PLASTICS LAND TO SEA

A microfluidic approach for label-free identification of small-sized microplastics in seawater

Liyuan Gong[1], Omar Martinez[1], Pedro Mesquita[1], Yang Xu[2], Yang Lin[1]

[1]Department of Mechanical, Industrial & Systems Engineering, University of Rhode Island, Kingston, RI 02881
[2]Department of Computer Science, San Diego State University, San Diego, CA 92115

Marine microplastics emerge as a growing environmental concern due to potential harm to marine biota. The large variations in physical and chemical properties make sampling and characterization of small-sized microplastics a challenging task. Here, we propose a novel microfluidic approach that allows for streamlining the trapping and identification processes of microplastics in surface seawater in a label- free manner. Models including support vector machine (SVM), random forest (RF), convolutional neural network (CNN) and residual neural network (ResNet34) are studied to evaluate identification performance of 11 common plastics. Among them, the CNN method outperforms the others and achieve an accuracy of 93% and a mean area under the curve (AUC) of 98±0.02%. Finally, we prove that the trapping and identification of microplastics smaller than 45 µm can be achieved in miniaturized devices. Overall, the proposed approach promotes efficient sampling and identification of small-sized microplastics, potentially benefiting imperative long-term monitoring and treatment.