



**April - June
2022**

NATIONAL SUGAR INSTITUTE, KANPUR – 208017 (U.P.) INDIA



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Even after expected diversion of 3.5 MMT of sugar for ethanol production, the country is expected to record all time high sugar production of 35.5 MMT. Thanks to exports, expected to be 9.0-10.0 MMT, the carryovers shall not be worrying.

The Indian Sugar Industry has now understood the magic of ethanol for balancing demand-supply of sugar and thus to have economic sustainability. I hope, with the prices of ethanol from various feed stocks remaining reasonable, country will witness higher diversion of sugar for ethanol production. However, for achieving higher blending rates, more juice or syrup diversion shall be required. The challenges in fermentation and spent wash handling, thus, are to be circumvented.

Institute is all set to commence it's new academic session 2022-23 with increased seats in courses of Alcohol Technology, Sugar Engineering and Quality Control. On the research front, the pace is maintained with development of technology for producing nano silica particles from bagasse fly ash and two more patents in shelves.

**Narendra Mohan
Director**

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INAUGURATION OF TRAINING CUM CONVENTION HALL:

Inauguration of "**Training Centre cum Convention Hall**" and distribution of awards to sugar factories of Northern India for their exemplary performance was made by Sadhvi Niranjan Jyoti, Hon'ble Minister of State in Ministry of Consumer Affairs, Food & Public Distribution and Rural Development, Government of India.



Mrs. Neelima Katiyar, Hon'ble Member of Legislative Assembly, U.P., also graced the occasion. Stalwarts of sugar industry received the awards in a glittering ceremony on 8th June 2022.

With this facility, institute shall be better placed to conduct its training programmes on hybrid mode involving

overseas delegates, said Sadhvi Niranjan Jyoti, Minister of State in Ministry of Consumer Affairs, Food & Public Distribution and Rural Development, Government of India

WORLD EARTH DAY 2022 CELEBRATED:

"**World Earth Day 2022**" was celebrated on 22th April 2022 at National Sugar Institute, Kanpur on the theme "**Invest in our Planet**". Director called upon the staff and students for carrying out vigorous efforts and creating more awareness about the dire need to protect the environment. On this special day, emphasis should be made on the reasons for increasing environmental problems, including over population, loss of biodiversity, depleting ozone layer which all results in rising pollution.



54th ADVISORY BOARD MEETING:

The 54th Meeting of the Advisory Board of the National Sugar Institute, Kanpur was held under the Chairmanship of Joint



Secretary (Sugar & Admn.) on 17th May 2022. Important issues related to restructuring of the institute, development of infrastructural facilities and for enhancing institute-industry interaction were discussed.

ENTRANCE EXAMINATION:

Online Entrance Examination-2022 for admission to various courses conducted by National Sugar Institute, Kanpur was organized on 26th June 2022 at various centres across the country. The regular classes to commence from July 2022.



ONE DAY NATIONAL SEMINAR ORGANIZED:

One day National Seminar on “**Modelling of Indian Sugar Industry in Diversification Era**” organized jointly by National sugar Institute, Kanpur and U.P. Sugar Mills Association was inaugurated on 29th June 2022, by Shri Laxmi Narayan Chaudhary, Hon’ble Minister for Sugarcane Development & Sugar Industries, Government of Uttar Pradesh.



Experts discussed various models for sacrificing sugar for boosting ethanol production and also producing value added products from by-products of sugar factories with simultaneous balancing of plant & machinery and also having fuel-steam-power balance.

TRAINING PROGRAMME ORGANISED:

1. Two weeks training programme on **“Quality & Chemical Control”** for the technical staff of sugar factories of U.P. Cooperative Sugar Factories Federation Ltd., commenced on 23rd May 2022, at National Sugar Institute, Kanpur. The training programme was attended by 40 personnel from 20 sugar factories of the federation.

Inaugurating the training programme, Shri Narendra Mohan, Director, National Sugar Institute called upon the participants to take advantage of theoretical & practical training to be imparted for enriching their knowledge about the analytical procedures to be followed in sugar industry as per the recommendations of ICUMSA.



2. Another Training Programme was organized for the staff of Uttar Pradesh Cooperative Sugar Factories on the topic **“Automation & Instrumentation”** organized during the period at National Sugar Institute, Kanpur. The participants were imparted knowledge about the latest techniques of process control including use of artificial intelligence.



3. Training programme was organized for the pan boiler staff of Uttar Pradesh Cooperative Sugar Factories on the topic **“Advancements in Sugar Crystallization & Centrifugation”** at National Sugar Institute, Kanpur.



4. Short duration training programme was conducted for the officials of



Udupi Chamber of Commerce & Industry (Incorporated), Karnataka on "**Models of Ethanol Production**".

5. One-week training programme on "**Chemical & Quality Control Techniques**" for officials of M/s Wave Sugar Industries Ltd. commenced from 27th June 2022 at the National Sugar Institute, Kanpur. Theoretical as well as practical training is being imparted to the participants with focus on calculation of sugar recovery while undertaking diversion of sugar.



MoU SIGNED:

National Sugar Institute, Kanpur Director Prof. Narendra Mohan, exchanged the Memorandum of understanding with H.E. Indonesian Ambassador in India at Delhi



(signed virtually on 14th June 2022) for conducting training programmes and providing consultancy to Indonesian Sugar Industry in the presence of Foreign Ministers of the two countries, Dr. S Jaishankar, India and H.E. Ms. Retno Marsudi, Indonesia on 17th June 2022.

RESEARCH WORK:

- 1. Studies on isolation of Lignin from sugar industry-based biomass and development of the process for the conversion of derived lignin and fermentable sugar to Value-added product** - Optimized reaction conditions for synthesis of vanillin from bagasse derived lignin have been established and preliminary results were compiled in form of a paper and communicated to ISSCT towards consideration for its presentation.
- 2. Studies on production of chloromethyl furfural from bagasse derived cellulose in biorefinery approach-** Optimized reaction conditions for synthesis of 5-(Chloromethyl) furfural (CMF) and 5-(Hydroxymethyl) furfural (CMF) (HMF) from bagasse derived cellulose have been established and preliminary results were compiled in form of a paper and communicated to STAI for

its presentation during the forthcoming convention.

3. Studies on Sweet Sorghum Bagasse value addition – Initial studies related to synthesis and of 5-(Chloromethyl) furfural and vanillin from sweet sorghum bagasse derived cellulose and lignin has been completed. After completion of date, future strategy shall be planned.

4. Studies on utilization of molasses for synthesis of 5-alkoxymethylfurfural ethers as promising biofuel candidates - The reactions related to prepare alkyl levulinates from the intermediated obtained from molasse were executed. The isolation, purification and identification of the products from the said reaction mixture is ongoing.

5. To study the impact on performance of mechanically coupled twin induction motor drives for Shredder/Fibrizer having unequal sharing of load and to design & develop dedicated drive for the application –The study is almost completed. One paper is prepared and submitted for DSTA convention. Another one paper shall also be prepared for presentation on a reputed sugar industry platform.

6. Comparative study of Five varieties of sweet sorghum for production of ethanol yield - Out of nine only five sweet sorghum varieties namely Phule Vasundhra, CSH 22SS, SSV 84, SSV 74 and ICSSH-28 performed better as compared to other varieties. So only these varieties were considered for further trials and were sown on in March 2022. Gap filling was done in April 2022. The crop once matured will be harvested and analyzed for the production of ethanol.

7. Cane juice syrup study for self-life and production of alcohol - Two Syrup samples were preserved in Bio-Chemistry division at room temperature, one collected from Dalmia Bharat Sugars Ltd. Jawaharpur- unit and other from Experimental Sugar Factory of the institute. Preserved Syrup showed no deterioration without addition of any enzyme even after 3-4 months. Study is still on going to observe the shelf life of the same. Data was presented in National Seminar organized by the institute in collaboration with UPSMA on “Modelling of Indian Sugar Industry in Diversification Era.”.

8. Comparative study on polarization by using lead, non-lead, non-lead clarificants and NIR polarimetry - Procurement of chemicals for NIR polarimetry has been made. Trials of Carrez reagent for clarification of samples is being conducted. The studies on polarising samples in NIR region without using lead as clarifying agent are also being carried out.

9. Study of B Heavy molasses for use as edible molasses - Heavy metals analysis of 03 nos. B Heavy molasses samples was performed in Agriculture Chemistry division and the analytical data has been compiled with the previous analysis. More samples are being procured to repeat the analysis to obtain conclusive results.

10. Use of Guljag Crystasulf for sugar cane juice clarification - Two sets of experiments were conducted during the month by applying different doses of CRYSTASULF i.e. @ 500 ppm, 800 ppm, 1000 ppm & 1500 ppm were applied to the raw juice & then lime @ 1.2 % v/v was

added. Excess alkalinity was further neutralized by adding CRYSTASULF again. Then juice was subjected to heating to 101-102 deg.c. and flocculant @ 1 ppm was also applied to facilitate settling of juice. Analysis of juice before & after treatment was carried out for pH, Brix, Pol% Pty & RS% and the preliminary results are encouraging.

11. Preservation of syrup and B-heavy molasses storage by the use of different chemicals

- 07 set of samples (blank or treated) were stored in custom made molasses tanks. Five samples were from Double Sulphitation Process and other two samples were from Defecation Process. Different doses of commercially available enzymes were added to the samples. The samples were analysed for Brix, Pol, Purity, Viscosity, R.S., T.R.S., pH & VFA etc. on fortnightly basis.

More experiment shall be carried out to assess rate of deterioration by keeping the molasses samples in water jacketed molasses tanks.

12. Juice concentration by using Membrane Technology

- Based on the trials conducted at two commercial sugar samples, a paper entitled "Clear juice concentration with the help of reverse osmosis" was prepared and submitted for publication in upcoming STAI convention. During the trials, the clear juice could be concentrated from 12-13° brix. However, certain drop in purity was observed, perhaps due to higher retention & microbial activity.

RESEARCH PAPERS:

1. A paper entitled "**Hybrid Sulphitation Cum Re-Crystallization Process for**

Production of Superior Quality White Sugar

by Narendra Mohan, V. P. Srivastava, S Mohan & Ashish Kumar was sent for publication in the proceedings of seminar organized by The Deccan Sugar Technologists' Association (India) seminar in collaboration with Vishwaraj Sugar Industries Ltd.

2. A research paper entitled "**Artificial Sweeteners - A Threat to Sugar Consumption**" by Sneha Agarwal & Narendra Mohan was sent for publication in 80th Annual Convention and International Sugar Expo 2022 of Sugar Technologists' Association of India (STAI).

3. A research paper entitled "**A Study to Synthesize Practical Substitute of 5-HMF from Sugarcane Bagasse Cellulose: A Biorefinery Approach to Access Furanic Biofuels and Value-Added Products**" by Narendra Mohan, Vishnu Prabhakar Srivastava, Chitra Yadav & Mamta Shukla has been sent for publication in 80th Annual Convention and International Sugar Expo 2022 of Sugar Technologists' Association of India (STAI).

4. A research paper entitled "**HACCP Implementation for Jaggery Processing**" by Ashok Kumar Garg, Anushka Akash Kanodia & Shruti Shukla has been sent for publication in 80th Annual Convention and International Sugar Expo 2022 of Sugar Technologists' Association of India (STAI).

5. A research paper entitled "**Preliminary Trials on Partial Cane**

Juice Concentration Through Reverse Osmosis Technology” by Narendra Mohan, Ashok Kumar Garg, Anurag Verma & Priya Bajpai has been sent for publication in 80th Annual Convention and International Sugar Expo 2022 of Sugar Technologists’ Association of India (STAI).

6. A research paper entitled **“MECHANICAL VAPOUR RECOMPRESSION – FUTURE TOOL FOR STEAM ECONOMY”** by Narendra Mohan, Mahendra Kumar Yadav & Amresh Pratap Singh has been sent for publication in 80th Annual Convention and International Sugar Expo 2022 of Sugar Technologists’ Association of India (STAI).

7. A research paper namely **“Bio Ethanol – Saviour of Indian Sugar Industry”** by Narendra Mohan has been sent for presentation in XXXI Congress of the International Society of Sugar Cane Technologists (ISSCT) to be held from 20-23 February 2023 at the Hyderabad International Convention Centre, Hyderabad, India.

8. A research paper namely **“Importance of Diversification & Integrations in Sugar Industry”** by Narendra Mohan & Anushka Akash Kanodia has been sent for presentation in XXXI Congress of the International Society of Sugar Cane Technologists (ISSCT) to be held from 20-23 February 2023 at the Hyderabad International Convention Centre, Hyderabad, India.

9. A research paper namely **“A biorefinery method for production of chloromethyl-furfural (CMF) and**

Vanillin with simultaneous fraction of pentose syrup and lignin from sugar cane bagasse” by Narendra Mohan, Vishnu Prabhakar Srivastava, Chitra Yadav, Mamta Shukla has been sent for presentation in XXXI Congress of the International Society of Sugar Cane Technologists (ISSCT) to be held from 20-23 February 2023 at the Hyderabad International Convention Centre, Hyderabad, India.

10. A research paper entitled **“Novel Steps for Evaporator Configuration to Reduce Steam Demand by Use of Mechanical Vapour Recompressor”** by Narendra Mohan, Mahendra Kumar Yadav & Amresh Pratap Singh was presented during the National Seminar **"Modelling of Indian Sugar Industry in Diversification Era"** at National Sugar Institute, Kanpur on 29th June 2022.

11. A research paper entitled **“Carbonation & Phosphatation Process: A Practical Approach”** by Narendra Mohan, Mahendra Yadav & Amresh Pratap Singh was presented during the National Seminar **"Modelling of Indian Sugar Industry in Diversification Era"** at National Sugar Institute, Kanpur on 29th June 2022.

12. A research paper entitled **“Diversification in Indian Sugar Industry: A Sustainable Sugar-Ethanol Model”** by Narendra Mohan & Anoop Kumar Kanaujia was presented during the National Seminar **"Modelling of Indian Sugar Industry in Diversification Era"** at National

Sugar Institute, Kanpur on 29th June 2022.

13. A research paper entitled **“Synthesis of Silica Nanoparticles from Sugarcane Bagasse Fly”** by Shalini Kumari, Vishnu Prabhakar Srivastava and Narendra Mohan has been sent for publication in 80th Annual Convention and International Sugar Expo 2022 of Sugar Technologists’ Association of India (STAI).

14. A research paper on **“Production of Activated Bio-Char from sugarcane Bagasse and its application in Decolourising sugar melt”** by Narendra Mohan, Sudhanshu Mohan and Shalini Kumari was published in International Journal of Science and Research in May 2022.

CONSULTANCY:

The consultancy services of the institute were provided to the following 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 etc.

1	M/s Bajaj Hindusthan Sugar Ltd., Unit – Palia Kalan District – Lakhimpur Kheri, U.P.
2	M/s Dhampur Sugar Mills LTD., Unit – Dhampur, District - Bijnor, U.P.
3	M/s Dhampur Sugar Mills LTD., Unit – Rajpura, District - Sambhal, U.P.
4	M/s Dhampur Sugar Mills LTD., Unit – Asmoli, District - Sambhal, U.P.

5	M/s Bajaj Hindusthan Sugar Ltd., Unit – Palia Kalan, (Distillery) Lakhimpur Kheri, U.P.
6	M/s Kesar Enterprises Ltd., Baheri, District – Bareilly, U.P.
7	M/s Majhulia Sugar Industries Pvt. Ltd., Majhulia, W. Champaran, Bihar
8	M/s Avadh Sugar & Energy Ltd., Hargaon Distillery, Sitapur, U.P.
9	M/s M/s Seksaria Biswan Sugar Factory Ltd., Sitapur, U.P.
10	M/s M/s Wave Sugar Industries, Unit-Dhanaura Mandi, Amroha, U.P.
11	M/s Doon Valley Distillers (liquors Unit) Rajpur Road, Dehradun, U.K.
12	M/s Avadh Sugar & Energy Ltd., Unit- Seohara, Bijnor, U.P.
13	M/s Bajaj Hindusthan Sugar Ltd. Unit – Bilai, Bijnor, U.P.
14	M/s Uttam Sugar Mills, Unit – Barkatpur, Bijnor, U. P.
15	M/s Simbhaoli Sugar Mills Ltd., Unit – Simbhaoli, Ghaziabad, U.P.
16	M/s Dalmia Bharat Sugar & Industries Ltd., Distillery Unit – Ramgarh, Sitapur, U.P.
17	M/s Dalmia Bharat Sugar & Industries Ltd., Sugar Unit – Ramgarh, Sitapur, U.P.
18	M/s Dhampur Sugar Mills Ltd., Chemical Division Dhampur, Bijnor, U.P.
19	M/s Dalmia Bharat Sugar & Industries Ltd., Distillery Unit – Nigohi, Shahjahanpur, U.P.
20	M/s Bajaj Hindusthan Sugar Ltd., Unit – Khambarkhera, U.P.
21	M/s Daurala Sugar Works, Unit – Daurala, Meerut, U.P.
22	M/s Magadh Sugar & Energy Ltd., Unit – New Swadeshi Sugar, Narkatiaganj, Bihar

23	<i>M/s Triveni Engineering & Industries Ltd., Unit – Milak Narayanpur, Rampur, U.P.</i>
24	<i>M/s Bajaj Hindusthan Sugar Ltd., Unit – Kinauni, Meerut, U.P.</i>
25	<i>M/s EID Parry (India) Ltd., Unit – Sankili, Srikakulam, Andhra Pradesh</i>

ANALYTICAL SERVICES:

Besides analysis of sugar & sugar house products, Ethanol and effluents etc. Institute started offering 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 also taken up during the period. Analytical services were rendered to following:

1	<i>M/s Kisan Sahkari Chini Mills Ltd., Sampurna Nagar, Lakhimpur Kheri, U.P.</i>
2	<i>M/s The Kisan Sahkari Chini Mills Ltd., Gajraula, Hasanpur, Amroha, U.P.</i>
3	<i>M/s Balrampur Chini Mills Ltd., Unit – Akbarpur, U.P.</i>
4	<i>M/s Avadh Sugar Energy Ltd., Unit - Seohara, Bijnor, U.P.</i>
5	<i>M/s Dalmia Bharat Sugar & Industries Ltd., Unit – Jawaharpur, Sitapur, U.P.</i>
6	<i>M/s Magadh Sugar & Energy Ltd., Sidhwalia, Gopalganj, Bihar</i>
7	<i>M/s The Seksaria Biswan Sugar Factory Ltd., Biswan, Sitapur, U.P.</i>
8	<i>M/s Dhampur Sugar Mills LTD., Unit – Asmoli, Sambhal, U.P.</i>
9	<i>M/s Dhampur Sugar Mills LTD., Unit – Meerganj, Bareilly, U.P.</i>
10	<i>M/s Dhampur Sugar Mills LTD., Unit – Mansoorpur, Muzaffarnagar, U.P.</i>
11	<i>M/s LH Sugar Factory Ltd., Pilibhit, U.P.</i>

12	<i>M/s Triveni Sugar & Engineering & Ind. Ltd., Unit – Sabitgarh, Bulanshahr, U.P.</i>
13	<i>M/s Wave Industries Pvt. Ltd., Bulanshahr, U.P.</i>
14	<i>M/s Triveni Sugar & Engineering & Ind. Ltd., Unit – Raninangal, Moradabad, U.P.</i>
15	<i>M/s Majhauria Sugar Industries Pvt. Ltd., Majhauria, W. Champaran, Bihar</i>
16	<i>M/s Kisan Co-operative Sugar Factory Ltd., Sarsawa, Saharanpur, U.P.</i>
17	<i>M/s Triveni Sugar & Engineering & Ind. Ltd., Unit – Khatauli, Muzaffarnagar, U.P.</i>
18	<i>M/s Govind Sugar Mills Ltd., Unit-Aira, Lakhimpur Kheri, U.P.</i>
19	<i>M/s Triveni Engineering & Ind. Ltd., Unit – Sabitgarh, Bulandshahr, U.P.</i>
20	<i>M/s Rasi Nutr Foods India Pvt. Ltd., Tamilnadu</i>
21	<i>M/s Kisan Sahkari Chini Mills Ltd., Unit – Kaimganj, Farrukhabad, U.P.</i>
22	<i>M/s The Kisan Sahkari Chini Mills Ltd., Unit – Sathiaon, Azamgarh, U.P.</i>
23	<i>M/s Maa Mahamaya Sahkari Shakahar Karkhana, Chhattisgarh</i>
24	<i>M/s Rana Sugar Sugars Ltd., Shahabad, Rampur, U.P.</i>
25	<i>M/s Balrampur Chini Mills Ltd., Unit – Balrampur, U.P.</i>
26	<i>M/s ISGEC Heavy Engineering Ltd., Noida, U.P.</i>
27	<i>M/s Novel Sugar Ltd., Barkhera, Pilibhit, U.P.</i>

OUR OTHER ACTIVITIES:

1. Director, National Sugar Institute, Kanpur instructed departmental canteen to use eco-friendly & 100% bio-compostable crockery made of

sugarcane bagasse. As per the new arrangements effective from 1st April, 2022, while the food products are being served in the utensils made of sugarcane bagasse, the beverages shall be served in the earthen pots. This will open new avenues for utilization of sugarcane bagasse.



2. Director, National Sugar Institute, Kanpur attended Symposium on Bagasse Drying which was organized by M/s Seksaria Biswan Sugars Ltd. at Lucknow as a Chief Guest. Good discussions on design features and ROI of such systems and brainstorming on reasons for inhibition in adopting such systems were made. The present system installed at the factory is good results



consistently with moisture in final bagasse been 40-41% only.

3. On the occasion of Bharat Ratna, Dr. BR Ambedkar Jayanti, National Sugar Institute, Kanpur paid tributes to the son of soil who spread the message of equality and right to education. Dr. BR Ambedkar was an Indian jurist, politician, philosopher, anthropologist, historian, and economist who was a key architect of the Indian Constitution. Words are not enough to describe the role he played for building new India said Director while addressing the institute employees.



4. Field exposure was given to the students of ANSI - Sugar Technology



and Sugarcane Productivity & Maturity Management courses at the institute farm. Students learnt the importance of seed treatment and methods of planting.

5. Karnataka State officials and members of Governing Council of S. Nijlingappa Sugar Institute were visited, to seek support of National Sugar Institute, Kanpur in training of in-service personnel and modernization of sugar factories and allied industries.



6. **"National Technology Day"** was celebrated at the National Sugar Institute, Kanpur on 11th May 2022. Director NSI highlighted the technological advancement in the Indian sugar Industry during the post-independence era.



7. An online meeting was held between NSI, Kanpur and ICAR-Indian Institute of Maize Research, Ludhiana to work together for identifying suitable maize hybrids for ethanol production and also for assessing various process parameters to attain higher ethanol yield. The action plan was worked out during the meeting.



8. A team of Ministry Officials under the leadership of Shri Dharendra Kumar, Director, Department of Food & Public Distribution at National Sugar Institute, Kanpur on 13th May 2022, to observe the status of **"Swachhta Activities"**. They also distributed towels to multi-tasking staff.



9. Meeting with officials of M/s Hydranautics (a Nitto group, Japan company) for conducting further trials

of Reverse Osmosis technique for juice concentration in place of existing evaporation technique was organized on 18th May 2022.



10. Badminton court re-opened at Hostel No. 2 of National Sugar Institute, Kanpur on 29th May 2022. Few matches between NSI officials and students of different courses were played.

11. **“World Environment Day -2022”** was celebrated at the institute on 5th June 2020. Director, NSI addressed on possibilities of **“Green Hydrogen”** from sugar industry as the future fuel. Tree plantation drive was jointly conducted with Jyoti Mahila Samiti followed by distribution of saplings and cloth bags.



12. National Sugar Institute, Kanpur got success in producing another value-

added product from the waste of the sugar industry i.e. **“Nano Silica Particles”** from fly ash of the boilers in sugar factories. Nano Silica Particles have wide applications in paints, lithium batteries, as adsorbent in pollution treatment, in bio-technology & bio-medical application and as Nano fertilizer for crop improvement.



13. राष्ट्रीय शर्करा संस्थान द्वारा दिनांक २१ जून २०२२ को **“अंतरराष्ट्रीय योग दिवस – 2022”** का आयोजन किया गया जिसमें संस्थान के अधिकारियों एवं कर्मचारियों ने बढ़-चढ़ कर भाग लिया।



14. Team of M/s Ponni Sugars (Erode) Limited, Tamil Nadu led by Senior Vice President (Operations) on 25th June 2022, visited to National Sugar Institute, Kanpur to seek support for producing value added items from by-products of sugar industry.