Phenanthrene Degradation Ability of Phyllosphere Bacteria Inhabiting the Urban Areas in Sri Lanka

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Abstract

Air pollution from polyaromatic hydrocarbonic (PAH) pollutants are one of the most severe problems in the world. Out of many PAH pollutants, phenantherene is important due to their high carcinogenicity and genotoxicity to all living beings. Although there are many anthropogenic sources of PAHs, the key sources of phenanthrene are vehicular emission and oil refinery processes. The release of such air pollutants in heavy concentrations are getting settled over the phyllosphere through dry deposition, and wet deposition and most of the phyllosphere bacteria are able to degrade phenanthrene. This attempt is to isolate, select and identify the best

phenanthrene degrading bacteria to use them as phylloremediators of PAH pollutants. Bacterial isolations were obtained from leaf samples collected from Panchikawatta, Orugodawatta, Pettah, Maradana, Colombo Fort and Sapugaskanda oil refinery areas in Sri Lanka. Initially, phenanthrene degradation ability of isolated phyllosphere bacteria was screened using the plate assay method. Subsequently, phenanthrene degradation by each bacterial species was analysed using the absorbance values from UV-Vis spectrophotometric analysis and High-performance liquid chromatography (HPLC). The selected bacterial isolates were identified up to species level through PCR amplification and sequencing the amplified fragments using the primers 1492R (GGTTACCTTGTTACGACTT) and 27F (AGAGTTTGATCMTGGCTCAG). Ninety-three morphologically different bacterial strains were isolated from the leaf samples collected from the five selected urban-polluted areas. According to the results of plate assay, out of 93 bacterial strains, nine were able to grow on phenanthrene added Bacto Bushnell Hass agar medium. Further analysis results of UV-Vis spectrophotometric and HPLC methods revealed, five bacterial species, *Bacillus pumilus* strain I_21, *B. pumilus* strain X4, *Bacillus* sp. LWYT1353, *B. megaterium* strain F4-2-27 and Bacillus sp. AIIW2 were able to degrade more than 20% of phenanthrene and out of them *B. megaterium* strain F4-2-27 has showed the best phenanthrene degradation ability. The consortium of these nine bacterial strains can be used for bioremediation of polluted sites which is contaminated from phenanthrene.

Keywords: phyllosphere, aromatic hydrocarbon, bioremediation, phenanthrene