Microbial treatment of petrochemical wastewater

Applications

The petrochemical effluent is tough to treat using biological means and it generates sludge that itself needs labour intense treatment. The present technology could develop a sludge free system and it provides an alternative to an expensive physic - chemical approach or a less efficient biological approach to produce clear and dischargeable - grade treated water.

This bacterial biofilm-based treatment is robust for all the pollutants handled at the ETP, and has wider applications in:

- Waste Water Treatment Plants
- Oil refineries

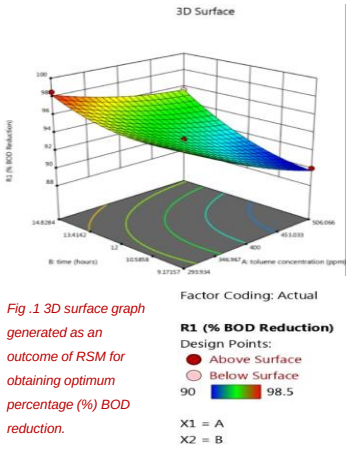

Fig .1 3D surface graph generated as an outcome of RSM for obtaining optimum percentage (%) BOD reduction.

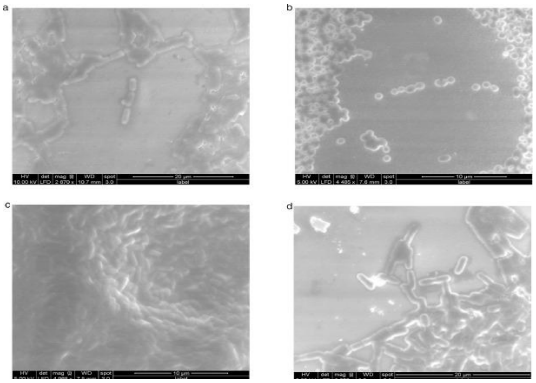

Fig. 2 Scanning Electron Microscopic (under environmental mode) image of isolates (a) E1, (b) E15, (c) E19 and (d) E24 for studying the cell morphology.

Intellectual Property

Formulation of bacterial consortium for bioremediation of petrochemical wastewater.

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Indian Patent - 202031011766 (Filed)

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Categories of this invention

- **Water Treatment**
- **Lifesciences**
  - Biotechnology
  - Environment
    - Bioremediation
      - Petrochemical Effluent

Process Workflow

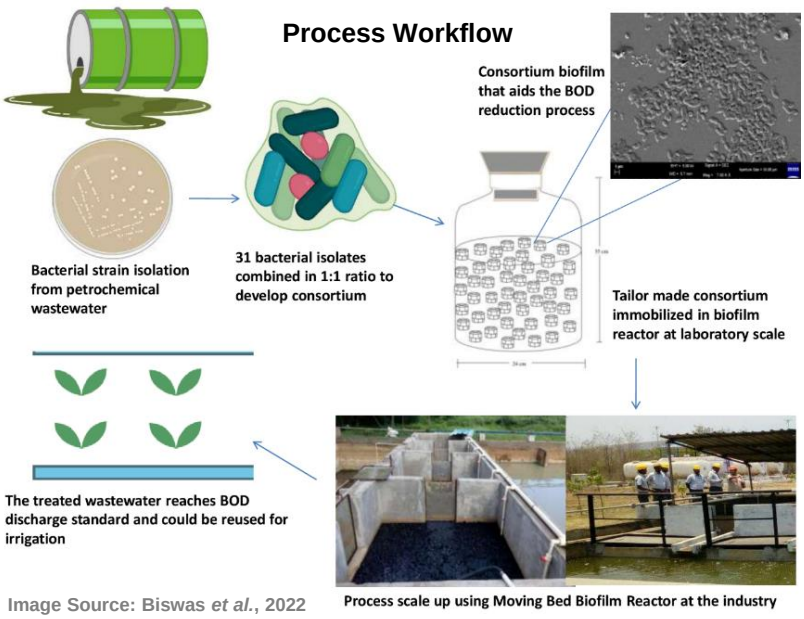

Image Source: Biswas *et al.*, 2022

Process scale up using Moving Bed Biofilm Reactor at the industry

Technology

Rapid population growth and urbanization, growing demand for new water resources, and stringent governmental regulations on treating wastewater are the key factors driving the growth of the wastewater treatment. Moreover, petrochemical wastewater treatment is more challenging due to their multipollutant and refractory nature.

In the study conducted by the inventors, a total of 31 pure bacterial isolates were obtained from the ETP samples based on dilution plating technique and subsequent colony morphology and these are designated as E1 to E31 (*Fig. 2,3).* Furthermore, the enzyme activities were quantified to select bacterial isolates who can tolerate a wide range of pollutant composition. (Biswas *et al.,* 2022)

In the present technology, a tailor-made microbial consortium for petrochemical waste water treatment was formulated by mixing well-characterized bacterial isolates in 1:1 proportion which could reduce biological oxygen demand (BOD) by 88% under the immobilized condition at a laboratory scale. Further, response surface methodology (RSM) - based optimization revealed a reduction of 93.33% BOD within 12 h from simulated wastewater at 37°C from a starting concentration of 400 ppm of toluene *(Fig.1)*. Upon scale-up to 12m3 /day industrial scale processing capacity, approximately 92% removal of BOD could be achieved within 18 to 20 h at the ambient condition in two moving bed biofilm reactors combined in series. The reactor remains stable if run as per standard operating procedure (SOP) with one-time bacterial charging with continuous performance over extended period of time with little dead scum.

Additionally, it ensures recovery of non-potable water for land irrigation and firefighting. The treated water attained discharge level as per the Environmental Protection Agency norms.

Publications

Bacterial consortium based petrochemical wastewater treatment: from strain isolation to industrial effluent treatment Bacterial consortium based petrochemical wastewater treatment: from strain isolation to industrial effluent treatment. Environmental Advances. (2022)

Advantages

1. Microbes used in the consortium are from the environmental origin
2. Sludge free system
3. Stable for years if run as per SOP
4. Needs one-time bacterial inoculation

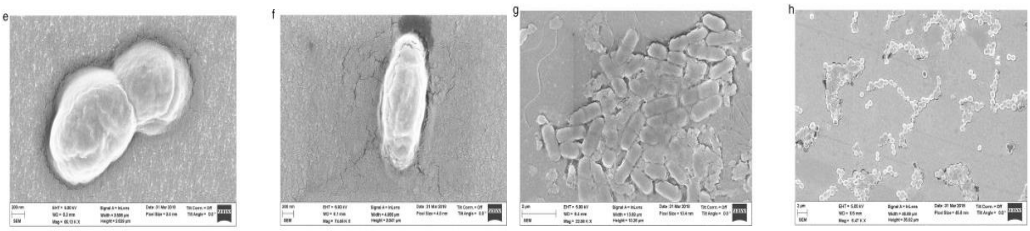

Fig.3 Field Emission Scanning Electron Microscopic image of isolates (e) E14, (f) E17, (g) E23 and (h) E25 showing the detailed cell surface structure.

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