Rhamnolipids Compositions for Hydrocarbon-Contaminated Soil Remediation

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Rhamnolipids are a class of naturally occurring glycolipid biosurfactants produced in soil microbiomes, such as those comprising *Pseudomonas aeruginosa*, and can also be produced for commercial application by fermentation processing. Numerous studies have shown these surfactants are capable of promoting hydrophobic organic compound (HOC) biodegradation in contaminated soils (*Harvey 1990, Le Floch 1999*). The literature to date highlights the dual role of Rhamnolipids in this augmentation effect. The superior surfactant properties of this class of biosurfactants (*Zhong 2015*) enable oil mobilization from the soil matrix (*Herman 1997*), with subsequent solubilization (*Zhang 1992, Shin 2004*) that can lead to enhanced bioavailability of the oil for degradation by soil bacteria (*Fenibo 2019*).

Synthetic surfactants (and solvents) are commonly used in remediation techniques such as Soil Washing, Surfactant-Enhanced Aquifer Remediation (SEAR) or in Emergency Oil Spill Response. However, their short and long term ecotoxicological impact on flora & fauna has raised significant concerns (*Mascarelli 2011*). In addition, their use in a pre-treatment step prior to bioremediation could be damaging to the indigenous populations of soil bacteria (*Shin 2006*). In this respect, Rhamnolipids can provide a unique sustainable & high-performance alternative to synthetic products. In addition to being naturally occurring surfactants, they have an excellent ecotoxicity profile, show good biodegradation in the soil (*Bustamante 2012*) and there's no strong evidence supporting cytotoxic effects of rhamnolipids (*Barhali 2018)*.

This study focuses on rhamnolipid surfactant properties in the presence of HOCs. Results of lab studies of using O_2 respirometry for monitoring the impact of rhamnolipid-assisted bioremediation will be discussed. The plans for utilizing lab-generated data for forthcoming field trials will also be presented. This research aims at identifying conditions for successful application of rhamnolipids as a sustainable and economical option for bioremediation.

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