



Evaluation of uptake and chronic toxicity of virgin polystyrene microbeads in freshwater zebra mussel *Dreissena polymorpha* (Mollusca: Bivalvia)



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HIGHLIGHTS

- Few information about microplastic toxicity in freshwaters were available.
- Uptake/toxicity of virgin polystyrene microbeads (PMs) were evaluated in zebra mussel.
- PMs are concentrated in the gut lumen, tissues and hemolymph of zebra mussel.
- PMs induce a low alteration of oxidative status and dopamine level in zebra mussel.
- A considerable uptake and low toxicity summarize the effects of PMs in zebra mussel.

GRAPHICAL ABSTRACT



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ABSTRACT

Microplastics (MPs), plastic debris smaller than 5 mm, are widely found in both marine and freshwater ecosystems. However, few studies regarding their hazardous effects on inland water organisms, have been conducted. For this reason, the aim of our research was the evaluation of uptake and chronic toxicity of two mixtures (MIXs) of virgin polystyrene microbeads (PMs) of 10 µm and 1 µm in size (MIX 1, with 5×10^5 of 1 µm size PMs/L and 5×10^5 of 10 µm size PMs/L, and MIX 2 with 2×10^6 of 1 µm size PMs/L and 2×10^6 of 10 µm size PMs/L) on freshwater zebra mussel *Dreissena polymorpha* (Mollusca: Bivalvia) during 6 exposure days. The PM uptake in the mussel body and hemolymph was assessed using confocal microscopy, while the chronic toxicity of PMs was evaluated on exposed mussels using a comprehensive battery of biomarkers of cellular stress, oxidative damage and neuro-genotoxicity. Confocal microscopy analyses showed that MPs concentrated in the gut lumen of exposed mussels, absorbed and transferred firstly in the tissues and then in the hemolymph. The results revealed that PMs do not produce oxidative stress and genetic damage, with the exception of a significant modulation of catalase and glutathione peroxidase activities in mussels exposed to MIX 1. Regarding neurotoxicity, we observed only a significant increase of dopamine concentration in mussels exposed to both MIXs, suggesting a possible implication of this neurotransmitter in an elimination process of accumulated PMs. This research represents a first study about the evaluation of virgin MP toxicity in zebra mussel and more research is warranted concerning the long term neurological effects of virgin MPs.

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