Microplastic Formation from A Newly Developed Biocomposite

Niu Zhiyue*, Catarino Ana Isabel, Davies Peter, Le Gall Maelenn, Curto Marco, Jiang Chulin, Dotcheva Mariana, Vancoillie Gertjan, Dhakal Hom, Vandegehuchte Michiel and Everaert Gert

* zhiyue.niu@vliz.be, ***VLIZ, Ostend, Belgium.***

Background

- Concerns have arisen about the environmental persistence and biological impacts of microplastic (MP) in the global ocean.
- An important source of MP in the marine environment is the degradation of fossil-based polymers such as polypropylene (PP) induced by the hydromechanical forces and Ultra-violet (UV) radiation.
- Polymers and composite materials made from a natural-sourced feedstock, like polylactic acid (PLA) known as biopolymers and biocomposites, are seen potential alternative with lower environmental impacts.
- To date, few studies have focused on the degradation behavior of biopolymers and biocoposites in the marine environment.

Objective

- To compare and quantify the MP formation of a newly developed biocomposite and a fossil-based polymer during their degradation under UV radiation.

Methodology

- we exposed self-reinforced PLA and PP specimens in seawater to UV radiation simulating natural exposure for up to 18 months.
- To identify and characterize MP particles, we applied a combination of fluorescence microscopy and infrared technology (μFT-IR)

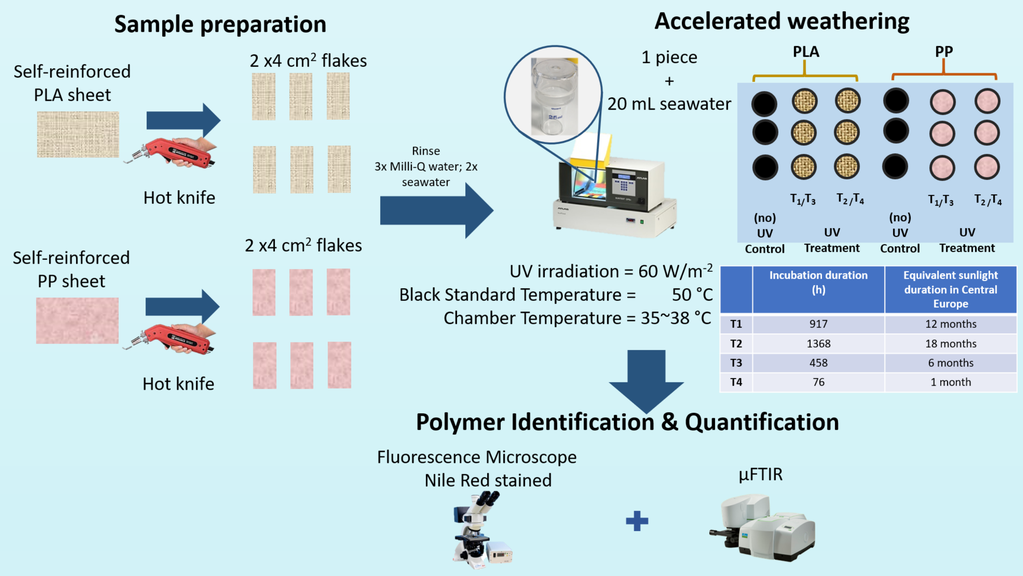

Figure 1. Graphical scheme of the experimental design.

Results

Particle identification

- PLA and PP showed similar color under UV filter and blue filter (Fig.2).
- Polymer type was confirmed using μFTIR with library spectra.
- Recovery test: > 95% of particles detected.

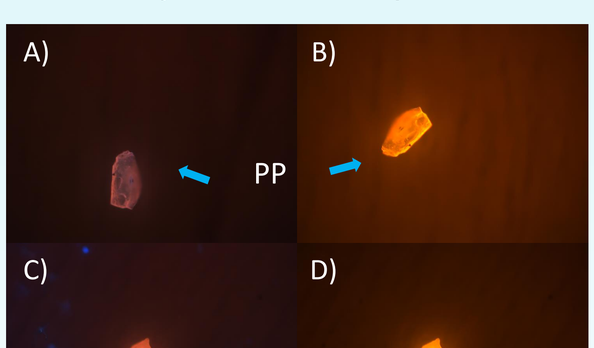

Figure 2. Fluorescent microscope Images of identified PP/PLA debris. A) and C)Image captured under UV filter. B) and D) Image captured under blue filter.

Microplastic formation

- Significant number of PP microplastic (>50μm) formed after 1368h UV exposure; while no PLA microplastic formed.
- PP has a higher microplastic generation rate than PLA (Fig.3).
- The frequency of formed microplastic decreased with their size increasing (Fig.4).

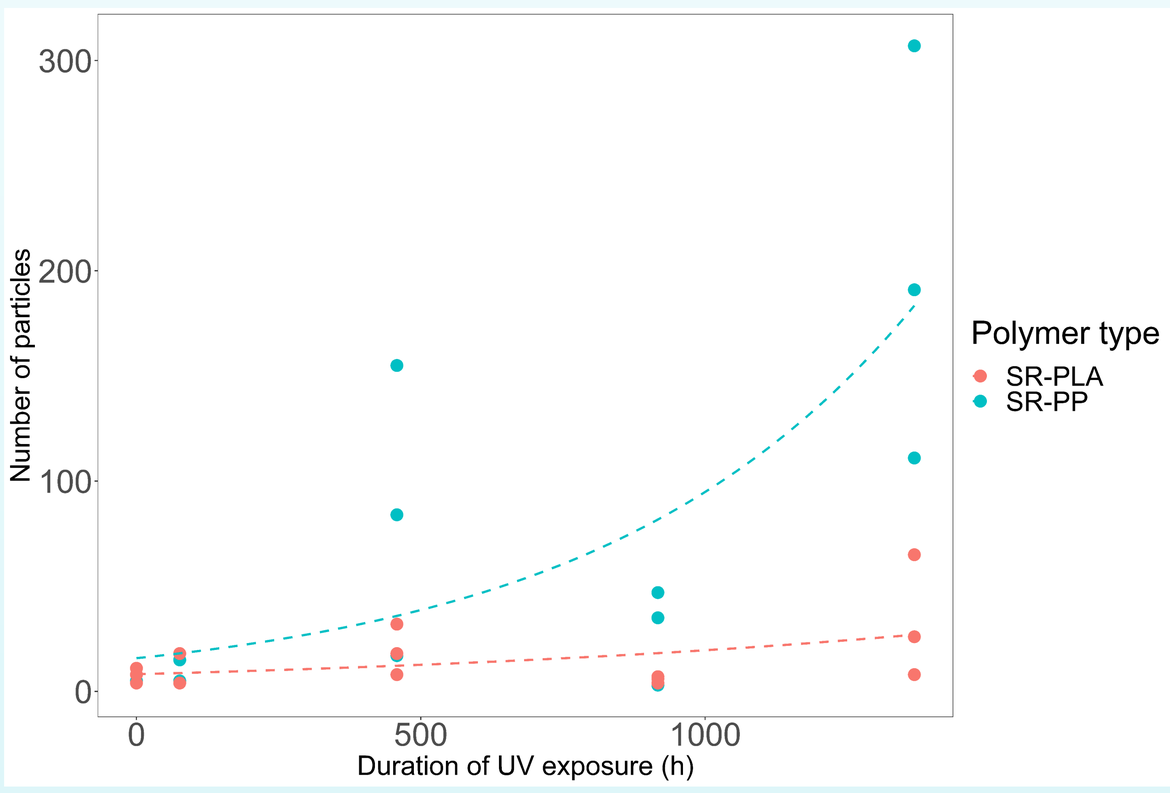

Figure 3. Number of PLA/PP microplastic (>50 μm) detected against duration of UV exposure (h). The count of microplastic particles (N) from each polymer type is a function of UV exposure (UV) according to a Poisson regression analysis (confidential interval = 95%). The equations of fitted curve are as: $N_{SR-PP} = e^{2.76+0.00179 \cdot UV}$; $N_{SR-PLA} = e^{2.10+0.000871 \cdot UV}$.

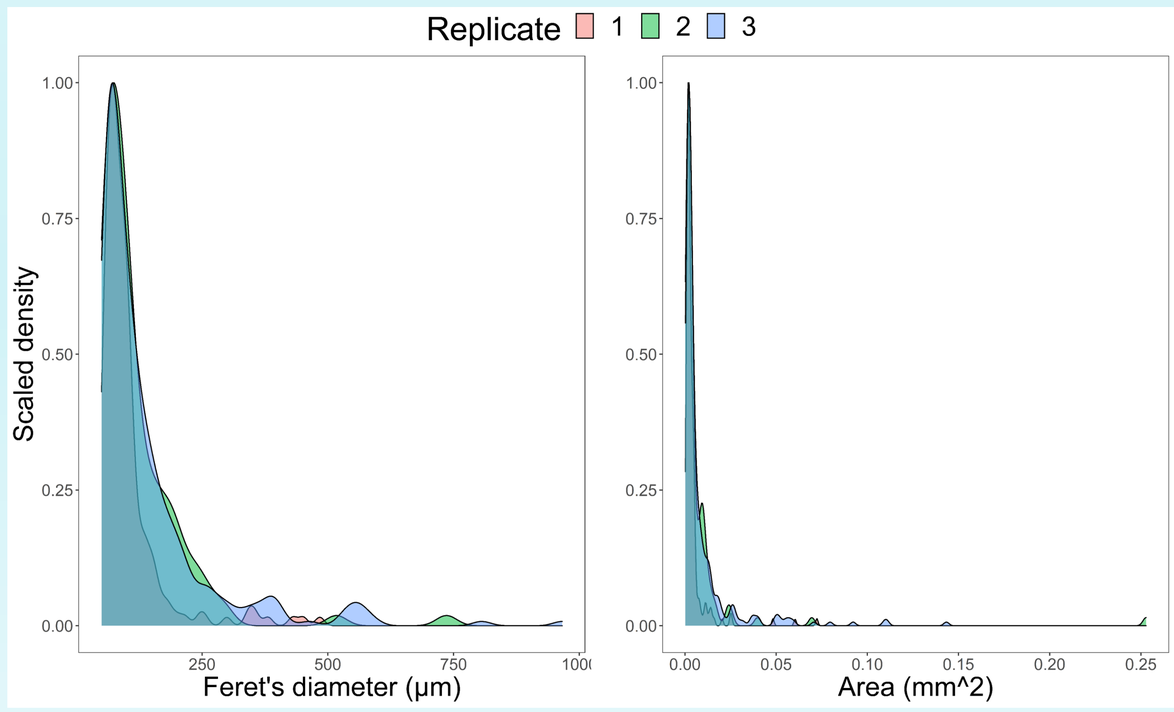

Figure 4. Size frequency distribution of PP microplastic (>50 μm) after 1368h UV exposure. The Maximum density is scaled as 1. The Feret's diameter (μm) and area (mm^2) were quantified using ImageJ.

Conclusions

- PP are more easily degrede to microplastic than PLA under UV radiation.
- Our results will contribute to assessing the risk of biocomposites which can present a more sustainable alternative to fossil-based polymers

Partners:

Cofinanced by

More Information: http://seabiocomp.eu/

or Scan the QR-code: