BIOREMEDIATION OF CONTAMINATED MATRICES

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The aim of the research line is to develop innovative biotechnological processes for the decontamination of soils, sediments, groundwaters and wastewaters contaminated by chlorinated and non-chlorinated hydrocarbons and by polimeric compounds. The decontamination is attained either by stimulating the indigenous microbial population of the contaminated matrix (with the possible addition of a suitable growth substrate for cometabolic processes), or by introducting in the contaminated matrix microbial populations specialized in the degradation of the target pollutants (bioaugmentation).
The main aspects of the research approach are: (1) the enrichment and selection of indigenous microbial cultures, capable to degrade the target pollutants; (2) the biochemical, physiological, kinetic and phylogenetic characterization, of the microbial cultures; (3) the design, development, optimization and scale-up of the biodegradation process; (4) the evaluation of the process through an integrated chemical, microbiological, molecular-biological and ecotoxicological monitoring; (5) the fluid-dynamic and kinetic modeling of the process, and its further optimization on the basis of the results obtained.
The main goals of the research are: (a) to develop immobilized-biomass processes in packed bed reactors, for the decontamination of ground- and waste-waters contaminated by non-ionic synthetic surfactants, polychlorinated biphenyls (PCBs), chlorobenzoic acids, phenols and chlorinated solvents; (b) to develop innovative bioreactors and advanced biodegradation strategies (use of biogenous mobilizing agents to increase pollutant bioavailability; bioaugmentation; cometabolism with pulsed feed of growth substrate) for the decontamination of soils; (c) to detect, characterize and stimulate the microbial degradation of chlorinated and non-chlorinated organic pollutants in anaerobic sediments; d) to verify the applicability and the effectiveness of the proposed biodegradation approach to the treatment of rain waters collected from streets and industrial areas, by studying the pilot-scale application of the process in Sequencing Batch Reactors.

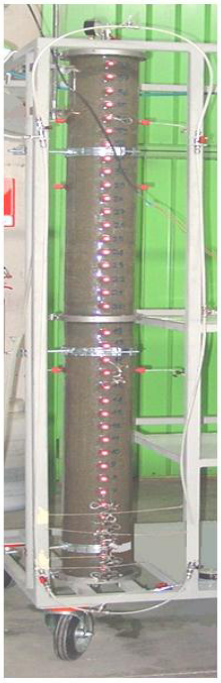

Fig. 1 Attached-cell bioreactor for the treatment of groundwater.

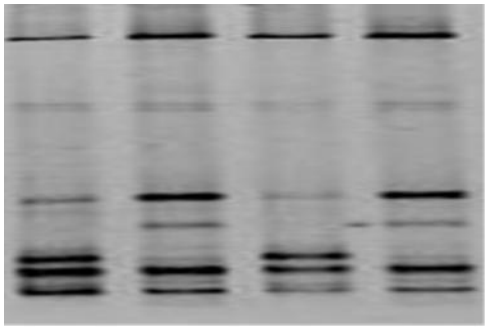

Fig.2. Molecular analysis of the active microbial populations.

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RESEARCH PROJECTS

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EU Project EU FP7-KBBE-2012-3.5-01 ID 312139: KILL SPILL (Integrated biotechnological solutions for combating oil spills).

EU Project EU FP7-KBBE-2010-4 ID 265946: MINOTAURUS (Microorganism and enzyme Immobilization: novel techniques and approaches for upgraded remediation of underground-, wastewater and soil).

EU Project EU Project FP7-KBBE-2010-4 ID 266473: ULIXES (Unravelling and exploiting Mediterranean Sea microbial diversity and ecology for xenobiotics' and pollutants' clean up).

PRIN 2008: Novel processes for the sustainable remediation of groundwater contaminated by chlorinated compounds.

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