Microplastic retention in urban tree canopies of Hamburg, Germany

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Abstract

Recent studies on the atmospheric deposition of microplastic particles in the greater Hamburg area, showed evidence of particle retention within the canopy of forests. That is what set us off to investigate the canopy of urban trees in parallel to further atmospheric investigations.

Four sampling stations were selected representing different anthropogenic pressures. At each sampling station, fresh leaves from the outer crown area of two individuals of lime (Tilia spp.) or oak (Quercus robur) were taken in three different expositions to the adjacent road once in early summer and once in autumn 2021. Furthermore, the underlying sediment or soil was sampled in early summer in 4 replicates each. In the MRC laboratory, leave samples were put into (1) filtered MilliQ water and (2) SDS solution and subsequently shaken in a standardised manner over 30 minutes. Concerning sediment samples the biogenic organic matter was digested (H2O2 - NaClO), and samples underwent density separation (NaI, > 1.5 g/cm3). Sample suspensions were transferred to cellulose filters, stained with Nile Red (1 mg/ml in chloroform) and investigated with fluorescence microscopy (Axioscope 5/7 KMAT, Zeiss) for microplastic particle counts and dimensions. A subset of potentially identified synthetic particles were investigated for their polymer composition via Raman spectroscopy (DXR2xi Raman Imaging Microscope, Thermo Fisher Scientific).

Microplastics are found in all samples investigated. Microplastic mean concentrations in leaf samples are 493 ± 231 particles per m2 of leaf surface. Mean concentrations of microplastics in associated sediments are 17.174,2 (±11.643) per kg dry weight. Both for leaf and sediment samples, highest concentrations are found at a central investigation site affected by high anthropogenic pressure. Results are closely linked to the findings on microplastics in atmospheric deposition (see talk given by Malin Klein, MRC, Hamburg).

Keywords: atmosphere, vegetation, urban environments, nile red, Raman

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