ABSTRACT

Petroleum Bioremediation Potential of Microbial Cultures and Consortia from Two Natural Hydrocarbon Seepages in Trinidad, West Indies

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Trinidad and Tobago is known for its extensive reserves of oil and natural gas but faces major environmental challenges due to spills and generation of oily wastes generated by the petroleum industry. In this study, hydrocarbon-degrading bacteria and fungi from two natural petroleum seepage sites in Trinidad, the La Brea Pitch Lake and the Digity Seepage, Penal, were assessed for bioremediation potential of petroleum-contaminated soil. The results indicated that the two seepages sites had an abundance of microbes capable of degrading all the oil fractions. A total of 141 bacterial isolates were selected for detailed evaluation. The majority of these isolates were identified as *Bacillus* spp. (60%) which was followed by *Paenibacillus* spp., *Achromobacter* spp., *Burkholderia* spp. and *Pseudomonas* spp. (17%, 11%, 5% and 4%, respectively). The isolates varied significantly in their ability to degrade crude oil. A four-member consortium comprising three isolates of *Bacillus* spp. and one *Achromobacter* sp, selected from best degraders of the different hydrocarbon fractions, resulted in removal of up to 88 % petroleum from contaminated soil. 16S community profiling showed the presence of 1654 non-cultured OTUs in hydrocarbon enriched cultures, with

81 OTUs being unclassified even to the phylum level. A total of 67 fungal isolates were selected for detailed evaluation and were identified as *Aspergillus* spp. (52%), *Fusarium* spp. (20%), *Penicillum* spp. (14%) and members of the Mucorales (8%). The majority (70%) of the fungal isolates were from Pitch Lake samples as compared to Digity Seepage (30%). A consortium comprising of two isolates of *Aspergillus* spp. and two *Fusarium* spp. resulted in degradation of up to 92% of hydrocarbons in contaminated soil. The findings of the study indicate that the two seepage sites are potentially good sources of petroleum hydrocarbon degrading bacteria for developing local bioremediation technology in Trinidad and Tobago.

Keywords: Tropics; Hydrocarbon - degrading microorganisms; Petroleum Bioremediation; Biostimulation; Bioaugmentation; Natural Attenuation.