

WEATHER-MIC

How microplastic weathering changes its transport, fate and toxicity in the marine environment

Short Description

Project Coordinator: Dr. Annika Jahnke, Helmholtz Centre for Environmental Research – UFZ, Leipzig, Germany

Understanding the hazards posed by microplastics in the sea requires understanding the changes they undergo as a result of various environmental weathering processes, like UV exposure, biofilm growth and physical stress. These processes will influence parameters such as their brittleness, density, size and surface charge, which can in turn affect their environmental fate as the microplastics undergo fragmentation, aggregation and ultimately sedimentation or mineralization. As these processes occur, there are a series of tradeoffs of hazard to the marine environment. Changes that lead to fragmentation or mineralization into benign fragments or molecules will reduce potential hazards; though changes that lead to the production of problematic size fractions (e.g. that can accumulate in gills) and release toxic chemicals will increase potential hazards. Similarly, the influence on mobility is also wide-ranging, as some fragments may be soluble while others form aggregates that settle on the seabed.

The WEATHER-MIC project assembles a multidisciplinary consortium of European experts from five institutes and four countries that together will develop novel tools to tackle the complex implications of weathering of microplastics in a holistic manner. The toolbox of analytical and (eco) toxicological methods, models, and new knowledge that WEATHER-MIC seeks to establish and validate in case studies for the Baltic Sea and Oslo Harbor will consist of:

- "fingerprinting" methods to track microplastic weathering (ACES),
- mechanisms of chemical release from microplastics (ACES, UFZ, NGI),

- advanced particle imaging methods to investigate size distribution and morphological changes with weathering (IKTS),
- improved understanding of ecological information on the biofilm that accumulates on microplastics and its trophic transfer (ACES),
- hydrodynamic models to account for changes in sedimentation and transport with microplastic fragmentation-aggregation (KUL, NGI),
- toxicity profiles for weathered microplastics (UFZ).

The scientific products of WEATHER-MIC will provide a basis to integrate weathering of microplastics into risk assessments of marine plastic debris, considering both exposure and effects. The project has identified local stakeholders from its respective countries and will identify additional ones from the regulatory, educational, environmental and industry sectors. The communication with these stakeholders will involve education on the fact that the implications of complex microplastic weathering need to be approached by research and informed public policymaking, such as the development of proper tools. The tools which will be developed in WEATHER-MIC will open avenues to improved guidelines for plastic handling, safeguards that can minimize the hazards of microplastic pollution, and public education that aims to reduce the levels of plastic litter in the marine environment of Europe and globally.

Consortium

| Name | Organisation | Country |
|-----------------------|--|---------|
| Dr. Annika Jahnke | Helmholtz Centre for Environmental Research – UFZ, Leipzig | Germany |
| Dr. Matthew MacLeod | Stockholm University, Stockholm | Sweden |
| Dr. Hans Peter Arp | Norwegian Geotechnical Institute, Oslo | Norway |
| Dr. Annegret Potthoff | Fraunhofer Gesellschaft (IKTS), Dresden | Germany |
| Dr. Erik Toorman | Katholieke Universiteit Leuven, Heverlee (Leuven) | Belgium |