

Interactive comment on “Mass yields of secondary organic aerosols from the oxidation of α -pinene and real plant emissions” by L. Q. Hao et al.

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The authors thank the reviewer for his/her constructive and helpful comments:

P. 28789 - Line 12: “The SOA yields from oxidation the real plant emissions vary from 1.9% at an aerosol loading of $0.69 \mu\text{g m}^{-3}$ to 13.6% at $32.8 \mu\text{g m}^{-3}$ ”. In table 2, the SOA yields vary from 1.9 % to 17.7%... this SOA yield of 17.7 % should be mentioned by the authors. Same remark P28799 - line 10. Same remark P28804 - line 21.

Answer: This comment has been accepted. The text of P28789 was modified as follows: ‘...varying from 1.9% at an aerosol mass loading of $0.69 \mu\text{g m}^{-3}$ to 17.7% at $26.0 \mu\text{g m}^{-3}$ ’. Similar changes were made on P28799 and P28804.

P. 28794 - Line 2: “It is assumed that the wall loss rate is first order and the loss

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rate constant is independent of size particle". Have the authors verified that the wall losses are independent of the size particle? What is the experimental procedure used to determine the SOA wall losses?

Answer: The experimental procedure for determining aerosol wall loss coefficients is presented in Sec. 2.1. For the OH-dominated experiments, wall loss rate was estimated from the measurements performed after the oxidants (OH+O₃) were completely consumed (Please refer to Fig. 1 and Fig. 5, where it is noted that the oxidants were gone completely after 100 min). For the O₃-initiated experiments, wall loss rate was estimated using the measurements performed after the reactivity fraction, defined as $\frac{k_{OH}}{k_{OH} + k_{O_3}}$, contributed less than 10% of the total reactivity, where k_{OH} and k_{O_3} are the reaction rates of with OH and O₃ at time t (min), respectively. Aerosol wall loss corrections were calculated uniquely and applied to each separate experiment. The SOA volume concentrations derived from SMPS were fitted vs. time to obtain the aerosol wall loss rate.

Regarding the diameter-dependence of aerosol wall loss, the Table S1 below shows aerosol wall loss rate constant vs. aerosol geometric mean diameter (GMD). From the table, it appears aerosol loss rates are not correlated to diameter.

Table S1 is provided in a form of supplement.

Since both reviewers had questions about our wall loss procedure, we have improved our description of this in the text as follows: "The value of k was estimated using the measurements after the oxidation reactivity had completely stopped in the OH-dominated chemistry or the reactivity fraction contributed less than 10% of total reactivity in the O₃-initiated chemistry. To establish this we used model estimates of OH concentrations that are described in greater detail in Hao et al. (2009). The experimental data fit to Eq. 3 was excellent ($R^2 > 0.95$), which gives us confidence that the model assumptions of diameter-independent volume loss and negligible gas-particle partitioning during the analysis period were valid."

P. 28794 - Line 11: "The parameter k varied from 0.0026 to 0.0086 min⁻¹". How do the

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authors explain such variability?

Answer: The sources for the variability in the calculated wall loss rate in separate experiments are not exactly well known. This variability is presumed to reflect air circulation in the chamber and variations in chamber volume due to the experimental operations (e.g., the introduction of clean air into the chamber and the continuous sampling of the instruments).

P. 28795 - Line 7: the dilution factor F should be expressed in the same unit as the SOA wall losses (in min^{-1} and h^{-1} ; see P. 28794).

Answer: The dilution factor F has been changed to $4.0 \times 10^{-3} \text{ min}^{-1}$.

Have the authors performed “blank” experiments with the same procedure (addition of O_3 , TME or 2-butanol) but without plant or α -pinene inside the chamber? If yes, what are the values of the SOA mass concentrations obtained?

Answer: We performed a successful blank chamber run using experimental concentration levels as follows. First the chamber was flushed overnight with laboratory compressed air and cleaned via exposure to high level ozone ($\sim 2 \text{ ppm}$). The background aerosol number concentration was observed to be ~ 40 to a few hundred cm^{-3} . Next we added 1000 ppb TME, after which we observed no change in particle number concentration. Afterwards, an ozone enriched air flow (200 ppb) was introduced into the chamber for 30 min. The aerosol number concentration increased slightly from 43 cm^{-3} to 227 cm^{-3} ($\text{GMD} = 11 \text{ nm}$), however the aerosol mass concentration was negligible.

A similar test was performed with 2-butanol (54 ppm) and ozone (60 ppb enriched air) for 30 min. The background aerosol concentration was almost constant ($\sim 300 \text{ cm}^{-3}$) and the resulting mass concentration was again negligible.

P. 28816 - Fig. 2: The authors should add “Exp. R1024” in the title of Fig. 2.

Answer: Exp. R1024 has been added as the title.

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P. 28820 - Fig. 6: why the authors do not represent the aerosol volume concentration corrected for SOA wall losses (dashed black curve).

Answer: The reasons for using the raw aerosol volume concentration, not the corrected volume concentration are to show there is not particle formation or growth in the pink bar region, which is characterized by the observations that geometric mean diameter remains constant and aerosol volume concentration goes down due to the aerosol deposition to the chamber wall. The corrected aerosol volume concentration for the same experiment (P1023) was already presented as the red curve in Fig. 1b.

Technical corrections

P. 28795 - equations (5) and (6): the way to describe the different terms of the equation should be homogeneous (see the subscripts). P. 28798 - Line 3: “p” is missing: “presented” and not “resented”.

Answer: All above corrections are accepted and have been fixed in the revised manuscript.

Please also note the supplement to this comment:

<http://www.atmos-chem-phys-discuss.net/10/C13137/2011/acpd-10-C13137-2011-supplement.pdf>

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

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