Optimizing a Controlled Environment for Microplastics Uptake by Aquatic Plants

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Abstract

Due to their small size and potential to enter organisms, microplastics in aquatic ecosystems, are posing an emerging threat. Plants play a crucial role in these environments both from the point of endangered species and like a way to mitigate the pollution so understanding their interaction with microplastics is essential. This study analyses the dispersion of polypropylene microparticles in different water matrices. Polypropylene was chosen for this study, since it has lower density than water, allowing its particles to float at the water-air interface, mimicking the natural position of many aquatic plants and potentially facilitating their interaction. Polypropylene nanoparticles were prepared by sieving a polypropylene powder through 500 um mesh. Particle size distribution and chemical composition were analyzed using various techniques: Scanning Electron Microscopy, Micro-Raman, Fourier-Transform Infrared Spectroscopy, Optical Microscopy and Laser diffraction. Four water matrices were used: tap water, Milli-Q water, pure water and with 0.1% surfactant. Surface tension and two polypropylene concentrations (1 mg/L and 4 mg/L) were analyzed in each. In samples with surfactant, particles stuck to the glass walls, hindering analysis of surface dispersion. Without surfactant, particles dispersed differently in tap and Milli-Q water: tap water showed central dispersion, while Milli-Q displayed a capillary flow from center to wall. Since all particles are floating at the surface of the water, no matter what is the volume, we propose that for this type of microplastics analysis surface concentration is introduced. The surface concentration could be calculated as a correlation between weight and particle size distribution. These findings provide valuable insights into the surface characteristics, behavior, and potential ecological interactions of polypropylene microparticles in aquatic environments. This initial study paves the way for further research on plant-microplastic interactions. **Acknowledgements:** Ministry of Science, Technological Development and Innovation, Republic of Serbia (451-03-66/2024-03/200134, 451-03-68/2024-14/200024). CA20101 PRIORITY, supported by COST

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