INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Petroleum has proved to be an important source, and petrochemicals are one of the most efficient sectors for energy generation and consumption. Along with India, the whole world depends heavily on petroleum refinery products to meet daily requirements. However, these refineries generate a huge amount of waste in the form of oily sludge during the process of refining crude oil into essential components or while treating toxic effluents. Hence, for the biotic to sustain, removal of these highly toxic chemical compounds is a necessity. In this study, the sludge sample was collected from Indian Oil Corporation Ltd. (IOCL), Guwahati refinery and its characteristics were determined. Further, indigenous microbes were isolated using enrichment method and were identified based on their 16 rRNA sequences. The isolates were subjected to incubation in different classes of hydrocarbons such as *n*-hexadecane, anthracene, phenanthrene, benzene, toluene and xylene to investigate their inherent potential of hydrocarbon utilization and applicability for bioremediation. A strategic development of an optimal nutrient medium and microbial consortia was undertaken, that would enhance removal of harmful contaminants and minimize the effect of sludge spillage or improper disposal. The focus has been driven to obtain a novel consortium to highly affect the degradation and removal efficiency of the pollutants. Several micronutrient and growth conditions were considered for optimization study and finally application using the optimized parameters and consortia were undertaken for best removal efficiency and minimizing the sludge toxicity. Biomass composition in the form of lipid, carbohydrate and protein contents, and enzyme activities of alkane hydroxylase (*alkB*), naphthalene dioxygenase (*ndo*) and catechol dioxygenases (*catA* and *catE*) were also studied as an indicative to proficiently gain insights into the role of the isolates to secrete extracellular biomolecules under stressful hydrocarbon contaminated environment and efficiency of the microbial strains to metabolize the aliphatic, aromatic and polyaromatic hydrocarbon (PAH) components during the bioremediation process. Finally, the optimized consortia were applied on the real sludge sample with added nutrients in the form of N and P with a suitable proportion in terms of C:N:P to understand the applicability of the optimized formulations of nutrient media and consortia. The degradation efficiency and nutrient utilization capacity of the consortia in addition to higher biomass quality and enzyme activities suggested the potential of application for bioremediation of petroleum refinery waste.