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Enhanced PAHs' Biodegradation by Consortia Developed with Biofilm – Biosurfactant - Producing Microorganisms

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Abstract : The study hypothesizes that enhanced biodegradation of Polycyclic Aromatic Hydrocarbons (PAHs) is achievable with an assemblage of microorganisms that are capable of producing biofilm and biosurfactants. Accordingly, PAHs degrading microorganism's (bacteria, fungi, actinomycetes and yeast) were screened and grouped into different consortia based on their capabilities to produce biofilm and biosurfactants. Among these, Consortium BTSN09 consisting of bacterial fungal cocultures showed highest degradation due to the synergistic action between them. Degradation effiencies were evaluated using HPLC and GC-MS. Within 7days, BTSN09 showed 51% and 50.7% degradation of Phenanthrene (PHE) and Pyrene (PYR) with 200mg/L and 100 mg/L concentrations respectively in a liquid medium. In addition, several degradative enzymes like laccases, 1hydroxy-2-naphthoicacid dioxygenase, 2-carboxybenzaldehyde dehydrogenase, catechol1,2 dioxygenase and catechol2,3 dioxygenase activity was observed during degradation. Degradation metabolites were identified using GC-MS analysis and from the results it was confirmed that the metabolism of degradation proceeds via pthalic acid pathway for both PAHs. Besides, Microbial consortia also demonstrated good biosurfactant production capacity, achieving maximum oil displacement area and emulsification activity of 19.62 cm2, 65.5% in presence of PAHs as sole carbon source. Scanning Electron Microscopy analysis revealed exopolysaccharides (EPS) production, micro and macrocolonies formation with different stages of biofim development in presence of PAHs during degradation.

Keywords : PAHs, biosurfactant, biofilm, biodegradation
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