(14)

Date: 21/07/2023

PROCEEDINGS OF THE MEETING

Venue: Vasantdada Sugar Institute, Pune
Date : 18th May 2023 & 19th June 2023

The Technical Committee meeting was held on 18th May 2023 & 19th June 2023 for the review of completed experiments during 2022-23; ongoing technical performance of each experiment and future research programs for 2023-24 of Sugar Engineering, Sugar Technology, Alcohol Technology & Biofuels, Environmental Science and Electronics and Computer Departments.

The minutes of meeting is placed below for approval please.

Through,
1) Head & TA, SE- 21/7/2023
2) ~~IAO~~-
21/7

D.G.
21/7

SEAL OF THE VASANTDADA SUGAR INSTITUTE, PUNE
VSI

Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

3१

PROCEEDINGS OF THE TECHNICAL COMMITTEE MEETING

The technical committee meeting was held on 18th May, 2023 and 19th June, 2023 for the review of research projects of Technical Departments conducted during 2022-23, ongoing and future research programme for 2023-24 of each Department.

Date: 18th May 2023 (Sugar Engineering, Sugar Technology)

Following members were present during this meeting held on 18th May 2023.

1. Shri. Jayant Patil, Chairman,
2. Shri. Diliprao Deshmukh, Member,
3. Shri. Balasaheb Patil, Member,
4. Shri. Bhiravnath B. Thombare, Member,
5. Shri. Shivajirao C. Deshmukh, Adviser, VSI,
6. Shri. Sambhaji KaduPatil, Director General, VSI

Shri. Shivajirao C. Deshmukh, Adviser & Shri. Sambhaji Kadu Patil, Director General, VSI, warmly welcomed Shri. Jayant Patil, Chairman and members of the Technical committee, VSI.

Also Shri. R A Chandgude, Head, Sugar Engineering Department, VSI, Pune welcomed Chairman, Ccommittee members, Head of the departments of VSI Pune, Professors & Research Students of COEP Technological University, Pune.

Date: 19th June, 2023 (Alcohol Technology & Biofuels, Environmental Science and Electronics & Computer Departments.)

Following members were present during this meeting held on 19th June, 2023.

1. Shri. Jayant Patil, Chairman,
2. Shri. Rajesh Tope, Member,
3. Shri. Balasaheb Patil, Member,
4. Shri. Harshvardhan Patil, Member,
5. Shri. Ashokrao Pawar,
6. Shri. Shivajirao C. Deshmukh, Adviser, VSI,
7. Shri. Sambhaji Kadu Patil, Director General, VSI

(619)

2. Material cost of the R&D equipment to be born by the concerned sugar mill where the equipment is installed.
3. COEP students involved in the projects should visit the factory site for the practical observations in variation of the parameters at site.

C) ALCOHOL TECHNOLOGY & BIOFUELS DEPARTMENT

The R & D programme conducted during 2022-23 and proposed work to be completed in the year 2023-24:

The R & D programme of the Department of Alcohol Technology & Biofuels for the year 2022-23 and 2023-24 was briefed by Dr. K. S. Konde, Head, Professor and Technical Adviser, Department of Alcohol Technology & Biofuels. He informed the committee regarding 4 completed projects, 8 ongoing projects in the year 2022-23 and proposed 3 new projects for the year 2023-24. Dr. Konde also highlighted the list of publications (9 papers and 4 patents) completed by the Department based on the R & D projects.

The details of discussions on these projects are given below,

1. **Pilot study on recovery of potash from incineration boiler ash (VSI-KS Kale SSKL)**

   Comments:

   - Dr. Konde started his presentation with the explanation of potash recovery project.
   - He informed that based on laboratory scale results, the pilot scale plant of potash recovery is installed at VSI which is funded by M/s. Karmaveer Shankarrao Kale SSKL with total funding of Rs. 50 lakh.
   - He also said that potash extraction efficiency around 90% was obtained on pilot scale and field trials of the recovered potash fertilizer will be conducted by Soil Sciences Department of VSI, Pune.
   - He explained that pilot scale plant will be shifted to M/s. K. S. Kale SSKL after pilot scale study at VSI for three months.
   - Dr. Konde also informed that ash residue after water extraction can be used as a filler in bricks manufacturing and joint studies will be carried out with COEP.

SEAL OF THE VASANTDADA SUGAR INSTITUTE, PUNE

Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

- The committee members appreciated the project work & allowed to continue the project.

2. **A. Valorising waste (vWa) from sugarcane industries via innovations in pre-treatment, bio-transformation and process intensification (INDO-UK collaborative project)**

- Dr. Konde explained vWa project concept and the role of VSI in the project.
- He informed that 100 g/L and 97.5 g/L of lactic acid was achieved with synthetic media and 2G media (alkali treated enzyme hydrolyzed bagasse).
- He also emphasized on the importance of alkali recycle process required during pretreatment for lactic acid production. He informed that 25% alkali could be recycled up to 10 recycle without affecting lactic acid yield and productivity.
- He also explained about the achievement of biogas production of 110 M^3 per ton of PMC.
- He informed that project completed in March 2022 & project review meeting attended on 6th June 2023 and final UC, SoE & report submitted to DBT.

2. B. Biomethanation of cellulosic waste (VSI)

Comments:

- Dr. Konde informed regarding the lab-scale experiments on optimization of C/N ratio & co-digestion study of PMC & SCB for biogas production.
- He informed that biogas yield 125 M^3 per ton SCB and 195 M^3 per ton of PMC & SCB (co-digestion) was obtained on 200 L scale.
- He further informed that two AD pilot scale (50 M^3) digesters are running at Nira-Bhima SSK & achieved biogas yield of 95-100 M^3 per ton PMC with 65 % methane.
- He also informed that fermented organic manure trials will be carried out with the help of Soil Science Department, VSI.
- He informed to the committee that project is completed and further technical support will be given to Nira Bhima in near future.
- The committee members given permission to conclude the project.

(612)

3. **Green solvent assisted recovery of wax from press mud cake and downstream processing of dewaxed press mud cake through biomethanation & bio-composting (RGSTC)**

   Comments:

   - Dr. Konde presented and discussed the objectives and current status of the project.
   - He informed regarding the wax recovery method from PMC using different techniques such as Soxhlet Extractor, Batch Reactor and Screw Type Extractor.
   - He informed that wax recovery of 7.8 g (using hexane) and 10.5 g (Isopropyl alcohol-green solvent) was achieved from 100 g of PMC.
   - He informed that wax recovery of 11.7 g (Soxhlet Extractor), 11.1 g (Batch Reactor) and 11.9 g (Screw Type Extractor) was achieved from 100 g of PMC.
   - Dr. Konde also informed that un-grinded PMC and recycled solvent could be used without compromising wax recovery.
   - He also mentioned that de-waxed PMC is comparable with raw PMC for biogas production.
   - He told that further research work on purification of crude wax & the effect of de-waxing of PMC over bio-composting will be carried out.
   - The committee members approved for continuation of project work.

4. **Second generation ethanol production through enzymatic route and/or using genetically modified microbial strains (VSI)**

   Comments:

   - Dr. Konde described about the objectives and current status of the project.
   - He explained regarding the completion of lab-scale optimization work for 2G ethanol production using SCB on 30 L bench scale, 7% (v/v) ethanol concentration and 80% fermentation efficiency was achieved with yield of 155-160 L ethanol per ton of dry SCB.

SEAL OF THE VASANTDADA SUGAR INSTITUTE, PUNE ★ VSI

Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

- Dr. Konde also mentioned that 40-50% of enzyme recovery was achieved on flask scale.
- He also infomed that lab-scale demo unit for enzyme recovery work is received and will be installed at VSI.
- He requested for project extension up to March 2024 to see the efficiency of the lab-scale demo unit for enzyme recovery.
- The committee members approved extension of the project work without additional funding.

5. **Water mining-next generation water-smart management systems: large scale demonstrations for a circular economy & society (EU)**

Comments:

- Dr. Konde informed regarding the involvement of 10 technical universities (including VSI) and 29 technology partners from different countries in this project. VSI is the only Indian partner in this project.
- He informed that VSI is regularly attending project web meetings.
- Dr. Konde informed that analysis report related to raw and bio-methanated spent wash was sent to KVT.
- Dr. Konde further informed to the committee that VSI will be involved for the treatment of low and high strength effluents through High Pressure Oxidization using equipment provided by KVT. Also, organic matter in spent wash will be converted to value added bio-based polymers using Kaumera Technology to be provided by TU-Delft University.
- He also told that VSI will send solid/liquid samples to TU-Delft and KVT for lab trials of above-mentioned technologies, if required.
- The committee members allowed to continue the project.

(63)

6. **Process development for enhanced biobutanol production through fermentation (VSI).**

   Comments:

   - Dr. Behera informed regarding the objectives of the project which is mainly based on the screening of bacterial strains for butanol production & to optimize the process for maximum butanol production.
   - He said that titre of 6.3 g/L butanol was achieved.
   - He informed that butanol concentration will be enhanced through adaptation of bacterial strains with higher solvent concentration & optimization of fermentation process will be carried out.
   - The committee members approved for continuation of the project work.

7. **Nano-catalyst assisted hydrogen production in sugar & distillery industries (VSI)**

   Comments:

   - Dr. Behera described about the importance of nano-catalyst assisted hydrogen production in sugar and distillery industries. He informed that this project has been undertaken in collaboration with C-MET, Pune.
   - He said that VSI will develop protocol for hydrogen production using nano-catalyst provided by C-MET. VSI will evaluate the efficiency of nano-catalysts on different substrate.
   - He informed that preliminary experiments were carried out using nano catalyst for diluted spent wash.
   - He mentioned that the photo-catalytic reactor set up is installed at VSI which will be used for further hydrogen production.
   - The committee members allowed to continue the project.

8. **Microbial process for gluconic acid production (VSI)**

   - Dr. Behera started his presentation with project objectives and applications of gluconic acid (GA).
   - He informed that 397 g/L of gluconic acid with 0.85 g/g-glc yield and 2.36 g/L/hr of productivity was achieved using *Aspergillus niger* NCIM 545 on fermenter scale.
   - He mentioned that project completed in December 2022.

SEAL OF THE VASANTDADA SUGAR INSTITUTE, PUNE

Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

9. **Traditional vs scientific technologies for mahua spirit and heritage alcoholic beverages production-optimization, evaluation and training (Heritage Wine Policy) (Ministry of Tribal Affairs, GoMP)**

- Dr. Behera started his presentation with the project objectives and informed regarding the Mahua project which was funded by Ministry of Tribal Affairs, Govt. of Madhya Pradesh.
- He infomed that optimization of fermentation and single pot distillation processes have been completed & successfully developed the lab-scale protocol for mahua liquor production.
- He also informed regarding the installation and commissioning of 2 pilot plants at Alirajpur and Dindori, Madhya Pradesh.
- He told that about 65 L of potable alcohol with 36-38% (v/v) alcohol content was achieved from 130 kg of Mahua flowers.
- He finally mentioned that project is completed on Feb 2023. Further supporting to pilot plant may be provided in future as per the requirement.

10. **Process development for Neera based liquor and vinegar production (VSI)**

- Dr. S. Behera started his presentation with the project objectives and informed that the project was undertaken after receiving request from the State Excise Department.
- He informed regarding the storage of neera which could be successfully stored up to 3-month duration at 4 ^{0}C.
- He informed regarding successful development of a kit for detection of adulteration in toddy.
- Dr. Behera also informed that neera to arrack production will be carried out.
- He also informed that 60 g/L of acetic acid was achieved on fermenter scale.
- The committee members allowed to continue the project work up to Dec 2023.

11. **Distillery fermentation process modelling and optimization using artificial intelligence (VSI)**

- Dr. Konde informed that the project is undertaken with the help of both VSI & COEP to generate a process model for the estimation of ethanol production using measurement of CO_2.
- He informed regarding the completion of 33 successful fermentation batches using molasses and 5 successful fermentation batches using sugarcane syrup.
- He informed that the database of fermentation batches shared with COEP.
- He told that COEP has developed preliminary model based on the received database from VSI.
- He informed that if lab scale study is successful, plant scale trials will be conducted.
- The committee members allowed to continue the project work up to Dec 2023.

12. Development of lab scale soft sensor for neera quality using artificial intelligence (VSI)

- Dr. Konde informed that the project is undertaken with the help of COEP to identify the quality of neera.
- He informed regarding the complete analysis of 25 control and 44 local market neera samples.
- He informed that the database prepared on the basis of analysis of neera samples and shared with COEP.
- He told that COEP will develop soft sensor based on the received database from VSI.
- The committee members allowed to continue the project work up to Dec 2023.

13. Scientific study on Mahua spirit ageing and maturation (Ministry of Tribal Affairs, GoMP)

- Dr. Konde informed that the new project entitled "Scientific study on Mahua spirit ageing and maturation" which has been approved by Govt. of MP.
- He said that project will focus on mahua liquor maturation & maturation losses will be monitored.
- He further informed that in future guidelines will be prepared based on the maturation losses.

SEAL OF THE VASANTDADA SUGAR INSTITUTE, PUNE

Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

14. **Investigation and development of fruit wines from selected north eastern fruits (NEC through PSA, GoI)**

- Dr. Konde informed that the project was approved by NEC (PSA).
- He briefly explained the project objectives and development of fruit wines.
- He said that project will focus on fruits from North East region of India for wine production.
- He informed that project work on optimization of wine production will be initiated after receiving of the grant.
- The committee members approved the project work & suggested to start work after getting the grant from NEC.

15. **Manufacturing of construction bricks from the ash and residue remaining after recovery of potash from incineration boiler ESP ash (VSI)**

- Dr. Konde informed that the project is recently sanctioned in GC meeting held on 30th March 2023.
- He further informed that project will focus on manufacturing of bricks using ash generated after potash recovery.
- He informed that analysis of ash residue samples from different sugar mills will be analyzed and bricks strength will be compared with existing brick.
- The committee members approved the project work.

(534)

D) ENVIRONMENTAL SCIENCE DEPARTMENT

The work done on following ongoing projects was presented to the committee

1. **Assessment of workplace air quality in various sections of a sugar mill/allied units.**

Dr. Deepali Nimbalkar explained the significance of this project and the work done in the past year which included monitoring of areas for PM10, PM 2.5 & SO_2 in different sugar mills. Along with this SO_2 content of freshly stored sugar is also being monitored so as to corelate with emissions in storage areas. She also explained that monitoring at M/s. Venkateshkrupa Sugar Mills Ltd., M/s. Kumbhi Kasari SSKL, M/s. Sharayu Agro Industries Ltd. were done for comparison in pollution load (particulate matter) as they had installed/used dust collector on sugar hopper, covered hopper system etc. Results shows that particulate matter concentration is less where mitigation were taken to control it as compare to non-mitigated (polluted) locations. The committee appreciated the work done and asked that it should be followed wherever possible. The committee also granted one-year extension to the project and approved one research staff along with increase in budget by Rs. 2.4 lakhs towards research staff. It also allowed for publication of the results.

2. **Assessment of noise levels in various sections of a sugar mill/allied units.**

Dr. Deepali Nimbalkar presented this project and explained the work carried out in the previous years. She also explained that the work had to be stopped in mid December due to due to breakdown of sound level meter and deputation of staff for GPI Inspection work for CPCB. The committee granted one year extension for this project.

3. **Monitoring the water footprint of the sugar industry**

Dr. Nimbalkar first explained the concept of water footprint to the committee as a measure of sustainability. The water footprint of a product is the volume of freshwater used to produce the product, measured over the full supply chain.

She then explained the system boundary of the study was to include only processing/sugar manufacturing and not sugarcane agriculture. The study carried out at

Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

SEAL OF THE VASANTDADA SUGAR INSTITUTE, PUNE two mill in the past two years was presented along with the reduction in blue and gray water footprint due to installation of CPU, ETP upgradation and recycling. She also gave the example of the success story at Shri Datta Shirol where recycling of treated condensate helped to achieve zero water intake and saving in water cost. The committtee appreciated the project and asked that letter be sent to sugar mills under signature of Chairman regarding achieving ZLD in the industry.

Increase in project budget by Rs. 4.8 lakhs as salary for one research staff for two years was requested. The committee approved the proposal for one research staff and the additional budget for salary.

4. Characterization of flue gasses due to burning of spent wash and coal/bagasse focusing on measuring the levels of dioxins/furans, CO, VOC and NMHC

This project was presented by Dr. Amol Deshmane who explained the objective i.e. to study and assess the probability of generation of dioxin/furans due to burning of spentwash with coal or bagasse. He presented the analysis carried out on concentrated spentwash samples.The department had approached a laboratory (Bioanalytical Technologies India Pvt Ltd., Pune) for dioxin sample analysis. During the meeting and subsequent discussions as well as literature survey, it was observed that the dioxin sample collection and its analysis protocol development is feasible. This process involves a joint effort between the VSI, Dept of Environmental Sciences and Bioanalytical Technologies India Pvt Ltd., Pune. Method for sampling of dioxin is available with US Environment Protection Agency's portal. This method needs to be checked for its technical feasibility for us (i.e. technical setup development at our lab) for our environment and industrial conditions. This is a main part in the protocol development. Therefore, protocol development work will be on trial-error basis.The committee approved the project. Preliminary estimates showed that, the project requires minimum Rs. 7 to 8 lakhs of fund at this stage and dioxin standard may be required on recurring basis. This may add a cost of Rs. 3.00 lakhs to the estimated cost (i.e. Rs. 8.00 lakhs). Therefore committee was requested to increase the project budget to Rs.15 lakhs. The committee approved the increased budget and asked to continue the work.

5. **Treatment of sugar industry and distillery effluent using microbial fuel cell with bioelectrode.**

This project of treatment of sugar industry and distillery effluent using MFC with bioelectrodes has been taken up in collaboration with College of Engineering Pune Technological University (COEPTU). The project was presented by Dr. Deepali Nimbalkar and Dr. Archana Thosar from COEPTU. One research student is working on this project. Initial experiments were carried out with sugar effluent using the dual chamber microbial fuel cell and rice husk electrode. Initial voltage of 0.2 V and max. voltage of 0.4 V was observed when sugar effluent is used as anolyte and distilled water is used as catholyte. Further experiments are in progress. The committee took note of the work and approved the continuation of the project.

6. **Use of Rotary Vacuum Filter as an alternative for clarification system in effluent treatment plant (proposed).**

Dr. Deepali Nimbalkar explained the several problems related to the operation of primary and secondary clarifiers in effluent treatment plants such as operational issues, mechanical breakdown, sludge settling problems etc. She also explained that RVF have been widely used in sugar and a variety of other industries for many years. It is a very important tool for solid-liquid separation and well suited to applications where both dewatering and washing are required and appear to be the best of the available equipment for the treatment of cane sugar muds. The main advantage of this equipment is its relatively small space, low cost and easy to be maintained.

It is proposed to explore the use of RVF for effluent clarification and sludge separation in sugar effluent treatment. If successful, this will help to considerable reduce the footprint of ETPs.

The committee approved the project with a budget of 8 lakhs for 2 years which includes

- Lab scale model design- Rs. 2 lakhs
- Consumables & chemicals- Rs. 1.2 lakhs
- Research staff salary for 2 years- Rs. 4.8 lakhs

SEAL OF THE VASANTDADA SUGAR INSTITUTE, PUNE

Principal
Vasantdada Sugar Institute
Manjari (Bk.), Tal. Haveli,
Dist. Pune - 412 307

E) Electronics and Computer Department.

Mr. A. N. Jamadar presented the activities carried by the department. Mobile app for Cane Plantation and Field Slip completed. RFID base man less weighbridge is completed and installed at Bagamoyo Sugar Tanzania and Naranja SSK Karnataka. The committee has given approval to design Mobile app for Farmers, Cane yard number taker system and VSI Farmer Portal and continue implementation of VSI Sugar ERP Software.