



## **A Novel PTR-ToF-MS Inlet System for On-line Chemical Analysis of SOA**

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Secondary organic aerosol (SOA) is formed from biogenic and anthropogenic precursors in the atmosphere. Because of its impact on human health and the environment there is a strong interest in understanding the chemistry of SOA formation and transformation. Its volatility, chemical complexity and reactivity and low ambient concentrations challenge the chemical analysis of SOA.

Here we present a novel analytical setup for on-line measurements of SOA under ambient conditions by chemical ionization mass spectrometry. The method overcomes current limitations in the chemical analysis of SOA by combining on-line enrichment of the particle concentration and on-line mass spectrometric detection using soft chemical ionization. On-line sampling allows for highly time-resolved analysis of organic aerosol compounds and avoids potential sampling artifacts from sample pre-collection and pretreatment. The deployment of a soft ionization method minimizes the fragmentation of fragile organic aerosol compounds in the mass spectrometer.

A proton-transfer-reaction time-of-flight mass-spectrometer (PTR-ToF-MS) is combined with a three-stage aerosol inlet system consisting of an activated carbon monolith denuder, an aerodynamic lens (ADL) and a thermodesorption unit. The denuder strips off gas-phase organic compounds and the ADL enriches the particle concentration in the sample flow. Ultimately, organic aerosol compounds are volatilized at 120 °C in the thermodesorption unit before being introduced into the PTR-ToF-MS system for chemical analysis.

The ADL is designed to increase the particle concentration in the sample flow by a factor of up to 50 for particles in the size range between 50 and 1000 nm. This novel enrichment step enables the real-time in situ analysis of SOA at sub  $\mu\text{g}/\text{m}^3$ -levels by PTR-ToF-MS.

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