PETRO-1 Bioprocess

(Oil spill – « marée noire »)

Bioremediation of Heavy Crude Oil and Paraffin Contaminated Sand

Problem description

- As a result of industrial activities or oil spills, large quantities of soil and sand are contaminated with heavy crude oil and paraffins.

MADEP solution

- By the enrichment culture technique, MADEP s.a. has isolated micro-organisms that degrade aliphatic and aromatic hydrocarbons at high rates and with specificity.
- The contaminated soil is placed in piles and aerated. Hydrocarbon degrading strains of bacteria isolated by MADEP s.a. are cultivated on-site and used to innoculate the piles of contaminated sand.
- Biodegradation is further stimulated by addition of inorganic nutrients.
- The highest degradation rates are obtained when the soil is mechanically agitated.

Laboratory-scale biodegradation of a mixture of heavy crude oil and paraffins in sand

Materials and Methods:

Contaminated sand was placed in a 15 l rotating drum bioreactor. The CO_2 concentration measured in the exhaust gas is an indicator of biological activity. The initial CO_2 concentration in the exhaust gas was zero. Following addition of a suspension of bacteria isolated by MADEP, biological activity increased rapidly. The contaminant degradation rate was calculated from the CO_2 concentration measured in the exhaust gas.

Experimental conditions	**Value**
Soil type	sand
Soil mass	3 kg
Moisture	10% water
Initial heavy crude oil concentration	500 ppm
Initial paraffin concentration	1000 ppm
Temperature	21 - 23°C (unregulated)
Agitation	2 Rotations per minute for 30 minutes, one time per day
Aeration	1.6 bed volumes/hour using a perforated tube placed in the sand

Results:

Average hydrocarbon degradation rate 25 ppm/day

Maximum hydrocarbon degradation rate (sustained for 24 hours) 100 ppm/day