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From invisible marine exopolymers to hetero-aggregates: Plastics sinking?

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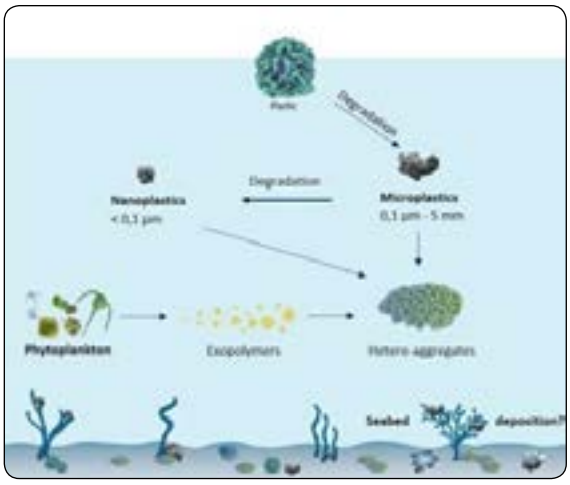
Human consumerism gave rise to a sea filled with plastic debris resistant to degradation, and with increasing accumulation in the marine environment. Nano (0.1 µm) and micro-plastics (0.1 µm - 0.5 mm) are of particular concern because they can be eaten by marine life and enter the food chain. Plastics particles have been found throughout the ocean, from the surface to sediment on the seabed. However, plastic concentrations at the surface of the ocean were lower than expected, leading to think on a deposition of plastics from the surface to deeper layers of the ocean. To understand the plastics particles bioavailability to marine organisms as well as their fate in the water column, it is essential to investigate their interactions with phytoplankton. Microalgae display sticky substances that can form aggregates which can retain plastic particles. This work was focused to answer the question: Does the phytoplankton aggregate plastics and transport them to the seabed? Thus, the microalgae potential to form hetero-aggregates with plastic particles, was studied. Factors as the microalgae species, and their physiological status, the plastic particles type and size, were also analysed. Microalgae were exposed to nano and micro-plastics during their growth culture cycles and hetero-aggregates (a gel-like structure) constituted of microalgae, microplastics and exopolymers were formed. The effects of nano and micro-plastics were determined on microalgal physiology in terms of growth and chlorophyll fluorescence. The hetero-aggregate pores structure, composition and the density were determined. Overall, the results highlight the potential of the exopolymers to interact with plastic particles, and the hetero-aggregates importance for the plastics vertical transport from the water surface to the sediment.



Recent Publications:

1. H.S. Auta, et al. (2017). Distribution and importance of microplastics in the marine environment: A review of the sources, fate, effects, and potential solutions. Environment International, 102, 165-176.
2. Tomásia Fernandes, Igor Fernandes, Carlos A. P. Andrade, Nereida Cordeiro (2017). Marine microalgae monosaccharide fluctuations as a stress response to nutrients inputs, Algal Research, 24 (Part A), 340-346.

3. Tomásia Fernandes, Igor Fernandes, Carlos A. P. Andrade, Nereida Cordeiro (2017). Changes in fatty acid biosynthesis in marine microalgae as a response to medium nutrient, Availability, Algal Research, 18, 314-320.
4. Deepa B., Abraham E., Pothan LA, Cordeiro N, Faria M., Thomas S., (2015) Biodegradable Nanocomposite Films Based on Sodium Alginate and Cellulose Nanofibrils. Materials, 9(1):50.

Biography

Nereida Cordeiro is an Associated Professor of Chemistry in the Faculty of Sciences and Engineering of the University of Madeira. She holds a degree in Analytical Chemistry (University of Aveiro) and PhD in Chemistry (University of Aveiro). Her main research interests are in Analytical and Environmental Chemistry, with focus on biomaterials and biotechnology. She authored more than 70 scientific publications in international journals.

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