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Can plastic bag derived-microplastics act as vectors for metal exposure in terrestrial invertebrates?

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Microplastics are widely reported contaminants in marine and freshwater ecosystems and studies have shown that they can be ingested by aquatic organisms and lead to potential negative effects on health. The effects can arise from the physical effects of the plastics (e.g. food displacement and blockages of the digestive tract) and from their potential to adsorb contaminants, primarily organic compounds, resulting in an increased exposure of the organism to toxic contaminants. Studies are beginning to emerge that also show a high abundance of microplastics in the terrestrial environment but there remains a lack of data on the impacts of these terrestrial microplastics or their interaction with other terrestrial pollutants.

We conducted Zn adsorption experiments using HDPE microplastics, derived from plastic bags. Zinc adsorption to microplastics was similar to that observed in soils, but in the presence of both soil and microplastics, preferential adsorption onto the soil was observed. In desorption experiments, desorption of Zn from microplastics and soils was minimal (< 10 %) in 0.01 M CaCl2 solution, but in synthetic earthworm guts desorption of 40 – 60% was observed for the microplastics compared to 2 – 15 % for the soils. In earthworm exposure experiments Lumbricus terrestris earthworms cultivated in soils containing 0.35% by mass of Zn-bearing plastic (236 - 4505 mg kg-1) ingested the microplastics with no evidence for either preferential feeding or avoidance. There was no evidence for an accumulation of the microplastics in the earthworm gut or for signs of toxicity.

Our experiments demonstrate that earthworms will ingest microplastics and that microplastics can adsorb metals and act as vectors for metal exposure in soil invertebrates. However, for Zn, the risk associated with this exposure appears to be minimal.