Journal of
Bioremediation & Biodegradation

Siegert and Krüger, J Bioremed Biodegrad 2012, 3:2
DOI: 10.4172/2155-6199.1000e107

Editorial Open Access

Microbially Enhanced Oil Recovery (MEOR) can Benefit from Bioremediation

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Abstract

Bioremediation of hydrocarbon contaminated sites has a long history and great achievements were made during the last decades. However, this had too little impact on microbially enhanced oil recovery (MEOR). Now that world-wide demand for oil exceeds the supply it has become necessary to use the scientific achievements from the field of bioremediation to enhance hydrocarbon extraction from yet inaccessible resources.

Keywords: Microbially enhanced oil recovery; Oil spill; Bioremediation; Bioavailability; Biosurfactant; Oil peak

Steady supply of petroleum is required to maintain our comfortable lifestyle. This has lead to conflicts between nations competing for this resource. Burning fossil fuel and spilling hydrocarbons cause harm to our natural environment and so we have to find ways to minimize the adverse effects of using oil and other liquid fossil fuels. During decades of research on microbial oil degradation we have discovered and proven viable strategies to clean up oil spills-albeit incomplete. An enormous amount of literature investigating microbial hydrocarbon degradation in terms of spill treatment has accumulated, but an important aspect of the ability of microbes to degrade this material has unfortunately received insufficient attention by the scientific community.

Microbes not only help us to clean up hydrocarbon contamination, they can also help us to increase oil production from unproductive oilfields. This biotechnological process is called microbially enhanced oil recovery (MEOR).

In the same way that microbiologists and environmental scientists have demonstrated bioremediation of contaminated sites we may be able to help maintain a steady oil supply to our world while other energy resource are being developed. That is, the capability of microbes to utilize oil compounds as their carbon source can be useful to increase oil production from oil fields harboring large amounts of petroleum that can be difficult to extract. Great efforts have been made on both sides MEOR research and bioremediation to solve their relevant problems. MEOR investigators have followed a more applied strategy, resulting in a lack of understanding in bio-geochemical processes leading to oil displacement. Now time has come to look beyond just one single application and see how cooperation can lead to more synergistic effects. Both fields address the same problems like bioavailability, toxicity, kinetics and metabolism. Unfortunately, in part due to the different funding sources (public on the bioremediation side and private investors for MEOR), the studies are reported with two different publishing cultures. Peer reviewed literature is well available for biodegradation and bioremediation, but reports and conference proceedings are preferred on the MEOR side. The reluctance of industry to employ a technology that is based on unreliable literature is understandable and it is the responsibility of principle investigators to make their results withstand peer-review. At the same time, peer-reviewed literature reporting environmental effect of oil spills is often ignored by the industry as it is natural for profit oriented enterprises to focus, well, on profit. The environmental scientist on the other side is often driven by a credo of benefiting mankind through research and therefore he may be reluctant to support the oil industry through applied research in that field. Good reasons for this reluctance are easy to find. However, the interrelation between diminishing petroleum resources and flare-ups of social conflicts are less obvious than the oil slick in the Gulf of Mexico and elsewhere. While it is natural that oil firms are interested in profit, this should not deceive our perception of the need for oil in the developing world. Indeed, a number of studies have demonstrated that it is possible to slow down the decrease of oil supply from oilfields that have been considered to be exhausted [1].

Research on the biodegradation and bioremediation of oil contaminated sites can contribute a valuable knowledge resource to MEOR when the right questions are being asked: what are the factors that enable microbes to make oil bioavailable? How can we benefit from the bioavailability without sacrificing too much oil carbon to the microbial communities? Unlike cleaning up contaminated sites, a complete mineralization of the oil is not desired in MEOR. Which are the adverse effects of microbial action in the oilfield and how can we counteract? The questions of MEOR research are different but the answers may be similar to those of the bioremediation field and better cooperation between these groups will lead to more successful outcomes in both areas.

References

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Received February 20, 2012; **Accepted** February 22, 2012; **Published** February 24, 2012

Citation: Siegert M, Krüger M (2012) Microbially Enhanced Oil Recovery (MEOR) can Benefit from Bioremediation. J Bioremed Biodegrad 3:e107. doi:10.4172/2155-6199.1000e107