

Occurrence, Ubiquity and Proficiency of Hydrocarbon-Degrading Microbial Assemblages in Nature

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The ecological importance of diverse microbial assemblages with putative hydrocarbon-utilizing potentials in nature cannot be overemphasized, especially given large quantities of various hydrocarbon-based products that are commonly found in various environments, and coupled with the obvious limitations associated with alternative cleanup approaches (e.g., chemical and physical methods) that are often applied to remedy hydrocarbon-contaminations [1]. Generally, high quantities of hydrocarbon pollutants constantly find their way into natural environments as a result of several anthropogenic influences, including but not limited to, accidental spills of petroleum-based fuels, constant leakage during underground storage as well as frequent use and disposal of synthetic petroleum-based products [2-4]. Although most petroleum residues are known to be easily degraded by indigenous microbial assemblages in contaminated sites [5], however some organic pollutants often persist in the environment as a result of their toxic and carcinogenic potentials [6-8], causing the destruction of the inner membranes in gram-negative bacteria [9].

Therefore, since various hydrocarbon types, such as the aromatics (i.e. benzene, toluene and xylene isomers), that are major constituents of petroleum and industrial solvents are ubiquitously found in the environment, it is not at all surprising that various autochthonous microorganisms with putative hydrocarbon-utilizing potentials have also been isolated from diverse environments [10-13]. Even though the exclusive dominance of bacterial members belonging to the *Proteobacteria* has been well established in hydrocarbon-utilization [13,14], similarly, the metabolic capabilities of various other gram-negative and gram-positive bacterial phylotypes as well as fungi have also been well documented [15,16].

Mostly, the degradative proficiencies of hydrocarbon-utilizing microbes especially under aerobic conditions are somewhat dependent on the possession of oxygenase-catalysed enzyme complexes [17] as well as the influences of various environmental variables, including oxygen, water, nutrients (mostly nitrates and phosphates), pH and temperature, at polluted site [3]. Although less efficient microbial degradation of various mono-aromatic hydrocarbon residues are also not uncommon under anaerobic, denitrifying, iron-reducing, sulfate reducing and methanogenic conditions [18].

Overall, while it may be somewhat difficult to accurately predict or estimate the effects of wide array of organic pollutants on autochthonous microbial assemblages in nature, it is however safe to assume that hydrocarbon contaminants, at the least will probably alter and/or shift the community structures and compositions in favor of phylotypes with putative degradative potentials [14]. Therefore, to reduce the obvious burden constantly exerted by various organic chemicals on microbial assemblages in nature, there is urgent need to heed the call to explore and embrace alternative products and technologies with benign impacts on our environments [19].

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