

**MINUTES OF ELEVENTH MEETING OF TECHNICAL AND FINANCIAL APPRAISAL COMMITTEE (TFAC) OF THE R&D SCHEME FOR CONSERVATION & DEVELOPMENT OF THE MoEF&CC HELD ON 20<sup>th</sup> DECEMBER, 2019 AT INDIRA PARYAVARAN BHAWAN, MoEFCC, NEW DELHI.**

The 11<sup>th</sup> meeting of the Technical and Financial Appraisal Committee (TFAC) of the Scheme on R&D for Conservation & Development of the MoEFCC was held under the chairmanship of Prof C.R. Babu on **20<sup>th</sup> December, 2019** at MoEFCC, Indus Conference Hall, Ground Floor, Jal Wing, Indira Paryavaran Bhawan, New Delhi. Advisor (RE), MoEF&CC and Member-Secretary of the TFAC welcomed the Chairperson and members of the TFAC for the meeting. List of participants is at **Annexure-1**. A total of **4 proposals** of on-going/completed projects under the old R&D Scheme were considered, and these are listed at **Annexure-2**.

**1.0 Confirmation of Minutes of the Tenth Meeting of TFAC held on 11<sup>th</sup> December, 2019**

The minutes of the tenth meeting of TFAC held on 11.12.2019 were confirmed.

**I RECONSIDERATION OF R&D PROJECTS OF OLD R&D SCHEME:**

1. F.No.19-183/2013-RE Project titled **“Nanno-bioremediation of Textile Industrial Effluents in Tiruppur District, Tamil Nadu”**. PI: Dr.P.Jegathambal, Prof., Water Institute, Karunya University, Coimbatore, Tamil Nadu

The project as considered in the 4<sup>th</sup> meeting of Steering Committee held on 04.09.2018.

Project Details: This ongoing project was started on 9<sup>th</sup> September, 2016 for a period of 3 years with a total cost of Rs. 42,17,000/-. The tenure of the project will be over on 8<sup>th</sup> September, 2019. A total of Rs 18,26,500/- has been released so far out of approved project cost of Rs 42,17,000/-. PI has submitted audited Utilization Certificate, Expenditure Statement, GFR 12 A, GFR 19, bills/invoices and undertaking for completion of the project and 5 copies of Annual Progress Report for the FY 2017-18 during the meeting.

Objectives:

- To develop efficient and cost effective treatment method of textile wastewater using nanotechnology (nanoclay and carbon nano tubes) and Bioremediation (Using Bio Blocks, Algae).
- To model behavior of sorption and biotransformation processes.
- To determine the adsorption capacity, Kinetic coefficients, effects of pH and concentration of adsorbent and Kinetics of microorganisms onto the removal of dye, organic matter and inorganic salts on a Nano Bio Block.
- To develop and integrated cost effective alternative for dye and inorganic salt removal by combining stabilization pond with micro algae and biocoagulation using *Moringa oleifera* seed extract.
- To characterize the influent and effluent parameters of the wastewater.
- To standardize the design and operational parameters.

- To determine the techno economic viability of the proposed methodology.

PI made a presentation on the progress of the study. The major findings of the study are:

- Microbial biodegradation has been demonstrated as a viable treatment of textile effluent based on the batch studies resulting in 90-96% removal of colour from textile effluents.
- The domestic sewage treatment plant in Karunya University itself is a viable source of mixed microbial culture for biodegradation of textile effluent.
- Microbial activity mediated fixation of nitrates and sulphates was observed resulting in decrease of their concentration in the leachate.
- The continuous flow soil reactor can be extended to reactive barrier technology in *in-situ* application. The robustness of the system was demonstrated by 6 weeks of treatment without any external inputs.
- Mixed microbial culture mediated in-situ bioremediation is a feasible solution to clean up of textile dye waste contaminated soil-aquifer systems.
- After 6 hours of contact time the removal efficiency of the carbon nano tubes has been found to be 21% and that of the *Moringa* alginate beads is 26% in the clayey soil.
- By increasing the contact time from 6hr to 24 hr, the dye removal also increased from 21% to 28% using carbon nano tubes and from 26% to 35% using *Moringa* beads in the clayey soil. and from 13% to 20% in the sandy soil.
- In the sandy soil the removal % increased from 30% to 57% using carbon nano tubes and from 36.5 % to 60 % using *Moringa* beads.
- After 36 hrs of contact time, the dye removal in the clayey soil was 34% using carbon nano tubes and 36.5% using *Moringa*. While the removal of dye in the sand was 69% using *Moringa* and 59% using carbon. This implies that the dye removal efficiency of the alginate beads differs with the type of soil. The low removal percentage in the clay soil may also imply the water retaining property of the soil.
- The moisture content of the clay soil is maintained at 24% to 26% and in the sand 4 to 8 % implying the constant release of water from the alginate beads.

Work Plan (October 2018 – August 2020):

- Upflow fluidized bed reactor using eco-friendly materials – encapsulated hydrogel/beads – October 2018 – March 2019.
- Performance Evaluation of PVA hydrogel/beads and Magnetite beads (as barrier with membrane) in remediation of dye contamination - April 2019 – December 2019.
- Transfer of Technology to the small scale dyeing unit – June 2020 – May 2020.
- Report writing – June 2020 – August 2020. Propose to apply for patent for the technology.

The Steering Committee had desired to know the economics of treatment vis-a-vis conventional treatment and efficacy of colour removal and other physic-chemical parameters vide notified standards and sustainable use of the technology in real conditions in textile industries in a comparative table.

The project was considered by the TFAC. The PI informed the Committee that due to late release of funds, the objectives projected for 2019 could not be completed and therefore, has sought extension of the project by one year. An Interim Report and other documents such as UC, ES, etc have been submitted.

The PI made a presentation. It was stated that the Textile industry is the second largest industry in India next to the agricultural sector. It provides employment opportunities for sustained economic development, contributing to country's export earnings, etc. Textile industries work in collaboration with the dyestuff industries to meet the needs of the modern world. Nearly 70% of the dyes produced are utilized by the textile industry. The dyes used by Textile industry include Azo dyes, direct dyes, disperse dyes, vat dyes, reactive dyes, etc. Large quantities of water are required for textile processing, dyeing and printing. The daily water consumption for an average sized textile mill having a production of about 8000 kg of fabric per day is about 1.6 million litres. 16% of water is consumed in dyeing and 8% in printing. Dyeing section contributes to 15% - 20% of the total waste water flow. The dyestuff used in the dyeing process is not completely taken-up by the material. About 10-15% of the total dye is lost or discharged as waste. For all of these reasons, it is really important to treat the water from these type of industries due to that the quantity of waste water is high

The dye effluent contains chemical compounds that are highly toxic or carcinogenic to living organisms. Dye effluents contaminate the surface and ground water, thereby making it unfit for drinking and irrigation purpose. Conventional physio-chemical wastewater treatment methods have limited applicability due to high cost, continuous use of chemicals, accumulation of toxic intermediate compounds, etc. Hence, bioremediation serves as an alternative method which is eco-friendly and cost effective. Microorganisms help in the degradation of the dyestuff in the effluents.

It was stated that the Nano Bio Blocks developed under the project would be useful for treatment of any type of wastewater treatment involving dye, TDS, BOD, COD and heavy metals. Demonstration units based on the standardized design and operational parameters are to be established using this potential efficient and cost-effective treatment methodology. It was stated that the agencies that can utilise the outcome of the project include Small Scale Textile Industries and industries discharging effluents containing heavy metals.

The PI that Decolourization studies undertaken so far with mixed microbial culture against single blue dye and textile dye wastewater have showed remarkable results. The study was further narrowed down to species level to obtain more specific results and it was found that each species of microorganisms responds in a unique way to every individual dye group. The reaction mechanisms depends on the chromophore and auxochrome group of the dyestuff. For this study, mixed microbial culture, *E.coli isolate*, *A.niger* is treated against the single blue dye and textile dye wastewater. Efficiency of mixed microbial culture against the industrial dye effluent can be enhanced by combing it with the nano-particles.

The study also involves preparation of biochar from sugarcane bagasse, coir pith, corn waste and plantain leaf (from our agricultural farm) using Pyrolysis process, ii) Characterization of prepared biochar (ash content, volatile matter, water retention capacity, moisture content, surface morphology, particle size and functional group using SEM, EDAX, XRD and FTIR), iii) Preparation of biochar encapsulated alginate beads and evaluate their performance in treatment of textile dye effluent and iv) Preparation of biochar, activated carbon based foam blocks and evaluate their performance in treatment of textile dye effluent

Biochar is a charcoal and it is highly porous material produced from plant waste. Like other charcoal, biochar is made via pyrolysis. Biochar is black, highly porous, lightweight, fine-grained and has a large surface area, which helps absorb the chemicals from effluents. It was stated that the next phase involves Continuous Flow Pilot Phase study using Foam + Nanomaterial + Biochar Blocks. It was clarified that the treated would meet irrigation standards.

#### **Work Plan (January 2020 – December 2020)**

- Developing microbial consortium for dye removal – **Jan 2020 to March 2020**
- Preparation, characterization and evaluation of Biochar – **Jan 2020**
- Preparation, characterization and evaluation of cost-effective nanocomposite polymer membrane – Feb 2020 to May 2020
- Development and performance evaluation of nano-bio foam block - **June 2020 – September 2020**
- Demonstration of nanobio remediation technology in the field – **September 2020 – December 2020**

The PI requested for release of grant for purchase of equipment and also release of next instalment for continuing the study upto December 2020.

The Committee was of the view that the study must provide quantitative data on physico-chemical parameters such as COD, BOD, TDS, Colour and other parameters of the textile effluent before and after treatment for each treatment and compare the treated water with standards recommended for use of water in irrigation. The Committee desired that PI should also focus on the safe disposal of biochar blocks after use. The Committee also observed that PI should also examine the efficacy and cost effectiveness of the technology that emerge out of the study over the present methods used in the treatment of textile effluents. The Committee after deliberations recommended the release of next instalment subject to submission of all relevant documents, and extension of time period upto January 2021 for submission of FTR.

## **II PROJECT OF NEW R&D SCHEME FOR RECONSIDERATION**

2. No. 404/2018/RE Project titled **“Impact of Gold Mine Tailings on Agriculture, Environment and household Health in Kolar District”**. PI: Dr. V Suresh Babu, National Institute of Rural Development and Panchayati Raj, Ministry of Rural Development, Government of India, Rajendranagar, Hyderabad.

The project was considered in the 7<sup>th</sup> meeting of TFAC held on 04.09.2019.

The PI made a presentation.

Dr.G.Rambabu, Expert, CPCB and Member, TFAC stated that the component of the study involving characterisation of the soil around the mine in the study area is contaminated with gold tailings would be expensive and may increase the project cost. The Committee after deliberations was of the view that the project requires multi-disciplinary approach and organisations such as ICMR, Land Use, Karnataka SPCB, etc should be involved right in the planning stage itself.

The Committee was also of the view that a sub-committee consisting of MS, TFAC and two members of TFAC Shri VP Yadav and Shri G Rambabu along with representatives of KSPCB may visit the project site to examine the various aspects of the proposed study and submit a report to the TFAC for further consideration of the project.

### **III INTERNAL CONSIDERATION OF R&D PROJECTS OF OLD R&D SCHEME:**

3. F.No.19-99/2009-RE – Project titled **“Assessment of Air Pollutants and its impact on Tropical Forest of Northern Chhattisgarh”**. PI: Dr S.S Singh, Project at Dept of Forestry, Wildlife & Environment Sciences, G.G.V., Bilaspur

The proposal was considered in the first meeting of Steering Committee held on 09.06.2018 and clarification sought were further considered in the 3<sup>rd</sup> TFAC meeting held on 17.05.2019. In this context, CPCB had raised a number of issues regarding the FTR. The TFAC, after deliberations, had decided that the letter of CPCB may be forwarded to PI for his point-wise response which may be submitted as Additional Report to the FTR. The Committee decided that upon receipt of its clarifications as an Addendum Report to the FTR, the Ministry may consider release of Rs 5 lakhs balance (in addition to the Rs 2 lakhs unspent with PI) and then close the project.

The Addendum Report submitted by the PI with respect to the issues raised by CPCB project was taken up for internal discussion. The Committee, after deliberations, recommended closure of the project and release of the balance amount/settlement of dues including release of grant to the Research Scholar pending under the project subject to submission of all relevant documents by the PI.

### **IV Internal Discussion on Applications of R&D Projects Received under New R&D Scheme**

Consideration of this item was deferred to next meeting

#### **3.0 Any Other Matter with the Permission of the Chair**

4. F.No. 19/79/2013-RE – Project titled **“Remediation of Groundwater contaminated with Hexavalent Chromium in Sukinda Valley, Odisha, using nano Zero Valent Iron (n-ZVI) Technology”**. PI: Dr.Alok Sinha, Centre of Mining Environment, Indian School of Mines, Dhanbad.

The project was listed for consideration in the Third Meeting of the Steering Committee held on 30.08.2018 and was considered in the 4<sup>th</sup> Meeting of SC held on 09.10.20218.

Project Details: This ongoing project was started on 3<sup>rd</sup> March, 2017 for a period of 2 years with a total cost of Rs. 24,80,800/-. The tenure of the project will be over on 2<sup>nd</sup> March, 2019. A total of Rs 17,12,320/- has been released so far out of approved project cost of Rs. 24,80,800/-. Audited UC, ES, GFR -12A, GFR 19 and 5 copies of APR for FY 2017-18 have been received.

Objectives of the study:

- To establish the current groundwater quality at Sukinda Mining area for different seasons.
- To study the mobility of n-ZVI slurry in soil obtained from study area and to optimize the mobility of n-ZVI slurry using different surfactants.
- To study the feasibility of reduction of chromate by n-ZVI and modified n-ZVI by preparing synthetic groundwater samples.
- To study the impact of associated water quality parameters on the reduction of chromate.
- To conduct pilot scale studies for in-situ remediation of contaminated groundwater as per actual geology of the area.

PI had made a presentation to the SC on the progress of the study. Sukinda Valley, Odisha carries the largest deposit of chromite ore ( $\text{FeO} \cdot \text{Cr}_2\text{O}_3$  or  $\text{FeCr}_2\text{O}_4$ ) in India, which approximately produces the 96% of the total chromite ore in India. Presently there are 14 chromite mines operating in Sukinda. Out of these, one mine, Mahagiri Chromite Mines (IMFA) has started its operation of mining lumpy chromites, recently at the foot hills of the Mahagiri hill range. The concentration of Metal in sukinda sediments varies in order of  $\text{TCr} > \text{Mn} > \text{Ni} > \text{Co} > \text{Zn} > \text{Cu}$  with average concentration 26.778 g/kg, 3.098 g/kg, 1.813 g/kg, 0.184 g/kg, 0.116 g/kg and 0.044 g/kg respectively. Concentration of Cr (VI) ranged between 0.02- 0.23mg/l in the Damsal Nala and BDL- 0.13 mg/l in tubewells water. Tubewells in areas such as in Patna Majhi Sahi are showing Cr (VI) concentrations as high as 0.484 mg/l which is nearly 10 times of the drinking water quality standards. Generally mine owners treat their effluents by adding  $\text{FeSO}_4$  to convert Cr (VI) into the less toxic Cr (III), by adjusting the pH and Total Dissolve Solids.

The PI stated that the next stage would involve testing the technology in Sukinda Mines.

Work under progress/to be done:

- Kinetic Studies for reduction of Cr (VI) by n-ZVI in batch reactors with and without stabilizing nano particles (n-ZVI) is under progress.
- The procurement of Planetary Ball Mill is under progress.
- The impact of various concentration of n-ZVI in slurry on the reduction of Cr(VI) and to optimize the dose of n-ZVI for proper remediation of Cr(VI).
- The impact of associated water quality parameters on the reduction of chromate is under progress.
- Pilot scale tests will be performed to simulate actual site conditions. It was informed that TISCO has agreed to have the trials done at their mines.
- Impact of the injection of n-ZVI slurry in columns/boxes containing soil saturated with simulated groundwater, moving at actual velocity, will also be studied and analyzed in laboratory is to be done on the month of December.

The Steering Committee had desired that the efficacy of the technology vide conventional technology may be examined vide standards and also the cost-economics of treatment of effluents and groundwater vide conventional treatment and details furnished as part of the report.

MS, TFAC explained that the project was included for internal discussion as the IFD of the MoEFCC had returned the file stating that the balance work to be carried out cannot be completed by March 2020. Further, the IFD had sought refund of Rs 10 lakhs for equipment still to be purchased at this late stage of project. MS, TFAC stated that the PI had provided the following clarification vide letter dated 19.11.2019 that the process of purchase of the Equipment – Planetary Ball Mill is in progress. The tender had been rejected twice which had resulted in delay. The tender has now been finalised. It was also clarified by the PI that two types of nano particles viz, nZVI which is synthesised chemically and nHCIF which is synthesised using Planetary Ball Mill. Till date, due to unavailability of the Planetary Ball Mill, nHCIF samples were prepared by using Planetary Ball Mill at Chemical Engineering Department, IIT-ISM, Dhanbad by paying grinding cost. Since the amount required in the bench scale had been small, the batch studies were completed by using the Ball Mill in the Chemical Engineering Dept. However, for the completion of the pilot study performed to simulate actual site conditions in TISCO mines in actual field study, a large amount is required for which the PI requires purchase of this equipment. The PI had specifically requested for permitting the use of Rs 10 lakhs unspent and still available under the project with the PI.

The Committee, after deliberations, agreed with the request of the PI for purchase of equipment with the amount released by the Ministry and also for release of long pending next instalment by the Ministry.

3.2 The TFAC placed on record its appreciation for the services rendered by Dr Rubab Jaaffer, Joint Director, RE Division for the smooth functioning of TFAC.

The meeting ended with a Vote of Thanks to the Chair.

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**ANNEXURE-1****LIST OF PARTICIPANTS OF TENTH MEETING OF TECHNICAL & FINANCIAL APPRAISAL COMMITTEE (TFAC) OF R&D SCHEME HELD ON 11.12.2019 IN MoEFCC**

1.	Prof. C. R. Babu (Retd.), Prof Emeritus and former Pro-VC, University of Delhi	...	....	Chairperson
2.	Shri V.P. Yadav, Scientist, CPCB	...	....	Member
3.	Shri G.Rambabu, Scientist, CPCB	...	....	Member
4.	Dr.K.Chandra Sekar, Scientist, representing Director, GBPNIHESD	...	....	Member
5.	Dr.T.Chandini, Advisor, MoEFCC & Member-Secretary	...	....	Member

**MOEFCC**

1. Dr.Rubab Jaffer, Joint Director, MoEFCC
2. Shri NareshJaiswal US(RE)
3. Ms. Akanksha Sachan, ASO
4. Shri Goldie, Office Assistant

**LIST OF PROJECT INVESTIGATORS (PIs) PARTICIPATED IN THE 11<sup>th</sup> TFAC MEETING**

1. Dr.P.Jegathambal, Prof., Water Institute, Karunya University, Coimbatore, Tamil Nadu
2. Dr. V Suresh Babu, National Institute of Rural Development and Panchayati Raj, Ministry of Rural Development, Government of India, Rajendranagar, Hyderabad.

**ANNEXURE-2****Projects to be considered:****I RECONSIDERATION OF R&D PROJECTS OF OLD R&D SCHEME:**

<b>S. N.</b>	<b>File No.</b>	<b>Thematic Area</b>	<b>Title of project</b>	<b>Details of P.I.</b>
1.	F.No.19-183/2013-RE	Water Pollution	Nanno-bioremediation of Textile Industrial Effluents in Tiruppur District, Tamil Nadu.	Dr.P.Jegathambal, Prof., Water Institute, Karunya University, Coimbatore, Tamil Nadu

**II PROJECT OF NEW R&D SCHEME FOR RECONSIDERATION**

2.	404/2018/RE	Pollution and Waste Minimisation	“Impact of Gold Mine Tailings on Agriculture, Environment and household Health in Kolar District”	PI: Dr. V Suresh Babu, National Institute of Rural Development and Panchayati Raj, Ministry of Rural Development, Government of India, Rajendranagar, Hyderabad.
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**III INTERNAL CONSIDERATION OF R&D PROJECTS OF OLD R&D SCHEME:**

3.	19-99/2009-RE	Pollution	Assessment of Air Pollutants and its impact on Tropical Forest of Northern Chhattisgarh	Dr S.S Singh, Project at Dept of Forestry, Wildlife & Environment Sciences, G.G.V., Bilaspur	FTR considered in the 1 <sup>st</sup> meeting of Steering Committee and an Addendum to FTR in 3 <sup>rd</sup> meeting of TFAC held on 17.05.2019. CPCB had raised some issues on the FTR and Addendum. In response, another Addendum has been submitted by PI which is to be considered.
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**IV Internal Discussion on Applications of R&D Projects Received under New R&D Scheme****3.0 Any Other Matter with the Permission of the Chair**

4. F.No. 19/79/2013-RE – Project titled **“Remediation of Groundwater contaminated with Hexavalent Chromium in Sukinda Valley, Odisha, using nano Zero Valent Iron (n-ZVI) Technology”**. PI: Dr.Alok Sinha, Centre of Mining Environment, Indian School of Mines, Dhanbad.

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