



Newly developed instrumentation for measuring highly oxidized molecules at atmospheric pressure

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The Highly Oxidized Molecule Ion Spectrometer (HOMIS) is a novel instrument for measuring the total concentration of highly oxidized molecules (HOM-s) (Bianchi et al., 2019) at atmospheric pressure. The device combines a chemical ionization charger with a multi-channel differential mobility analyzer. The chemical ionization charger is based on the principles outlined by Eisele and Tanner (1993). The charger is attached to a parallel differential mobility analyzer identical to the ones used in the Neutral cluster and Air Ion Spectrometer (NAIS, Mirme 2011), but with modified sample and sheath air flow rates to improve the mobility resolution of the device. The complete mobility distribution in the range from 3.2 to 0.056 cm²/V/s is measured simultaneously by 25 electrometers. The range captures the charger ions, monomers, dimers, trimers but also extends far towards larger particles to possibly detect larger HOM-s that have not been measured with existing instrumentation. The maximum time resolution of the device is 1 second allowing it to detect rapid changes in the sample. The device has been designed to be easy to use, require little maintenance and work reliably in various environments during long term measurements.

First results of the prototype were acquired from laboratory experiments and ambient measurements. Experiments were conducted at the Laboratory of Environmental Physics, University of Tartu. The sample was drawn from a reaction chamber where alpha-pinene and ozone were introduced. Initial results show a good response when concentrations of alpha-pinene and ozone were changed.

Ambient measurements were conducted at the SMEAR Estonia measurement station in a hemiboreal forest for 10 days in the spring and two months in the winter of 2020. The HOMIS measurements were performed together with a CI-API-TOF (Jokinen et al., 2012).

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