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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Effect of NO_x level on secondary organic aerosol (SOA) formation from the photooxidation of terpenes" *by* N. L. Ng et al.

Anonymous Referee #1

Received and published: 9 August 2007

General Comments:

This paper describes laboratory studies of secondary organic aerosol (SOA) formation from the photooxidation of one monoterpene and two sesquiterpenes under NOx concentrations ranging from approximately zero to "high NOx" levels. The SOA is analyzed using an SMPS to determine SOA yields, and an Aerodyne AMS and electrospray ionization mass spectrometry (ESI-MS) are used to determine chemical composition.

The aim of the study is to compare the effect of NOx concentrations on SOA yields and chemical composition for representative C10 monoterpenes and C15 sesquiterpenes. Previous studies with monoterpenes and aromatics have indicated that SOA yields decrease with increasing NOx concentrations, possibly because hydroperoxides and peroxyhemiacetals that are thought to be important in SOA formation under low NOx concentrations are replaced by organic nitrates and other more volatile compounds at higher NOx levels. Here, it is shown that SOA yields instead increase with increasing NOx concentrations for the sesquiterpenes (the opposite trend is observed for the monoterpene), indicating that for these higher molecular weight VOCs the multifunctional organic nitrate products (identified using ESI-MS) have low enough volatilities to contribute significantly to SOA mass. This is important, since it means sesquiterpenes may form more aerosol in polluted air than in clean air. The effect of NOx on SOA formation is therefore more complicated than has been generally thought, and clearly in need of much further study.

The experiments are well done and not easy. They require the ability to work at low VOC concentrations and to create a number of different oxidants. They also require sophisticated mass spectrometric analyses and data interpretation. The conclusions are fairly straightforward and well supported by the data. The paper is clearly and concisely written, and the figures, tables, and references are fine. I recommend the paper for publication in Atmospheric Chemistry and Physics. I have just a few comments.

Specific Comments:

1. Some of the terpene concentrations used in these experiments are very low, 5 ppbv or less, which corresponds to a vapor pressure of approximately 4 x 10-6 torr. This is in the semi-volatile range. I could imagine compounds condensed on the walls of the chamber from previous experiments having similar vapor pressures and thus contributing to the VOC loading. Have experiments been performed without added terpene but with all other components (seed particles, oxidant, etc.) in order to determine background contributions to SOA mass?

2. In Table 6 there are two compounds listed with molecular formulas containing 12 carbon atoms. The parent terpene, a-pinene, only has 10 carbon atoms. Also, in Table 7 there is one compound listed with a molecular formula containing 16 carbon atoms

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and 13 compounds with 17 carbon atoms. The parent terpene, longifolene, only has 15 carbon atoms. Are these thought to be oligomers or could the formulas be wrong?

Technical Comments:

1. Figure 8: In the bottom panel I suggest using the same -100 to +100 Percentage Change scale used in Figure 9 so the two figures can be visually compared more easily.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 10131, 2007.

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