10th Quarterly Report (No-Cost Extension)

Paraffin Control in Oil Wells Using Anaerobic Microorganisms

Period Covered by the Report: January 16, 2008 to April 15, 2008
Date of Report: May 21, 2008
EPA Grant Number: X83-2428-01
Title: Paraffin Control in Oil Wells Using Anaerobic Microorganisms
Investigators: J. M. Suflita and L. M. Gieg
Institution: The University of Oklahoma
EPA Project Officer: Bala Krishnan
Project Period: 10-16-07 to 10-15-08 (Year 3)
Project Amount: No-cost extension
Research Category: Petroleum Environmental Technology, Wellbore Cleanout

Objective(s) of the Research Project:

Paraffins that form waxy deposits upon removal from reservoirs have been implicated in numerous oil field problems leading to reductions in oil recovery. In oil reservoirs, anaerobic conditions usually predominate. Thus the addition of anaerobic microbial populations that can definitively biodegrade paraffins under such conditions may be of great use to treat wax accumulations. For this project, our aim was to evaluate the feasibility of using anaerobic microbial consortia to biodegrade waxy hydrocarbons in order to treat paraffin accumulations in oil reservoirs.

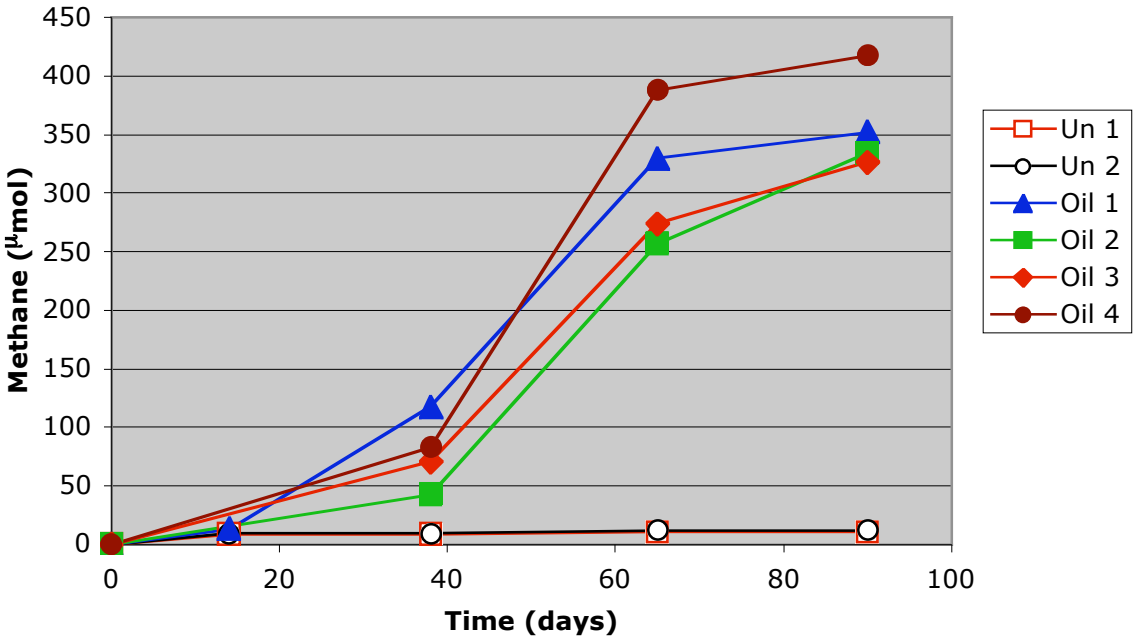
Progress Summary/ Accomplishments:

In the previous report, we showed that anaerobic populations enriched from gas condensate-contaminated aquifer sediments on long-chain paraffins produced enhanced levels of methane and consumed enhanced levels of sulfate relative to controls. During this reporting period, we transferred the active cultures into fresh medium under conditions of methanogenesis (no added electron acceptor) and sulfate reduction (sodium sulfate supplied at ~ 10 mM). Transfers were amended with another aliquot of field paraffins and the experiment also included paraffin-free controls. After about 6 weeks of incubation, only a few cultures are showing enhanced levels of methane production relative to controls. Sulfate analysis is underway. More incubation time is needed to further assess the activity of the transferred cultures. Method development for high temperature GC analysis is also currently underway in order to measure the paraffins remaining in the previous incubations.

In our last report, we described the establishment of sulfate-reducing and methanogenic enrichment cultures from two Alaska North Slope oilfield production water samples on a variety of different paraffinic substrates at 55°C. Methanogenesis appeared to be the preferred electron-accepting process in the initial incubations for both of the production water samples. Upon transferring these cultures into fresh medium containing paraffinic crude oil, enhanced methanogenesis ensued in enrichments derived

from one of the production water samples relative to substrate-unamended controls, shown in Figure 1. These cultures will be further transferred and analysis of the remaining oil fraction will determine which hydrocarbons have been consumed by the methanogenic consortium.

Figure 1. Methane production by a methanogenic consortium incubated with a paraffinic oil under thermophilic conditions. Closed symbols indicate methane production in oil-amended replicates and open symbols indicate that from oil-free controls.



Publications/ Presentations:

Gieg, L. M., Duncan, K. E., Suflita, J.M. 2006. Anaerobic Paraffin Biodegradation. *In:* Abstracts of the 11th International Symposium on Microbial Ecology, Vienna, Austria, August 20 - 25 (poster presentation).

Gieg, L.M., Davidova, I.A., Duncan, K.E., Suflita, J.M. 2007. Paraffin Control in Oil Wells Using Anaerobic Microorganisms. Oral presentation at the 14th IPEC Meeting, Houston, TX, November 6 – 9.

Future activities:

This project is continuing as a no-cost extension. Maintenance and monitoring of all enrichment cultures capable of utilizing paraffinic substrates are ongoing as is method development to assess alterations of paraffin composition and metabolites analysis.

Supplemental Keywords: paraffin treatment, anaerobe, biodegradation, oilfield reservoir

Relevant Web Sites: Not applicable at this time.