

US EPA ARCHIVE DOCUMENT

Abstract title: Anaerobic Biodegradation of Vegetable Oil by Freshwater Sediment Bacteria

Abstract:

An innovative response alternative for vegetable oil spills that is based on sedimentation of floating oil by clay-oil flocculation followed by anaerobic biodegradation in the sediments is currently under investigation. In bench-scale experiments, floating canola oil could be completely transferred to the sediment compartment by addition of a sufficient mass of clay. Canola oil could be completely mineralized in anaerobic sediment microcosms, but its biodegradation appeared to be transiently self inhibitory, probably due to the release of free fatty acids, under methanogenic conditions when the initial oil concentration was high. Several factors that were expected to reduce the toxicity of free fatty acids were investigated using a full-factorial experimental design to determine whether they affected the rate and/or extent of oil biodegradation: ferrous iron and calcium were both expected to reduce fatty acid toxicity by formation of insoluble complexes and clay can reduce their toxicity by adsorption. Surprisingly, anaerobic vegetable oil biodegradation was inhibited in the presence of calcium, especially when clay was also present, whereas ferrous iron and clay-alone or in combination-had no effect or were stimulatory. In addition, the toxicity of the microcosm sediments were investigated using the solid-phase Microtox assay: the toxicity of the sediments increased during the initial stages of anaerobic biodegradation, but returned to the level of unsoiled sediments after biodegradation was complete.

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