Differences in the occurrence of microplastic at two technically diverse drinking water treatment plants within the same river catchment

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Abstract

Microplastics (MPs) are one of the most discussed emerging pollutants of aquatic environments. Until now, MPs occurrence has been investigated in seas, oceans and freshwater reservoir. There are also studies investigating the MPs occurrence in drinking water. Although the adverse effects of MPs on human health are still largely unknown, the presence of MPs in drinking water and their removal options deserve more attention, while drinking water treatment plants (DWTPs) pose barriers for MPs to enter water for human consumption. In this study, we provided a unique insight into the occurrence of MPs at two different DWTPs situated on the same river (upstream and downstream) but differing in treatment technology. Analysis of MPs $\geq 1\mu$m, including their quantification and characterization, was conducted in raw and treated water and after each treatment step. It was found that the content of MPs varied between the two monitored DWTPs significantly. While at one DWTP (upstream), there were 23 $\pm$ 2 and 14 $\pm$ 1 MPs L–1 in raw and treated water, respectively, at the second DWTP (downstream), there were 1296 $\pm$ 35 and 151 $\pm$ 4 MPs L–1. Most of the detected MPs ($>$ 70%) were smaller than 10μm and irregular fragment shape prevailed over fibres. With regard to material composition, cellulose acetate, polyethylene terephthalate, polyvinyl chloride, polyethylene, and polypropylene were the most occurring materials. The maximum MPs removal was achieved at the downstream DWTP (88% compared to 40% at upstream DWTP) that had a higher initial MPs content and operate more complex treatment technology consisting of coagulation-flocculation-sedimentation, deep-bed filtration, and granular activated carbon adsorption. These technologies contributed to MPs elimination by 62%, 20%, and 6%, respectively. The achieved results contributed to filling the knowledge gap regarding the removability of MPs by distinct drinking water treatment technologies operating under ordinary conditions.

Keywords: drinking water, microplastics, water treatment

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