid lab-based detection of SCBV infection in sugarcane.

Design and Experiment of Double Scissor Sugarcane Field Transporter, by Bing Xu, Li-Min Tao, Shang-Ping Li, Sugar Tech-April, 2023

At present, the sugarcane field transporters used widely in Guangxi, China, have insufficient applicability and efficiency due to the integral working mechanism. Thus, a self-propelled double scissor sugarcane field transporter for small plots in hilly areas was designed. The double scissor lifting mechanism and side opening carriage was used to improve the efficiency and stability, and the auxiliary support unit control by electric unit can enhance adaptability of the transporter to slope. The leveling performance of auxiliary support unit and the transverse stability of the field transporter were studied by simulation and experiments. Experimental results showed that the unloading angle of newly proposed field transporter was 30.02°, while this value of the traditional sugarcane field transporter was about 120°. The unloading angle of the double scissor sugarcane field transporter was reduced by 74.98% compared with the traditional sugarcane field transporters.

A Systematic Framework for Studying Two Sugarcane Harvesting Systems Based on National Policy Implementation in Sri Lanka, by Thilanka Ariyawansha, Dimuthu Abeyrathna, Dinesh Kodithuwakku, Janaka Wijayawardhana, Natasha, Sugar Tech-April, 2023

Owing to the vast complexity of the Sri Lankan sugar sector, immediate implementations of novel research findings, such as those concerning cane and dry leaf harvesting (CDLH), affect the total system stability. Therefore, there is an imperative need for a system dynamics model for analyzing CDLH. The objective of this study was to develop such a model, and to use it to evaluate the implementation of CDLH as combined with the Sri Lanka Sugar Sector Development Policy (SSDP) relative to the existing harvesting, i.e., cleaned cane harvesting (CCH). We considered all subsystem interrelations, such as those concerning sugarcane cultivation, processing, energy, environment, social, and economic aspects. A mental model was created and transformed into a stock flow. Then, the model was simulated by adopting two scenarios implementing the SSDP: the CCH and CDLH connected with two high sugarcane yield configurations. The results showed that combining the SSDP with CDLH provides an advantage over CCH. The implementation of CDLH combined with the SSDP minimized the risk of labor shortage and maximizes the appropriate mechanization of harvesting.

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