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Isolation and identification of indigenous hydrocarbon tolerant bacteria from soil contaminated with used engine oil in Ogbomoso, Nigeria

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ABSTRACT

Environmental pollution by petroleum hydrocarbons has become a serious problem all around the world. In recent years, many microbial ecologists have identified various microbial species that are effective degraders of hydrocarbons in natural environments. This study was primarily carried to isolate and characterize hydrocarbon degrading bacteria from soil contaminated with used engine oil in Ogbomoso, Nigeria. Five types of indigenous bacteria were isolated and identified from the test soil: they were Pseudomonas aeruginosa, Salmonella typhi ,Bacillus cereus, Streptococcus faecium and Proteus vulgaris. It was recommended that ability of the isolated and identified bacteria to bioremediate or utilize hydrocarbons; especially used engine oil should be investigated.

INTRODUCTION

Environmental pollution by petroleum hydrocarbons has become a seriousproblem all around the world. Large-scale incineration plants have been developed, and incineration of hydrocarbon pollutants is carried out to clean up hydrocarbon contaminated sites. The treatment time is short, but the system requires huge machines and large amounts of heavy oils (Matsumiya and Kubo, 2007). Biological treatments for hydrocarbon-degradation have also been investigated. For the construction of such bioremediation systems,many kinds of hydrocarbon-degrading bacteria have been isolated and analyzed (Dua et al. 2002; Aislabie et al., 2006).

In recent years, many microbial ecologists have identified various microbial species that are effective degraders of hydrocarbons in natural environments. Many of these microbial consortia have been isolated from heavily contaminated areas. They were isolated based on their ability to metabolize various carbon sources, such as aliphatic and aromatic compounds and their chlorinated derivates.

The driving force for petroleum biodegradation is the ability of microorganisms to utilize hydrocarbons to satisfy their cell growth and energy needs. A large number of studies report that low molecular weight alkanes are degraded most rapidly. Mixed cultures carry out more extensive biodegradation of petroleum than pure cultures (Trindade et al., 2004). In many ecosystems there is already an adequate indigenous microbial community capable of extensive oil biodegradation, provided that environmental conditions are favorable for oil-degrading metabolic activity (Kim et al., 2004).

There are several advantages relying on indigenous microorganisms rather than adding microorganisms to degrade hydrocarbons. First, natural populations have developed through many years. These microorganisms are adapted for

survival and proliferation in that environment. Secondly, the ability to utilize hydrocarbons is distributed among a diverse microbial population. This population occurs in natural ecosystems and either independently or in combination metabolizes various hydrocarbons. This study was primarily carried to isolate and characterize hydrocarbon degrading bacteria from soil contaminated with used engine oil in Ogbomoso, Nigeria, with the view that such bacteria isolates will be further screen for their biodegradation potentials using different hydrocarbons.

MATERIALS AND METHODS

Five (5) Sampling sites were selected by observing regular practice of metal contaminated wastes in the vicinity of auto batteries and automobile workshops in Ogbomoso, Oyo state Nigeria. Automobile workshops that has being in existence for more than five years were randomly selected.

Surface soil sample was collected from automobile workshops into sterile polythene bags and transported to the laboratory of the Department of food science and engineering of Ladoke Akintola University of Technology, Ogbomoso, Oyo State Nigeria.

One gram of soil sample was suspended in 9ml sterile distilled water and was diluted serially up to 10-10. 0.2ml (aliquot) of the suspension was inoculated separately in to Nutrient agar plates. The plates were incubated at 35^0C for 24-72 hours. Distinct colonies growing on each plate were selected, subcultured and stored in glycerol broth at freezing temperatures. The bacteria were identified by using the method described in Bergey manual of systematic bacteriology.

RESULTS

Table 1: Distribution of bacteria species among the sampling points

ORGANISMS	SAMPLE SOURCES				
	OD	SR	ON	HS	OS
Pseudomonas aeruginosa	+	+	+	+	+
Salmonella typhi	-	+	+	-	+
Bacillus cereus	-	-	-	+	+
Streptococcus faecium	+	+	+	-	-
Proteus vulgaris	+		-	+	-

OD: ODELOBA, SR; STADIUM ROAD;HS HIGH SCHOOL; OS; OSUPA; ON; LAUTECH ROAD

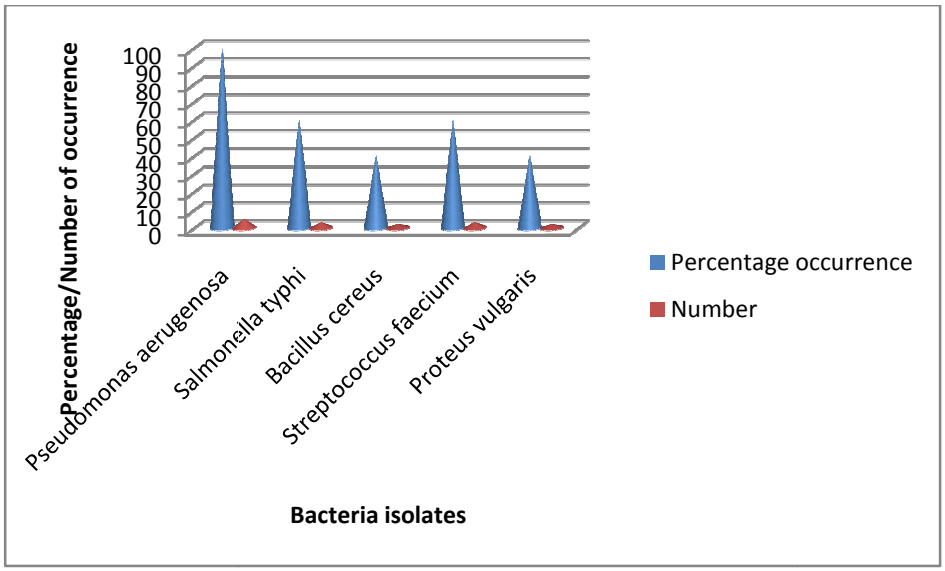

Fig.1: Percentage distribution of the bacteria isolates in the sampling points

DISCUSSION

A lot of works have been reported on bioremediation of hydrocarbon pollutants, but just a few had reported on bioremediation of soil contaminated with used motor oil. Most work reported in the literature on the biological treatment of soil contaminated with used motor oil had been focused on the identification of microorganisms, which can be used to degrade used motor oil (Anoliefo and Edegbai, 2000) and the use of plants for the degradation of used motor oil (Bagherzadeh-Namazi *et al*., 2008). The current study corroborated the exist data on the indigenous bacteria that can utilize or metabolize hydrocarbons in any polluted site.

In this study *Pseudomonas, Bacillus, Proteus, Salmonella and Streptococcus* were isolated from oil contaminated soil samples, two of these bacteria(Pseudomonas and Bacillus) have been reported to be among the most frequently isolated bacteria from hydrocarbon-polluted sites (Atlas 1992; Okoh and Trejo-Hernandez 2006).Pseudomonas sp. have been reported to represent one ofthe most versatile groups of organisms involved in thedegradation of hydrocarbons (Wackett and Hershberger, 2001). Also, Pseudomonas spp has been reported to have specificity for a range of hydrocarbon compounds including biphenyl, PAHs and petroleum products commonly used in the Nigerian environment (Obayori *et al*. 2008). Therefore, its presence in all the soil samples analyzed in this study is not a surprise.

Similarly, the biodegradation potential of *B. subtilis*and *P. aeruginosa*strains isolated from India have been reported to be far higher than other bacteria isolates (Chhatreet al., 1996; Del'Arco and de Franca, 2001; Obuekwe andAl-Zarban, 1998; Sugiura et al., 1997) a similarly trend was also noticed in *B. subtilis*and *P. aeruginosa*strains isolated from crude oil-polluted soil fromNigeria in the study of Ilori and Amund, (2000).

CONCLUSION

Five types of indigenous bacteria were isolated and identified from the test soil: they were *Pseudomonas aeruginosa, Salmonella typhi,Bacillus cereus,Streptococcus faecium and Proteus vulgaris.* It is therefore recommended that ability of the isolated and identified bacteria to bioremediate or utilize hydrocarbons, especially used engine oil should be investigated.

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