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Atmospheric Chemistry and Physics Discussions

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Interactive Comment

Interactive comment on "Secondary organic aerosol formation from acetylene (C_2H_2): seed effect on SOA yields due to organic photochemistry in the aerosol aqueous phase" *by* R. Volkamer et al.

R. Volkamer et al.

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We like to thank the reviewer for the detailed reading and thoughtful comments of our manuscript, which overall are very positive. In the following we respond to all the specific remarks and technical corrections. Reviewer comments are copied inbetween quotation marks first, and are followed by our response.

Response to specific comments

"1) Scientific questions addressed by this paper clearly are within the scope of ACP. It demonstrates the incompleteness of current SOA formation theory. Volatility of precursors as well as influence of the chemical composition of seed aerosols and the influence of organic photochemistry have to be newly evaluated to improve our understanding of SOA formation. 2) A complete set of data for SOA formation from glyoxal is presented. Influences of chemical composition of seed aerosols under photochemical and dark conditions were investigated systematically for the first time through one experimental course. In addition to the conclusions reached, the authors found the widely-used seed aerosol ammonium sulfate to have one of the lowest SOA yields under the investigated chemical compositions of seed aerosols. SOA yields can be enhanced by adding a WSOC component to the inorganic seed aerosol, which is interesting not only for laboratory scientists and their own experiments, but also for modelers. 3) The conclusions reached, which I already summed up in my general comments, are substantial. 4) The scientific approach and applied methods are valid. Both are clearly outlined. 5) The scientific results and conclusions are presented in a clear and concise way. Number and appearance of figures and tables are appropriate and support the conclusions reached in the text."

We agree with comments 1-5.

"6) Description of experiments should include time scale and flows to and from the reaction chamber while experiments are running. The authors state they calculated the SOA mass formed by multiplying the observed volume change of the aerosol by a factor auf 1.68 gcm-3, which should correspond to the density of glyoxal oligomers in the absence of water. This surely is an appropriate way to calculate the SOA mass, but it’s not quite clear to me how this factor is calculated out of the density of 40%w/w glyoxal aqueous solution (1.27 gcm-3). I don’t think it’s even possible to accurately calculate the density of glyoxal oligomers from the density of their aqueous solution because the density should vary with the grade of oligomerization, which actually is unknown for the particle phase. However, these uncertainties will only affect the values of SOA yields calculated, not their significance."

We have added that the chamber was operated as a static reactor; the flows to and

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from the chamber during experiment set up, and sampling flows from the chamber during the experiment are now given in Section 2.

The reviewer makes a valid point concerning the uncertain and possibly variable density of glyoxal oligomers. The actual density of oligomers and their dependence on the degree of oligomerization is unknown. We have chosen to base our calculations on the equilibrium density of oligomers in 40%w/w dilute aqueous glyoxal solutions throughout the manuscript. As noted by the reviewer, density cancels out in the relative comparisons between experiments that lead to major conclusions of our work. In revisiting our calculations of the oligomer density, we realize that our previous value of 1.68 g cm-3 was based on volume percent, and not on mass percent. A calculation based on mass percent leads to a density of oligomers of 2.13 g cm-3. In lack of a measured number we have based the revised manuscript conservatively on a rounded value of 2 g cm-3. Use of this 20% higher density value leads to an according upward correction of the SOA yields, and Heff values.

We have no means of addressing the degree to which density may depend on the degree of oligomerization. It is possible that some variations with the grade of oligomerization might occur, possibly also between experiments on different seeds. However, these variations are expected in the few 10% range (and not in the range comparable to the factor 3-5 seed effect). We have slightly expanded our discussion how uncertainties in density might affect our results in Section 2.

"7) The authors give proper credit to related work and very clearly indicate their own new/original data. 8) The title clearly reflects the contents of the paper. 9) The abstract provides a concise and complete summary. 10) The presentation of the whole paper is well structured and clear. 11) The language in which the paper is presented is fluent and precise."

We agree with comments 7-11.

"12) What kind of unit is μcmˆ3 used in table 1 and fig. 4?"

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We have updated these units.

"13) Conclusion part seems to be just a summary of discussion part. Maybe these parts should be more clearly separated."

We have revised the conclusions to avoid repetitions of the discussion.

"14) The number of references is appropriate as well as the quality."

We agree.

"15) Technical corrections" - all done. P. 14846 L. 21: "seed aerosol" should be "seed aerosols"? P. 14846 L. 23-27: Please fill in missing names or used abbreviations of chemicals later referred to in the text (e.g. AS, SA..). P. 14858 L. 2: "under dark" should be "under dark conditions". P. 14888 text of fig. 4: "see table 2" should be "see table 1". Citations listed at the bottom of P. 14865, 14869, 14870 should be removed and included in reference list to unify citation style.

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 14841, 2008.

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