Contribution ID: **10** Type: **not specified**

Milena Latz (EAC): High-resolution TD-PTR-MS as a novel analytical technique for nanoplastic detection and quantification in environmental samples

Wednesday 7 May 2025 09:45 (15 minutes)

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Abstract: “Research during recent years has showed that plastic pollution has already penetrated all areas of the world. Not only in urban-, but also in rural regions, environmental research showed high contamination of primary and secondary plastic debris. While the majority of research focuses on plastic particles >1 µm (macro- and microplastics), smaller particles have been largely omitted due to their size-dependent difficulty to analyze.

To counteract this knowledge gap, TD-PTR-MS has been established as a novel analytical technique for plastic analysis in the sub 1 µm area (nanoplastics, NPs). This simple analytical method allows fast, real-time analysis, of various sample types including samples containing complex matrices. In the past, NPs have already been detected via TD-PTR-MS in a broad variety of environmental samples (air, water, ice, snow) even in remote regions such as the Siberian Tundra. Moreover, recent research on mussel tissue revealed contamination of plastic particles as small as 200 nm.

To increase application areas, subsequent work focuses on the implementation of high-resolution (>10000 FWHM) TD-PTR-MS in nanoplastic analysis. We will discuss advantages and challenges of high-resolution instrumentation compared to lower resolution methods. In previous research, a fingerprinting library, consisting of up to 40 plastic specific markers, has been developed for six of the most common plastic types (PE, PP, PS, PVC, PET, and Tire Wear). After mass spectrometric analysis of the sample, an algorithm then allowed for the exact discrimination between different plastic types. With this work we also present an improved high-resolution library for qualifying organic ions of the most common plastic types, scanning for a mass range from m/z 100-1000. Compared to other analytical methods, the large number of markers implemented greatly increases the probability of correct identification in the subsequent step.

While the upscaling to a high-resolution analysis technique allows for an increased resolution and selectivity as well as a lower detection limit during NPs analysis, challenges during data processing, and an increased complexity of the resulting mass spectrum resulting in an increase in data size have been observed as well.”

Session Classification: Session I: Environmental Chemistry, Chair: tbd