Influence of metals on PAHs biodegradation processes in soils

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During the last century, the high number of anthropogenic activities related to societies' development has seriously contributed to the release of multiple families of compounds to the environment which eventually can significantly alter the equilibrium of the ecosystem. When pollutants arrive to a particular media, many chemicals and biological processes can take place, leading to the formation of derivate substances that can be less or more toxic than the initial compound. In soils, biodegradation by microorganisms is the principal mechanism involved in such transformation and it can be affected by soil properties as well as by interactions with other present pollutants (co-contamination).[1,2]

The aim of the present work is to evaluate the influence of different concentration levels of some heavy metals on the degradation of some PAHs by soil microorganisms in soil samples. To develop the experimental part, groups of microcosms of a natural soil from the region of Sabadell (Spain) were prepared as a reproduction of the native environment at laboratory scale, under controlled conditions. Mixtures of PAHs and metals were carefully selected, according to soil characterization and microbiological growth preliminary assays, and were added to microcosms. Phenanthrene, fluoranthene, pyrene, benzo[b]fluoranthene and benzo[a]pyrene were the selected PAHs, and Cr, Mn, Co, Ni, Cu, Zn and Pb the heavy metals. These microcosms were analyzed during two months to obtain PAHs dissipation profile. The different rate constants and DT50 values (time for 50% dissipation) where calculated by using a first-order kinetic model, as a function of the metal levels introduced in microcosms.

Results show that when metals concentration increases the biodegradation of PAHs of 3-4 rings (phenantrene, fluoranthene and pyrene) decreases, affecting likely specific degrading strains and not the total number of soils microorganisms. For higher molecular weight PAHs (benzo[b]fluoranthene and benzo[a]pyrene), no significant effect on their dissipation was observed at the different concentration levels of tested metals, so metals did not interfere on their degradation process (under the period of study).

References
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