Optimizing Aquatic Oil Spill Clean Up: Oil Viscosity and Ferrofluid Composition

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In 2024, over 10,000 tons of oil were spilled into the ocean, damaging the environment and costing billions of dollars in mitigation efforts. This project is a continuation of previous research that found that magnetizing oil using ferrofluid is an efficient method for oil cleanup. In 2019, a study found that, in low concentrations, ferrofluid was not toxic to marine organisms. This year's research assessed the efficacy of different compositions of ferrofluid in magnetizing oils of various viscosities to clean up aquatic spills. Different ferrofluid compositions were created (unmodified ferrofluid, ferrofluid+iron, ferrofluid+surfactant) and added to oils of various viscosities (low, medium, high). A novel method of separating oil from water via magnetization was used to clean up these simulated spills. Over 120 trials were conducted. Mean percent changes in mass of oil were analyzed using an Analysis of Variance Test and Tukey's Honest Significant Difference Test. Current oil spill remediation methods only recover 2-6% of oil involved in oceanic spills, compared to =30% of oil removed using all ferrofluid compositions tested. When ferrofluid was repeatedly introduced to oil-water samples, it removed over 90% of the oil, regardless of oil viscosity. The unmodified ferrofluid solution was most effective in magnetizing oil to clean up oil spills. A novel solution to implement the use of ferrofluid into aquatic ecosystems was designed and tested. This practical prototype was effective in removing =70% of oil. These findings are environmentally revolutionary, with the potential to reduce damage to marine ecosystems globally.

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