



Performance appraisal of bioremediation materials for polluted surface water treatment

Monika Simon and Himanshu Joshi

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE, DEPARTMENT OF HYDROLOGY, India (simonmonica24@gmail.com)

This study investigates the efficacy of microbial (bioremediation) materials by exploring the kinetics of the removal of pollutants in polluted surface water bodies representing real world conditions. The experiments were performed in three sets for three commercially available microbial materials viz. Enbiozyme Aqua-S (EAS), Bacta cult (BC) and NatureVel-WWB (NVWWB). All the experiments were carried out under controlled conditions of pH (7.0 ± 0.5), dissolved oxygen (4 ± 0.5 mg/l), Mix Liquor Suspended Solid (2500-3000 mg/l) and temperature (25 ± 5 °C). For bench scale studies, the laboratory reactors were used for the degradation experiments at variable hydraulic retention time (HRTs) ranges from 6-72 h along with control (without addition of biomaterial) reactor for each study.

The samples were collected from a nearby polluted tributary (Solani) of River Ganges. During remediation experiments, the raw and treated samples were characterized for Biochemical Oxygen Demand (BOD), Chemical oxygen demand (COD), Total Suspended Solid (TSS), Colour, Total & Fecal Coliform (TC and FC), Total nitrogen (TN) and Total phosphates. Adenosine triphosphate (ATP) quantification for the evaluation of microbial biomass was performed by using luminometer (ATP Analyzer), which involves the determination of intracellular (inactive ATP) and extracellular (active ATP) ATPs. Among the mentioned biomaterials, the Bacta cult (BC) was examined higher microbial viability as compared to those of Enbiozyme Aqua-S (EAS) and NatureVel-WWB (NVWWB). Furthermore, this biomaterial (BC) was also found to be lower percentage of Biomass Stress Index (BSI).

The maximum pollutant removal in Control after 72 h of treatment for BOD-77 %, COD-71%, TSS-71 %, Colour- 64 %, TN-55 % and TP-15 % respectively while using BC increased with a percentage of 12% for BOD, 15% for COD, 15% for TSS, 25% for Colour, 10% for TN and 1% for TP. A remarkable degradation rate of organic pollutants was examined up to 24 h, 24 h and 48 h for BC, NVWWB and EAS, respectively. The nutrient (TP and TN) removal rate was observed to be 24 h for BC and NVWWB while 36 h for EAS. The study concludes that the Bacta Cult (BC) is efficient in removing the pollutants except TC and FC under optimum conditions. Moreover, the performance of biomaterial NVWWB was found to be fairly good, whereas, the efficiency of EAS was insignificant under the same controlled conditions. [HJ1] The Biomass Stress Index (BSI) was calculated to be < 30 % BC and NVWWB, whereas, it was > 50 % for EAS.

The present investigation will help in selective utilization of bioremediation materials for their

application in real world and synthesis of robust and frugal bioremediation material. It will also lead to addition to the existing knowledge base on bioremediation will enable and promote further research in this area at various levels. Furthermore, ATP analysis (microbial viability analysis) might play an important role in field screening and monitoring of bio-remediation based efforts.

Keywords: Commercial bio-materials, bioremediation, pollutants, surface water, bio-preparation.