Introduction

Polycyclic aromatic hydrocarbons (PAHs) are widely spread as pollutants of soils and waters. PAHs are toxic, mutagenic and carcinogenic. Phoenoumenon is known as polychromating for human skin and lung disorders. The complete biodegradation of hydrocarbons lead to final products like CO₂, water and cellular biomass. Several microorganisms have been characterized for their ability to degrade phenanthrene, i.e., Phenanthrobacterium hominivorans endures the molecules in CV and CD marine cytochrome-like pigment 

Biodeterioration of PAHs in soils is not frequently applied. PAHs are recalcitrant to biodegradation and their high water solubility makes them available to the microbial attack. At 37°C the behaviour was completely dependent on soil microbial activity. Without cyclodextrins it was observed a decrease in degradation efficiency (14.5%) while in presence of cyclodextrins it was always observed an increase: β-CD: 56.8%; α-CD: 58.6%; γ-CD: 18.9%. This indicates that an increase of degradation efficiency is not due to the microbial attack but rather to the interaction of the inclusion complexes, even if they increase water solubility of phenanthrene. The presence of a homogenous microbial population of microcosms was examined.

Results

Phenanthrene analysis

DNA from fungal isolates was extracted and purified; primers ITS1 and ITS4 were used to amplify a region of rDNA sequences. PCR products were cloned and sequenced and the 16S rDNA sequences were aligned by using ClustalX software, version 1.81.

Conclusion

Biodeterioration of PAHs in soils is not frequently applied. PAHs are recalcitrant to biodegradation and their high water solubility makes them available to the microbial attack. At 37°C the behaviour was completely dependent on soil microbial activity. Without cyclodextrins it was observed a decrease in degradation efficiency (14.5%) while in presence of cyclodextrins it was always observed an increase: β-CD: 56.8%; α-CD: 58.6%; γ-CD: 18.9%. This indicates that an increase of degradation efficiency is not due to the microbial attack but rather to the interaction of the inclusion complexes, even if they increase water solubility of phenanthrene. The presence of a homogenous microbial population of microcosms was examined.

Microorganisms

The heterogeneous microbial population in microcosms at the end of degradation processes shown to be different in aqueous phase and soil. In aqueous phase almost one-Salvador was found, that after the molecular analysis shown a similarity 99.6% to a β-Pseudomonas (closely related to β-Hydrocarbomonas) already described in a benzopyrene-degrading microbial consortium [18]. In soil microcosms a more variable microbial population was observed, in which nine strains were chosen as different on the basis of the different morphological aspects of colonies grown in solid medium and of cells observed in optical microscopy. These strains were purified and analyzed for the 16S rDNA sequences. They shown to be three Streptomyces spp., two Bacillus sp. (Bacillus sp. and Bacillus subtilis), two Pseudomonas spp. (Pseudomonas putida and Pseudomonas putida) and Penicillium sp. (Aspergillus sp. + Streptomyces sp.; Penicillium sp. + Aspergillus sp. + Streptomyces sp. are already known for their capability to degrade PAHs). The presence of Bacillus sp. and Bacillus subtilis is in the presence of the presence of cyclodextrins was confirmed. The presence of β-CD increased the degradation in both solid and slurry phase, as a confirmation of the fact that bioavailability has a crucial role in biodegradation of phenanthrene. The better performance obtained in solid phase can be explained by the higher oxygen availability respect to the slurry phase.

Microbial consortions

The heterogeneous microbial consortium in microcosms at the end of degradation processes shown to be different in aqueous phase and soil. In aqueous phase almost one-Salvador was found, that after the molecular analysis shown a similarity 99.6% to a β-Pseudomonas (closely related to β-Hydrocarbomonas) already described in a benzopyrene-degrading microbial consortium [18]. In soil microcosms a more variable microbial population was observed, in which nine strains were chosen as different on the basis of the different morphological aspects of colonies grown in solid medium and of cells observed in optical microscopy. These strains were purified and analyzed for the 16S rDNA sequences. They shown to be three Streptomyces spp., two Bacillus sp. (Bacillus sp. and Bacillus subtilis), two Pseudomonas spp. (Pseudomonas putida and Pseudomonas putida) and Penicillium sp. (Aspergillus sp. + Streptomyces sp.; Penicillium sp. + Aspergillus sp. + Streptomyces sp. are already known for their capability to degrade PAHs). The presence of Bacillus sp. and Bacillus subtilis is in the presence of the presence of cyclodextrins was confirmed. The presence of β-CD increased the degradation in both solid and slurry phase, as a confirmation of the fact that bioavailability has a crucial role in biodegradation of phenanthrene. The better performance obtained in solid phase can be explained by the higher oxygen availability respect to the slurry phase.

References