CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

S1107

Project Title

The Extraction of Oil from Oceanic Areas Using Ferromagnetic Fluids

Abstract

Objectives/Goals

We plan to effectively harvest oil from an aquatic environment by synthesizing a ferrofluid. We will achieve this goal by synthesizing ferrofluid, a liquid that is magnetized in the presence of a strong magnetic field. Ferrofluid is a magnetic material and oil bonded together, so by placing a magnet near the ferrofluid, the magnet will attract the magnetic material and oil to the magnet, and the solution is extracted through this process.

Methods/Materials

We began our first step by making magnetite, a natural ferrimagnetic mineral in nature. To make magnetite, we added 10 mL of PCB etchant and 10 mL of distilled water into a beaker. We than added a steel wool to the solution. This made a solution called ferrous chloride. We filtered the solution, and added another 20 mL of PCB etchant to the solution. We added 150 mL of ammonia, and magnetite falls out of the solution. We heated the solution and coated the magnetite with oleic acid, a surfactant. A surfactant is used to lower surface tension, and it will stop the magnetite from clumping. Once the oleic acid bonds with the magnetite, oil is added to the solution. The oil represents the actual oil in oil spills. The magnetite will separate form the water and bond to the oil. There will be two solutions in the beaker, one solution is an aqueous solution of water and ammonia, the other solution is the ferrofluid.

Results

In our four experiments, we were only partially successful. Our first trial failed because we failed to create magnetite. In our second, third, and fourth experiments, we successfully made ferrofluid, but the solution was not extremely magnetic. Our second experiment was the best because half of the solution we made was strong ferrofluid.

Conclusions/Discussion

We discovered that many of our problems lies with the materials we used to make ferrofluid. The materials had to be new, and we had to work quickly so our substances would not go foul. We were only able to make weak ferrofluid, and we believe the ferrofluid is weak because the oleic acid did not coat the magnetite properly. The oleic acid coats the magnetite because it has a polar head and a non-polar head. Non-polar substances such as oil only attract to other non-polar substances. Water is a polar substance, so water and oil will not mix. The oleic acid's non-polar head should bond to the oil, and the polar tail should bond to the magnetite.

Summary Statement

Our project is focused on removing oil from oceanic areas by bonding magnetite to the oil and removing it as ferrofluid.

Help Received

Special thanks to Mrs. Messenger and Mr. Burns, my chemistry and physics teacher, for analyzing the problems we ran into.