**Atmospheric
Chemistry
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Discussions**

Interactive
Comment

Interactive comment on "Mass yields of secondary organic aerosols from the oxidation of $\vec{\alpha}$-pinene and real plant emissions" *by* L. Q. Hao et al.

Anonymous Referee #2

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General comment:
This manuscript describes SOA formation of plant emissions and a-pinene as a reference under various oxidation conditions. The influence of the oxidation condition O3 vs. OH dominated is discussed in relation to SOA mass yields and volatility of the particles. Here the authors detect an ageing process in absence of oxidants, which increased the persistence of the particles. The authors demonstrated that their observations for Spruce and Pine emissions are comparable to field observations at the Hyytiälä station in Finland. The derived an average mass SOA yield of 10The authors present interesting and important new material and the manuscript is well written. It should be published in ACP with minor changes and after consideration of the comments below.

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Comments:

P. 28793, l. 9 and P. 28801, l. 9

Definition of volume growth factor is ambiguous. Do you refer by size to the diameter or to the volume? Please, define V-GF precisely. Moreover, calling the quantity which describes the shrinking a growth factor is somewhat confusing, it is correct though. I suggest to reconsider the terminology.

P.28794, l. 3ff

This approach to determine the loss rates is applicable only after the aerosol mass production stopped. You did not specify a criterion when you assumed/know that this was indeed the case. This criterion maybe easy for the reaction O_3 with a-pinene, since a-pinene ozonolysis products do hardly react further with O_3. However Ng et al. (2006) demonstrated that particles grow significantly even when the primary precursors are totally consumed.

How do you determine that the aerosol mass production really stopped when OH was in the system?

How did you determine that no further reaction of multiple unsaturated terpenes took place after the primary precursors were consumed?

I suggest to explain this a little more in the manuscript.

P.28795, l. 5f

I don't understand, how can you have an inlet flow of 40 l/min and an out flow of only 15 l/min? Do you inflate the chamber? But then the volume is not 6 m3 all the time. Please, explain.

P. 28800, l. 9

Fig. 10 of Mentel et al. 2009 does not show the mass yields, but the mass as a function of consumed VOC. Let's call this type of plot for the moment a growth curve. Since these linear growth curves have positive x-intercepts (nucleation thresholds), the mass yields as a function of ΔVOC or the formed aerosol mass, will also have curvature (like in your Figure 2a). Consider the following equation (m: aerosol mass, yinc: incremental

yield, b: y-intercept of the growth curves):

m = yinc x $\triangle$VOC-b

m/$\triangle$VOC = Y = yinc - b/$\triangle$VOC

Y is increasing with increasing $\triangle$VOC, thus with increasing m because b/$\triangle$VOC is decreasing and yinc approaches Y for large $\triangle$VOC. The slopes of the linear growth curves (= yinc) give the maximum yield (in the case of linear growth curves).

If you compare Mentel et al. 2009 Figure 10 with Ng et al. 2006 Figures 3 and 4 and consider the $\triangle$VOC you will recognize that for that small turnovers, below 100 ug/m3 Ng's curves are also quasi-linear. Mentel et al.'s dynamic range of $\triangle$VOC is small, thus they may have underestimated the maximum yield. Considering this there seems to be no difference within the errors for the different type of studies.

Question: how did your growth curves look like compared to Mentel et al. (2009) and Ng et al. (2006)? Are they straight or slightly upward bent?

Can you estimate your nucleation thresholds? Is your mass dependent yield really mass dependent or does it reflect essentially the fact that you also observe a nucleation threshold.

P.28802 l.23 P.28804, l.26

Do you have an idea about the driving force of this aging in the absence of oxidants?

P. 28803, l.24

Could it be that the particles were in an amorphous state - liquid or glassy - and started to crystallize?

P. 28805, l. 1

The fact that the observations can be described by one set of parameters for the two product model suggests that the SOA formation is independent on the precursor mix. This seems to be in contrast to the previous statement that SOA formation depends on the precursor mix ?

Corrections:

C12539

P. 28970, l.15 Must read Saathoff et al. 2009

P. 28791, l. 1 Capitel S in name of reference Kiendler-Scharr et al. 2009 The reference Kiendler-Scharr et al. 2009b does not appear throughout the body of the manuscript. Please check.

P. 28793, l. 6 9 Typos: evapourate evapouration evaporate evaporation

P. 28797, l. 18 You refer to Fig. 2a

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 28787, 2010.

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