An Analysis Into the Removal of Microplastics From Water Using Oil-Based Ferrofluids

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Plastics are everywhere, and have become one of the most useful, yet harmful products utilized worldwide. Over time, plastics break down into smaller microplastics that pose potential physical and toxicological risks to organisms that can spread throughout ecosystems. Current methods for extracting microplastics either fail to extract smaller particles, are not cost or energy efficient, or harm beneficial aspects of the environment. However, microplastics suspended in water can be extracted using ferrofluids, or fluids containing a magnetic suspension, when infused with non-polar fluids such as oils and attracted by a magnetic field. The purpose of this project was to explore the effectiveness of ferrofluids based on mustard, canola, and vegetable oil in extracting the six most common plastics. It was hypothesized that oil-based ferrofluids would remove a greater amount of microplastics from water than if they were not used, and of them, mustard-oil-based ferrofluids would remove the greatest amount of microplastics due to their high toxicity and viscosity and low percentage of oleic acid. Samples were taken from suspensions of each microplastic in water as controls, which were subsequently and treated separately by each ferrofluid. The samples underwent microscopy and analysis via ImageJ software for their extraction rates. The results were proven statistically significant, and showed a significant increase in extraction rate over control groups. While all oils were successful to a similar degree, canola oil created the most successful ferrofluid overall, supporting the generalization that oil-based ferrofluids between the extremes regarding toxicity, viscosity, and percentage of oleic acid are the most successful at extracting microplastics suspended in water.

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