BIOTREATMENT OF SYNTHETIC DRILL-CUTTING WASTE

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Oil and gas drilling operations create drill-cutting wastes at many sites around the world, and an effective means of disposing of these wastes is biological treatment. Drill cutting waste material includes synthetic drill fluids, which typically consist of petroleum-based compounds mixed with clay-like materials and water. Biological treatment is an effective means of disposing of drill cutting wastes, but proper biodegradation conditions are critical. In this research biological treatment of drill cutting wastes (rock chips and drilling fluids) collected from a drilling site in Southeast Asia was examined using a variety of amendments to study the effect of different conditions on the biodegradability of synthetic drill cutting wastes. Amendments evaluated included native soil as a bulking agent and source of inoculum, rice hulls as a bulking agent to improve aeration and urea as a source of nitrogen fertilizer. Microcosms were incubated in a controlled environment to mimic the dry season of the field site. The rate and amount of hydrocarbon biodegradation was evaluated using gas chromatography (GC) analysis of total petroleum hydrocarbon (TPH) concentration of each microcosm. Microcosms were sampled every 30 days for a period of 4 months. All microcosms were maintained with 15-20% moisture and kept at 30oC (average temperature at the site).

Results showed that maximum biodegradation occurred with a 1:1 mixture of soil and drill cuttings that contained 1% urea and 10% rice hulls. Biodegradation proceeded with a half-life of about 30 days under these optimal conditions. After 4 months, 91% of the TPH was biodegraded under optimum conditions. Little or no biodegradation was observed for drill cuttings without amendments suggesting addition of soil bulking agent and fertilizer is essential. No decrease in TPH concentration was observed for a control with 1% sodium azide, indicating that observed decreases in TPH under optimum conditions was due to biodegradation alone. No volatilization was observed under the conditions of this experiment. A separate volatilization experiment in open containers showed evaporation could contribute significantly to TPH loss in the field.