



Report of training programme on ‘Cleaner Technology and Waste minimization for Prevention of Industrial Pollution and 4 R’s – case Studies’ organized by National Sugar Institute, Kanpur during 20 – 24 January 2020.



Sponsored by :
Central Pollution Control Board
Delhi

Organized by :
National Sugar Institute
Kanpur

सारांश

केन्द्रीय प्रदूषण नियंत्रण बोर्ड के प्रशिक्षण अनुभाग द्वारा राज्य प्रदूषण नियंत्रण बोर्ड व पर्यावरण संरक्षण से संबंधित संस्थानों के अधिकारियों के सतत् उन्मयन के उद्देश्य से वर्ष भर अनेक प्रशिक्षण कार्यक्रम आयोजित किये जाते हैं। इन प्रशिक्षण कार्यक्रमों का मूल उद्देश्य पर्यावरणीय प्रदूषण नियंत्रण व पर्यावरण प्रबंधन के क्षेत्र में किये जा रहे कार्यों व नये आविष्कारों से सभी अधिकारियों को अपडेट रखना होता है। इसी क्रम में वर्ष 2019-20 के प्रशिक्षण कार्यक्रम में राष्ट्रीय शर्करा संस्थान, कानपुर के द्वारा एक प्रशिक्षण कार्यक्रम 'Cleaner Technology and Waste minimization for Prevention of Industrial Pollution and four R's – Reduce, Reuse, Recycle and Recover – case Studies' विषय पर दिनांक 20 से 24 जनवरी, 2020 के मध्य कानपुर में आयोजित किया गया। इस प्रशिक्षण कार्यक्रम में कर्नाटक, पांडिचेरी, बंगाल, हिमाचल, महाराष्ट्र के राज्य प्रदूषण नियंत्रण बोर्ड, विश्वविद्यालय के प्राध्यापकों व केन्द्रीय प्रदूषण नियंत्रण बोर्ड के अधिकारियों द्वारा भाग लिया गया।

प्रशिक्षण कार्यक्रम का शुभारंभ माननीय मंत्री, उच्च शिक्षा, विज्ञान एवं तकनीकी विभाग उत्तर प्रदेश सरकार द्वारा किया गया। कार्यक्रम में संस्थान के निदेशक, वरिष्ठ प्राध्यापकों के साथ-साथ उद्योग में कार्यरत वरिष्ठ स्तर के अधिकारियों द्वारा शर्करा व आसवनी उद्योग में पर्यावरण प्रबंधन से संबंधित व्याख्यान दिये। व्याख्यानों की श्रृंखला में एगोबेस उद्योगों के उत्पादों के निर्माण, उससे निकलने वाले उप उत्पादों का सही उपयोग तथा निस्तारित जल के प्रभावी उपचार संबंधि विषयों पर विशेष प्रकाश डाला गया। प्रशिक्षण के दौरान औद्योगिक भ्रमण भी आयोजित किया गया जहाँ पर्यावरण प्रदूषकों के उपचार हेतु अपनाये जा रहे अद्यतन उपकरण जैसे एम.ई.ई. व ई.टी.पी. संयंत्रों के बारे में विस्तार से जानकारी प्रदान की। भ्रमण के दौरान शर्करा व एल्कोहल निर्माण की प्रक्रिया के सभी तकनीकी पहलुओं पर जानकारी प्रदान की गई।

प्रशिक्षण के दौरान देश के विभिन्न राज्य प्रदूषण नियंत्रण बोर्ड से आये हुये प्रतिभागियों के मध्य आपसी संवाद भी हुआ तथा एक-दूसरे के क्षेत्र में शर्करा तथा आसवनी उद्योग में पर्यावरण प्रबंधन के लिये अपनायी जा रही अद्यतन तकनीक के बारे में विचारों का आदान-प्रदान किया गया।

प्रशिक्षण कार्यक्रम आशानुरूप सफल रहा क्योंकि इसमें वरिष्ठ अध्यापक, वरिष्ठ अधिकारी, औद्योगिक प्रतिष्ठानों के प्रतिनिधि तथा उपकरण निर्माताओं द्वारा एक ही मंच पर अपने अनुभव व समस्याओं को साझा किया तथा इसके व्यावहारिक अनुपालन की योजनाओं पर विचार विमर्श किया गया।

प्रशिक्षण की सफलता हेतु श्री एम. मोहन, निदेशक राष्ट्रीय शर्करा संस्थान, कानपुर डॉ. सीमा पारोहा, प्राध्यापक व अन्य अधिकारियों व कर्मचारियों के द्वारा सराहनिय प्रयास किये गये, आशा है संस्थान द्वारा आगे भी इस तरह के प्रशिक्षण कार्यक्रमों का सफल आयोजन किया जाता रहेगा।



**Central Pollution Control Board
Regional Directorate, Bhopal**

Report of Training Programme Organized By NSI, Kanpur.

Introduction

The 4 R's provides an ecologically sound and environmentally friendly approach to minimizing and managing waste and waste streams. The 4 R's approach attacks a waste stream in a logical and methodical method by taking steps to sequentially Reduce, Reuse, Recycle and Recover a waste stream into incremental fractions.

India is one of the world's largest producers of sugar from sugarcane. Crystal sugar is produced in organised sugar mills located in different parts of the country. Sugar and distilleries have been classed as the most water polluting amongst the other agro based industries. The main impediment in the way of implementation of effluent treatment schemes has been the large capital investment involved in setting up the treatment plants. The capital cost of the treatment plant is as much as the cost of the sugar mill or distillery itself.



During the early history of the industry the distilleries and sugar mills have taken recourse to releasing the waste on open land causing pollution and foul odour in the surrounding area and contamination of groundwater but after the concept of 4R's the situation has been changed.

Therefore, proper knowledge and skill development for pollution control becomes most crucial factor for regulators i.e. CPCB and SPCB. ETU division of CPCB, Delhi recognizes this need and organized a five days training programme– cum workshop on ‘Cleaner Technology and Waste minimization for Prevention of Industrial Pollution and four R’s – Reduce, Reuse, Recycle and Recover – case Studies at National Sugar Institute, Kanpur (UP) during 20 – 24 January 2020. The training programme had been grouped as technical classes by experts, technology demonstration, group exercises, presentation and field visits for practical experience.

First day Inaugural cum Technical session (20st Jan. 2020):

The programme was inaugurated by Mrs. Nilima Katiyar, Hon’ble State Minister, Higher Education, Science & Technology, Government of Uttar Pradesh. In her address, Minister expressed her pleasure and complimented National Sugar Institute on conducting training programme on such an important issue. The state and central government are committed to combat the menace of both municipal and industrial pollution and it is the duty of every citizen to feel the onus and contribute to prevent exploitation of natural resources and polluting rivers and other natural water bodies. More such training programmes are needed to create awareness and take effective measures for controlling pollution, she said. She also appreciated the work of NSI, Kanpur in the field of sugar production and to provide the technical guidelines for waste treatment also as it is requirement of present scenario to develop a sense of 4R’s by the industries to optimize use of available natural resource.

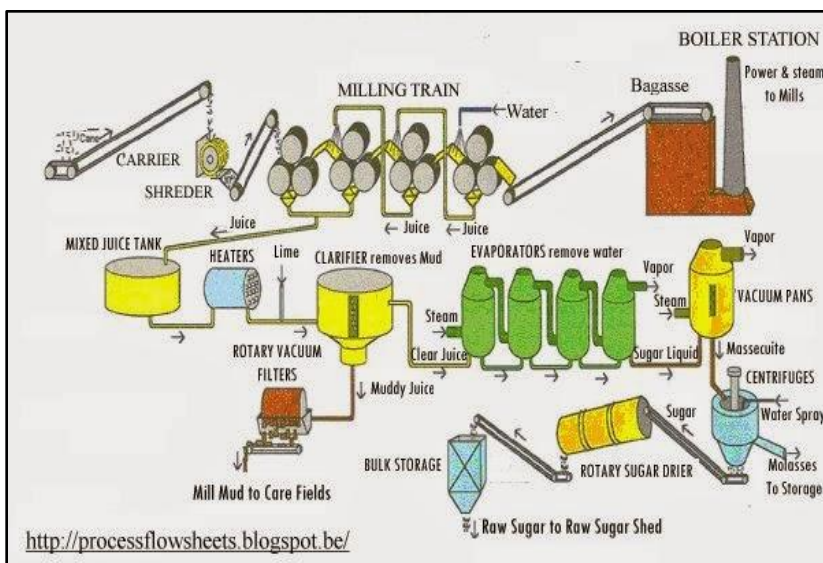


In his inaugural address, Prof. Narendra Mohan, Director, National Sugar Institute made a presentation on fresh water usage and effluent generation in Indian Sugar Factories. Since sugar factories produce different kind of sugars i.e. raw,

refined and plantation white sugar adopting different process technologies, the effluent also differs in quality and there is need for modifying the effluent treatment systems as per requirement to have treated effluent as per norms, he stressed. While elaborating on various such technologies on “Sulphate Removal” and “Brine Recovery”, he called upon the participants to look for implementation of five R’s i.e Reduce, Reuse, Recycle, Renew and Return so as to reduce the fresh water consumption and effluent discharge.

Dr (Mrs.) Seema Paroha, Convener and Prof. Biochemistry highlighted the necessity of achieving “Zero Liquid Discharge” in molasses based distilleries by adopting incineration or bio-composting techniques. She also emphasized upon developing newer technologies of effluent treatment in distilleries and taking up production of value added potash rich fertilizer from boiler ash in combination with sludge from fermenters.

Dr Ashutosh Bajpai, Prof. of Sugar Technology elaborated the process techniques of plantation white sugar and refined sugar factories being followed in Indian sugar factories and their impact on effluent quantity and quality. He described the process in detailed; harvested sugarcane is shredded and washed to remove dirt using water sprays. This water mostly helps in extracting maximum sugarcane juice. The remaining solid fibrous material is known as bagasse.



After removing solid residues from sugarcane juice by using filter cloth technique, the juice is purified by either double sulphitation or double carbonation, the former being used to larger extent in India.

The sulphitation process involves heating of juice to 70°C and milk of lime (2.0-1.5% v/v) is added therein. About 8-11% gaseous sulphur dioxide is then passed through to bring down alkaline juice pH to neutral.

The treated juice is boiled by indirect steam heating. It is then sent to clarifiers where some insoluble compounds settle as a sludge and others rise to form scum. Coagulants are also added.

In double carbonation process, milk of lime (6-10% v/v) of juice is added and then carbon dioxide gas is passed to produce alkalinity of 350-450 mg/l as CaCO₃. Second carbonation is carried out at pH 8.5-9.2 after which gaseous sulphur dioxide is passed to have a pH of 6.8-7.0 and the treated juice is clarified as described above.

For both the process, chemicals used for purification of juice are listed below:

Triple superphosphate (45-48% P₂O₅) 0.12-0.016 kg per 1000/kg of sugarcane is used to improve clarification. Clarified juice is concentrated in multiple effect evaporations in which 75% of water from the sugarcane juice gets removed producing a syrup containing 60-70% solids.

The syrup is further concentrated in vacuum pans (pan-boiling), yielding a dense mixture of crystals and syrup called 'massicuit'. It is centrifuged for separation of crystals as raw sugar. The remaining syrup, known as 'molasses' is returned to the vacuum pans for further crystallization and finally the spent molasses is removed from the process as the by-product. Molasses is the basic raw material for alcohol industry (distillery).



Shri Mahendra Yadav, Technical Officer, elaborated latest technological interventions made in the process of effluent control and treatment. The programme was conducted by Prof. D Swain, Prof. Sugar Engineering who also delivered the vote of thanks.

Second day (21st Jan. 2020):

On the second day technical session started with the lecture on Condensate Polishing Unit water treatment presented by Dr.Sunil Bhate, Mumbai in his presentation he explained in managing the available resources and achieving the total water management through resource conservation, reutilization and recycling wherein it was possible to achieve “Zero water intake” practically to meet the process demand of sugar factory and Co-generation unit. Water in sugar cane is most reliable source, and condensate gained is almost pure, except for a few impurities, which are required to be tackled and treated before the water is available for the specific use desired. The utilization of this condensate as it is has however proven detrimental because of trace organic matter and more particularly, the Ammonical Nitrogen contents.

In second technical lecture was delivered by Sh. Avent Gadre delivered his lecture on ‘Spent wash incineration technology’ he explained that the Spent wash Incineration can be said to be the best viable solution to treat distillery spent wash economically today to meet the zero liquid discharge from the distillery. It helps in meeting the complete steam and power requirement of the distillery, thereby making it self-reliant.



The third technical lecture delivered by Dr. Anubha Goel of IIT, Kanpur delivered her lecture on ‘Air pollution cause, control device in use & system for measurement in sugar factory’

she explained that the Air Pollution Control Device is the mechanism or the equipment that cleans emissions generated by a source e.g. an incinerator or industrial smokestack. by removing pollutants that would otherwise be released to the atmosphere. Sugar mill may choose one of the three remaining air pollution control equipment, viz. multi-cyclones, wet collectors and bag filters, depending upon the actual emission standards stipulated by the State Pollution Control Board.

Fourth technical lecture was delivered by Prof. D.Swine of NSI on ‘Details of ETP capacity, process and lay out-case study’ he explained that the Effluent Treatment Plant or ETP is one type of waste water treatment method which is particularly designed to purify industrial waste water for its reuse and it's aim is to release safe water to environment from the harmful effect caused by the effluent and reuse in the process.

Third day (22nd Jan. 2020):

On Third day technical session started with the lecture on ‘Multiple Effect Evaporator (MEE)’ by Sh. Pandey representative of M/s Excel Engg. Pune. In his presentation he explained about the function of MEE in molasses based distillery and the basic problems that arises during its operation and its rectifications. MEE, as defined in chemical engineering, is an apparatus for efficiently using the heat from steam to evaporate water. In a multiple-effect evaporator, water is boiled in a sequence of vessels, each held at a lower pressure than the last. Because the boiling temperature of water decreases as pressure decreases, the vapor boiled off in one vessel can be used to heat the next, and only the first vessel (at the highest pressure) requires an external source of heat. Finally the concentrate is burnt in incinerator and condensate water recycled in the process.



The second technical lecture was delivered by the representative of M/s Raj Process equipment & system Ltd. on 'Spray drying of spent wash' he explained in detailed about the drying system and how it is useful to achieved the ZLD status.

On third day Dr.Vishnu Shrivastav and Dr.Alka Gupta jointly explained about the analytical procedures of the various parameters i.e. pH, TSS, COD and BOD and how it is relevant with the process control and to evaluate the ETP performance. A hand on training on analysis was also organized for the participants for estimation of COD in given water samples in the laboratory of NSI.

Fourth day (23rd Jan. 2020):

On fourth day a field visit had been organized at M/s DSCL at Hariawan, Hardoi District of Uttar Pradesh.to explained the actual operation and performance of the various process. The plant production facilities have co-generation power plants, based on bagasse, a sugar by-product. Unit has installed co-generation capacity of 141 MW, out of which they supply some renewable energy to the national grid and the rest is for captive use.

M/s DSCL also having 150 KLD Distillery at Hariawan. Sh.Tyagi, Unit head explained about the sugar and alcohol production



process. This field visit was coordinated by Dr.Seema Paroha and Mr. Vinay Kumar of NSI.

Fifth day (24th Jan. 2020):

Fifth day technical session started with the lecture on 'Production process in modern grain based distillery, Water balance and ETP of grain based distillery' by Sh. H.S.Shukla of M/s Oasis distillery.

The second lecture was delivered by Mr.Govind Mishra from Birla Group on 'Effluent management by 4 R's –case study of distillery'. He explained about the best utilization process of water treatment and its recycling.

After the lecture group discussion on certain flagged issues raised by participants were taken up in last session for further discussions. All the queries and question were addressed and satisfactory solutions were suggest by the experts members. Feedback format were distributed among the participant to know their views w.r.t. quality of study material, qualitative & quantitative analysis of lecture etc.

In last session participants interacted with each other and shared their experience/views and various issues related to waste management system, laboratory analytical procedures and how to achieved the ZLD status.

The workshop concluded with the distribution of certificates by Prof. D Swain of the NSI to the participants and delegates. The participants were suggested to organize advance workshop on the topic to obtain useful insight.

What I learn from workshop:

After attending the workshop at NSI, I learnt about the various options available for water conservation in sugar and distillery industry and how it is function besides that I also came to know that the waste of one industry can be the raw material for other industry if we are using it in scientific manner. I also shared my knowledge with my senior officer and colleague which I got only after attending this workshop. The following points had been discussed by me during interaction in office.

- Difference between raw and sulphur sugar.
- Gainful utilization of sugar mill waste by other industry.
- How to reduce the fresh water requirement in agro based industry.



- Operational issues of MEE, ETP and Spray dryer in distillery unit.
- Possible air pollutant and its APCDs.
- Efforts required for ZLD in agro based production units.
- BAT on effluent management i.e. Composting, Cogeneration, Land application and recycling in process.
- What are the unintentional reasons of non compliances and how it will resolved by regulatory point of view.

What are my expectation from ETU, Division of CPCB:

1. To organized more training programme with other expert institute like NSI, CLRI etc.
2. To educate the RDs regarding new tools of verification, trouble shooting of ETP operations, new technology etc. through Video Conference / Webinar as and when required by expert members.
3. If possible then organize a advance training for the same participants in next year.
4. All the training reports, PPTs and course material shall be made available on our website for public access.

This is CPCB's first and only comprehensive training on 4 R's organized by NSI, Kanpur. It empowers the officers of CPCB and SPCBs with the knowledge of the best practices adopted around the nation. The training is very useful for me and definitely I will do my best for strengthening of the waste management system and implementation of 4R's in industrial and other relevant sector.

(Dr. Anoop Chaturvedi)
SSA, RD-Bhopal



Glimpse of Training

