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REMEDIATION OF OILS SPILL IMPACTED SOIL BY BIOAUGMENTATION WITH FREE LIVING NITROGEN FIXING BACTERIA

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Abstract

The oil industry in the state of Tabasco Mexico causes a yearly average of 114 environmental contingencies due to oil spills or leaks. Also faces risks of oil and oily water spilling, leaking and filtrations derived from operational accidents, insufficient maintenance or pipeline corrosion due to rains and prolonged floods. The presence of petroleum hydrocarbons in oil spill impacted sites has important impact in the environment and human health. Oil spills and leaks, drilling wastes and oily water alter the chemical, physical and biological properties of soil.

Bioaugmentation is a bioremediation technology useful for the treatment of these impacted sites by increasing the microbiota present in the contaminated soil by supplying exogenous or increasing the native microorganism. The objective of this work was to investigate the effect of augmentation the native free living nitrogen fixing bacteria (FLNFB) in combination with the addition of a biosurfactant produced by two of these bacteria over the bioremediation of soil contaminated with 120,000 ppm of total oil hydrocarbons in a biopile system. The total microbial account (UFC) previous to the inoculation with the FLNFB was 13 X 10^4 UFC, and after the inoculation was 200 X 10^7 UFC. Curiously, during the first two months of treatment, the UFC gradually decreased close to the initial value. Therefore more bacterial biomass was added to the system. After 6 months the UFC showed continuous augmentation until 22 X 10^{11} UFC after 16 months. By three months of treatment in the biopiles added with the FLNFB the hydrocarbons content was almost unchanged, however after 6 months the concentration decreased notoriously, and by 16 months the total hydrocarbon removal was 80%.

This is the first experiment performed in real condition for these bacteria native from the contaminated sites. Interestingly, these bacteria showed three important abilities: to fix nitrogen, to remove hydrocarbons, and to produce biosurfactant compounds. These results offer the opportunity to study the physical, chemical and biological interaction between the soil and microorganisms, beside the possibility to propose a bioremediation technology for oil spill impacted sites.