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On-site running waters are often sources of diffuse contamination around industrial sites that need to be treated to prevent detrimental effect to the adjacent environment. Settling process, such as sedimentary channels, is one way to limit pollutant spreading. However, in these specific media, pollution may accumulate and sediments become depositories of toxic substances. This project deals with the management of a sedimentary channel highly contaminated by hydrocarbons with the additional difficulty of proposing a solution preserving the nearby environment located within a Natural resource protection area. The aims of the treatment were i) to prevent contaminants mobility by degradation and/or stabilization and ii) to preserve the natural resources of the site. Among remediation process, phytoremediation is an all-encompassing term that includes a variety of techniques and strategies using higher plants that lead to contaminant degradation, removal, or immobilization, by removing contaminant sources, breaking exposure pathways between the source(s) and receptor(s). Furthermore, phytoremediation can be considering as a landscaping action within the global management of the site.
Since anaerobic conditions of the sediment compartment is unfavorable to plant growth and organic compounds biodegradation, we proposed a new approach combining phytoremediation and the use of a calcium peroxide (CaO_2) amendment to serve as an oxygen release product (ORP) in order to promote aerobic biodegradation and plant growth. Two experiments under controlled conditions in laboratory were performed: *i)* batch *in vitro* tests without plant in order to assess reactivity of the sediment with different ORP (ORP: IXPER75C, Solvay) levels and *ii)* plant growth assays with five selected species.
The batch *in vitro* test showed a strong ORP-effect on physico-chemical parameters, with increasing pH and decreasing redox potential. Only the highest level of ORP enabled hydrocarbons degradation but resulted also in detrimental pH values for both microorganisms' activity. pH increasing could also lead to strong negative effect on plant growth. Hydrocarbon dissipation was mainly attributed to oxidative processes. Lab plant growth experiments, with moderate levels of ORP to limit excessive pH increase, did not lead to any significant variation of hydrocarbon concentration. However, most of the tested species seemed to overcome the sediment detrimental growth conditions, confirming the phytoremediation feasibility for *in situ* application. Furthermore, ORP addition improved plant growth especially for *Thalia dealbata* and *Scirpus lacustris.* The absence of significant change in hydrocarbon content in sediments could be explained by the recalcitrant nature of the pollution a relative short term experiment. Organic chemistry characterization (GC analysis) revealed that hydrocarbon signature was marked by a large UCM (unresolved complex mixture) signal revealing an already aged and biologically stable pollution. Plant cover establishment should remain an asset in preventing sediment transfer, therefore insuring pollution stabilization, and in preserving the neighboring ecosystem.