Development of cost-effective methodologies to identify and quantify microplastics in seawater samples

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The accumulation of plastic debris in marine environments and their potential negative effects to marine organisms have become issues of high priority for environmental policy. Microplastics (MPs; 5 mm - 1 µm) are reported to be within the most abundant pieces of litter found in the marine environment accumulating in the water column, on beaches, in sediments, in biota and in the air. Despite recent improvements on the procedures to detect and identify MPs, there is still a need to standardise methods and to produce guidelines for a cost-effective detection, identification and quantification of MPs. The standardisation and establishment of cost-effective methodologies is essential to facilitate comparison among studies, to enable a robust assessment of risk of exposure of organisms and humans to plastic particles, and to support the establishment of long-term monitoring programmes. The goal of this work was to establish low-cost procedures for the identification of MPs (over 50 µm) in seawater samples, which could be applied in laboratories, *in-situ* and in citizen-science projects (e.g. Blackfish: www.blackfish.be). We have tested and optimised the digestion of seawater samples with a heavy load of organic matter using hydrogen peroxide (H_2O_2). Collected MPs were died using Nile Red, observed under blue and ultraviolet light filters, allowing detection and visualization of the particles under a fluorescence microscope. Using the C4.5 algorithm (Witten & Frank, 2005), a classification tree model was constructed to distinguish between polymer-based particles and other (cellulose, mineral, etc) particles. We applied threefold cross-validation to assess the model fit. In addition, we created an independent validation dataset where particles were further analysed with micro Fourier Transform Infrared (µFTIR) spectroscopy. Our results show that the classification tree model has an 82 % probability of a correct classification of MPs. We anticipate that our results will enable a cost-effective and standardized methodology for identification of MPs in seawater samples, supporting the establishment of long-term monitoring programmes.

Reference

Witten, I. H., & Frank, E. (2005). Data Mining: Practical Machine Learning Tools and Techniques. USA: Morgan Kaufmann Publisher

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