Morphology, Chemical Characterization and Sources of Microplastics in a Coastal City in the Equatorial Zone with Diverse Anthropogenic Activities (Fortaleza city, Brazil)

Maria E. Nolasco*[1], Viviane A. S. Lemos[1], Gina López[1], Sandra A. Soares[2], Johnny P. M. Feitosa[2], Bruno S. Araújo[3], Alejandro P. Ayala[3], Marleane M. F. De Azevedo[4], Francisco E. P. Santos[4], and Rivelino M. Cavalcante†[1]

[1]Organic Contaminant Assessment Laboratory -LACOr – Institute of Marine Sciences, Federal University of Ceará, Fortaleza, Ceará, 60165-081, Brazil, Brazil

[2]Polymer and Material Innovation Laboratory – Chemistry Department, Federal University of Ceará, Campus do Pici, Bloco 938, Fortaleza, CEP 60455-760, Brazil, Brazil

[3]Structural Crystallography Laboratory – Physics Department, Federal University of Ceará, Campus do Pici, Bloco 922, Fortaleza, CE, CEP 60355-636, Brazil, Brazil

[4]Department of Physics – Department of Physics, UFPI - Federal University of Piauí, Teresina, PI, CEP 64049-550, Brazil, Brazil

Abstract

Microplastics (MPs) are particles and fibers of synthetic polymers from 1 μm to 5 mm in size that have different compositions and chemical structures. Mainly due to poor waste management and the increase in anthropogenic activities, microplastics are now considered emerging pollutants and have caused worldwide concern because they are present in the main marine environments on Earth. The aim of the present study was to perform morphological and chemical characterizations of microplastics found in seawater samples from the coast of the city of Fortaleza (CE) using Fourier-transform infrared (FTIR) spectroscopy, Raman spectroscopy and differential scanning calorimetry (DSC). Sampling was performed using a neuston sampler and MPs were separated based on the difference in density. MPs with varied morphologies were found. Fibers and fragments were the most abundant (57% and 36.2%, respectively). FTIR, Raman spectroscopy and DSC confirmed the presence of polyurethane and alkyd resin, polyethylene, polypropylene, polystyrene, polyamide blends, thermoplastic rubber and polyester fibers. The main sources of MPs and their relative contribution were fishing activities, food packaging and household products with 55.1%, household laundry with 27.2%, wear of surface coatings with 10.0% and wear of automobile tires with 7.6%. As a result, polyethylene, polypropylene, polystyrene and polyamide are believed to enter the marine environment mainly through fishing activities and debris from food packaging, polyester mainly through domestic sewage contaminated by washing clothes fibers, polyurethane and alkyd resin from the abrasive wear of surface coatings, as well as rubber particles from the wear of the automobile tires. Thus, one may infer that the main sources

*Speaker

†Corresponding author: rivelino@ufc.br

of MPs in the marine environment on the coast of Fortaleza are anthropogenic activities. Additionally, the MP spectra obtained in this study can serve as a database to compare and characterize blends and weathered MPs.

Keywords: Microplastics · Marine environments · Morphological characterization · Chemical characterization