



Canadian Environmental Protection

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Biodispersion: a viable technology for treatment of floating oil

By Satya Ganti

It has been found that as much as 30,000 tons of oil enter the seas every year. Main contributor to this pollution is the industrial sector, with 62 percent of the total volume. In an equally important manner ships contribute a 22 percent of the total volume.

The volume of waste oil present in ponds, lagoons and storage tanks has not been determined. Hence, it is difficult to compute the quantity of waste oil under various conditions. In many cases professional response contractors store oily waste in ponds and lagoons for subsequent clean-up. In one such estimate in a South American country there are about 12,000 ponds and lagoons that contain thick layers of oil. Volume of oil in such sites around the world needs to be effectively remediated.

1. Industrial waste, 2. Refineries/Terminal, 3. Natural sources, 4. Tanker operations, 5. Tanker accidents, 6. Other shipping, 7. Offshore operations.

Objectives

In view of such a vast amount of oil in the aqueous environments, there is a need to treat this pollution at source and help reduce the "hidden" overheads incurred in treating oil pollution. There is a need to develop a technology that is non-invasive, cost effective and less labour intensive. Moreover, we believe that for remediation at source to be successful the solution needs to have the following properties:

- Be fast acting - remediation should take place in days or hours and not in months.
- Not disturb the existing ecosystem.
- Be available in a ready-to-use form.
- Not require supplementary addition of nutrients.
- Require little or no human intervention.
- Contain no genetically modified bacteria.
- Be environmentally safe.

Technology

Oil is insoluble in water; thus consumption of oil by bacteria does not take place in a normal way. There are four stages of

microbial utilization of oil, namely
Dispersion: A physical process by which oil is broken down into smaller globules.
Solubilization: A biochemical process wherein the same dispersed molecules are transformed into assimilable form.
Assimilation: A metabolic process wherein the assimilated molecules are transformed into glucose.
Mineralization: Final stage where oil is finally broken down into carbon dioxide and water.

Biodispersion is thus a biological process that promotes dispersion of oil and forms an important phase of remediation. In order to achieve an effective biodispersion, a medium was developed that is oleophilic and supports growth of oil-eating bac-



The berm after six weeks' remediation



The polluted berm after spray with SpillRemed



Close-up showing oil layer over the water.

teria. It is important that the bacteria are in a physiologically active state so that the effect of the activity of bacteria starts from day zero. The oleophilic nature of the medium ensures that the bacteria are not lost in the vast mass of water. In fact, bacteria remain actively attached to oil globules and continue breakdown of oil even after dispersion.

The properties and advantages of biodispersion are as follows:

The bacteria are aerobic since the entire process of utilization of oil is achieved through oxidation.

The bacteria are maintained in an Oleophilic Suspension of Physiologically Active Bacteria Culture (OSPABC) and are thus not lost in the water.

Action of bacteria is almost instantaneous, and does not require any additional nutrients for their growth and multiplication.

Biodispersion technology has a very wide area of application in industrial and shipping segments wherever oil is in direct contact with water. An example of application in an unusual situation is given below to demonstrate the philosophy described above.

Remediation of a spill in a mine

Our company received a request for shipment of SpillRemed for treating a controlled spill contained in a lined and bermed storage area in a mine in Canada, that wanted to conduct an experiment to test the effectiveness of SpillRemed in remediating minor spills encountered in such difficult terrains. The mine, Kemess Mine, extracts noble metals and is located in a mountainous region of British Columbia.

The first step the company had taken was to absorb most of the oil by introducing an oil absorbent boom in the pond. This was a normal routine and SpillRemed was going to be used as a supplementary polishing tool. But unfortunately, the oil absorbent boom also absorbed water and sank to the bottom of the pond, releasing the absorbed oil in the process.

SpillRemed thus became the only solution available for the mine at the time, and half the content of the sample was sprayed over the spilled oil. There was no facility to



provide constant agitation to the pond in order to provide the bacteria with oxygen. In a mine located in remote areas, even this

small request becomes a major demand and the problem was resolved by using a circulating pump after a week. Atmospheric temperature was less than 0°C and it was raining. None of this looked good for any type of bioremediation type of treatment since bacteria require warmer temperatures for growth and metabolism. The result observed next day was startling in that there was a noticeable reduction or thinning of the film. There were two more applications of SpillRemed and after six weeks the water became completely clear and was discharged into the waste stream.

The entire results recorded by our customers in Kemess Mines were surprising to say the least since the product worked under most adverse conditions. The clients were satisfied since there was no need for supervision, additional labor or constant vigil to monitor the spill. The photographs give an idea of the magnitude of the problem and the simplicity of our solution.

Conclusions

Products developed on the basis of biodispersion technology contribute to improve the environment by being user-friendly and effective even under adverse conditions. These products have been shown to meet the objectives listed earlier; in some cases they exceeded our expectations as in the case of Kemess mines where SpillRemed performed under subzero temperatures.

Sarva Bio Remed, LLC

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201 - 2323 Boundary Road
Vancouver, BC V5M 4V8
Phone: (604) 291-9900
Fax: (604) 291-1906
www.baumpub.com

Lorna Barchard Editor
e-mail: lbarchard@baumpub.com

Morena Zanotto Managing Editor
e-mail: mzanotto@baumpub.com

Linda Lemieux Production Manager
e-mail: llemieux@baumpub.com

Margaret Hewitt Circulation Manager
e-mail: mhewitt@baumpub.com

Rick Laity Sales Manager
e-mail: rlaity@baumpub.com

Margaret Goh Comptroller
e-mail: mgoh@baumpub.com

Engelbert J. Baum Publisher
e-mail: ebaum@baumpub.com

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