
Characterization of microplastic degradation in marine ecosystems using spectrometric techniques of stable isotopes and infrared

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Abstract

Microplastics (MPs) are plastics with size lower or equal to 5 mm. For this experimental study, we selected two primary microplastics, polyethylene (PE) pellets and polystyrene (PS) microballs, and a secondary, polypropylene (PP) mask pieces, and we exposed them in five different treatments. The MPs were exposed to seawater/light, seawater/darkness and ultrapure water/darkness with photoperiod cycles of 12 hours and total darkness. Simultaneously, the MPs were exposed to degradation *in situ* at Guanabara Bay, Niterói and at Cabo Frio Island, Arraial do Cabo, both at Brazilian Coast, to compare environments with different urbanization and pollution levels. In order to characterize, calculate degradation indexes and compare the microplastics changes in bond structures using Fourier Transform Infrared (FTIR) Spectroscopy and Elemental Analyser (EA). Carbonyl index and C-O index was calculated using the FTIR interest peaks of changes in chemical bonds structures (carbonyl groups, 1509 - 1780 cm⁻¹, and carbon-oxygen, 950 - 1200 cm⁻¹), using references peaks to identify PP (1394 - 1500 cm⁻¹ and 2885 - 2940 cm⁻¹) as denominator. Polypropylene preliminary results shows the most increase for both indexes in sea/light treatment during 14 days, but in 28 days the index reduced. As long as for the experimental *in situ* the index increases significantly. In Guanabara Bay, we observed growth of foraminifera in the MPs after one month, that is possible to see in FTIR results, there was an increase in the peak of carbonate (866 - 887 cm⁻¹). Our preliminary results show changes in the molecular composition of evaluated MPs as well as the advancement of biofilm formation and clusters between MPs and foraminifera along one month of experiments. With the advancement of the incubation, we hope to elucidate the relationship between assessed variables in order to understand the fate of MPs and their impacts on marine ecosystems.

Keywords: Degradation of microplastics, Microplastics, FTIR, Stable Isotopic, Degradation Index

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