Atmos. Meas. Tech. Discuss.,
doi:10.5194/amt-2019-22-RC1, 2019

Atmospheric Measurement Techniques Discussions

Interactive comment on "Novel Aerosol Flow Reactor to Study Secondary Organic Aerosol" *by* Kelly L. Pereira et al.

Anonymous Referee #3

Received and published: 8 March 2019

General Comments

This paper describes the design and operation of a new continuous flow reactor (CFR) for investigating the chemical composition and physical properties of secondary organic aerosol (SOA). The reactor was used to generate SOA from the photo-oxidation of four different precursors under a variety of experimental conditions. The SOA was collected onto filters or impactor plates and the chemical composition and physical properties were investigated using a range of off-line analytical techniques. The main advantage of this experimental apparatus is that it allows production of significantly more SOA mass than typically generated in simulation chamber experiments, thus making off-line analytical techniques more accessible. Indeed, sufficient SOA was generated in the experiments to enable CHNS elemental analysis to be performed, a technique which

is rarely performed on SOA samples.

Overall, this is a very well written paper which describes a useful new facility for generating SOA for off-line analysis. Technical aspects of the design, testing and operation of the CFR are described with a high level of detail. The results from the test experiments are of high quality and are well presented and interpreted. A more detailed analysis of SOA chemical composition will be presented in a future publication. One important finding of this work is the observed discrepancy in O/C ratio when measured by CHNS analysis and the more commonly applied technique of UHRMS. Further work is required in this area.

The CFR and analytical approaches presented in this paper represent a welcome addition to the range of experimental methods for investigating the complex nature of SOA. Publication in Atmospheric Measurement Techniques is recommended following consideration of the minor comments below.

Minor Comments

1. What is the difference between oxidative flow reactors (briefly described in the Introduction) and the continuous flow reactor built and operated by the authors? What is unconventional about the way the CFR is being used here? These points need to be clarified somewhere in the manuscript, probably in the last paragraph of the Introduction.

2. The light source emits radiation at 254 nm and 185 nm and is not representative of tropospheric conditions. While the authors do comment that the CFR is not being used to mimic atmospheric conditions, it is still important to ensure that the higher energy UV light used in these experiments does not significantly affect the representativeness of the oxidation chemistry of the SOA precursor, or the composition of the SOA itself. Maybe this issue can be addressed in section 3.3 CFR limitations?

3. Since the experiments were performed using high concentrations of precursors and

nitrogen oxides, there is the strong possibility of artefacts caused by deposition of gas-phase organic species on the filters and impactor plates. There is also the possibility of reactive nitrogen species interacting with the SOA via heterogeneous processes. The authors should provide some comments on the issue of possible artefacts. Denuders are commonly used in chamber experiments to remove gas-phase oxidation products and reduce artefacts. Could they be used in this set-up?

4. Page 8, lines 16-17: The SOA mass and number concentrations in the chamber background experiments given here seem to be very high (compared to chamber experiments). How do these concentrations compare., e.g. in % terms, to the concentrations produced during an experiment?

Technical comments

1. Page 1, line 16: Delete “mass”

2. Page 9, line 2: Replace “volatiles” with “organic compounds”

3. Page 14, line 3 and several other places in the manuscript and SI: The authors use the term “alcoholic hydroxyl” or “alcohol”, whereas I think that simply “hydroxyl” is more appropriate.

4. Page 17, line 33: should be “affect”

5. Page 21, line 5: should be “affecting”

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2019-22, 2019.