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Effects of Interfacial Tension and Viscosity on Sedimentation of Vegetable Oil by Clay

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Although vegetable oils are not acutely toxic in the conventional sense, spills of these materials onto surface water bodies can have many harmful effects, including the oiling of aquatic birds and mammals, depletion of water-column dissolved oxygen, and the formation of toxic products. Since most of the harmful effects of vegetable oil spills occur while the oil is floating on the water surface or suspended in the water column, this research is investigating a spill response alternative that involves sedimentation of the floating oil with dense minerals, such as clay, that can interact with the oil to form oil-mineral aggregates that are more dense than water. Previous research has shown that nearly complete sedimentation of floating canola oil can be achieved by addition of a sufficient quantity of high-surface-area montmorillonite clay and that the efficiency of oil sedimentation was higher in oil with higher concentrations of free fatty acids. Increasing the concentration of free fatty acids is expected to decrease the oil-water interfacial tension and the viscosity of the oil. Both of these properties can vary with the degree of processing that has occurred before a spill and the extent of weathering that occurs afterward. The effects of interfacial tension and viscosity on oil sedimentation efficiency will be determined using mixtures of canola oil with free fatty acids and fatty acid methyl esters. The fatty acid methyl esters, which decreased the oil viscosity but not the oil-water interfacial tension, had no effect on oil sedimentation efficiency. The effects of free fatty acids, which are expected to affect both properties, are currently under investigation.