Atmos. Chem. Phys. Discuss., 9, C1136–C1139, 2009
www.atmos-chem-phys-discuss.net/9/C1136/2009/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "New particle formation from the oxidation of direct emissions of pine seedlings" *by* L. Q. Hao et al.

Anonymous Referee #1

Received and published: 23 May 2009

The authors present data and a modelling treatment of a series of experiments in which emissions from plants were oxidised to produce aerosol particles. Particle formation from biogenic emissions is potentially an important source of aerosol, and the details of the process are still very much unknown. Studies such as this are therefore very much welcome. The experiments presented here are very interesting. The main point of the paper revolves around the question, whether particle nucleation is a result of oxidation of emitted VOC by the OH radical or ozone. The authors present as their conclusion that OH oxidation of VOCs leads to nucleation, while ozone oxidation products mainly contribute to growth.

In my opinion, this paper should be published in ACP, but I have a few reservations about some statements by the authors, as well as some suggestions for improvements.

The changes that need to be made are, in my opinion, not too extensive: mainly some more discussion on some points and adding a few bits of information.

First, as the authors state in the introduction and conclusios that realistic information on the dominant atmospheric process can be gained from the experiments, I would like to see some discussion on how realistic the oxidant levels are in the experiments. As the relative contribution of OH- and O3-oxidised VOC products to nucleation and growth is one of the main topics, it would be interesting to know how the relative ozone and OH levels in the experiments compare to 'realistic' ones. I also did not find a mention of the OH concentrations (except for peak concentrations in the chamber) in the article; as the abstract states that the experiments were in the 10ˆ6 molecules/cc regime, this should be stated somewhere in the article.

Second, while the authors have done a good job modelling the gas phase chemistry going on in the experiments, the interpretation of the results seems to me to be on a quite qualitative level. The points that are made would carry more weight if some more quantitative analysis was presented. This could include, for example, a direct comparison (or a listing or tabulating) of the formation and growth rates (or number of particles formed)to the OH and ozone oxidation rates, maybe in some averaged form. This would help the reader to get an overview of how the change in the oxidants changes the nucleation and growth parameters.

The effect of the amount of VOCs added to the chamber, as well as the changing VOC mixture is not discussed enough, in my opinion. For example, looking at table 3, one can see that the two experiments with the lowest nucleation rates are experiments E1c and E3; these have also no contribution from delta-3-carene. Of course it is evident that the OH reaction clearly plays a role here, as the nucleation rate decrases siginificantly when OH is removed. While this topic is touched upon on page 8237 for the case of b-pinene, a somewhat more thorough discussion would not go amiss.

Also, regarding the point of OH contributing to nucleation, some explanation, or for the

absence or weakness of nucleation at the second OH reaction peak in eg. experiments should be given or discussed.

In addition to these points, which I think should be addressed, I have some minor detailed comments below.

* page 8228, line 27: I think one should be careful with stating that the sulphuric acid effect is negligible; in an epty chamber with no sinks a quite low source could cause the concentration to become siginificant on a timescale of a few hours, if OH is present.

* page 8229, line 3: Add 'For off-line analysis,' in front of 'VOCs were...', otherwise this is confusing.

* page 8235, line 8 onwared: The gas-phase model indeed shows a good agreement at least on a qualitative level, but there are some deviations from the measurements, visible for example in figure 2 for formaldehyde. Is the reason for this known, or can the authors speculate what it could be? Also, I don't think that the sentence 'degraded products of these ten VOCs will contribute to new particle formation' is justified by the findings in this manuscript.

page 8236, line 24: The figure does not show correlations, but time series of several parameters.

page 8236, line 26: I think 'nucleation event' is usually used for the whole process of particle formation and growth, while here it seems to refer only to the period of intense nucleation. A rewording could be good.

page 8237, line 16: 'nucleation rates were lower even under...'; to what are the rates being compared to?

** Evaluation **

1. Does the paper address relevant scientific questions within the scope of ACP? -Yes; for details see general comments.

2. Does the paper present novel concepts, ideas, tools, or data? - Yes; see general comments.

3. Are substantial conclusions reached? - Yes.

4. Are the scientific methods and assumptions valid and clearly outlined? - For the most part, yes. More on this in comments.

5. Are the results sufficient to support the interpretations and conclusions? - See general comments.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)? - Yes.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution? - Yes.

8. Does the title clearly reflect the contents of the paper? -Yes.

9. Does the abstract provide a concise and complete summary? - Yes.

10. Is the overall presentation well structured and clear? - Yes.

11. Is the language fluent and precise? - The english is easily understandable, but contains a significant amount of errors. The manuscript could benefit from being read and corrected by a native speaker.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used? -Yes.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated? - No.

14. Are the number and quality of references appropriate? - Yes.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 8223, 2009.