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Analyses of Polycyclic Aromatic Hydrocarbon Degrading Bacteria Isolated from Contaminated Soils

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A collection of PAH-degrading bacteria isolated from PAH-contaminated soils was analyzed genotypically and phenotypically. The methods used for the analyses were DNA hybridization, PAH spray plate, 14C-PAH mineralization, and dioxygenase activity assays. The hybridization employed NAH7-derived gene probes. The results of the analyses showed a dominant number of PAH-degraders with NAH7-like genotype and an expanded role of the nahA gene probe to detect not only naphthalene degraders but also other PAH degraders.

The results support the continued use of the nahA probe for contaminated soils to monitor genetic potential of indigenous microorganisms to degrade PAHs. However, the finding of non-nahA-hybridizing PAH-degraders shows the limitation of NAH7-derived gene probes. Fifteen percent (13/89) of the PAH degraders were not detected with the nahA gene probe. Four PAH-degraders (A5PH1, A8AN3, B1PH2, and B10AN1) did not hybridize with any of the NAH7-derived gene probes used in this study; nahA, nahG, nahH, and nahR. Strains A8AN3, B1PH2, and B10AN1 were identified as Sphingomonas sp. strains based on chemotaxonomic traits or phenotypic characteristics. However, A5PH1 produced taxonomic uncertainty. A8AN3 did not hybridize with any of the NAH7-derived gene probes but did degrade a broad range of PAHs including benzo[a]pyrene. Considering the numerous unculturable microorganisms in nature and their potential genotypes, NAH7-derived gene probes might underestimate the microbial potential to catabolize PAHs. This necessitates developing new gene probes for PAH-degraders to better understand the in situ microbial potential to degrade PAHs.

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Biodegradation of Aromatic Hydrocarbons in Various Conditions

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To investigate the biodegrading capability of several white-rot fungi which were isolated in Korea, biodegradation of BTX (benzene, toluene, xylene), phenanthrene and pyrene were tested in fungal cultures. *Phanerochaete chrysosporium* removed 20-30% of BTX mixture during 21 days of incubation in serum bottle. *Coriolus versicolor* KR-11W and *Irpex lacteus* mineralized 10.02 and 8.26% of phenanthrene, respectively, which were higher than in other studies with *P. chrysosporium*. These two strains also showed the high mineralization rates (9.2-10.1%) of 4-ring pyrene. *I. lacteus* metabolized most of pyrene added and 23.29% was incorporated into fungal biomass. Almost 50% of pyrene was converted to polar metabolites and recovered from aqueous phase of culture. This results indicated that some white-rot fungi other than *P. chrysosporium* have higher biodegradability and could be used in bioremediation of aromatic hydrocarbon contaminants in soil.