

Detection and Identification of Microplastics Using Flow Imaging Microscopy



A Promising New Method for Microplastics Analysis

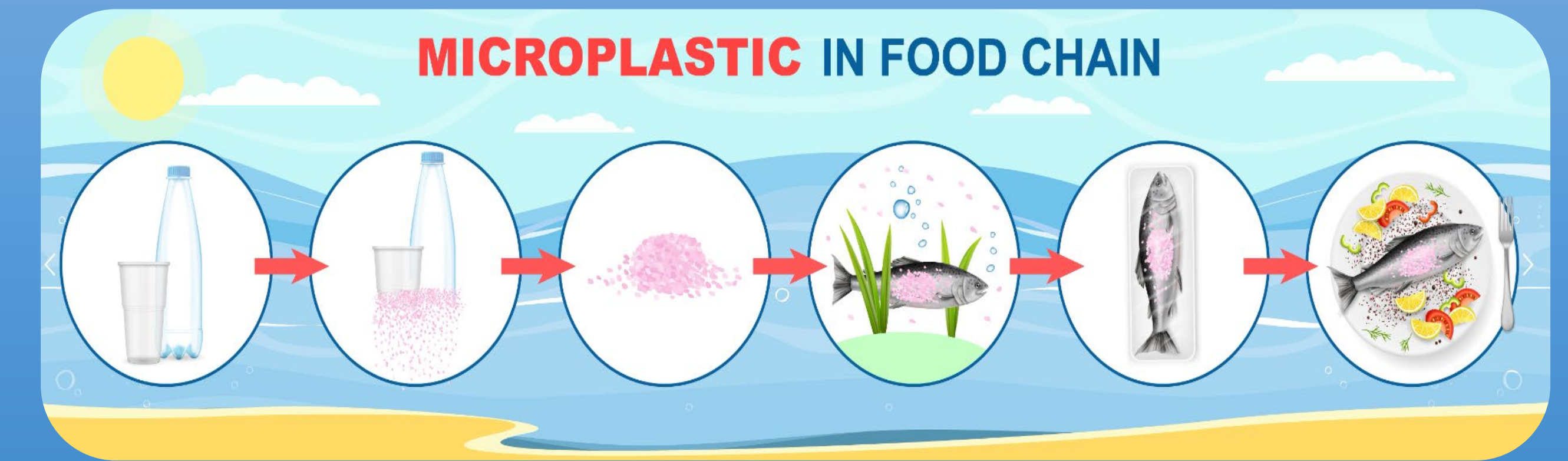
Polly Barrowman, Louise Brogan, Darin Fogg | Yokogawa Fluid Imaging Technologies, Inc.



Introduction

Plastics have endowed society remarkable advancements from medicine and transportation to electronics and consumer goods. Their low cost, versatility, and durability have fundamentally reshaped modern life.

However, the persistence of plastic litter in the world's oceans, lakes, and land-based resources is threatening natural habitats—endangering animal life, the food chain, and public health.



Materials & Methods

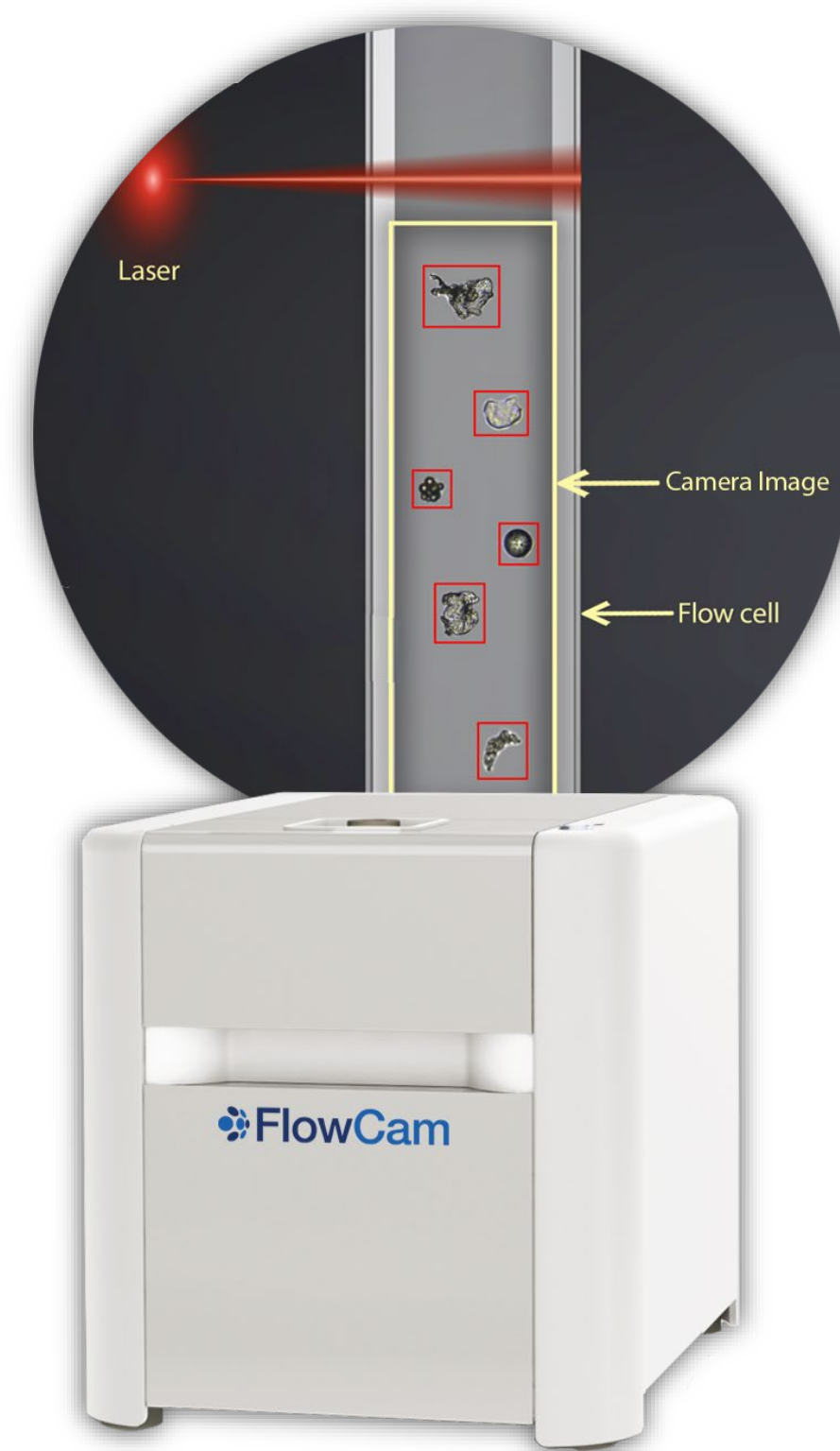
In this study, we set out to understand the capability of flow imaging microscopy (FIM) to detect and identify microplastics (MPs), using plastic particles ranging from 5 μm to 50 μm and Nile Red (NR) as a fluorescent stain.

Experimental Design:

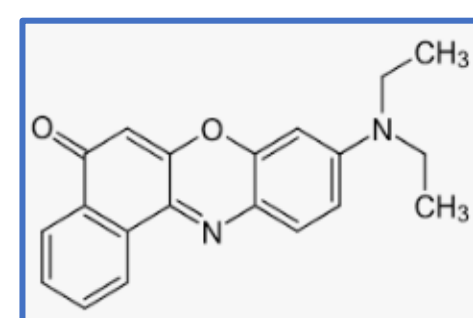
1) 5 mg purified polymer (1-50 μm)



4) Analyze with FlowCam in Autolmage & Trigger Modes



2) Add NILE RED in 25% Acetone
Incubate for 45 min at room temp

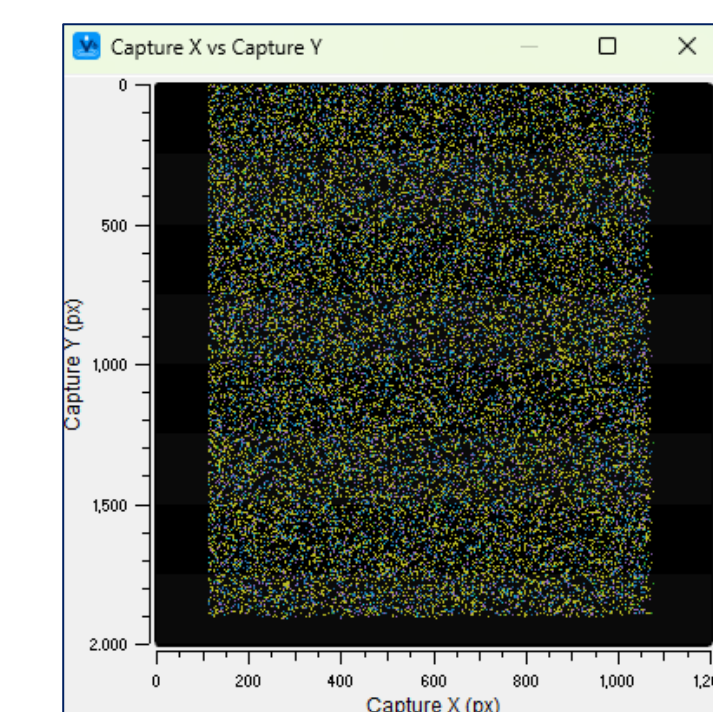


3) Strain to remove excess dye



Negative Controls Show No Auto-Fluorescence

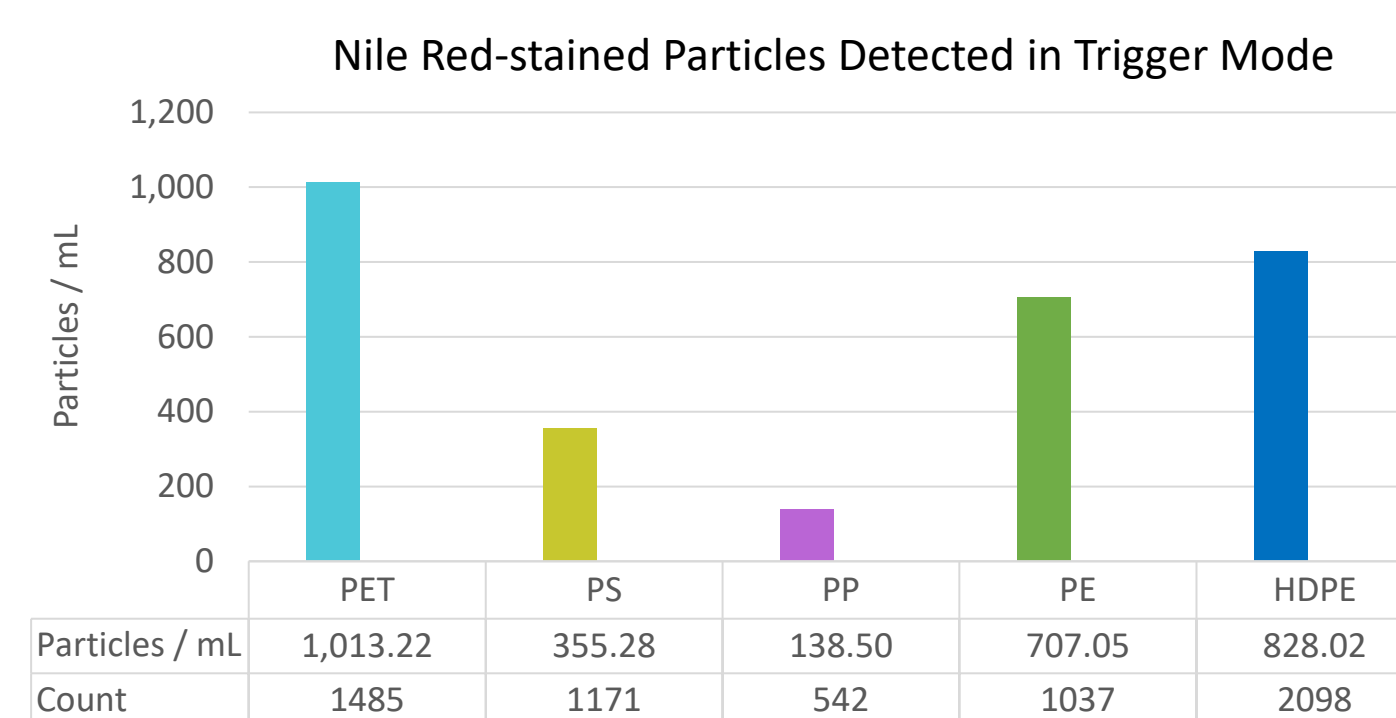
	Autolmage Mode					Trigger Mode				
	PET	PS	PP	PE	HDPE	PET	PS	PP	PE	HDPE
Count	1145	15237	1324	4107	6062	0	0	0	0	0
Particles/mL	3260.27	43367.20	3767.53	11684.24	17246.12	0	0	0	0	0



Autolmage Mode shows the presence of particles in each sample.

Unstained microplastics are not detected in Trigger Mode. *No autofluorescence.*

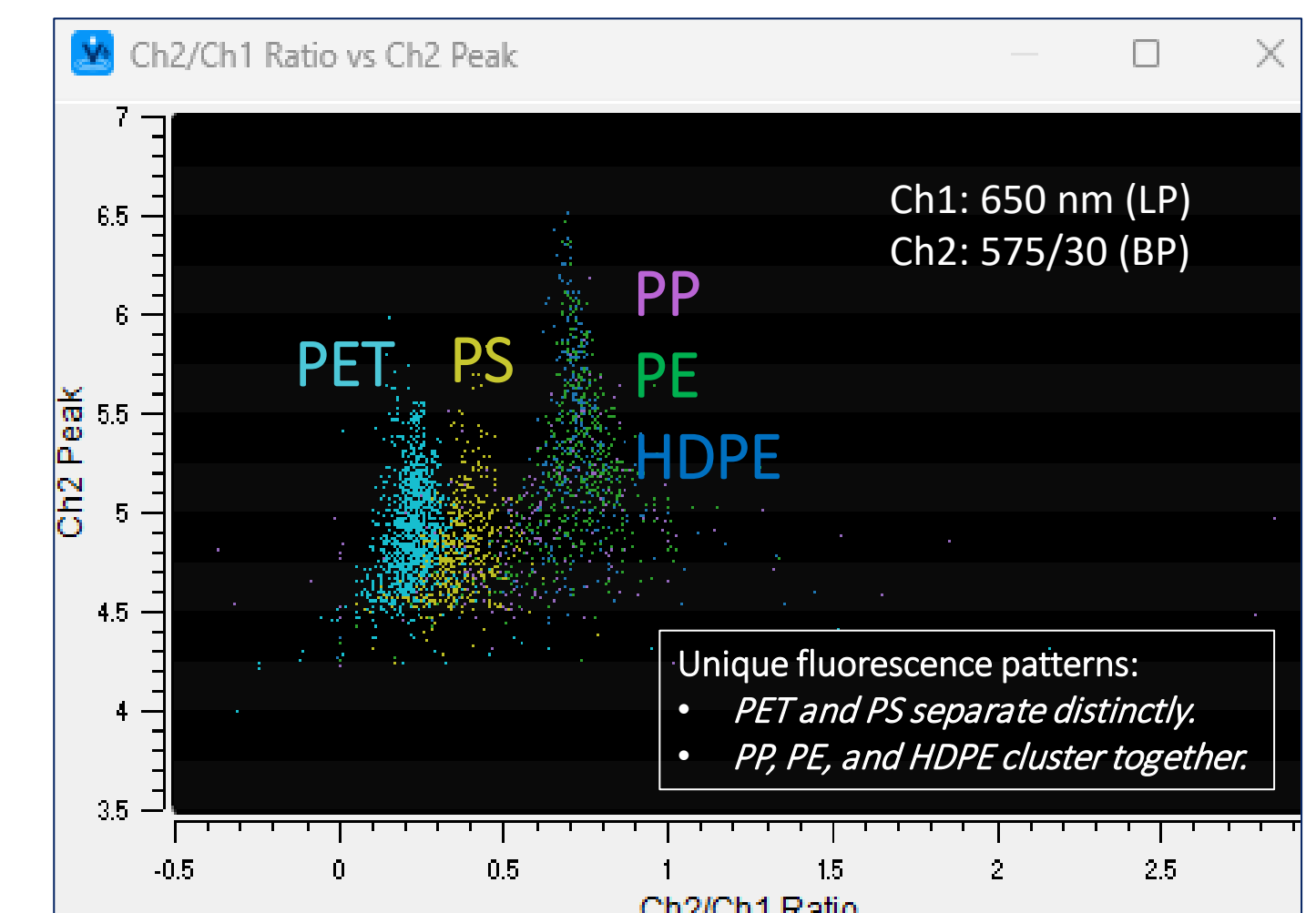
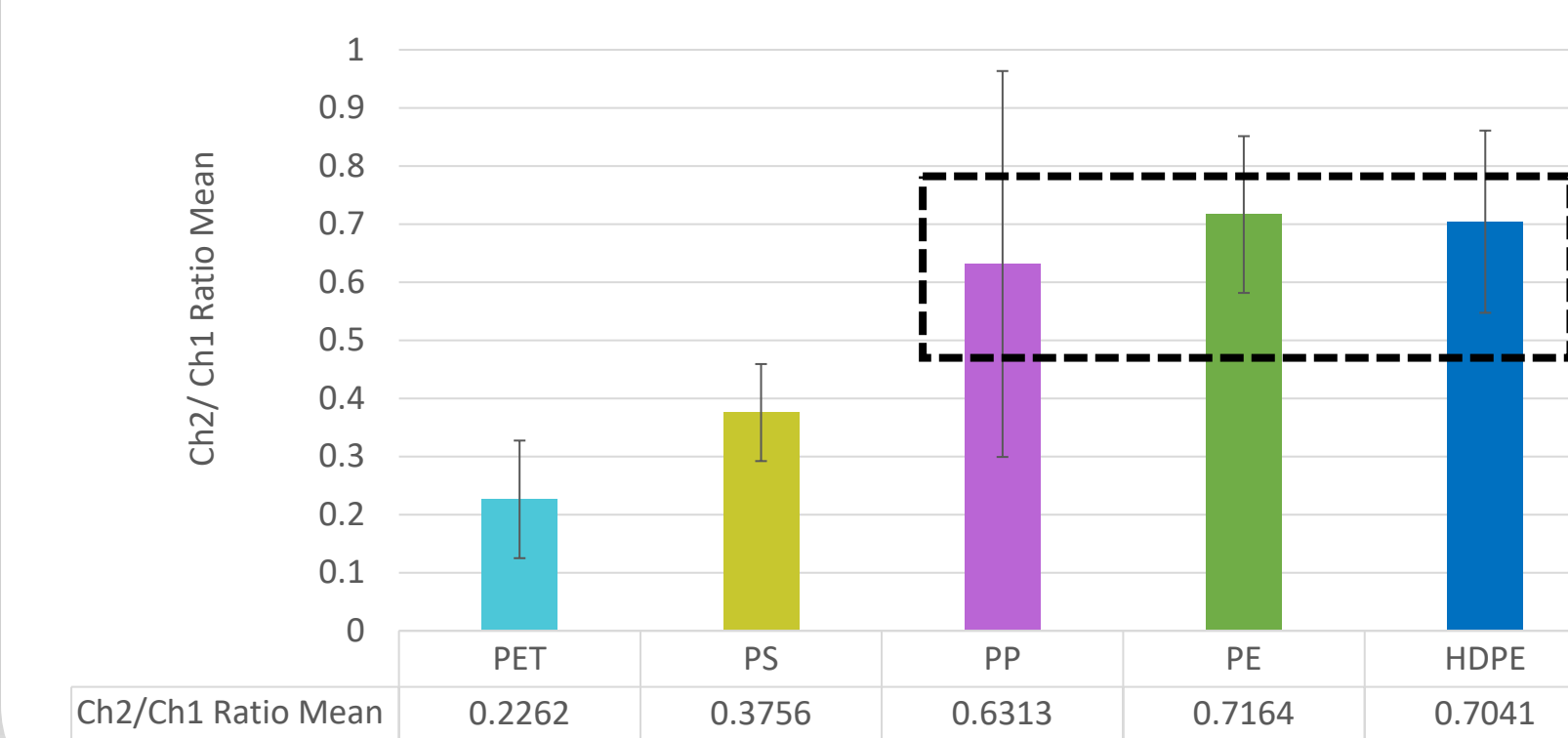
NR-Staining Efficiency Differs Across MPs



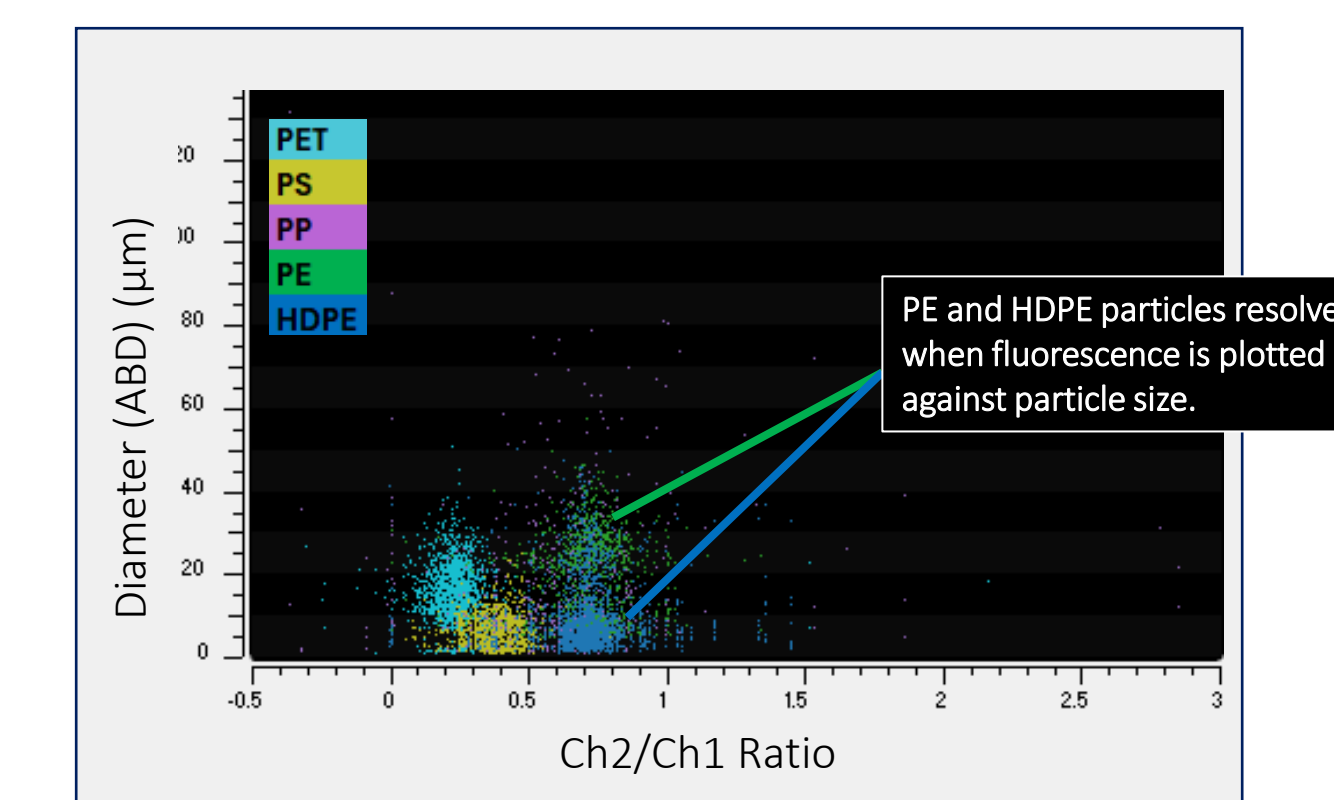
>500 to >2,000 NR-stained particles were counted across MP types.

- Differences in polymer polarity and functional group availability account for differences in staining efficiency

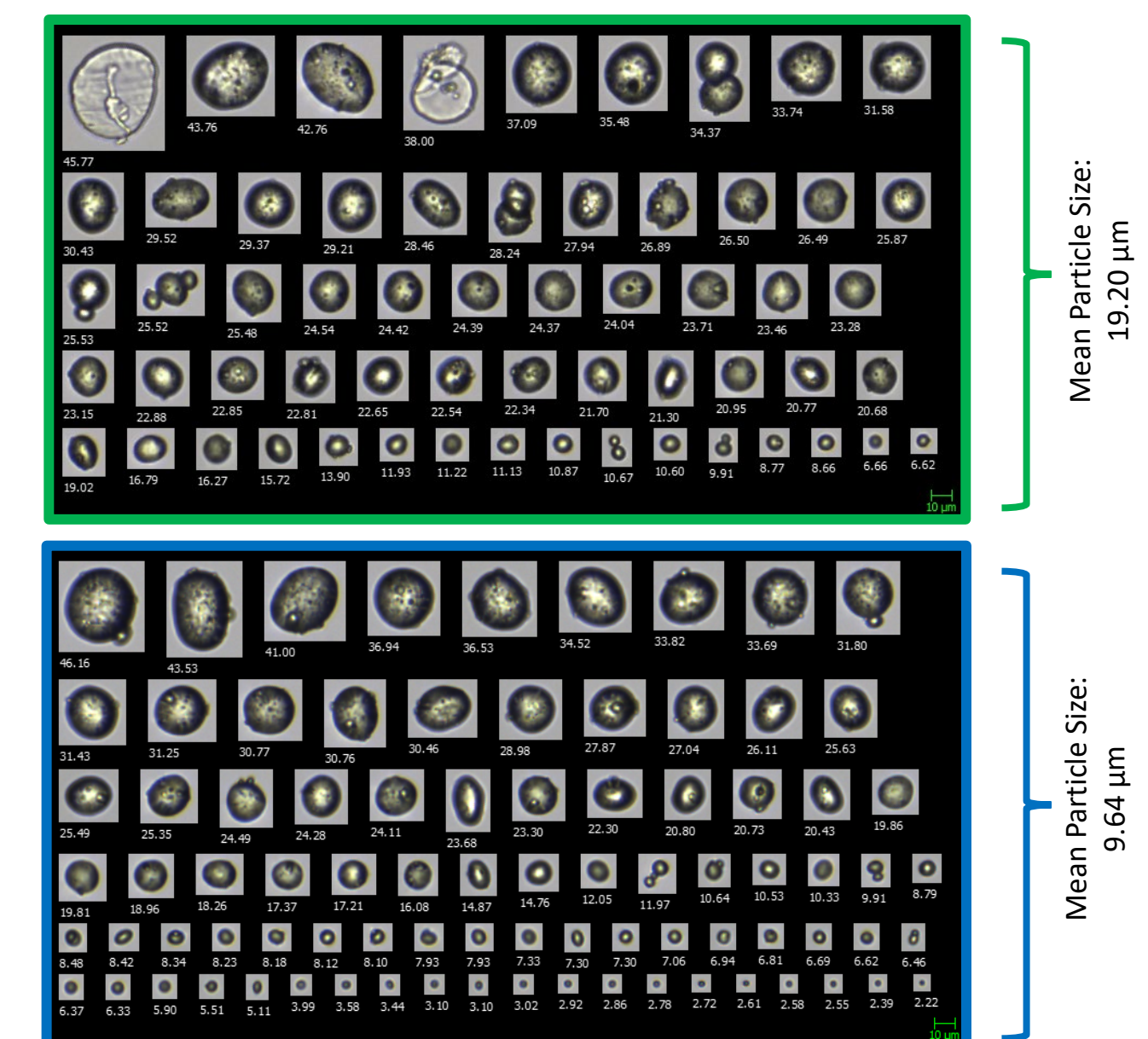
Separation of NR-MPs by Fluorescence



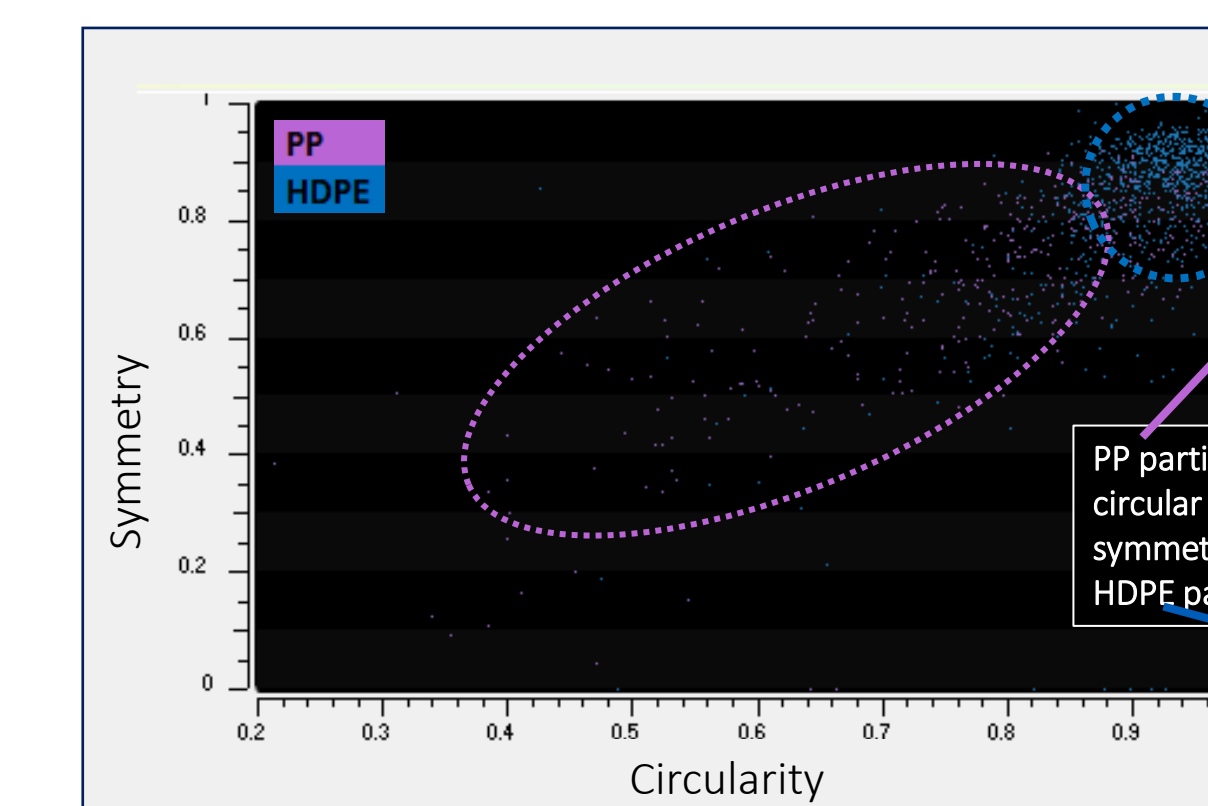
Separation of NR-MPs by Size



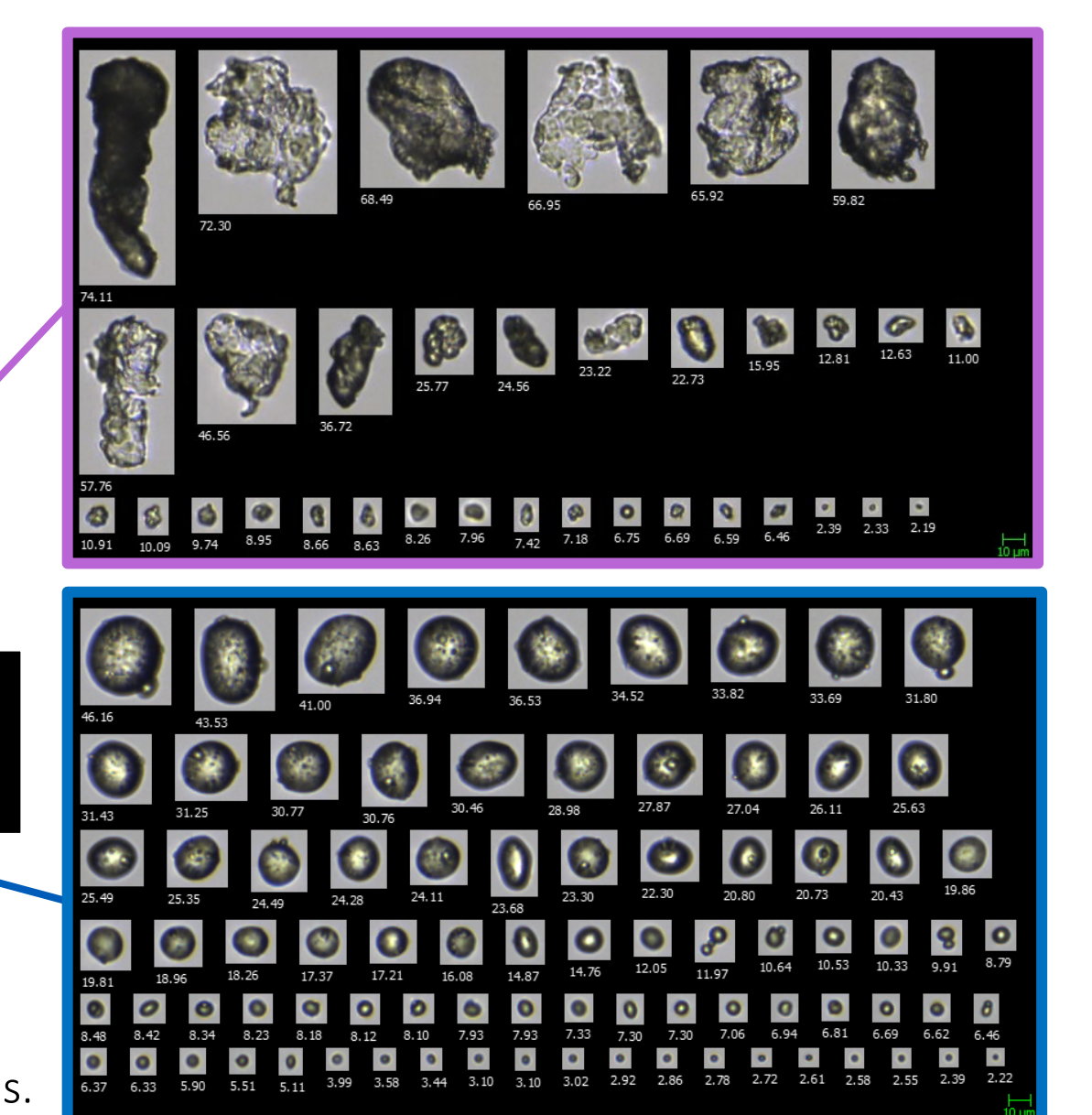
While PE and HDPE have similar fluorescence values, differences in particle sizes can be used to discriminate microplastic types.



Separation of NR-MPs by Morphology



Morphological measurements enable further differential analysis.



Results

NR-stained MPs were characterized for yield, size, and shape using FlowCam® 8400, by Yokogawa Fluid Imaging Technologies, equipped with a 532 nm laser and two detection channels (Ch1: 650 LP; Ch2 575/30 BP).

Conclusions

FlowCam 8400 with 532 nm laser is effective for:

- Rapid screening, enumeration, and morphological discrimination of MPs.
- Speciation of some Nile Red-stained MPs.

Next Steps

- Optimize NR-MP staining
- Apply to environmental samples