Microplastics distribution in bottom sediments of the Baltic Sea Proper

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Abstract

Concentration of microplastics particles (0.2-5 mm, MPs) in bottom sediments from 3 to 215 m depth is analyzed on the base of 53 samples obtained in 8 cruises of research vessels in the Gotland, Gdansk and Bornholm basins of the Baltic Sea in March-October of 2015-2016. MPs concentration varied from 103 up to 10 179 items/kgDW, with the bulk mean of 863 ± 1371 and median of 530 items/kgDW, showing general increase with water depth. As many as 74.5 % of MPs are fibres, followed by films (19.8%), and fragments (5.7%). In size distribution, maximum is in the range of 1-2 mm (36 % of items). Among 21 polymer types found, dominate Polyethylene (11.1%), Polypropylene (8.3%), and Polymer blend (5.6%). Nearly-homogeneous, weakly increasing and relatively small MPs content (mean 286, median 245 items/kgDW) is found on in coastal zone down to ~20 m depth, where strong currents and wave-induced mixing are at work. In intermediate layers (down to 50 m depth), the bulk mean MPs concentration remains the same, but the median drops to 186 items/kgDW, indicating patchy contamination pattern. The highest MPs concentrations (mean 1359, median 837 items/kgDW) are observed in relatively calm zone below the pycnohalocline (70-80 m). Statistically significant correlation between water depth and concentration of fibres is found, which proves that the deep sea is an ultimate sink for synthetic fibres. Distribution of MPs is analyzed in relation to the density stratification, the hydrodynamic zones, surface-wave impact on fine sediments, types of bottom sediments, and the grain size distribution (RSF project No 19-17-00041). Correlation between MPs concentration and type of sediments is not significant, highlighting different dynamic behavior of MPs particles and sediment grains. However, the erosion/transition/accumulation zones still can be distinguished for MPs, and are located slightly deeper than those for fine sediments.

Keywords: microplastics, bottom sediments, the Baltic Sea

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