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Effectiveness of Three-Surfactant Dispersants in Oil Spill Remediation

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The accidental release of natural crude oil into our marine waters and its subsequent effect on the environment is one of the major problems that the environmental protection agencies of most countries worldwide have to deal with. The application of chemical dispersants is one of the few feasible response measures for minimizing the impact of a large oil spill at sea. Effective use of dispersants can accelerate oil biodegradation by naturally occurring microorganisms and prevent the oil spill from coming ashore and damaging sensitive coastal ecosystems. The EPA requires that, for a chemical dispersant to be used in oil spill remediation, it should be able to disperse at-least 50±5 % of the oil in a laboratory test. In view of this, there is the need to look into the way traditional dispersants are formulated in order to optimize their dispersion effectiveness. To increase dispersant efficiency, three-surfactant dispersant formulations are being studied for their potential effectiveness in crude oil dispersion. In this study, the effectiveness of oil dispersion using the surfactant dioctyl sodium sulfosuccinate (DOSS), which is anionic, TWEEN 80 and TWEEN 85, which are nonionic, and lecithin, which is zwetterionic, was compared by delivering the surfactant from liquid solvents using the EPA's baffled flask procedure. Liquid delivery of the surfactants was accomplished by dissolving the surfactants in propylene glycol. The dispersion effectiveness of the DOSS, TWEEN 80, TWEEN 85 and lecithin was compared with the binary mixtures; DOSS-TWEEN 80, DOSS-TWEEN 85, DOSS-lecithin, TWEEN 80-lecithin, TWEEN 85-lecithin and the ternary mixtures; DOSS-TWEEN80-lecithin and DOSS-TWEEN85-lecithin. Preliminary results showed that, the dispersion effectiveness of DOSS was 65.8 % at DOSS-to-oil ratio (DOR) of 10 mg/g and that of TWEEN 80 was 65 % at TWEEN 80-to-oil ratio (TOR) of 10 mg/g. The main objective is to examine how the dispersion effectiveness of the formulated dispersants can be optimized by varying the ratios of the various surfactants, how the anionic, nonionic and zwetterionic surfactants interacts with each other and to generate a ternary diagram for the dispersion effectiveness of the three-surfactant dispersants.