Acoustic Filtration: Harnessing Ultrasonic Technology for the Streamlined Removal of Microplastic Particles From Water Flow

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Microplastics have become a prevalent global environmental issue, with an estimated 75 trillion microplastics in the oceans today. MPs pose dangers to wildlife and cause serious health issues for humans. Existing microplastic removal methods are limited because of high expenses or potentially hazardous chemicals; consequently, a non-invasive, energy-efficient, and cost-effective solution is necessary. In this project, a novel ultrasound filtration system was constructed with piezoelectric transducers attached to steel tubes, which were connected with silicon tubing. When suspended microplastics were pushed through the device, the ultrasound's acoustic radiation force prevented particles from passing, producing microplastic-free water. One-stage filtration of polyethylene yielded efficiencies between 84-94% with water flowing at rates of 10, 20, and 40 mL/minute; two-stage produced 94-96% efficiencies for the same flow rates. Cross-comparison using polyurethane and polystyrene had similar results, producing efficiencies greater than 95%. Additionally, when compared to a one-stage system of bigger diameter, it was found that smaller tubes had better filtration. The device was also tested on its ability to handle laundry water rinsed with polyester fabric and microplastic build-up from highly concentrated or large volumes of water, which it successfully filtered. A CFD simulation was created to mimic real-life applications and verify results. While future refining is needed, this new acoustic filtering approach is the first-of-its-kind, safely and effectively filtering microplastics through ultrasonic technology. With its robust abilities of intercepting source pollution and cleaning contaminated waters, its application can be extended to remove other particle pollutants.

Awards Won:

First Award of $5,000

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