Microplastic interaction with marine biological systems

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Abstract

Micro plastic (MP) particles are often transported from the water column to marine food webs by filter-feeder organisms which play an important role in benthic-pelagic coupling. The ingested MP may accumulate in the gut or may pass through the digestive system where they are subject to different pH fluctuations and to various digestive enzymes, ultimately excreted within the organism's feces. Feces sink down the water column transporting carbon to deeper waters, therefore acting as a vector of MP through marine zones.
Ascidians (Chordata, Ascidiacea) are highly efficient filter-feeders, able to remove even minute particulate matter from the water column. Therefore, they present fundamental opportunities for understanding the interaction of plastic debris with marine organisms.
Here, we use engineered MP particles of high environmental relevancy, to examine the consequences of transit through an organism's digestive system. Engineered MPs were prepared by subjecting crashed plastics to various degradation processes imitating the natural oxidation, thermal, and mechanical degradation. We examined the changes of the particle's surface area, size, morphology and surface functionality. We used both biodegradable and non-biodegradable plastic, synthesized from bulk plastic everyday products. These particles were fed and later extracted from the feces of two solitary ascidian species: *Styela plicata* collected from the Mediterranean, and the Red Sea *Polycarpa mytiligera*. We developed a protocol for MP extraction from ascidian feces while minimizing contamination of undigested MP. Our preliminary results reveal that the extracted MP (following digestion by ascidians) had a rough surface area coated by organic matter. This change in surface area and functionality may later influence the MP availability to other organisms. Currently, we examine the effect of MP on ascidian digestion system and feces. Overall, as MP transfer through marine food webs across marine ecosystems, it is essential to promote the understanding of the consequences of biological digestion.

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