

2nd Quarterly Report:

Paraffin Control in Oil Wells Using Anaerobic Microorganisms

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Title: Paraffin Control in Oil Wells Using Anaerobic Microorganisms

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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: We are continuing 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 C₂₈, C₄₀, or C₅₀ 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 also recently established incubations using anaerobic sediments from a hydrocarbon-impacted aquifer to determine the ability of the microbial population to utilize a commercially-available, high molecular weight paraffin mixture (Polywax 655, containing~ C₃₀ to C₁₀₀, Supelco) under sulfate-reducing and methanogenic conditions. These sediments are already known to be capable of utilizing alkanes up to C₃₄ in length under anaerobic conditions. Further, we established similar incubations using a known residual oil-degrading methanogenic population as the inoculum. Measurements to date have shown some enhanced levels of sulfate reduction in the sulfate and Polywax-amended incubations relative to substrate-free controls. No enhanced methane production has been observed to date, but this experiment continues to be monitored. We have also recently established some sediment-free enrichment cultures derived from marine sediments under methanogenic conditions in the presence of a variety of paraffinic substrates. These enrichments also continue to be monitored for enhanced levels of methane production relative to controls.

Publications/ Presentations: An Abstract describing the activity and microorganisms present in the C₂₈ to C₅₀-degrading enrichment culture was accepted as a poster 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 will be 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. Paraffin samples will be collected from the paraffinic reservoirs and will be used as substrates for some of the promising anaerobic paraffin-degrading enrichments described above.

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

Relevant Web Sites: Not applicable at this time.