Retention time of microplastics in the purple sea urchin *(Arbacia punctulata)*

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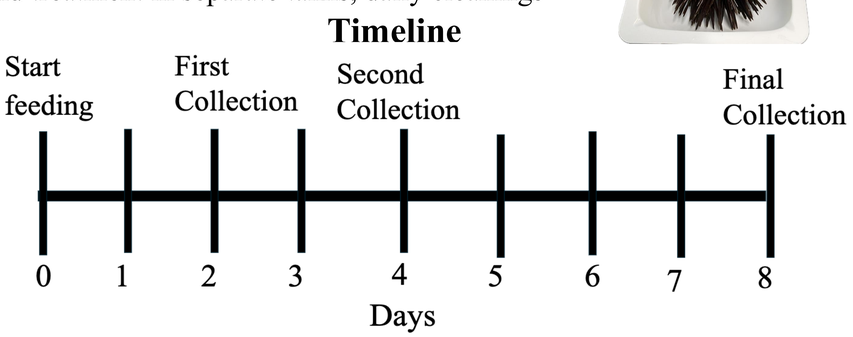
Introduction

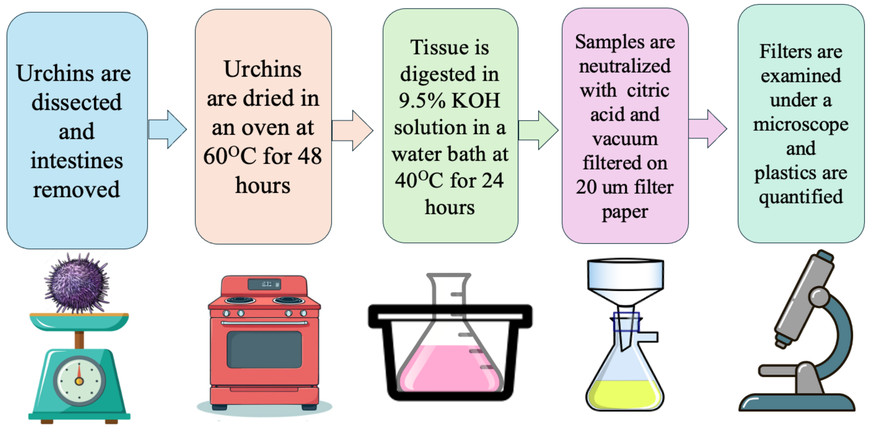
•Plastic pollution is a significant problem in marine environments; around 8 million metric tons of plastic enters the ocean every year[3]. Plastic weathers to microplastics (MPs,≤5mm), which eventually sink to the seabed[1,2,4].
•Sea urchins are ecologically important (ecosystem engineers, marine food web) benthic animals that graze on the seabed, putting them at risk of ingesting MPs[1,2,4].
•Better predict ecological impact of MPs by understanding retention time of MPs in gut of sea urchin
•**Hypothesis**: It is expected that microfibers will be more difficult to pass through the gut due to their elongated & flexible nature leading to a longer residence time than smooth spherical microbeads.

Methods

•Sea urchins collected from Fort Wetherill in Jamestown, RI
•Urchins housed individually in 2.3L plastic tanks supplied with 0.2 um filtered seawater (21.4 ± 0.3 ^{o}C, salinity 31.8 ± 1.4 ppm, pH 8.0 ± 0.1).
•The urchins were fed a 1 cm^3 pellet of formulated diet made of sugar kelp (*Saccharina latissima*), canned Eastern oysters (*Crassostrea virginica*), alginic acid, and agar for 24 hours[4]. The urchins were fed one of two treatment diets:
•**Control treatment** containing no MPs (n=9, mean test diameter (TD):21.9 ± 2.2 cm, whole animal wet weight (WAWM): 5.9 ± 1.3 g).
•**Microplastics treatment** laced with around 24 ± 4 polyethylene (PE) microspheres (length 391 ± 16 um) and around 8 ± 2.3 polyester (PES) microfibers (length 672 ± 27 um) (n=9, TD: 22.7 ± 2.2 cm, WAWM: 6.1 ± 1.6 g].

Quality controls
•Extraction efficiency, air and water filters, control and treatment in separate tanks, daily cleanings





Results

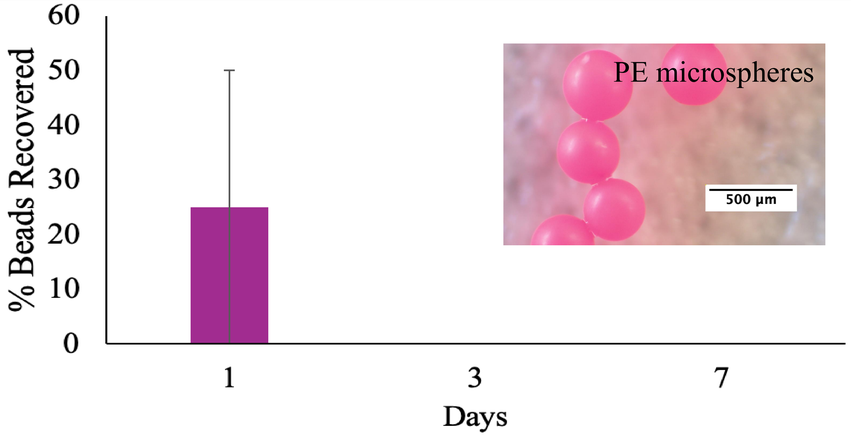


Figure 1: The Mean (±SE) % of 391 um (PE) microspheres extracted from urchin guts, relative to what was ingested from the diet.

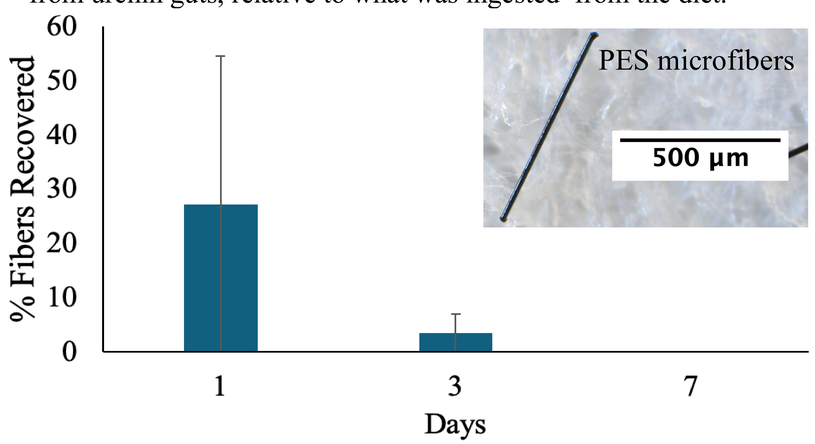


Figure 2: The mean (±SE) % of 672 um (PES) microfibers extracted from urchin guts relative to what was ingested from the diet.

•Urchins showed the PE microsphere were egested within 2-3 days, while PES microfibers were egested after a longer period within 4-7 days (Fig 1, 2).
•No MPs found at 7 days (Fig 1, 2, Table 1).
•Contamination of MPs found in a control sample were low (Table 1).

Table 1: The MPs present in control samples

	Days Since Ingestion		
MP Shape	1	2	3
Beads	0	0	0
Fibers	1	0	0

Discussion/Conclusion

•Differing retention time between fibers and beads could be due to shape, supports hypothesis
•Low retention rates of MPs could mean sea urchins are efficiently moving MPs through their digestive tract and are able to egest the MPs (Fig 1, 2).
  ○This could be because of their omnivorous diet
• One downfall is the sampling at limited time points.
• Future research: collection of urchin feces to quantify the number of MPs being excreted.

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