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Atmospheric Chemistry and Physics Discussions

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.

Anonymous Referee #1

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1. General comments

The authors describe a series of laboratory experiments on SOA formation by acetylene/glyoxal under photochemical and dark conditions in a reaction chamber. Several parameters, i.e. chemical composition and pH value of the seed aerosol and relative humidity, were varied systematically over the course of the experiments. The rate of SOA formation and the dependency of SOA yields from liquid water content (LWC) and organic mass portion (OMP) of seed aerosol were investigated. As main conclusions the authors state that the number of carbon atoms for a NMHC as SOA precursor

has to be lowered to 2 (and not 5), the rate of SOA formation greatly increases under photochemical conditions and that SOA yields were found to be uncorrelated with the OMP of the seed aerosol, but increase linearly with the LWC. Additionally chemical composition of seed aerosols was found to effect SOA yields and mild acidification was found to have no influence. In my opinion both scientific significance and quality of the paper can be rated as very high. However, I do have some smaller specific remarks and technical corrections. After these are taken into account I would recommend this paper for publication in ACP.

2. 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.

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Interactive Comment

Number and appearance of figures and tables are appropriate and support the conclusions reached in the text.

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 gcmˆ(-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 gcmˆ(-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.

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.

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

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

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

3. Technical corrections

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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.