JPI OCEANS

PLASTOX

PLASTOX: Direct and indirect ecotoxicological impacts of microplastics on marine organisms

WP1: Adsorption and Desorption of Pollutants on Microplastics

Kaori Sakaguchi-Söder[1], Michael Gottschling[1], Andy Booth[2], Paula Sobral[3], Marta Martins[3], Laura Airoldi[4], Stefania Piarulli[4], Richard Sempere[5], Vincent Fauvelle[5], Susanne Kühn[6], Kerstin Magnusson[7], Liam Morrison[8], Ana Mendes[8], Carl Van Colen[9], Brecht Vanhove[9], Dorte Herzke[10], Torben Kirchgeorg[11], Albert van Oyen[12]

[1] Technische Universität Darmstadt, Germany; [2] SINTEF Ocean, Norway; [3] FCT-NOVA, Portugal; [4] Alma Mater Studiorum - University of Bologna, Italy; [5] Aix-Marseille Université, Mediterranean Institute of Oceanography, France; [6] Wageningen Marine Research, Netherlands; [7] IVL Swedish Environmental Research Institute, Sweden; [8] National University of Ireland Galway, Ireland; [9] Ghent University, Belgium; [10] Norwegian Institute for Air Research, Norway; [11] Federal Maritime and Hydrographic Agency, Germany; [12] Carat GmbH, Germany

Dr. Sakaguchi-Söder
k.sakaguchi@iwar.tu-darmstadt.de

Production of a common reference material (WMR, Carat, SINTEF)

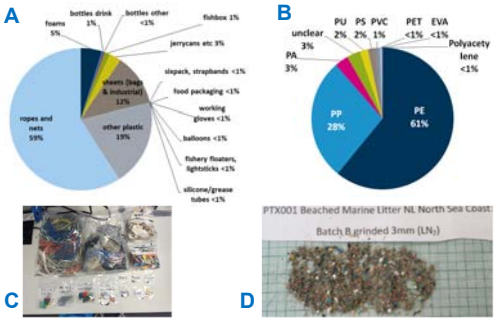

Fig. 1: Analysis of marine litter and production of marine litter-derived MPs

A: composition of litter items, B: polymer composition of litter, C: marine litter subcategories before milling, D: PTX001, marine litter-derived MPs - a representative mixture of polymers in the environment. Picture credits: WMR, SINTEF and Carat GmbH.

Along northern Dutch North Sea coast, plastic debris were systematically collected by WMR and cryogenically milled into MPs at Carat GmbH, providing a common reference material "PTX 001" for PLASTOX partners. PTX 001 mainly consists of HDPE and PP. Detailed physicochemical characterization of PTX 001 is in progress.

PLASTOX WP1: Approaches

PLASTOX will culminate in a series of experiments bringing together the knowledge generated about MPs and POPs/metals to study the combined fate and effects of these marine contaminants in food web studies.

PLASTOX WP1 is responsible for gathering knowledge about ad-/desorption of common pollutants on MPs in the laboratory and in long-term field experiments at stations representing a wide range of European marine environments and a wastewater treatment plant using:

- Commercially available feedstock MPs (pellets), recycled plastics wastes as well as pollutant-loaded and degrading MPs
- A range of POP and metal contaminants commonly found on MPs

PLASTOX WP1 also deals with developing experimental methods for the investigation of ad-/desorption of selected pollutants on MPs

Long-term field tests at 12 marine stations (Eight WP1 partners)

Fig. 2: Long-term field tests in PLASTOX WP1

Red circles indicate the location of the marine stations for a long-term field test. A: Plastic samples in a metal cage; B: The metal cage to be exposed to the marine environment; C: A deployment site in Belgium. Picture credits: UGent

Four types of pristine resin pellets (LDPE, PS, PP and PET, diameter approx. 5mm) provided by Carat GmbH are being deployed at 12 marine stations. Duration of the deployment test: 0.5, 1, 3, 6, 12 and 18 months.

Desorption of additives from MPs (AMU-MIO, France)

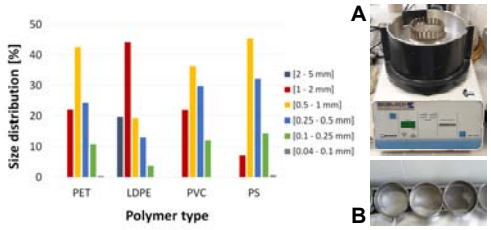

Fig. 3: Size distribution of plastic particles (PET, LDPE, PVC and PS) after grinding using Ultra centrifugal mill + N_2(liq). A: Ultra centrifugal mill B: Plastic particles after grinding. Picture credits: AMU-MIO.

For the determination of additive contents of plastic materials, two extraction methods are selected and evaluated at AMU-MIO: a) complete dissolution of plastic in a solvent + polymer precipitation with methanol and b) grinding of plastic + extraction of additives in MilliQ water.

The optimization of grinding method is in progress.

Adsorption of metals on MPs (NUIG, Ireland)

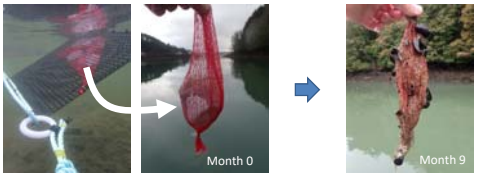

Fig. 4: Microplastics deployed at month 0 versus month 9. Picture credits: NUIG.

Longitudinal study investigating metal adsorption by microplastics is now almost complete (samples collected at times; 0, 1, 3, 6 and 9 months – only month 12 to collect. Five types of plastics were prepared by Carat GmbH (PE, PP, PS, PET and marine litter). Samples of seaweed (*Ascophyllum nodosum*, Fucales, Phaeophyceae) were collected at each sampling date for comparison.

Different methodologies (e.g. EDTA, HNO_3, *Aqua regia* and microwave digestion) were assessed for the extraction of metals from microplastics.

Adsorption of POPs on MPs (TUDA, Germany)

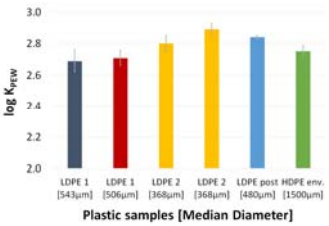

Fig. 5: PE-water partition coefficients of naphthalene on PE from different origins. The origin of "LDPE 1" and "LDPE 2" are pristine pellets by two different producers; "LDPE post" is recycled post industrial waste; "HDPE env." is beached yellow fish box.

Polyethylene-water partition coefficients of a PAH (naphthalene, log K_{OW} = 3.35) on five different polyethylene (PE) based plastic materials with different physicochemical properties were determined to be log K_{PEW} 2.69 – 2.89.

Currently, a series of adsorption tests using other pollutants with larger K_{OW}-values is in progress.

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