

# FATE OF MICROPLASTICS IN RIVER ENVIRONMENT: CHEMICAL COMPOSITION OF MOLECULAR RELEASING AFTER PHOTOLYSIS AND HYDROLYSIS

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The persistence of microplastics (1  $\mu\text{m}$ –5 mm) in the environment, combined with their large-scale production, raises major scientific and societal concerns. These particles undergo degradation through abiotic (photodegradation, hydrolysis, mechanical fragmentation) and biotic (biodegradation) processes, with photolysis playing a key role in breaking polymer chains under UV-B exposure.

Besides, more than 1,000 rivers contributing significantly to marine pollution (Meijer et al., 2021), understanding microplastic degradation in freshwater environments is crucial. This study examines how abiotic processes, like photodegradation and hydrolysis contribute to (i) greenhouse gas emissions and (ii) the diversity of molecules released from microplastics in aquatic environments, by using an experimental approach.

The plastics selected represent the main types in international demand: polypropylene (PP), low-density polyethylene (LDPE), high-density polyethylene (HDPE), polyethylene terephthalate (PET) and polystyrene (PS). The polymers were exposed to simulated solar radiation (321,8 W/m<sup>2</sup>) for eight weeks under dry and wet conditions using sterilized river water. Headspace was analyzed with a GC/TCD, structural degradation and organic adjuvants composition were determined by FTIR and GC/MS and aqueous phase was characterized (pH, DOC, DIC, ...).

Results indicate that all plastics consume O<sub>2</sub> and release greenhouse gases (CO<sub>2</sub>, CO, and CH<sub>4</sub>) for both conditions. In dry conditions, extract of these polymers show that irradiation allow the release of some adjuvants like palmitic or stearic acids, principally in PP and PS. Hydrolysis led to increased dissolved organic carbon and a pH drop.

Our results show that plastics appear to be a significant source of greenhouse gases to the atmosphere. Photolysis is the main process involved in greenhouse gases and hydrolysis allows the release of small organics degradation products in the environment. However, our study is based on a closed environment. The confined environment, with its production of free radicals, can accelerate degradation reactions and increase the production of volatile and water-soluble molecules.

[1] Meijer, L. J. J., Van Emmerik, T., Van Der Ent, R., Schmidt, C., & Lebreton, L. (2021). More than 1000 rivers account for 80% of global riverine plastic emissions into the