Evaluating Nano-Ferrofluid as a Technique for Microplastic Removal in Water

Lu, Katie (School: Central High School)

Microplastics, plastics under 5 millimeters in diameter, are becoming an increasingly problematic aspect of water pollution for both humans and the environment. There is an estimated microplastic presence in 83% of tap water worldwide with up to 94% in the United States. Due to their small size, microplastics are also able to circulate oceans and harm marine organisms on both physical and chemical levels. Currently, there are no feasible large or small-scale options to remove microplastics from water that are both effective and economical. Nano-ferrofluids have proven effective at removing oil spills from water and could be adapted to filter out microplastics. This investigation examined two types of nano-ferrofluid, magnetite and cobalt ferrite, to evaluate their feasibility in removing microplastics from water. The five most common types of plastic (HDPE, PP, PETE, PS, and LDPE) were tested. Twenty-milliliter samples of 5 g/L microplastic suspensions with .5 mL of added vegetable oil and varying amounts of ferrofluid were analyzed with microscopy to determine plastic removal. The results found significant plastic removal for both types of ferrofluid, with an average removal of 96.8% ± .42% for magnetite and 94.9% ± 0.58% for cobalt ferrite. All five plastics tested had similar removal rates, meaning that this removal technique does not rely on the type of plastic. This method of microplastic removal shows potential on both commercial and industrial levels, with possible applications in a variety of settings from household appliances to large-scale water treatment facilities.

Awards Won:

First Award of $3,000

Intel ISEF Best of Category Award of $5,000