Microplastic formation from a newly developed biocomposite

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Concerns have arisen about the environmental persistence and biological impacts of microplastic (MP, < 5 mm) in the global ocean. An important source of MP in the marine environment is the degradation of fossil-based polymers such as polypropylene (PP) and polyethylene (PE) induced by the hydromechanical forces and UV radiation. Polymers and composite materials made from a natural-sourced feedstock, like polylactic acid (PLA) and thermoplastic starch (TPS), known as biopolymers and biocomposites, are seen as a sustainable alternative with lower environmental impacts. However, to date, few studies have focused on the degradation behaviour of biopolymers and biocomposites in the marine environment.

As part of the Interreg 2 Seas Mers Zeeën project SeaBioComp (http://seabiocomp.eu/), we compared and quantified the MP formation of a newly developed biocomposite and a fossil-based polymer during their degradation under UV radiation. To do so, we exposed self-reinforced PLA and PP specimens in seawater to UV radiation simulating natural exposure of 18 months. To identify and characterize MP particles, we applied a combination of fluorescence microscopy, scanning electron microscopy coupled to an element detection system (SEM-EDX), and infrared technology (μFT-IR).

Our results show a significant number of PP MP formed due to UV exposure while no significant number of PLA MP, indicating that this biocomposite is more resistant to UV radiation than the reference fossil-based polymer. We anticipate that our results will contribute to assessing the risk of biocomposites which can present a more sustainable alternative to fossil-based polymers.

Keywords: Biopolymer; Microplastic formation; Fragmentation; Photo-degradation; Size frequency distribution; SeaBioComp