

DEGRADATION OF CRUDE OIL IN SEAWATER AND SAND BY MIXED BACTERIAL CULTURES

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Summary

Accidental oil spills at open sea is a common environmental problem. They lead to degradation of sea and shoreline life. In the last ten years there has been an increased interest in bioremediation using the enzymatic activity of the naturally occurring microorganisms. In this work the potential of mixed microbial cultures for biodegradation of crude oil in seawater and sand has been examined. Artificial seawater supplemented with nitrogen and phosphorus was inoculated with cultures isolated from refinery sludge. The same cultures were used for experiments in sand polluted by 5% (v/w) of crude oil. These experiments were performed in sterile and semi-natural (not sterile) conditions to see the degradation potential of isolated cultures, their growth characteristics and possible antagonisms between supplemented microorganisms and natural microflora. During the experiments the oxygen demand, number of bacteria (cfu) and optical density (OD₆₆₀) were monitored. After 14 days of cultivation, the concentration of total petroleum hydrocarbons (TPH) in all samples was measured.

All tested cultures had a potential for degradation of hydrocarbons in seawater and sand. After two weeks of experiment, loss of hydrocarbons in seawater polluted with crude oil was between 56.8% (A2 culture) and 64.4% (A1 culture). The most effective culture for bioaugmentation of seawater does not have to be the best solution for bioaugmentation of sand. In sand the best degraders in sterile and semi-natural conditions were found in the mixed cultures isolated from Corinth refinery sludge. For this culture concentration of

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hydrocarbons in sterile sand was 73.2% lower than in control sample and in non-sterile sand 70.5% lower than in control (sterile sand) without bioaugmentation. Finally, the addition of seawater and fertilizers to sand had also a positive influence on contaminants degradation by naturally occurring microorganisms (48%).

Experiments performed with different environments (seawater and sand) and under different conditions (sterilized material and semi-natural conditions) confirmed that cultures should be tested in semi-natural conditions especially when indigenous microflora can possess high degradation potential. Allochthonic cultures, very active in sterile conditions, after inoculation to natural environment can even slow down the degradation.