

Interactive comment on “Direct measurement of particle formation and growth from the oxidation of biogenic emissions” by T. M. VanReken et al.

T. M. VanReken et al.

Received and published: 2 September 2006

We thank the reviewer for his or her comments. The reviewer made several very useful suggestions regarding our experimental methods that we will be incorporating into our ongoing studies.

The reviewer raises the point that, because only one specimen for each species was used in the current study, that the results regarding interspecific variability must be considered tentative. He or she further suggests that for these experiments be replicated several times in order to validate what we have shown. These are good points, though they reach beyond the scope of the current work. The purpose of this paper is was primarily to describe the new facility and to demonstrate conclusively that new particle formation can occur in the laboratory directly from the oxidation of biogenic emissions at concentrations similar to that of the ambient atmosphere. Quantification

of the aerosol forming potentials of different species is the subject of future planned studies, which will certainly include more repetition of measurements. The variability observed between species in this study was interesting and therefore discussed, but is not intended to be conclusive. To reflect this more clearly the word “specimen” will be added after each species name in the final submission. Moreover, the following sentence will be added the end of the paragraph ending at line 17 of page 6603: “These results are interesting, but it should be noted that the results presented here are from single experiments involving single specimens; replication of the experiments using additional specimens are necessary in order to quantify the observed variability.”

To respond to the reviewer’s specific comments:

Page 6592, lines 21-23. We did not measure the temperature in the biogenic emissions chamber because such data are not particularly informative with respect to the goal of the study. Many studies have looked at the temperature dependence of biogenic VOC emissions, including some by several of this paper’s coauthors. In this study, the VOC concentrations entering and leaving the aerosol growth chamber were of primary concern.

Page 6592, lines 5, 10, 14, and 15. These numbers will be changed in the final submission, though it should be noted that English units were used because that is how the materials were specified when ordered.

Page 6593, line 11. We did not place a filter between the biogenic emissions enclosure and the aerosol growth chamber out of concern that monoterpenes and sesquiterpenes, both considered “sticky” compounds, would not make it through the filter. To reflect this, the following sentence will be added to the end of section 2.1 in the final submission: “No particle filter was placed between the biogenic emissions enclosure and the aerosol growth chamber out of concern that “sticky” VOCs would be trapped by the filter along with any particles.” With regard to the presence of primary particles from the plant specimen, we did not see any indication of such particles passing

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through our system. Figures 4 and 5 demonstrate this- if there were any significant contribution from primary particles, they would be observed throughout the night.

Page 6603, line 15. As noted above, quantifying this phenomenon is a subject of future investigations. In the final submission, this issue will be addressed as described in the general comments above.

Page 6603, lines 18-25, and figure 5. As the reviewer suggests, a change in emissions speciation (perhaps due to stress) could well effect a change in the intensity of the particle formation event. With respect to the reviewer's other question, it is difficult to say what additional species might contribute to aerosol formation. As noted in section 1 of the paper, field measurements by Goldstein et al. (2004) and Holzinger et al. (2005) indicate that there are undetermined classes of BVOCs contributing to ozone loss at forest sites. Identifying these compounds was not a focus of the current work. To better communicate these details, in the final submission this paragraph will be modified to read as follows:

“Other behavior observed during this study cannot be readily explained, even in a qualitative sense. For example, it is unclear why during the P. taeda experiment there was such variation in the magnitude of the particle formation event under seemingly similar experimental conditions. It is possible that the composition of the biogenic emissions changed from one day to the next, perhaps due to added stress on the plant specimen. Another possibility is that, as suggested by Goldstein et al. (2004) and Holzinger et al. (2005), some unknown gas species in addition to those observed during the study contributed to the particle formation event and varied during the experiment. Future studies will measure additional trace gas properties in effort to better characterize the system.”

Interactive comment on Atmos. Chem. Phys. Discuss., 6, 6587, 2006.

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