(079)

Evaluation of Soil Bacterial Consortium in the Biodegradation of Polycyclic Aromatic Hydrocarbons Under Iron (Fe) Stress Conditions

Vaishnavi, A.K.M., Abdul, H.M., Jayasena, C., Kodikara, L., Kavindya, D., Madanayaka, K., Dharmasiri, R.B.N.*
Faculty of Life and Medical Sciences, BMS Campus, Colombo 06, Sri Lanka
**nadeema.d@bms.ac.lk*

Abstract

Soil is a valuable natural resource supporting a diverse range of organisms, but excessive chemical or substance contamination causes pollution, which harms non-targeted organisms. Polycyclic Aromatic Hydrocarbons (PAHs) are organic contaminants with fused benzene rings produced by both natural and anthropogenic processes. Among them, phenanthrene (Phe) and naphthalene (Nap) are categorized as priority pollutants by the US EPA due to their high toxicity, carcinogenicity, and persistence in the environment. Microbial degradation is an eco-friendly alternative to costly and ineffective traditional methods for PAH removal. This study aimed to isolate and identify an Iron (Fe) tolerant bacterial consortium capable of degrading PAHs. The soil samples were collected from dumping sites (Jaffna, Colombo, Meemure, Galle) in Sri Lanka to isolate bacterial species. Meemure functioned as a control site, signifying low pollution with little impact from industry and cities. Plate assays were used to screen the best PAH degraders and confirmed through UV spectrophotometry. An antagonistic assay assessed strains compatibility for consortium formation. Further, their optimum Iron metal concentration was determined. Molecular characterizations of selected bacterial strains were identified through PCR amplification and sequencing using 27F (AGAGTTTGATCMTGGCTCAG) and 1492R (GGTTACCTTGTTACGACTT) primers. Only five bacterial strains were identified as the best degraders using screening assays, each capable of degrading above 55% of Phe and 35% of Nap. The most efficient were VM6 and VM7, which degraded 64% of Phe and 78% of Nap, respectively. Nap degradation rises significantly to 63% at the maximum Fe concentration of 30×10^3ppm, outpacing Phe, which reaches 55%, indicating Fe promotes PAH decomposition in a concentration-dependent way. VM6 was identified as *Bacillus safensis* PV942242, and VM7 was identified as *Bacillus subtilis* PV9442354; both were found to be spore-forming, gram-positive bacterial species under microscopic observation. According to these findings, *B. safensis* PV942242 and *B. subtilis* PV9442354 are promising biological agents for PAH bioremediation, and an appropriate Fe content may improve the microbial breakdown of PAHs.

Keywords: *Naphthalene, Phenanthrene, Iron, Bacteria, Biodegradation*