Supplementary material for the manuscript:

The link between organic aerosol mass loading and degree of oxygenation: An α-pinene photooxidation study

L. Pfaffenberger, P. Barmet, J. G. Slowik, A. P. Praplan, J. Dommen, A. S. H. Prévôt and U. Baltensperger

Laboratory of Atmospheric Chemistry, Paul Scherrer Institute, 5232 Villigen, Switzerland

Correspondence to: A. S. H. Prévôt (Andre.Prevot@psi.ch)

Table S 1: Overview of the HONO input into the smog chamber before switching on the lights. The last column contains the ratio between HONO and α-pinene initial concentrations.

Expt. No.	initial HONO ppbv (±10% instrument accuracy)	α-pinene ppbv	HONO / α-pinene
1	1.6	7	0.2
2	4.9	14	0.4
3	1.0	20	0.05
4	1.0	22	0.05
7	1.9	45	0.04
8	2.8	46	0.06
9	5.1	50	0.1

Table S 2: Slope of $\Delta f_{44}/\Delta$(OH exposure) for the period where aging dominates (see Fig. S6) and the OH exposure needed to increase f_{44} by 1%.

Expt. No.	$\Delta f_{44}/\Delta$(OH exposure) $\cdot 10^{-8}$ %$\cdot$cm$^3\cdot$h^{-1}	ΔOH exposure/Δf_{44} $\cdot 10^{7}\cdot$cm$^{-3}\cdot$h / %
8	2.0	5.1
3	2.1	4.7
2	3.3	3.1
4	3.5	2.8
9	3.7	2.7
1	3.9	2.6
6	5.5	1.8
7	5.7	1.8
5	8.6	1.2

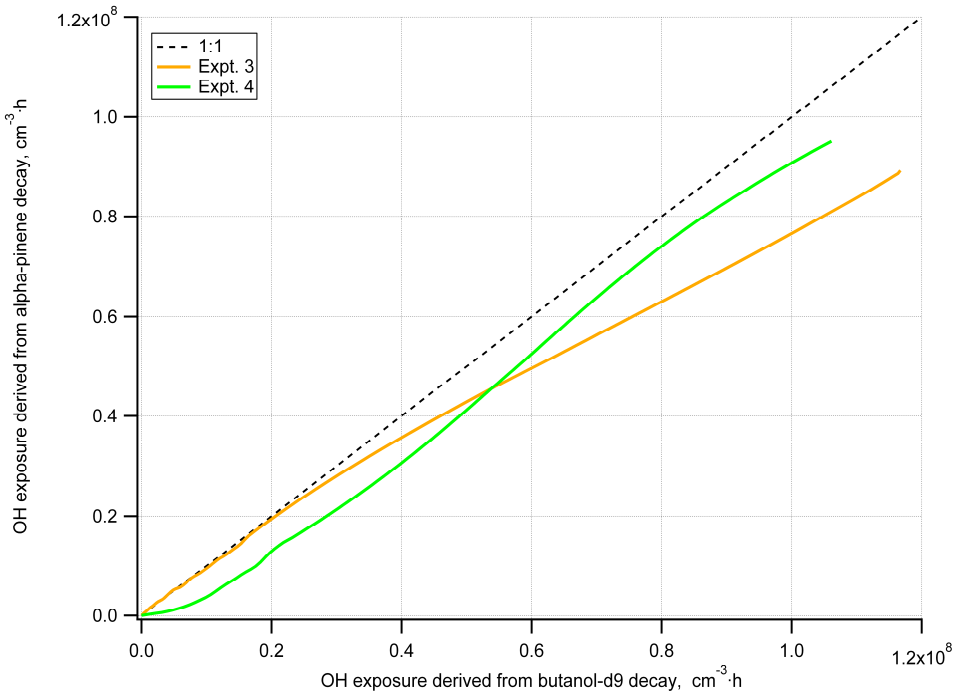


Fig. S 1: Comparison of OH exposures derived from α-pinene decay and butanol-d9 decay for experiments where butanol-d9 was above detection limit throughout the entire experiment. The dashed line represents the 1:1 line.

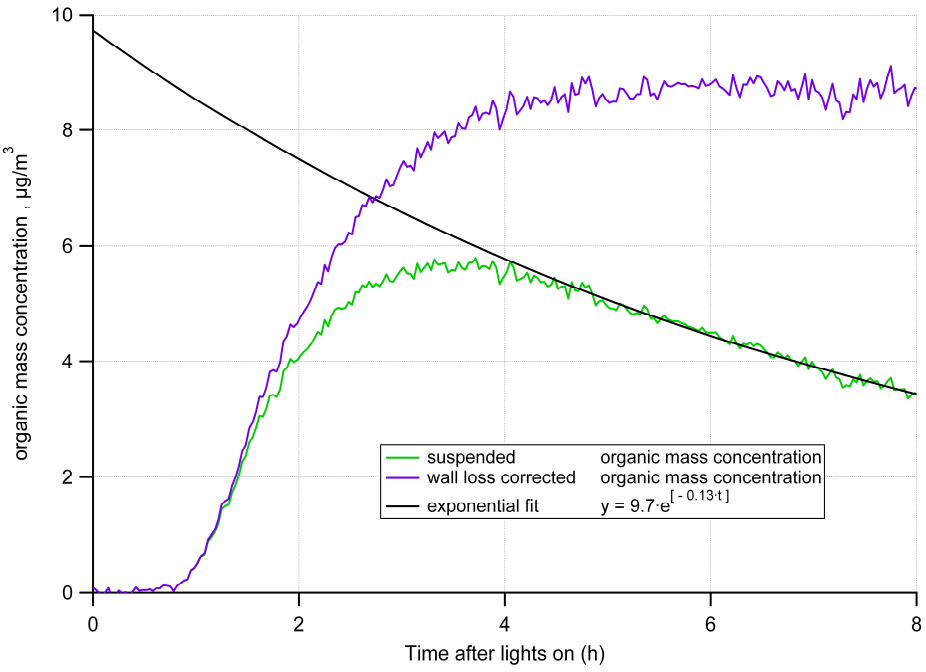


Fig. S 2: The measured organic mass concentration (green line) was fitted exponentially (black line) for the last three hours of experiment 5 where wall loss dominates over organic mass production. This procedure results into a lower limit of the wall loss corrected organic mass concentration (purple line).

Retrieval of the OH exposure of experiment 1 and 2 from a repeat experiment

As the decay of α-pinene in the beginning of experiment 1 and 2 was very rapid, using the α-pinene method including the extrapolation to the whole experiment time leads to a possibly strong overestimation of the OH exposure. For this reason a repeat experiment was conducted which showed the same characteristics in α-pinene decay, but with the OH tracer butanol-d9 present for the whole experiment time (See Fig. S 3). The repeat experiment resembles strongly experiment 2, which has the same initial α-pinene concentration (14 ppbv). During experiment 1 (with an initial α-pinene concentration of 7ppbv), the reactant decays within the same time. This lower initial α-pinene concentration is also the reason for the lower O_3 production. The replaced OH exposures derived from the α-pinene decay for experiments 1 (black line) and 2 (turquoise line) are shown in the lower panel together with the OH exposure of the repeat experiment (purple line).

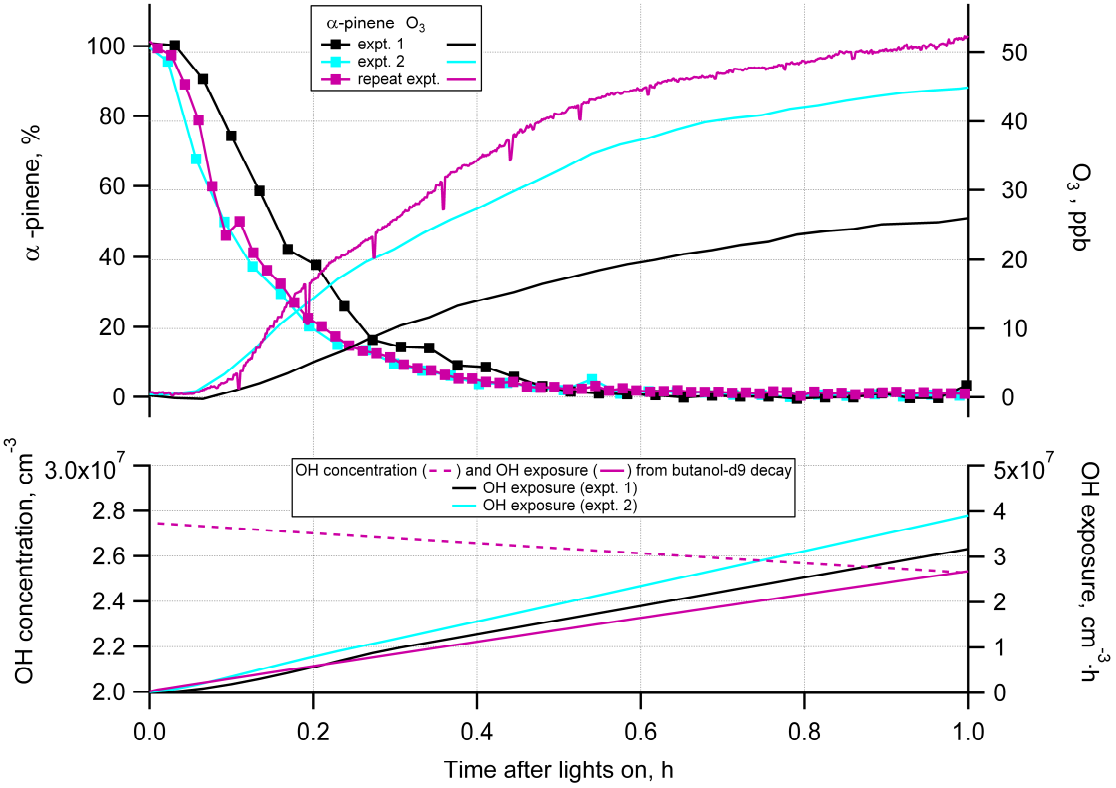


Fig. S 3: The α-pinene and O_3 concentrations of experiment 1, 2 and the repeat experiment are shown as a function of light exposure time (upper panel). The lower panel shows the OH concentration and exposure retrieved from the decay of the tracer butanol-d9, present during the repeat experiment as well as the replaced OH exposures derived from the α-pinene method.

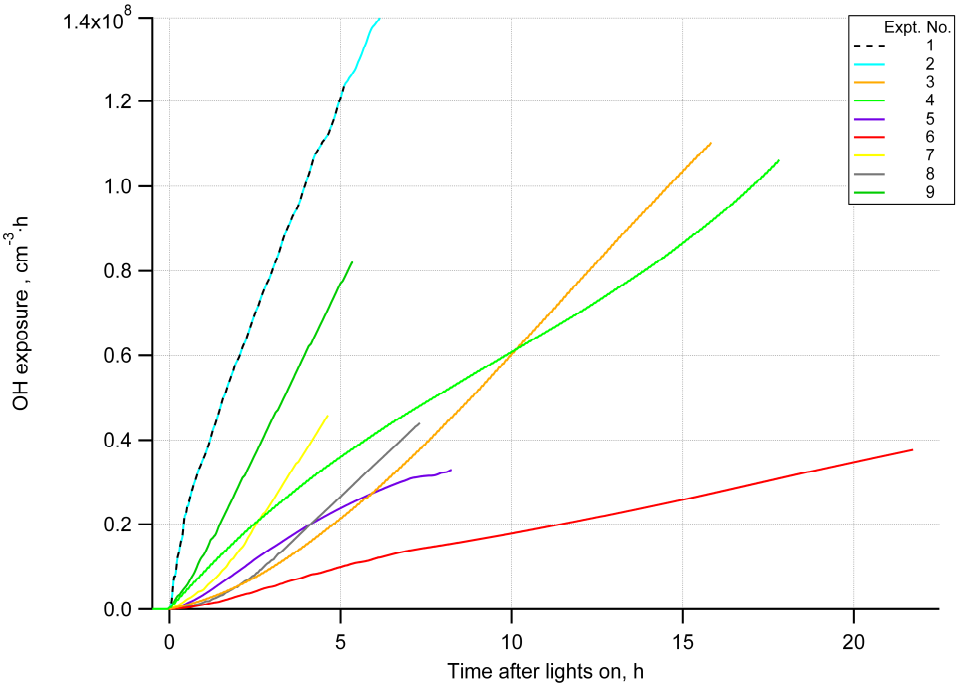
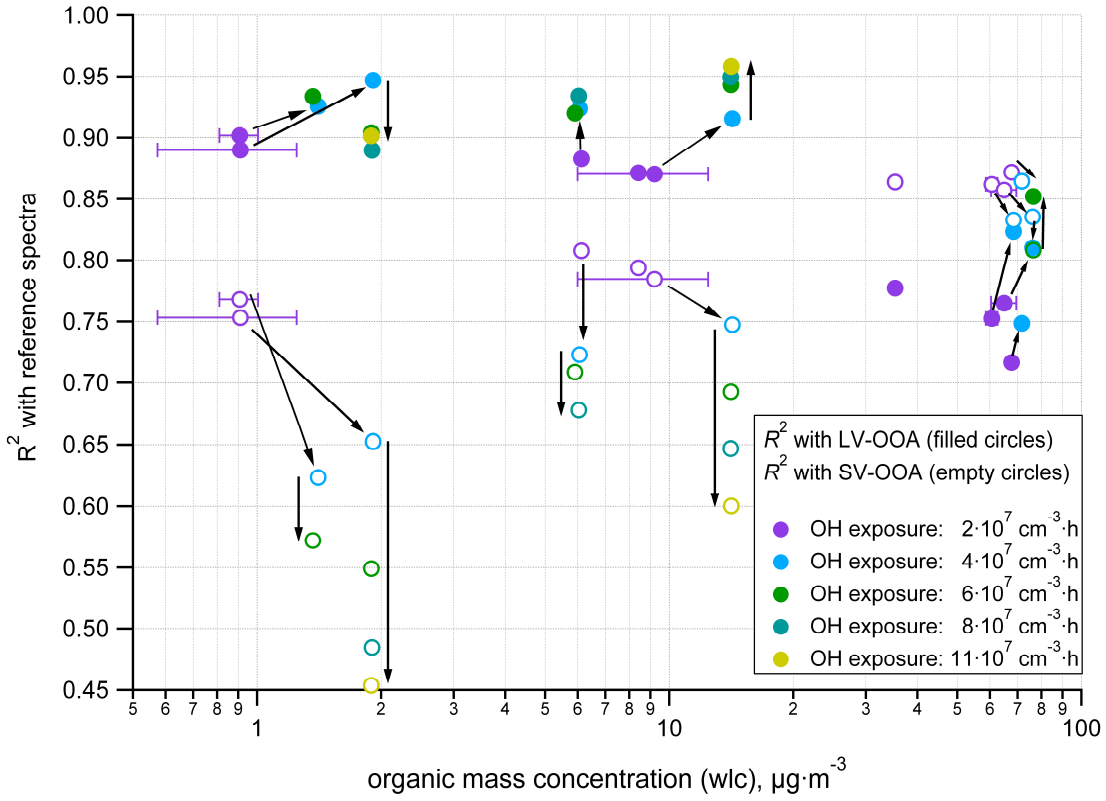


Fig. S 4: OH exposures for the nine different experiments (color code) derived from the decay of α-pinene, butanol-d9 or a combination of both. The OH exposure of experiment 1 and 2 was derived from a repeat experiment.



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67 **Fig. S 5**: Squares of the Pearson correlation coefficients, R^2, of measured mass spectra in
68 comparison with LV-OOA (filled circles) and SV-OOA (empty circles) reference spectra (Ng
69 et al., 2011) as a function of the organic mass concentration (wlc). The color code represents
70 the OH exposure as a time stamp around which the averaging of the measured mass spectra
71 was performed (± 15 min).

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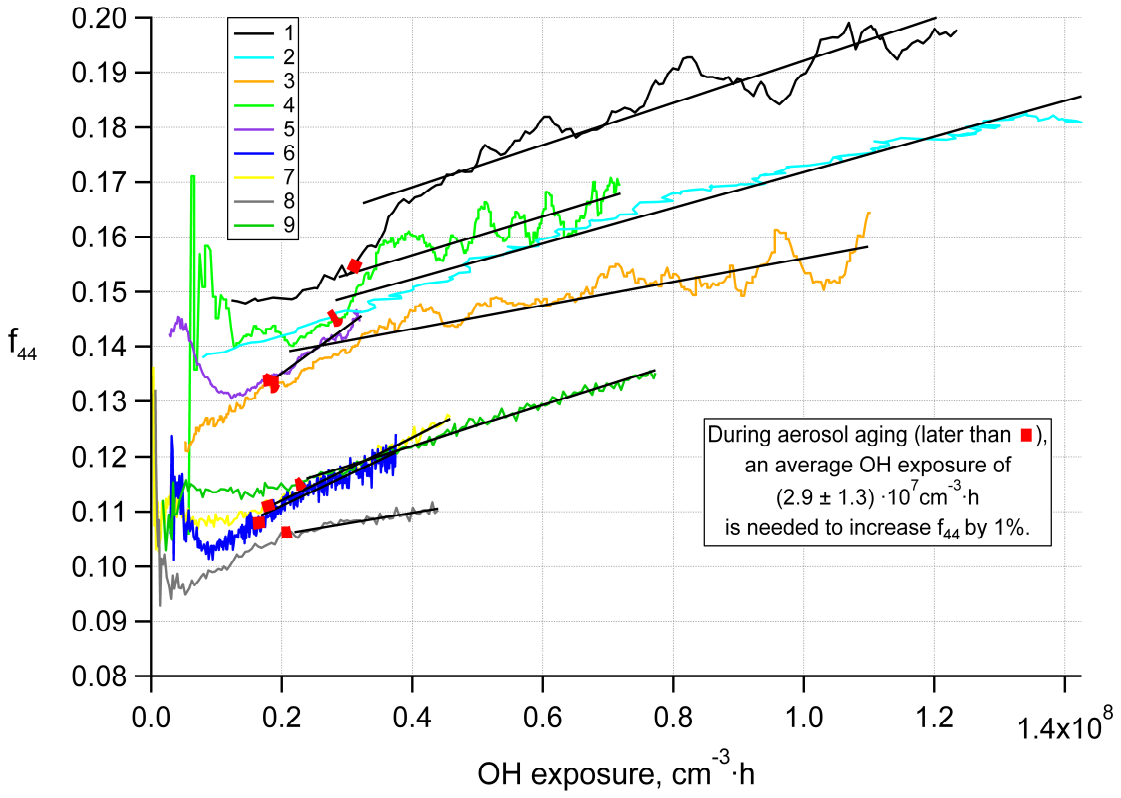

Fig. S 6: The organic mass fraction f_{44} as a function of OH exposure for the nine smog chamber experiments. The data was fitted with a line for the period when aging dominates, i.e. after the peak of suspended organic mass is reached. The slopes of $\Delta f_{44}/\Delta$(OH exposure) are shown in Table S2. The average slope of the nine experiments results in a needed OH exposure of $2.9 \pm 1.3 \cdot 10^7$ cm^{-3} ·h to increase f_{44} by 1%.

References

Ng, N. L., Canagaratna, M. R., Jimenez, J. L., Chhabra, P. S., Seinfeld, J. H., and Worsnop, D. R.: Changes in organic aerosol composition with aging inferred from aerosol mass spectra, Atmos. Chem. Phys., 11, 6465-6474, 2011.