

BIOREMEDIATION OF AN OIL POLLUTED BEACH

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Bioremediation of oil pollution in open systems presents several problems (BARTHA, 1990; GLASER, 1991; ROSENBERG, 1991). These include:

1. The long period required for biodegradation
2. Difficulties in making available a supply of nutrients, mainly nitrogen and phosphorus compounds, which dilute rapidly and become inaccessible.
3. The biological solutions have not been suitable for immediate emergency response.

We have been developing a novel technology for treating oil pollution in open systems - at sea, fresh water (lakes, ponds and rivers) and on beaches. The basis for this procedure is the combined use of specific bacterial strains that adhere to hydrocarbons (ROSENBERG & ROSENBERG, 1985; ROSENBERG, 1991) and a unique oleophilic, controlled-release, nitrogen and phosphorous source.

This technology was used for the bioremediation of the north beach of Haifa (30,000 m²) following an oil spill of several hundred tons of heavy crude oil. The rate of oil degradation was 0.13 mg per gram sand per day in the summer (25°C), and half this rate in the winter (less than 10°C). The major treatment took place in the winter and was completed in four months. It should be noted that the winter was unusually hard, and temperatures were around 5-10°C for a couple of months. At the end of the treatment about 90% of the oil has been degraded, and this included the heavy (up to C40) as well as the aromatic fractions of the oil.

Visual examination of the beach sand following the treatment, in addition to the analytical data described above, indicated that this technology was applicable for bioremediation of the sand, that also became light in color.

Biodegradation of hydrocarbon-contaminated sand
at Haifa beach during summer and winter

% Biodegradation Day	August		January	
	Natural	Treated	Natural	Treated
0	0	0	0	0
4	0	30		
9	18	50	11	25
14	26	77		
25	15	85	25	50
38			5	66
87			0	80
123			5	89

The initial concentration of hydrocarbon-contamination in the in the upper 10 cm of sand of the control plot was 2.3 mg/g sand and 3.8 mg/g sand in the experiment. The average standard deviation was 0.15 mg/g sand.

REFERENCES

- BARTHA R., 1990. Bioremediation potential of terrestrial fuel spills. *AEM* 56 : 652-656
GLASER JA., 1991. Nutrient-enhanced bioremediation of oil-contaminated shoreline: The Valdez experience. *In*: Hinchee RE, Olfenbittel RF (Eds) *On Site Bioreclamation* (pp 336-384). Butterworth-Heinemann, Stoneham.
ROSENBERG E., 1991. Hydrocarbon-oxidizing bacteria. *In*: Ballows, A (Ed) *The Prokaryotes* (pp441-459) Springer-verlag, Berlin
ROSENBERG M. & ROSENBERG E., 1985. Bacterial adherence at the hydrocarbon-water interface. *Oil & Petrochem Pollution*, 2 :155-162