

Characterisation of organic aerosols with new soft ionisation ultra-high resolution mass spectrometry techniques

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Organic compounds in atmospheric aerosol particles play an important role in climate and air pollution. However their sources and atmospheric processing are poorly understood, partly due to the lack of understanding of the chemical composition of the organic aerosol fraction. Organic aerosols are composed of hundreds to thousands of compounds, posing a significant analytical chemical challenge.

In recent years new ultra-high resolution mass spectrometry (UHR-MS) techniques, which allows determining the elemental composition of thousands of organic compounds in a single analysis, have been used to characterize the highly complex organic aerosol composition on a molecular level.

A range of different ionization techniques will be discussed which have been developed and coupled to UHR-MS over the last years to minimize sampling artifacts and which allow widening the chemical space available for the analysis. In addition, an online aerosol MS technique with a time resolution of about one minute, extractive electrospray ionization (EESI), will be presented with detection limits in the nanogram per m³ concentration levels.

Aerosol analyses from a range of field studies from urban and remote locations will be presented where UHR-MS was used to identify atmospheric organic aerosol sources, and aging processes. The samples are compared with laboratory analyses to identify secondary organic aerosol formation processes.

These examples show that new, soft ionization UHR-MS techniques allow for a significantly improved characterization of organic aerosol composition, sources and evolution over time, compared to conventional MS techniques.