
Risk assessment of microplastics in freshwater sediments guided by strict quality criteria and data alignment methods

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Abstract

Determining the risks of microplastics is difficult because data is of variable quality and cannot be compared. Although sediments are important sinks for microplastics, no holistic risk assessment framework is available for this compartment. Here we assess the risks of microplastics in freshwater sediments worldwide, using strict quality criteria and alignment methods. Published exposure data were screened for quality using new criteria for microplastics in sediment and were rescaled to the standard 1–5000 μm microplastic size range. Threshold effect data were also screened for quality and were aligned to account for the polydispersity of environmental microplastics and for their bioaccessible fraction. Risks were characterized for effects triggered by food dilution or translocation, using ingested particle volume and surface area as ecologically relevant metrics, respectively. Based on species sensitivity distributions, we determined Hazardous Concentrations for 5% of the species (HC5, with 95% CI) of 4.9×10^9 ($6.6 \times 10^7 - 1.9 \times 10^{11}$) and 1.1×10^{10} ($3.2 \times 10^8 - 4.0 \times 10^{11}$) particles / kg sediment dry weight, for food dilution and translocation, respectively. For all locations considered, exposure concentrations were either below or in the margin of uncertainty of the HC5 values. We conclude that risks from microplastics to benthic communities cannot be excluded at current concentrations in sediments worldwide.

Keywords: Risk assessment, microplastic, sediment, species sensitivity distribution, quality assurance

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