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**REVIEW**

# Vector transport of microplastics bound potentially toxic elements (PTEs) in water systems

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**Summary:** Microplastics can act as a vector to transport various organic and inorganic contaminants. Hydrophobic and hydrophilic organic contaminants tend to bind to microplastics due to their hydrophobicity and high surface area to volume ratio. Recent studies have focused their attention on evaluating the ability of microplastics to bind potentially toxic elements (PTEs). The co-occurrence of microplastics and PTEs may be facilitated by the ubiquitous presence of both in the environment. The metal adsorption of different microplastics has been investigated under different environmental factors and polymer properties to reveal possible interactions. The environmental factors such as solution pH, dissolved organics, dissolution media, and ionic strength have been studied the most and recognized as factors governing the adsorption of PTEs. Degree of aging and polymer type have been highlighted as the key polymer properties which influence the adsorption of PTEs. However, the effects may differ with different PTEs and environmental conditions. Though sorption capacities and mechanisms have been extensively studied, critical analysis of their behaviour in co-existence with other ions in aqueous media remains unexplored. This review focuses on critically assessing the partition coefficients between different microplastics and water for PTEs in the presence of various factors that influence the metal adsorption. Besides, postulated interactions for the adsorption of PTEs in the presence of dissolved organics, competitive ions, and different pH values are overviewed. Moreover, the associated health risks on biota and humans, when they are exposed to microplastics bound PTEs are also discussed.

**Keywords:** Ecotoxicity, heavy metals, microplastics, partition coefficient.

## INTRODUCTION

The ubiquitous presence and overuse of plastics have become a huge environmental problem up to date, as plastics are recognized as an emerging contaminating pollutant (Alimi *et al*., 2018; Atugoda *et al*., 2020). Due to the uncontrolled usage of plastics stuff, the release of plastics into the environment has distinctly increased. The main pathways to transport plastics into the environment are disposal effluents of wastewater treatment plants, compost, and bio-solids, landfills, treated sewage sludge, and atmospheric deposition (Kershaw, 2016; Kilponen 2016; Rochman, 2018). Any type of plastic nurdles, fragments, or fibres with a diameter ranging from 100 nm to < 5 mm are defined as microplastics (Alimi *et al*., 2018). Based on the formation pathways, microplastics can be categorized into two types as primary microplastics and secondary microplastics (Bradney *et al*., 2019). Synthetically produced microplastics, including plastic nurdles, fibres, and powders for the manufacturing of textiles, plastic products, personal care products, cosmetics, and pharmaceuticals are considered as primary microplastics (Duis & Coors, 2016). Secondary microplastics are formed from the breakdown of the larger plastic debris. As illustrated in Figure 1, microplastics act as leading sources of contaminants harmful to the terrestrial and aquatic environments and life forms.

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