

Interactive comment on “Elemental analysis of chamber organic aerosol using an aerodyne high-resolution aerosol mass spectrometer” by P. S. Chhabra et al.

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Response to Referee 3:

The authors appreciate the helpful comments and suggestions provided by the reviewer. The referee's comments are in italics, followed by the authors' responses.

1) Many of the figures show changing elemental ratios as a function of irradiation time. The authors clearly state that the elemental ratios in smog chamber experiments are a function of particle mass in addition to level of oxidation. So, it would be a good reference for the reader if the trends in organic mass loading with irradiation time were also presented as an additional panel in those figures.

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AMS organic mass as a function of experiment time has been added as an additional panel to figures 1, 3, 4, 6, 8, 11, and 12. Figure 13 has been changed to reflect organic mass calculated from DMA volume multiplied by a density.

2) Table 3 shows a nice comparison of O/C ratios observed for various laboratory systems. The range of ratios observed in this work is presented. However, for some of the other measurements only single values are entered and it is not clear what the uncertainties on these values are and whether these single values represent an average, lowest, or highest value for the ratio observed during the cited experiment. Since the degree of photochemical aging and organic mass in the cited experiments is not discussed or shown in Table 3, it is hard to know how to interpret differences that are observed for the same system. Particularly obvious in this context is the comparisons between the Aiken et al. (2008) O/C values and those presented in this work. The authors should provide some information either in the table or in the discussion to help the reader understand how to compare the numbers and what the differences may be due to.

A brief discussion of the O/C values listed in Table 3 has now been added to Section 4.1. It is unclear what the source of the discrepancy is between the O/C values from this study and those reported by Aiken et al. (2008) though we hypothesize that differences in experimental conditions and organic mass loading could lead to the differences.

3) In Table 3 and Figure 16 only O/C values are compared. Why not add in comparisons to H/C as well as OM/OC? Isoprene and Naphthalene have similar O/C values, but very different H/C values. So, understanding how the H/C values of the chamber SOA compare with ambient components will also be important. The addition of OM/OC values will allow for comparisons with other traditional filter based OM/OC methods as well. OM/OC measurements for the same SOA systems studied in this work have been published in other manuscripts (see some references below). Comparisons with those results would be useful.

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Kleindienst et al., *Estimates of the contributions of biogenic and anthropogenic hydrocarbons to secondary organic aerosol at a southeastern US location, Atmospheric Environment* 41 (2007) 8288–8300

Kleindienst, et al. *The Formation of Secondary Organic Aerosol from the isoprene + OH Reaction in the Absence of NO_x, Atmos. Chem. Phys.*, 9, 6541-6558, 2009.

We acknowledge the reviewer's insightful comments and suggestions. We decided to include only O/C values in Table 3 since not every elemental analysis method explicitly reported H/C or OM/OC values. Recent ambient analysis with the AMS has also concentrated on oxygen content of organic aerosol. Thus we have focused this manuscript on elemental analysis as opposed to organic mass to organic carbon analysis. We have decided to leave Table 3 as is however we have included the provided references in Section 4.1.

4) *The statement in the abstract that “m/z 44 is generally a good measure of SOA oxygenation for all systems except for glyoxal uptake” should be reworded to more explicitly mention the details of the observed variability in the O/C estimation for the various species. While glyoxal definitely has the worst agreement, O/C estimates for the aromatic systems agree within 50% of the measured values. Also, in some of the systems (i.e. isoprene low-Nox and Naphthalene high-Nox) the agreement between the f₄₄ based prediction of O/C and the actual measured values gets better with irradiation time for some systems. For the isoprene low-Nox case, as described by Ng et al. (ACPD, 9.27745-22789,2009) and references therein, the f₄₄ can have significant contributions from C₂H₄O. If this contribution was removed using the information in the HR data, how would that affect the O/C estimate?*

The abstract has been reworded to reflect the variability in O/C₄₄ estimations. For the isoprene low-NO_x system, the ratio of C₂H₄O₊ to CO₂₊ varies from approximately 0.30 at the peak of organic growth to 0.10 towards the end of the experiment. Since f₄₄ already underestimates the O/C_{HR}, removal of the contribution of C₂H₄O₊ would

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increase this discrepancy.

P 27488, Line 2. The O/C range should be .06-.1 instead of .06-.01.

Fixed.

P 27494, Line 4. I suggest getting rid of the first part of the sentence "To distinguish between the O/C ratios determined from V- and W-mode". This is awkward as it suggests that the O/C ratios were explicitly determined from the HR data in V-mode and compared to that from W-mode.

Fixed.

P 27494, Line 22. Can you be more explicit about what you mean by contributions from H₂O being estimated? You could do this by including H₂O/CO₂ fragmentation table values in Table S2.

We have edited the Table 3 caption to include these values.

P 27500, Line 25. How much of the mass do the glyceric acids and their corresponding esters account for? It is useful to know this at this point to put the AMS measurements in context.

Fixed

Fig. 1. Why is the N/C ratio in the low- NO_x cases not closer to zero, particularly at low uptake times?

It is not clear why that is the case, though it is possible that N-containing compounds are produced immediately after uptake and then are diluted after continued uptake.

Fig 5b. Two different m/zs are labeled with the same formula (C₃H₆O⁺)

Fixed

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 27485, 2009.

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