MICROBIAL BIOTRANSFORMATION OF HYDROCARBON

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Introduction

Crude oil and other hydrocarbon pollution generate enormous public concern and this highlights the need for cost effective and environmentally acceptable remedial technologies. Physicochemical methods are currently used to clean up these pollutants. However, these methods are not efficient. Currently, bioremediation which makes use of microbial degradative activities in restoration of hydrocarbon-polluted environment is becoming a more popular approach since it is environmentally friendly, cost effective and can be carried out in situ or ex-situ. Two general approaches of bioremediation are: a) addition of fertilisers to enhance the number and abilities of the indigenous hydrocarbon-utilising bacteria, and b) addition of naturally occurring adapted microbial hydrocarbon-degraders by seeding. The second approach leads us to the objectives of this project which were: to isolate local microbes that are able to biodegrade/transform hydrocarbons pollutants (our focus was on crude oil and Benzene, Toloune, Ethyl benzene and Xylene (BTEX), to characterise and optimise their biodegradation process, and to evaluate their bioremediation potentials on polluted samples.

Materials and Methods

Primary screening for crude oil degrading bacteria was done directly on selective agar plates containing 1.0% crude oil as the sole carbon and energy source. For BTEX degraders, toluene and benzene were used individually as the sole carbon and energy sources. Positive isolates were regrown in liquid media containing 1% crude oil or BTEX and incubated for 7 days at 37°C. The basal medium (BM) employed for this study consisted of (g/L); 0.5 K_2HPO_4, 1.0 NH_4Cl, 2.0 Na_2SO_4, 2.0 KNO_3 and 0.2 $MgSO_4.7H_2O$, pH 7.5. The degradation potentials were determined by GC. For crude oil analysis was performed on capillary column, 30mX 0.25mm ID 0.25µm thickness, 007 series Methyl Silicone.

Results and Discussion

We have isolated a number of local crude oil and mono aromatic (BTEX) degrading bacteria from crude oil contaminated soil and marine environments (Razak et. al. 1997a, b; Ali, 1998; Sannasi, 1998). Their individual degradation potentials have been determined. Factors affecting the degradation of crude oil by potential isolates were also determined (Razak et. et. 1998). For crude oil degradation, four bacterial isolates (*Acinetobacter* sp.(E11), *Bacillus* sp. (170), *Bacillus* sp. 183 and *Pseudomonas* sp. (181), have been identified as potential candidates to be used in bioremediation of crude oil-contaminated soils and waters. Bioremediation studies under laboratory condition using crude oil-contaminated soil and liquid with *Bacillus* sp. (170) showed that the isolate was able to degrade more than 80% of the total hydrocarbons compounds of crude oil (Ali, 1998). For mono aromatic (BTEX) degradation, six bacterial isolates (145yw, 205y, 113i, 205w, 113 and 146) showed ability to grow and withstand up to 75% (v/v) concentration of BTEX. Biodegradability of the isolates was confirmed by positive CO_2 production and the reduction in hydrocarbon peaks observed by GC (Sannasi, 1998). Currently, studies are being carried out to see the degradation potentials of a mixed culture (170, 181,183 and BTEX degraders). We hope to formulate a bacterial cocktail from the individual pure isolates of known hydrocarbon degrading potentials that will be effective in lowering the crude oil and hydrocarbon pollutants concentrations present in contaminated soil or industrial waste (petroleum- based).

Conclusions

Degradation potentials of four crude oil and six BTEX degrading bacteria, were determined. *Bacillus* sp. (170) showed alone degraded more than 80% of the total hydrocarbons in crude oil within 60 days.

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