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The impact of CO on secondary organic aerosols formed from the mixture of α-pinene and n-dodecane

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1 OH concentration estimation

OH concentrations were estimated from the temporal evolution of O_3 and the consumption of precursors, or alternatively from the depletion of CO.

Based on the consumption of α-pinene or n-dodecane:

$$[OH] = \frac{\frac{[VOC]_i - [VOC]_{i+1}}{\Delta t} - k_{VOC+O_3}[VOC]_i[O_3]}{k_{VOC+OH}[VOC]_i}$$

Based on the decay of CO:

$$[OH] = \frac{[CO]_i - [CO]_{i+1}}{k_{CO+OH}[CO]_i \Delta t}$$

where k_{VOC+O3} and k_{VOC+OH} denote the reaction rate coefficient of VOC with O_3 and OH, respectively. The reaction rate coefficients for α-pinene and n-dodecane with OH are 5.33×10^{-11} and 1.32×10^{-11} cm^3 $molecule^{-1}$ s^{-1}, respectively (Atkinson, 2003; Dash et al., 2014). The reaction rate coefficient for α-pinene with O_3 is 9.6×10^{-17} cm^3 $molecule^{-1}$ s^{-1} (Cox et al., 2020).

Table S1. Instrument availability for each experiment.

Experiment Type	Experiment No.	FIGAERO-CIMS	C-ToF-AMS	PTR-ToF-MS	Gas analysers
α-pinene	1	×	√	√	√
α-pinene	2	√	√	√	√
α-pinene + CO	3	√ (2 cycles)	√	√	√
n-dodecane	4	×	√	×	√
n-dodecane	5	√	√	√	√
n-dodecane + CO	6	√	√	√	√
n-dodecane + CO	7	√	√	√	√
mixture	8	√	√	×	√
mixture	9	√	√	√	√
mixture + CO	10	√	√	√	√
mixture + CO	11	×	√	√	√

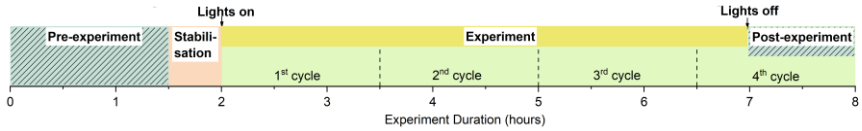

Figure S1: Schematic of the experimental timeline.

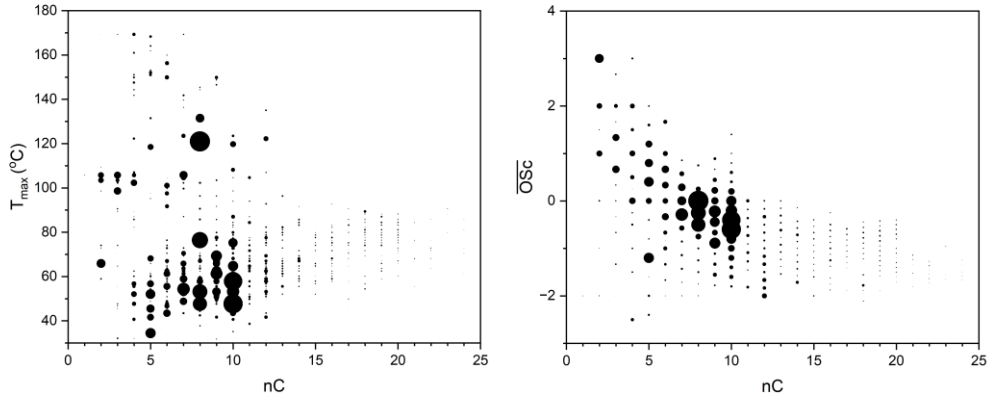

Figure S2. (Left panel) Maximum desorption temperature (T_{max}) against carbon number (nC) and (right panel) average carbon oxidation states ($\overline{OSc}$) against nC for all the particle-phase products for α-pinene system. The marker size is proportional to the signal intensity. For CHO compounds, the $\overline{OSc}$ is determined by the following equation (Kroll et al., 2011): $\overline{OSc} = 2 \times O/C - H/C$, where O/C and H/C represent the oxygen-to-carbon and hydrogen-to-carbon ratios, respectively. For CHON compounds, the $\overline{OSc}$ is determined by: $\overline{OSc} = 2 \times O/C - H/C - \left(\overline{OS_N} \times N/C\right)$, where N/C is the nitrogen-to-carbon ratio. Following previous studies, if nO < 3, $\overline{OS_N}$ = 3; if nO ≥ 3, $\overline{OS_N}$ = 5 (Shao et al., 2025).

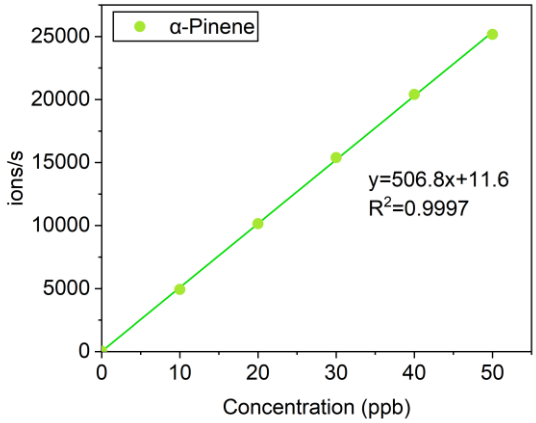

Figure S3: Calibration curve for α-pinene using Vocus PTR-ToF-MS (Experiment 3).

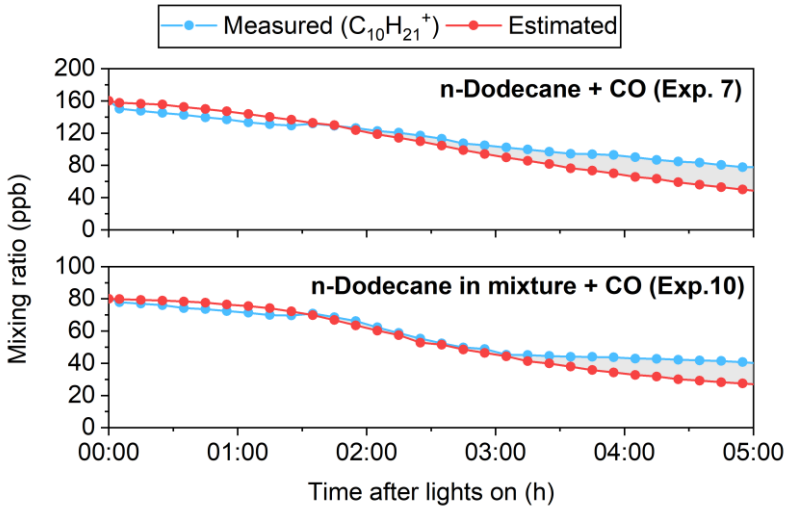

Figure S4: Comparison of n-dodecane concentrations estimated from OH concentrations (derived from CO decay) with those measured directly from the $C_{10}H_{21}^+$ fragment ion using Vocus PTR-ToF-MS. Note: During the first three hours of the reaction, the differences between the measured and estimated values were small. However, as the reaction progressed, the $C_{10}H_{21}^+$ signal may have been interfered with by other oxidation products, leading to an overestimation of the measured concentrations (grey shaded area). As a result, the SOA particle mass yields of n-dodecane and mixture may have been overestimated by up to ~30 % in this study. Nevertheless, the observed effects of CO on the overall trends and relative differences in yields remain reliable.

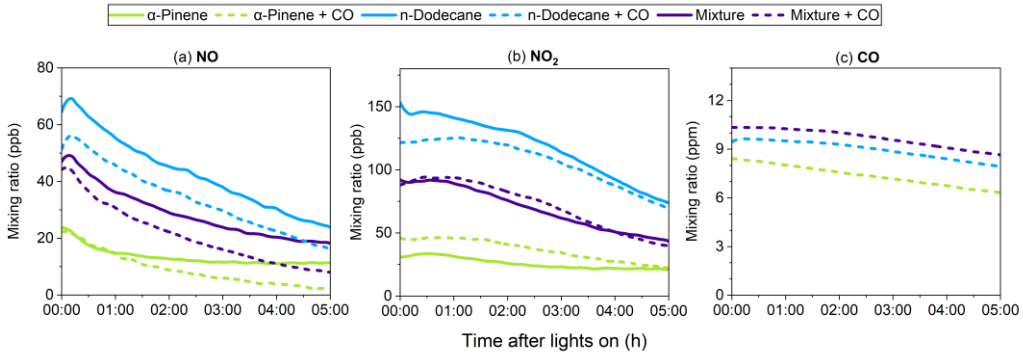

Figure S5: Time series of NO, NO_2, and CO in α-pinene, n-dodecane, and mixture experiments conducted in the absence (solid lines) and presence (dashed lines) of CO.

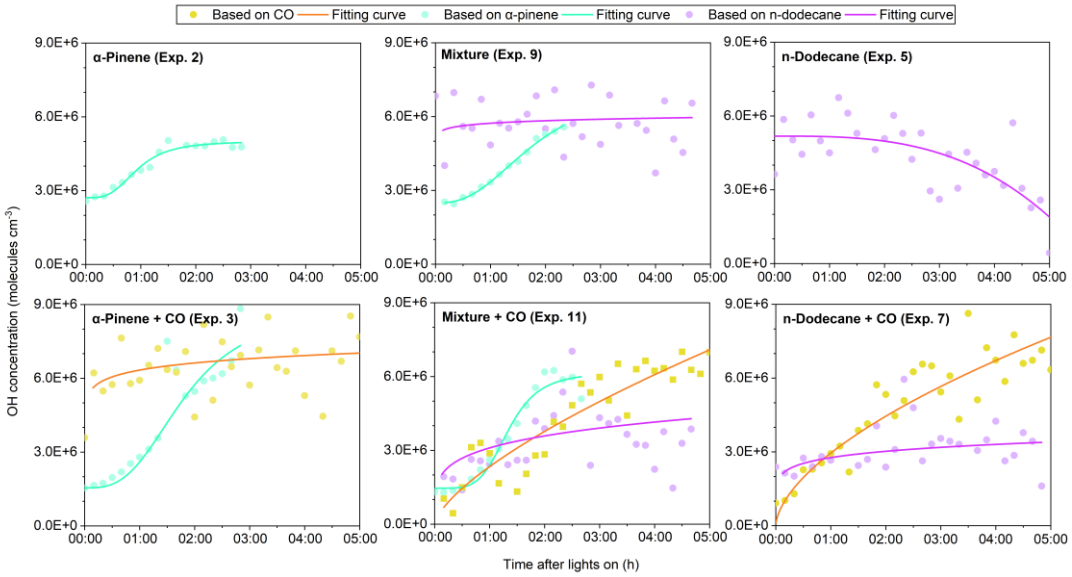

Figure S6: Estimated OH concentrations derived from the decay of precursors or CO. Fitting curves are shown as a visual guide. Data are from representative experiments.

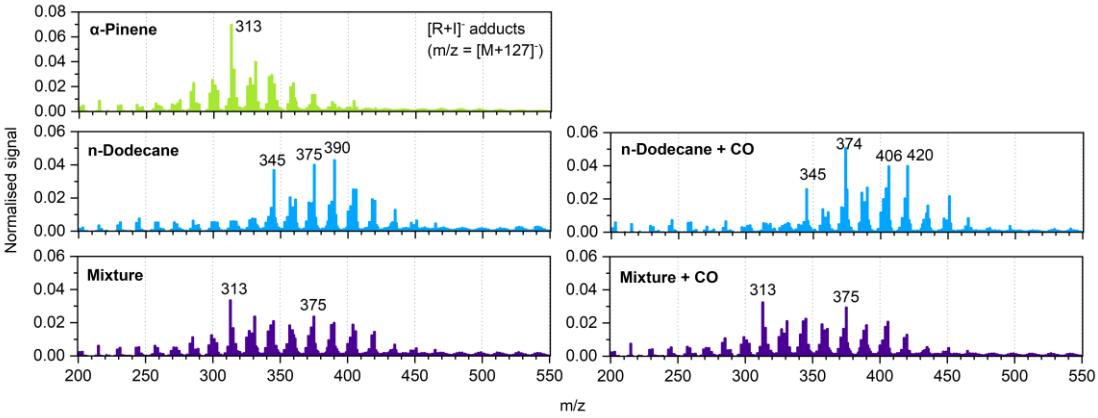

Figure S7: Unit mass resolution (UMR) spectra of SOA particles from α-pinene, n-dodecane and mixture experiments conducted in the absence and presence of CO (last FIGAERO cycle). Signal intensities are normalised to 1.

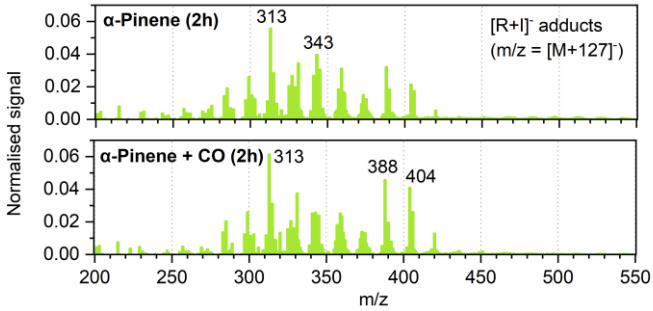

Figure S8: Unit mass resolution (UMR) spectra of SOA particles from α-pinene experiments conducted in the absence and presence of CO (second FIGAERO cycle). Signal intensities are normalised to 1.

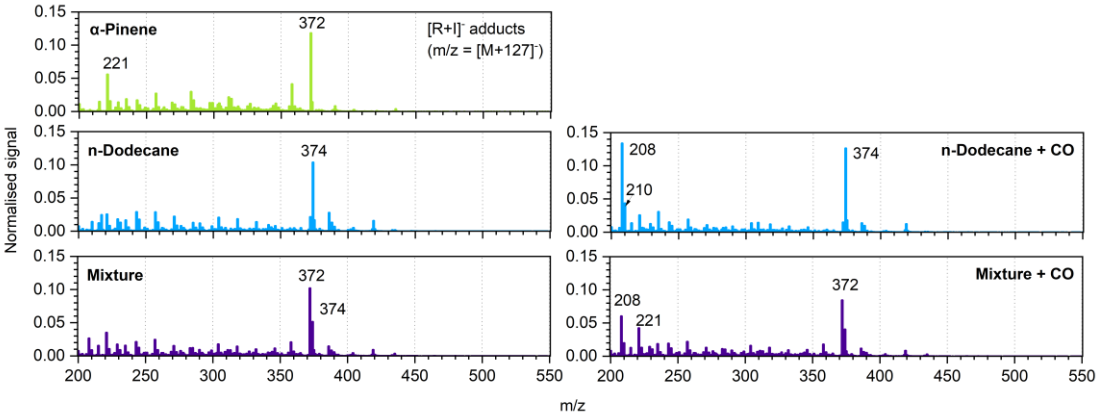

Figure S9: Unit mass resolution (UMR) spectra of gas-phase products from α-pinene, n-dodecane and mixture experiments conducted in the absence and presence of CO (last FIGAERO cycle). Signal intensities are normalised to 1.

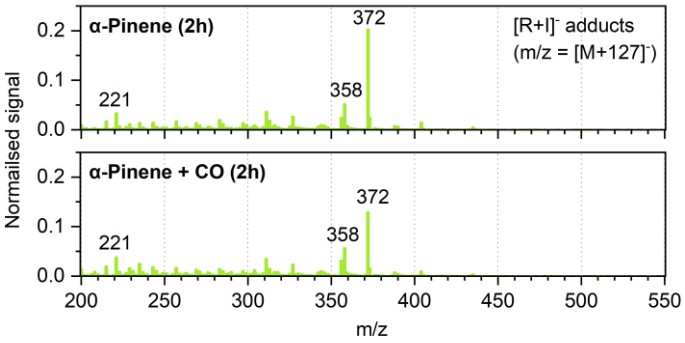

Figure S10: Unit mass resolution (UMR) spectra of gas-phase products from α-pinene experiments conducted in the absence and presence of CO (second FIGAERO cycle). Signal intensities are normalised to 1.

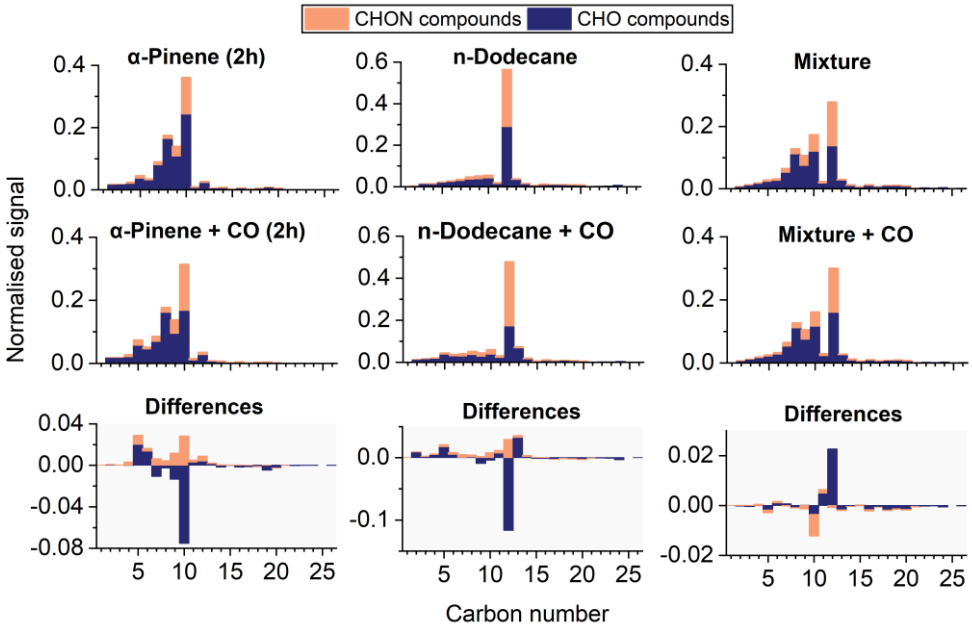

Figure S11: Carbon number distributions of particle-phase SOA compounds from α-pinene, n-dodecane, and their mixture, in the absence and presence of CO. The bottom panels show the differences between the CO-present and CO-absent experiments.

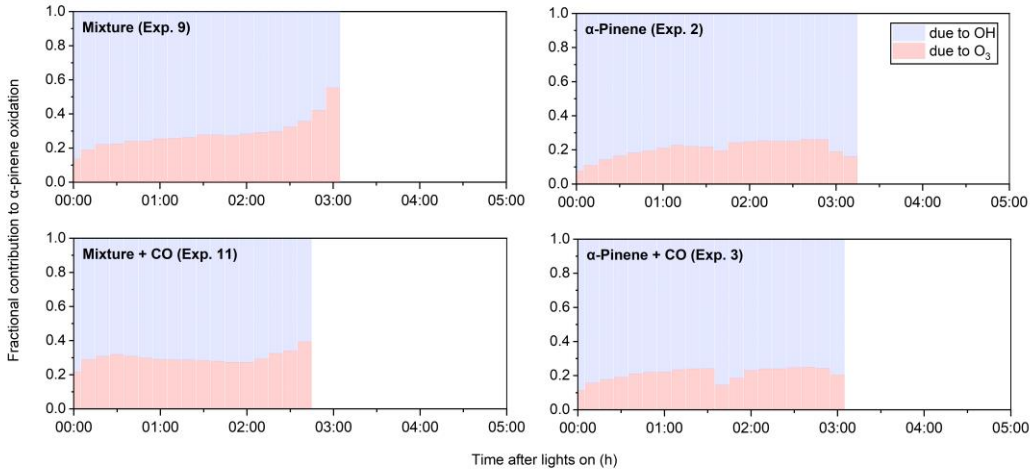

Figure S12: Relative contributions of O_3 and OH to α-pinene oxidation. These contributions are calculated based on the relative magnitudes of $k_{VOC+O_3}[VOC]_i[O_3]$ and $k_{VOC+OH}[VOC]_i[OH]$. Data are from representative experiments.

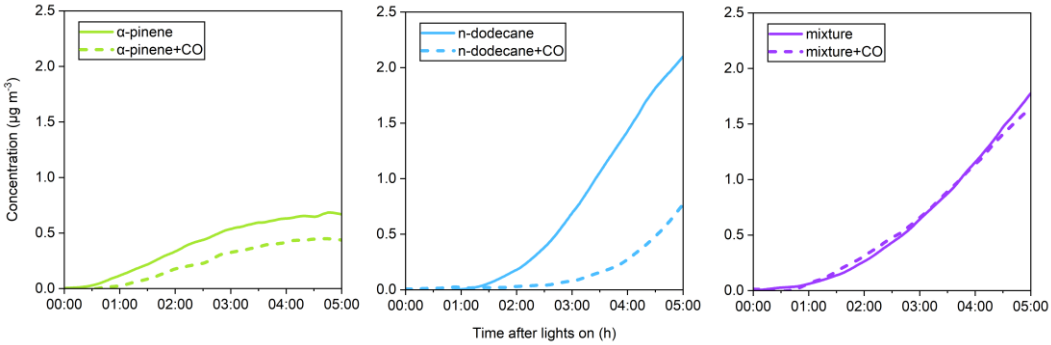

Figure S13: The concentration of organic nitrates estimated from AMS measurements.

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