Flux rates reflect microplastic sources and their temporal and spatial deposition patterns in aquatic environments

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Abstract

While our understanding of microplastic occurrence across aquatic environments has grown, the knowledge gap lies in predicting the future changes. Microplastics from aquatic sediments are often reported as concentrations i.e. pieces kg-1. While concentrations are critical from ecological aspects, the time is needed in the equation for evaluating the rate of change in microplastic concentrations and future risk assessments. Due to a lack of chronological control, the vertical flux rate of microplastics into sediments often remains unknown. In addition, the microplastics deposition rate is required in order to confirm and compare the feasibility and efficiency of different environmental conservation methods applied in order to reduce microplastic contamination in aquatic environments. A sediment trap method is widely applied in aquatic sedimentary studies in order to understand sedimentation processes in a certain environment. We have used near-bottom sediment traps in order to measure and quantify the annual and seasonal microplastic flux rates from several sites. Controlled temporal interval of trap maintenance enables calculation and determination of local vertical flux rate into sediments i.e. number of accumulating microplastic particles per time unit per surface area. Combined with heavy liquid separation technique, and FTIR technique, sediment trap monitoring shows promising results. Highest microplastic flux rates were detected in the vicinity of urban activities. However, microplastic concentrations cannot always be predicted based on sedimentation rates. Hence, high sedimentation rates can hamper detection of hot spots especially in coastal sites with high sedimentation rates. Our results indicate seasonal variation in microplastic deposition, the highest flux rates were measured during the growing season.

Keywords: flux rate, depositional processes, sediments, aquatic environments, seasonal variation

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