



“Gheorghe Asachi” Technical University of Iasi, Romania



P43

REMOVAL OF POLYCYCLIC AROMATIC HYDROCARBONS (PAHs) BY SELECTED MICROBIAL STRAINS ISOLATED FROM HIGHLY CONTAMINATED SOIL

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Abstract

Polycyclic aromatic hydrocarbons (PAHs) constitute a group of priority environmental pollutants in soils and sediments due to their toxic, mutagenic and carcinogenic effects. PAHs may be present at high concentrations at industrial sites associated with petrole, coal tar, gas production and wood preservation industries. The ACNA site, an industrial area of Cengio near Savona, is largely contaminated by different classes of organic compounds and it has been included in the list of national priorities for environmental reclamation. As compared to the physical-chemical treatments, the use of microbial technology to clean up contaminated soils was found to be more efficient, economical and eco-friendly. The aim of this work was to assess the capacity of selected microbial strains, isolated from very same polluted soil of the ACNA site, to degrade and remove the anthropogenic organic compounds present in the aqueous extracts from an ACNA soil.

In the extraction experiments, 30 g of soil were kept under reflux in a Soxhlet with 225 mL of an acetone/n-hexane (1:1) mixture for 48 hours. The organic extracts were first dried in a roto-evaporator at 40°C and redissolved in 5 mL of acetone and 145 mL of ultrapure water (final volume of 150 mL). An aliquot of these aqueous extracts was purified by solid phase extraction (SPE) through elution in Bond-Elut C-18 cartridges. Preliminary tests were carried out to optimize the volume of extract to apply and the type of organic solvent to be used for elution. Finally, an amount of 20 mL of extract and 30 mL of organic solvents (10 mL of n-hexane, 10 mL of diethyl ether followed by 10 mL of acetone) were utilized. After extraction with C-18 cartridges, the samples were dried, redissolved with 1 mL of CH₂Cl₂, containing 100 µg/ml octafluoronaphtalene solution in CH₂Cl₂ as internal standard, and analyzed by GC-MS. The aqueous extracts from the contaminated soil (CSAE) were used at a concentration 40% as growth media of microorganisms, represented by bacteria and mould strains isolated from the same ACNA soil, in order to evaluate by GC-MS analyses the removal of polycyclic aromatic hydrocarbons (PAHs) present in the CSAE.

The results obtained both with bacteria and mould selected strains showed a significant removal of the identified pollutants that varied from 28 to 100% depending on the pollutant class.

The development and optimization of such extractive, degradative and analytical methodology will allow to assess the effective ability of the isolated microbial strains to be further used in bio and mycoremediation of soils polluted by PAHs and other aromatic compounds.
