

HAP-2 Bioprocess

Bioremediation of Phenanthrene in Soil

Problem description

As a result of industrial activities, large quantities of soil and sand are contaminated with the very recalcitrant aromatic hydrocarbon phenanthrene.

MADEP solution

By the enrichment culture technique, MADEP s.a. has isolated micro-organisms that degrade phenanthrene at high rates and with specificity.

The contaminated soil is placed in piles and aerated. A consortium of phenanthrene degrading bacteria isolated by MADEP s.a. is cultivated on-site and used to inoculate the piles of contaminated soil.

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 phenanthrene in soil

Materials and Methods

Soil was placed in a 15 l rotating drum bioreactor. The CO₂ concentration measured in the exhaust gas is an indicator of biological activity. The initial CO₂ concentration in the exhaust gas was zero. A single carbon source, phenanthrene in the form of a fine powder, was added and the contents of the bioreactor were mixed well. Following addition of a suspension of live bacteria isolated by MADEP, biological activity increased rapidly. The phenanthrene degradation rate was calculated from the CO₂ concentration measured in the exhaust gas.

Experimental conditions

Experimental conditions	Value
Soil mass	2.24 kg
Moisture	10% water
Initial phenanthrene concentration	1000 ppm
Temperature	21 - 23°C (unregulated)
Agitation	2 Rotations per minute for 30 minutes, one time per day
Aeration	1.7 bed volumes/hour using a perforated tube placed in the soil

Results

Average phenanthrene degradation rate: 35 ppm/day

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

