

# 1<sup>st</sup> Quarterly Report: Paraffin Control in Oil Wells Using Anaerobic Microorganisms

**Period Covered by the Report:** October 15, 2005 to January 15, 2006

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**EPA Grant Number:** X83-2428-01

**Title:** Paraffin Control in Oil Wells Using Anaerobic Microorganisms

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**Institution:** The University of Oklahoma

**EPA Project Officer:** Bala Krishnan

**Project Period:** 10-15-05 to 10-14-06 (Year 1)

**Project Amount:** \$149, 298

**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 can be of great use to treat wax accumulations. Our aim is to evaluate the feasibility of using anaerobic microbial consortia to biodegrade waxy hydrocarbons in order to ameliorate paraffin accumulations in oil reservoirs.

**Progress Summary/ Accomplishments:** To date, we have begun to enrich for microbial populations from a variety of sources capable of degrading waxy paraffins under anaerobic conditions. Enrichment cultures derived from hydrocarbon-contaminated marine sediments have shown enhanced levels of sulfate reduction in the presence of C<sub>28</sub>, C<sub>40</sub>, or C<sub>50</sub> provided as a substrate relative to substrate-free controls. Initial molecular analysis of these mixed, sediment-free enrichment cultures have revealed the presence of several sulfate-reducing bacteria, some of which are closely related to known anaerobic hydrocarbon degraders. We have also established incubations using anaerobic sediments from a hydrocarbon-impacted aquifer to determine the ability of the microbial population to utilize a high molecular weight paraffin mixture (~ C<sub>30</sub> to C<sub>100</sub>) under sulfate-reducing and methanogenic conditions. These sediments are already known to be capable of utilizing alkanes up to C<sub>34</sub> in length under anaerobic conditions. Further, we established similar incubations using a known residual oil-degrading methanogenic population as the inoculum. These latter two experiments are in progress and data collection is ongoing.

**Publications/ Presentations:** An Abstract describing the activity and microorganisms present in the C<sub>28</sub> to C<sub>50</sub>-degrading enrichment culture will likely be submitted for presentation at the International Symposium for Microbial Ecology (ISME) to be held in Vienna, Austria in August, 2006.

**Future activities:** Enrichment and monitoring of the above-described cultures for the ability to degrade waxy paraffins under anaerobic conditions is ongoing. Experiments

will be conducted to determine the nutritional requirements of some of the enrichment cultures to improve growth. More detailed molecular analyses will continue to identify the organisms predominantly responsible for anaerobic paraffin biodegradation.

**Supplemental Keywords:** paraffin treatment, anaerobe, biodegradation, oil field reservoir

**Relevant Web Sites:** Not applicable at this time.