Polysorbate-80/Lecithin Mixtures

As possible alternative Oil Spill Dispersants

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The Deepwater Horizon Oil Spill of 2010 led to the release of nearly 5 million barrels of crude oil into the Gulf of Mexico. To treat the spill, approximately 2 million gallons of a chemical dispersant (or surfactant) package were used to disperse the oil into the ocean. Dispersant application is the most widely used method for treating oil spills because it yields oil droplets dispersed in water that can be biodegraded by naturally-occurring marine bacteria. However, there is growing evidence that conventional dispersant packages such as Corexit 9500A, which was used in the Deepwater spill, may be toxic to marine life and pose safety risks to coastal communities. The concerns relating to conventional dispersant packages highlight the need to develop environmentally friendly and effective dispersants to treat future oil spills. This study characterizes the dispersion efficiency of mixtures of polysorbate-80 and lecithin dissolved in ethanol or dispersed as aqueous micellar solutions. These two surfactants were chosen due to their applications in the food and pharmaceutical industry, their proven capabilities in forming stable emulsions, and the fact that both surfactants are environmentally friendly and have no known hazardous effects. Dispersion efficiency has been examined using baffled flask tests with synthetic seawater and Pennsylvania crude oil (used as a model crude oil) as a function of the dispersant or surfactant to oil ratios and the dispersant concentration. Our results show that an optimized polysorbate-80 + lecithin dispersant solution is capable of matching the initial dispersion effectiveness of Corexit 95000A. The findings obtained in this study will help to better understand the mechanisms of polysorbate-80/lecithin emulsification, and to determine the optimal concentration of the environmentally friendly dispersant system for crude oil.