Degradation of oily sludge: bioaugmentation & biostimulation in a soil from landfarming (RS)

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Abstract:
The oily sludge is the final residue of the petroleum refining process and corresponds to 1/3 of the initial volume of the crude oil used. This waste is classified as hazardous, belonging to class I and is characterized as an emulsion formed of water, sediment, aliphatic and aromatic hydrocarbons, resins and asphaltenes. Among the oily sludge treatment strategies we can cite the Landfarming (LF), a technique in which the residue is incorporated into the soil under controlled conditions to promote degradation and immobilization of pollutants, through the action of micro-organisms (biodegradation). Bioremediation techniques such as bioaugmentation and biostimulation can be adopted to accelerate the process of biodegradation. The objective of this study was to evaluate the oily sludge degradation capacity from three bioremediation strategies: natural attenuation, biostimulation and bioaugmentation. The experiment was conducted during 60 days in microcosms containing 300g of LF soil. The soil pH had been previously adjusted to 6.5. 18g of oil sludge were homogenized with the LF soil, simulating an oil spill. The LF soil used in this work had been 8 months without receiving waste. The treatments were: a) LF soil without sludge (control); b) natural attenuation (LF soil + 6% of oil sludge); c) biostimulation (LF soil + 6% of oil sludge and addition of N and P); and d) bioaugmentation (LF soil + 6% of oil sludge and inoculation of a consortium of five bacteria. The CO_2 released from the microcosms was captured and determined according with Stotzky (1965). The 16 PAHs listed by the US Environmental Protection Agency (USEPA) as priority pollutants for bioremediation due to its adverse effects on health and the environment, were quantified by Gas chromatography with mass spectrometry (GC/MS). The results showed that the bioaugmentation treatment with the bacterial consortium, as well as natural attenuation (only pH adjustment and aeration) triggeredalmost 100% of the 16 PHAs degradation. The biostimulation treatment showed fewer degradation rates (0-50%). Perhaps the biostimulation with N and P have stimulated the soil organic matter degraders, but not the carbon from the contaminant added. Results show that correction of pH and aeration of the soil, associated with competent autochthone microorganisms can be used as biodegradation strategies of oily sludge in LF.

Key-words: oil sludge, bioremediation, biodegradation.

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