

Analysis techniques for quantifying nano- and microplastic particles and their degradation in the marine environment.

The ANDROMEDA JPI-Ocean project

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Plastics are distributed in the ocean along a size continuum ranging from macros to MP (1 μm – 5 mm) and NP (<1 μm) due to their varied primary origin and degradation processes inducing fragmentation of secondary particles. However, analytical methods are still long and costly, and only a few techniques allow to detect NPs efficiently. Also, the processes of degradation and release of organic additives during plastic ageing into the environment still need to be better understood. Here, we present the main results of the JPI-Ocean funded Andromeda project (2020-2023), which focuses on (1) the completion of different types of analyses of MP and NP in the marine environment as well as (2) the degradation of different types of plastic materials (pristine, weathered and synthesized). Approaches are based on hyperspectral imaging, chemical markers and fluorometric detection techniques. Advanced analysis techniques making use of μFTIR , Raman imaging and SEM-EDX (amongst others) were also applied to quantify and characterize MP and NP down to 1 μm , 0.2 μm or lower. Comprehensive degradation studies have been conducted, focussing on the majorly used polymer types including tire wear particles, to study in detail the mechanisms of UV, hyperbaric pressure and microbial degradation, with a specific focus on additive chemical leaching. An effort has also been made to disseminate the results through the publication of specialized documents that are easily accessible to the general public as well as through field operations that empower young citizens.