

Toxicological assays with *Vicia faba* L. for monitoring bioremediation processes of soils contaminated by polycyclic aromatic hydrocarbons and total petroleum hydrocarbons.

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Abstract

The ecotoxicological assays are used both in the assessment of the toxicity of various matrices and to estimate the effectiveness of the remediation of a matrix over time.

Several organisms can be employed in eco-toxicological tests in the lab, or can be observed in their natural environment representing indicators of specific environmental conditions.

Higher plants can be exploited as good indicators of the quality of different matrices and used both as a standard during remediation processes of contaminated soil but also in the evaluation of soil quality. In fact, the only chemical characterization of a polluted soil does not allow to predict the real toxicity of the matrix, that may depend on the original pollutants, on degradations intermediates, often unknown, and on the synergic actions of the different toxicants.

The aim of this research was to evaluate the efficacy of the process abatement of the initial concentration, in a contaminated soil, of polycyclic aromatic hydrocarbons (PAHs, 6480 ppm) and of total petroleum hydrocarbons (TPHs, 18347 ppm) by means of a biopile in terms of reduction of the final matrix toxicity. For this reason soil samples at different time intervals from the beginning of treatment in biopile were collected and chemically characterized, for the monitoring and assessment of the possible phyto-genotoxic effects on the model system *Vicia faba* L. The biopile treatment determined the depletion of PAHs and TPHs below 10 and 100 ppm respectively. Biological parameters such as germination and root elongation were also evaluated as well as the possible genotoxic effects by means of cytological analysis of mitotic behaviour of root meristem, based on detection of chromosomal aberrations in mitotic cells, and of micronuclei formation, detectable in interphase cells. As additionally genotoxicity endpoint, cytohistochemical detection of *in situ* DNA fragmentation in root apices was achieved by TUNEL reaction, that allows to recognize both single and double-strand breaks at cellular and tissue level.

Comparing the obtained results it was found that the phyto-genotoxic effect of contaminated soil was completely depleted after treatment in biopile and *Vicia faba* was found to be a good approach for monitoring the biodegradation processes and the toxicity of these solid matrices at the end of a bio-based decontamination approach.

Keywords: genotoxicity, phytotoxicity, polycyclic aromatic hydrocarbons, total petroleum hydrocarbons