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Atmospheric Measurement Techniques Discussions

Interactive comment on "A novel inlet system for on-line chemical analysis of semi-volatile submicron particulate matter" *by* P. Eichler et al.

Anonymous Referee #3

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General comments: The paper presents a newly developed inlet system for online chemical analysis of semi-volatile organic particle components that can be coupled to various analyzers such as e.g. a PTR-MS. Measurements with high chemical and temporal resolution of both gas and particle phase compounds are very important for increasing our understanding of particle formation, growth, and aging processes; instrument developments in this direction are important. However, combining the measurement of both phases in one instrument is challenging due to the very different properties of the two phases. With the CHARON the authors present a very promising design. However, a few more characterization tests (quantitativeness, reproducibility, artifacts) to prove its usefulness should be performed before its publication. According to the authors, one of the main goals of the novel inlet is partitioning studies. These

studies require a very accurate determination of instrument backgrounds in general, and the specific backgrounds in both gas and particle phase measurements. More detailed analyses of regions in the inlet and the instrument where gas phase adsorption can occur (leading to both signal losses and increased backgrounds), and analyses of background measurements which are prone to interferences from the respective other phase are needed to fully prove the usefulness of the inlet. Tests for quantitativeness, where instrument response (mass measured) is plotted vs particle mass introduced (e. g. varying steady state concentrations in the room) would also reveal interferences and background artifacts and should be done before publication of the inlet design. Also, the authors show single mass spectra to validate their experimental setup, but they do not prove reproducibility of spectra and with that stability of their inlet system. Not mentioned or described is the setup for "simultaneous" gas and particle phase measurements, again essential for partitioning studies. How was this done for the data shown in Fig. 5? Does the CHARON have to be removed from the PTR-MS to directly measure the gas phase? Is there a manifold? Again, for this switching, however it is done, a characterization of possible artifacts will be very important.

Specific comments: P. 10111, l. 6-7: This statement is true in principle for all particle ionization techniques. P. 10112, section 2.1.1.: The particle transmission efficiency in the GPD was tested for particle number losses. However, semi-volatile particle components might evaporate in the GPD, leading to particle mass losses. Measurements of particle mass (or size) after the denuder and calculations of denuder residence times and volatilization times of different semi-volatile compounds would help identify these artifacts. P. 10116-10117, l. 26-2: A HEPA filter (also a new one) can have very high gas phase backgrounds itself, which would lead to an overestimation of background concentrations. I suggest testing various HEPA filters or using PTFE filters in filter holders. P. 10117, l. 2-3: What kind of submicron particulate filter was used ? Were these filters tested for gas phase adsorption ? Especially quartz fiber filters are very efficient gas phase adsorbers. P. 10121, section 3.4.: This paragraph and the corresponding figure are too short to be useful as proof of concept. I suggest repeating

these tests with different dilutions to show instrument response as a function of mass loading, show mass spectra reproducibility, and go a bit into detail in mass spectra analysis. Fig. 5: See general comments above. The figure shows that the measured gas phase signal decreases for compounds with increasing degree of oxygenation, and the authors conclude from this that “their inlet works”. However, the decrease in gas phase signal could also be from adsorption of the less volatile, more oxygenated compounds in the inlet/instrument. In addition, the particle phase concentrations do not show a proportional increase – if you were to take the ratio of gas-to-particle phase it would be difficult to make a final statement on partitioning as a function of degree of oxygenation.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 10109, 2014.