



Supplement of

Exploring the composition and volatility of secondary organic aerosols in mixed anthropogenic and biogenic precursor systems

Aristeidis Voliotis et al.

Correspondence to: Gordon McFiggans (gordon.b.mcfiggans@manchester.ac.uk)
and Aristeidis Voliotis (aristeidis.voliotis@manchester.ac.uk)

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Table S1: Instrument availability for each experiment listed on Table 1 in the original manuscript.

Experiment No.	HR-AMS	TD	FIGAERO-CIMS	
			Gas phase	Particle phase
1	✓	✓	✓	✓
2	✓	✓	✓	✓
3	x	✓	✓	x
4	x	✓	✓	x
5	✓	✓	x	x
6	x	✓	✓	✓
7	✓	x	✓	✓
8	✓	✓	✓	x
9	✓	✓	✓	✓
10	✓	✓	✓	✓

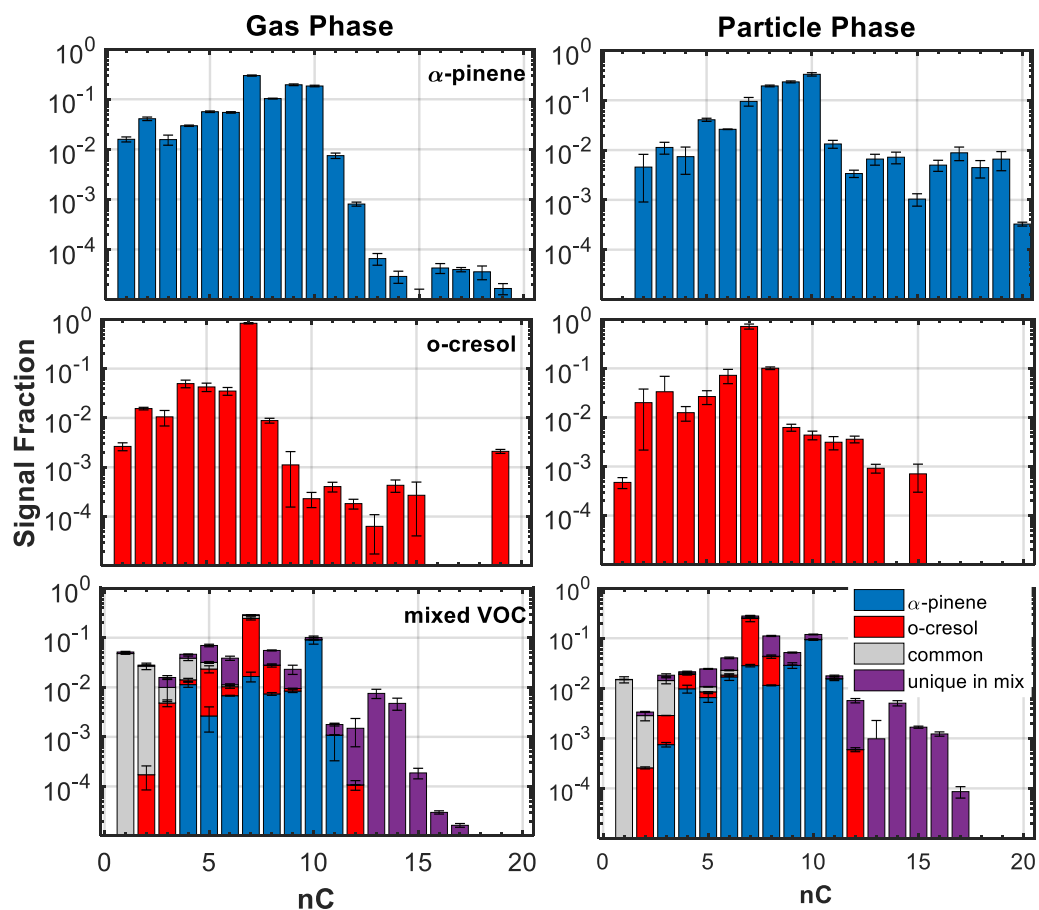


Figure S1: Average ($\pm 1 \sigma$) distributions of carbon number atoms (nC) for all the products identified all the experiments in each of the systems for the gas and particle phase. In mixed VOC system, the bars are separated to show the contributions of the products from either precursors, the common products as well as those that uniquely identified in the mixture.

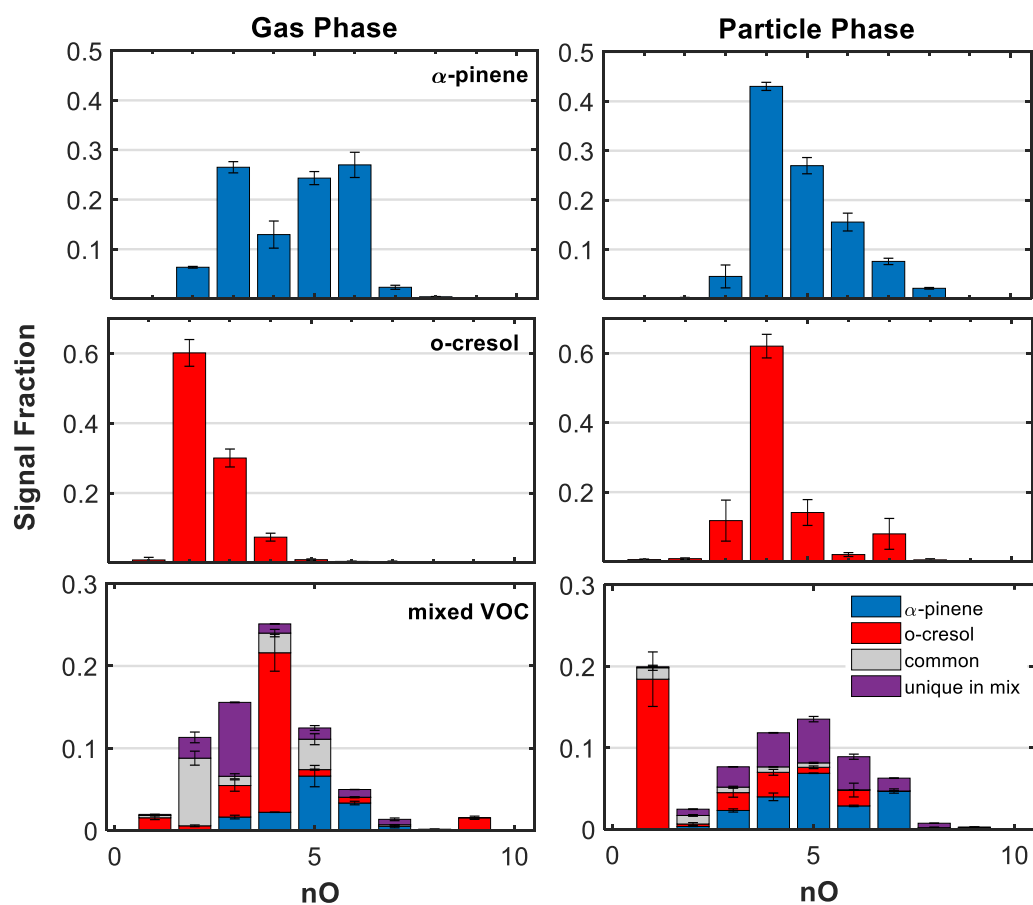


Figure S2: Average ($\pm 1 \sigma$) distributions of oxygen number atoms (nO) for all the products identified all the experiments in each of the systems for the gas and particle phase. In mixed VOC system, the bars are separated to show the contributions of the products from either precursors, the common products as well as those that uniquely identified in the mixture.

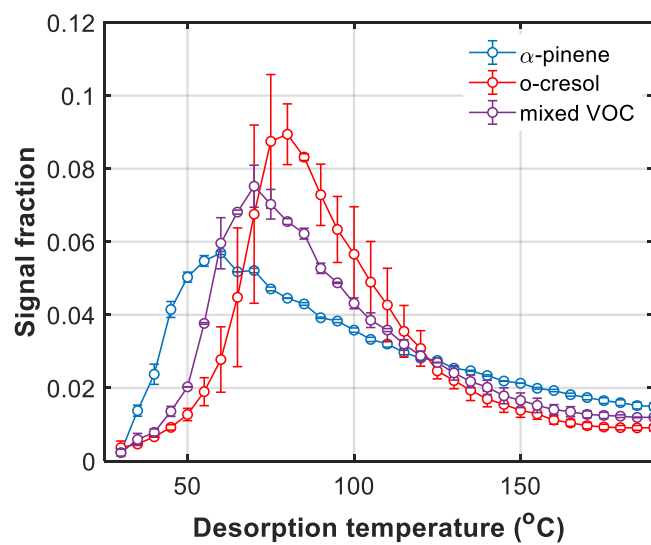


Figure S3: Average ($\pm 1 \sigma$) sum thermograms (i.e., sum of the individual thermograms of all the products in the FIGAERO) for all the experiments in each of the systems.

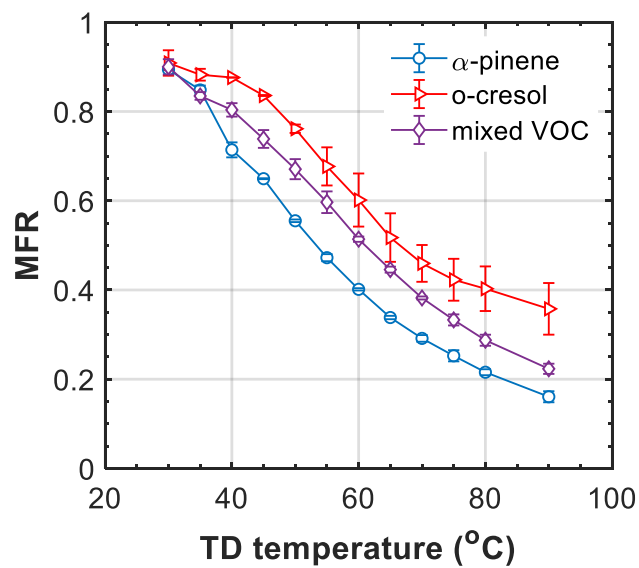


Figure S4: Average ($\pm 1 \sigma$) SOA mass fraction remaining (MFR) as a function of the thermal denuder (TD) temperature for all the experiments conducted in each system.

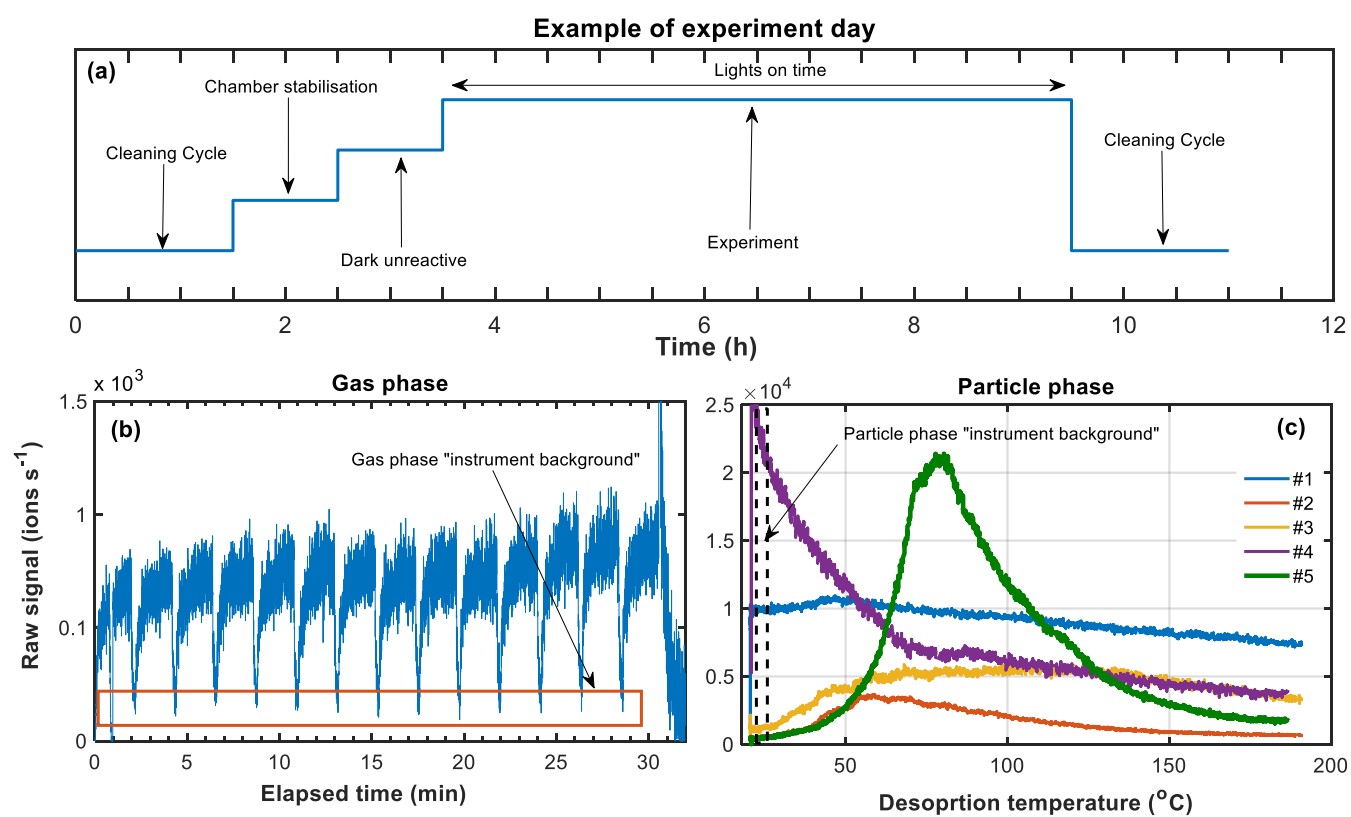


Fig. S5: (a) Schematic of the phases of an experiment, (b) example of FIGAERO-CIMS gas phase cycle and (c) examples of thermal desorption of characteristic products during the temperature ramp phase.

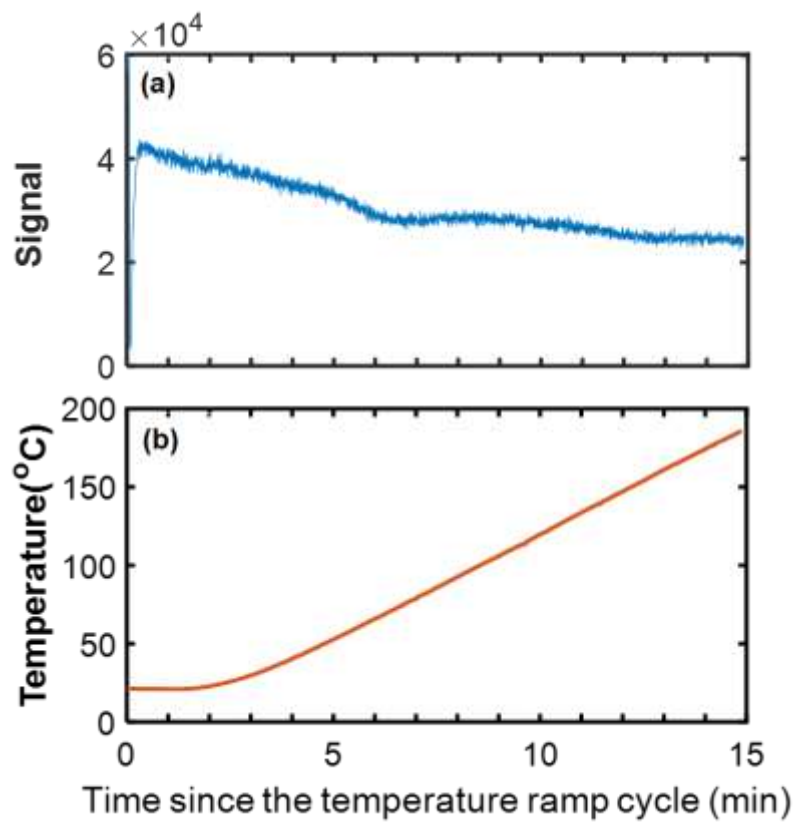


Fig. S6: (a) Example particle phase cycle with contamination from gas phase and (b) example temperature profile of FIGAERO-CIMS during the temperature ramp period.

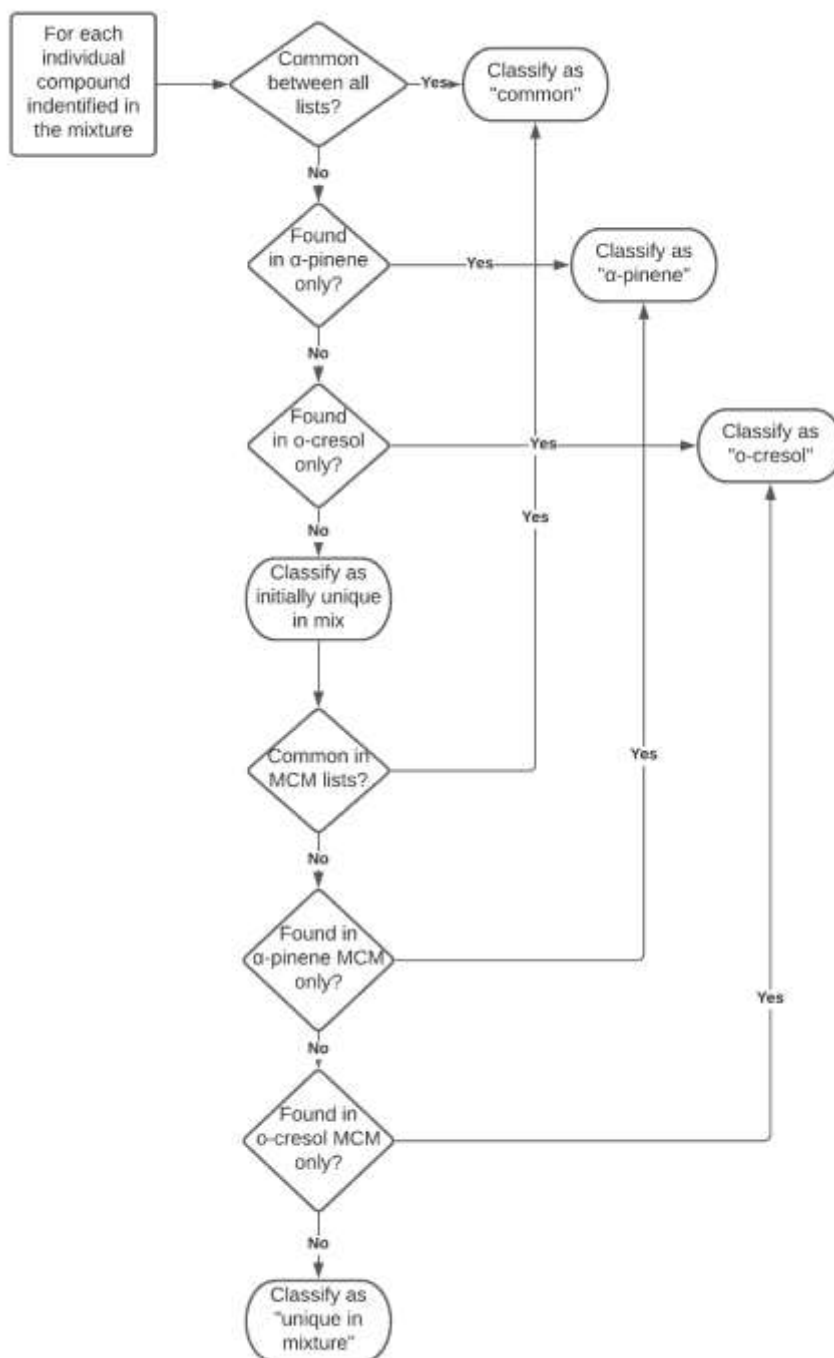


Figure S7: Schematic of the formula separation procedure to classify the products of the mixture as products deriving from either precursor (i.e., α -pinene/o-cresol), common (i.e., products with the same assigned formulae found in all systems) and unique products of the mixture.

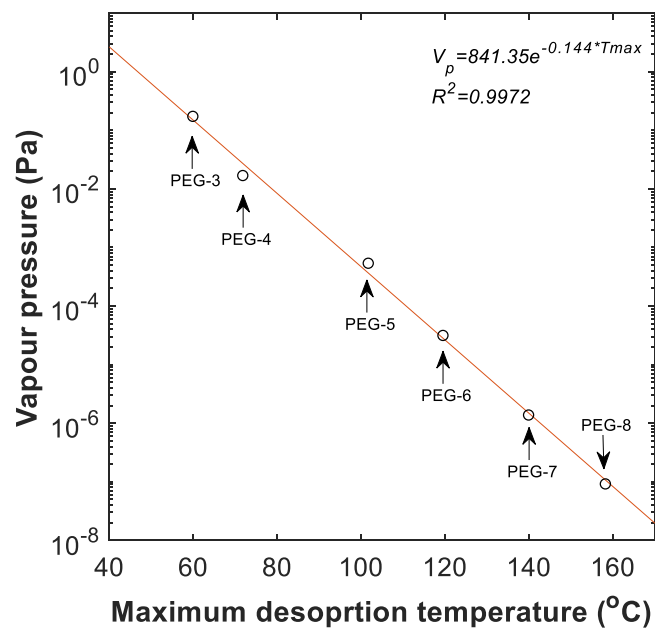


Figure S8: FIGAERO-CIMS vapour pressure (V_p) versus maximum desorption temperature (T_{max}) calibrations using the homologous series of polyethylene glycols (PEG-3–8) as calibrants, delivered in the filter with the syringe method and a filter loading of $\sim 3\mu\text{g}$.

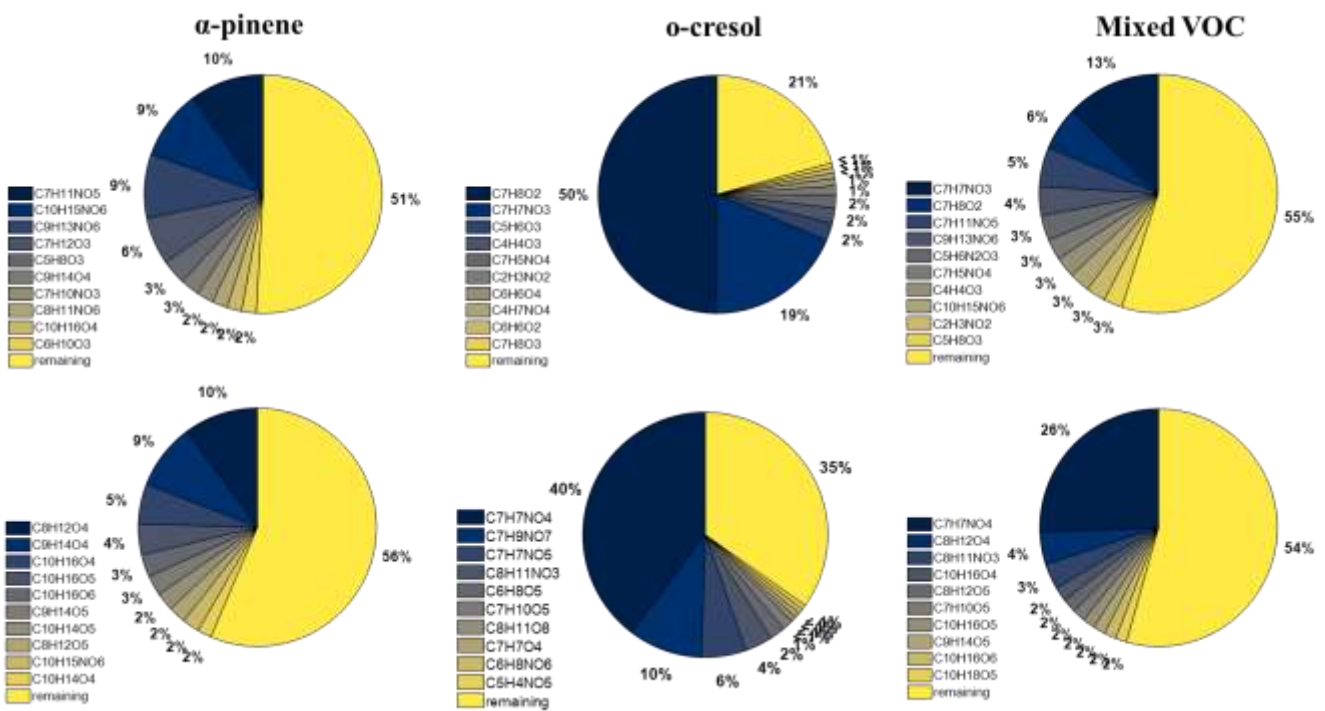


Fig. S9: FIGAERO-CIMS top 10 formula contributions to total signal of three characteristic experiments (Exp. no. 2, 5 and 10; Table 1) for the gas (top charts) and particle (bottom charts) phases.

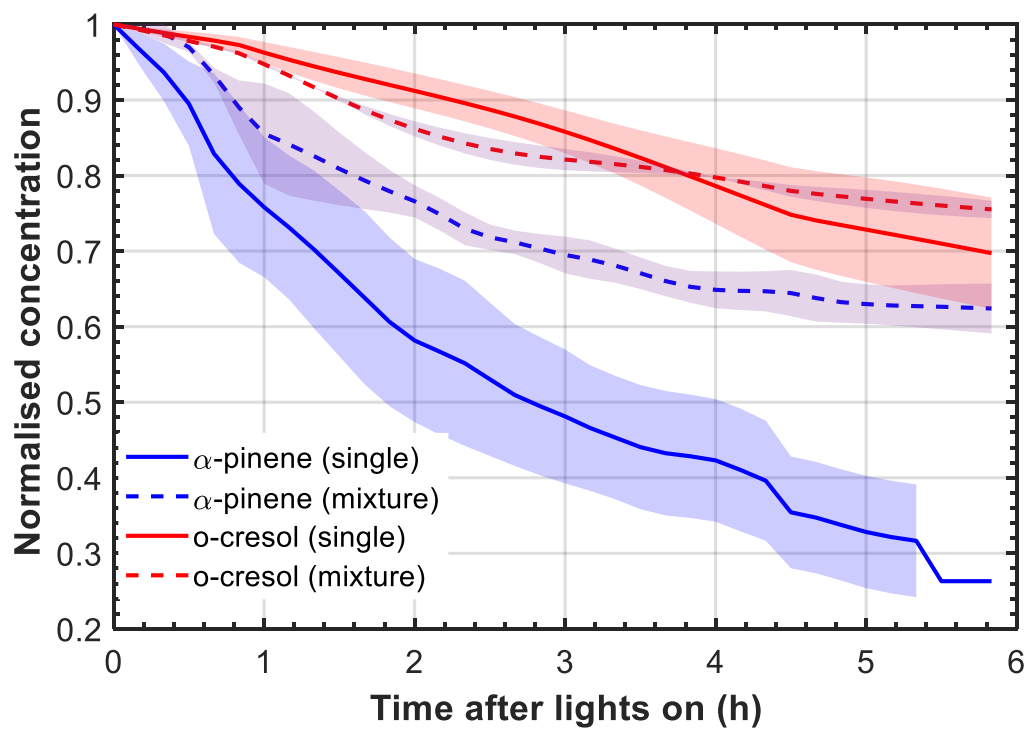


Figure S10: Average ($\pm 1\sigma$) normalised VOC decay in all the single and mixture experiments.

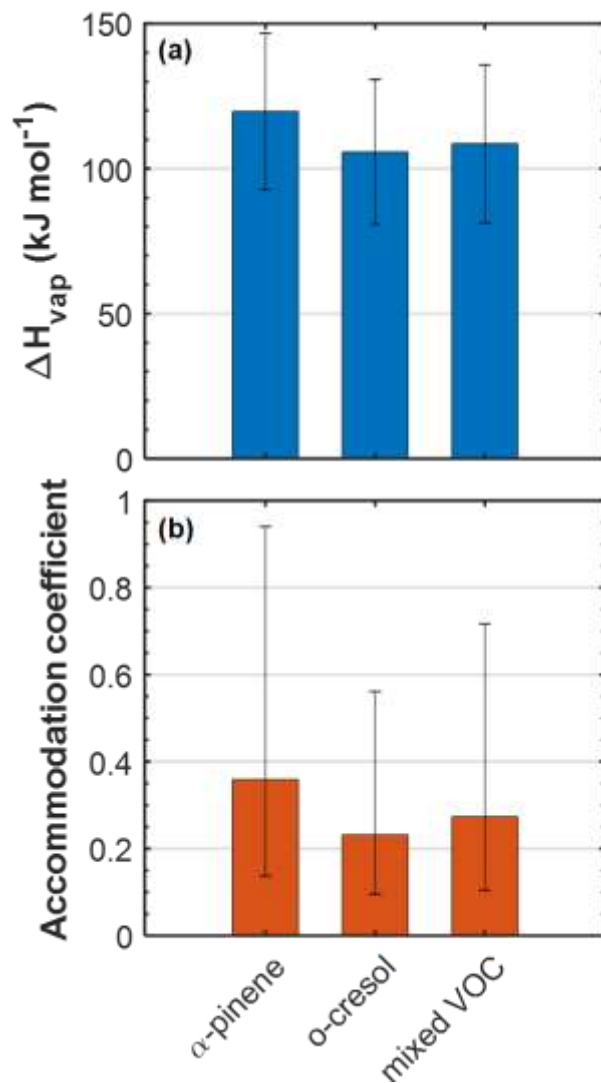


Fig S11: (a) Retrieved enthalpy of vapourisation (kJ mol^{-1}) and (b) accommodation coefficient from the Karnezi et al. (2014) algorithm for three characteristic experiments (Exp. No. 2, 5 and 10; Table 1).

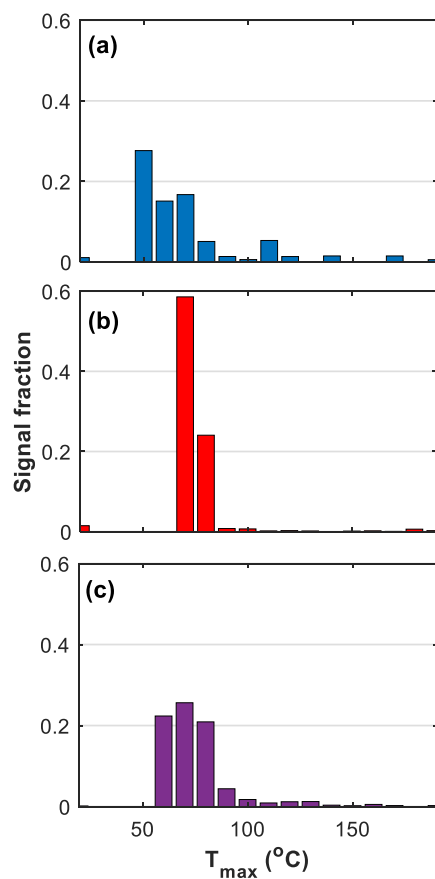


Fig S12: Distribution of the maximum desorption temperature (°C) of all the identified ions observed in the (a) α -pinene, (b) o-cresol and (c) mixed VOC systems.

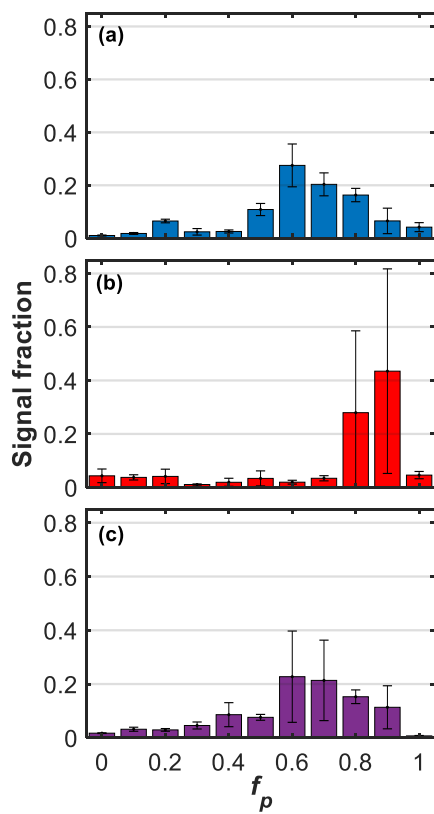


Fig S13: Distribution of the partitioning coefficient ($f_p \pm 1\sigma$) of all the identified ions observed in the (a) α -pinene, (b) o-cresol and (c) mixed VOC systems.

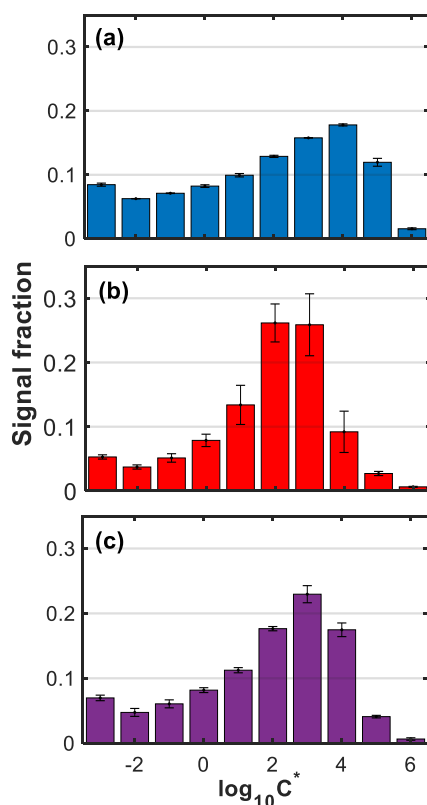


Fig S14: SOA particle volatility distributions ($\pm 1\sigma$) in the a) α -pinene, (b) o-cresol and (c) mixed VOC systems. The volatility distributions here were calculated by converting the desorption profile (i.e., thermogram) of each individual identified ion to a $\log_{10} C^*$ volatility distribution based on the $T_{\max}-V_p$ calibrations (Fig. S8) that were subsequently added together.

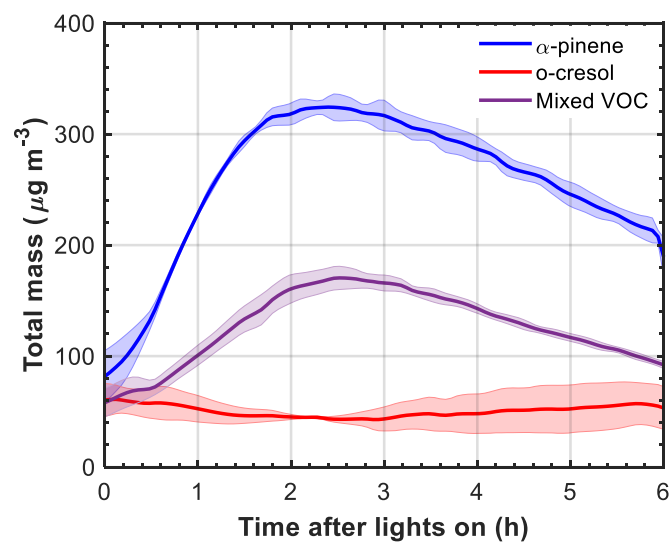


Figure S15: Evolution of the total particle mass concentration ($\pm 1\sigma$) measured by the HR-AMS in all the systems

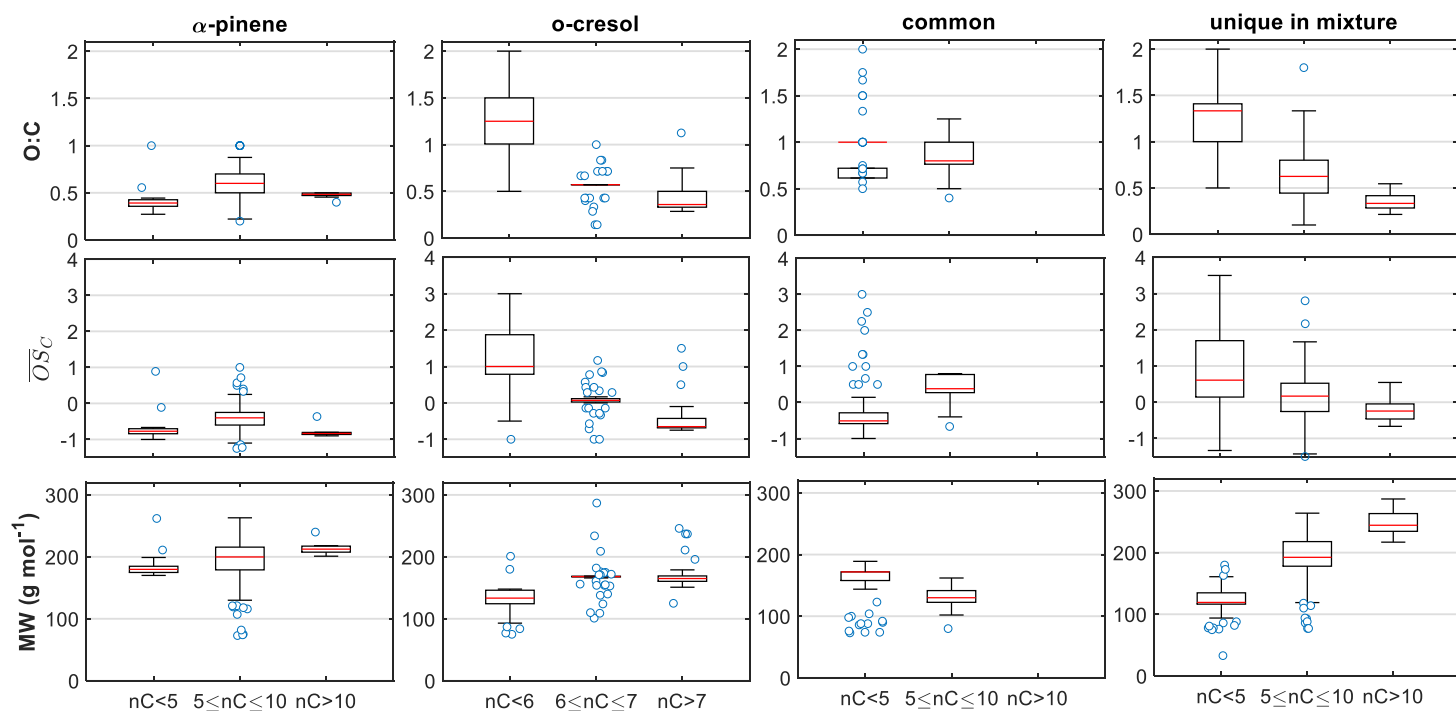


Figure S16: Boxplots of the estimated oxygen to carbon ratio (O:C; top panels), oxidation state (\overline{OS}_c ; middle panels) and molecular weight (MW; bottom panels) of the products identified in the mixture and were classified as products of α -pinene, o-cresol, common and unique to the mixture, weighted to their contributions to the total particle phase signal and grouped based on their number of carbon atoms. Red lines represent the median values, each boxes' upper and lower limits represent the 75th and 25th percentile, respectively, while the errorbars represent the minimum and maximum values. The open circles show the individual compounds that were classified as outliers being outside the interquartile range times 1.5.

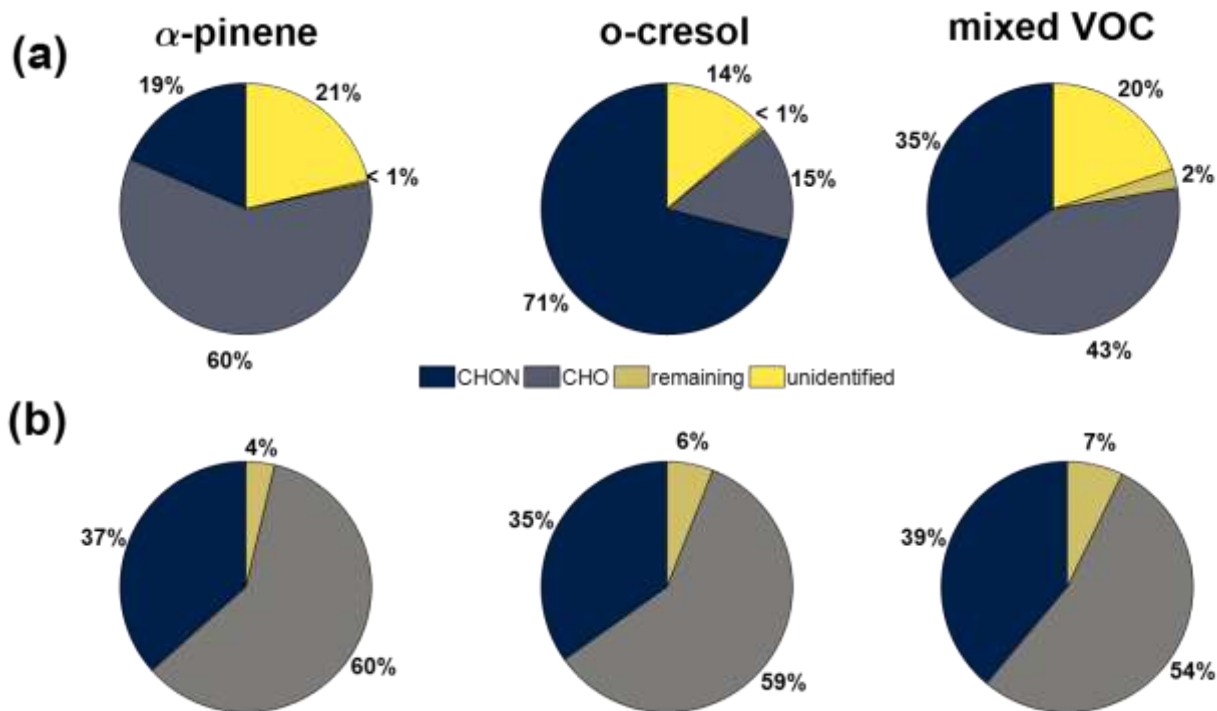


Fig. S17: Particle phase FIGAERO-CIMS elemental formula (a) signal contributions and (b) number fraction of products identified, in three characteristic experiments for each system (Exp. No. 2, 5 and 10; Table 1).

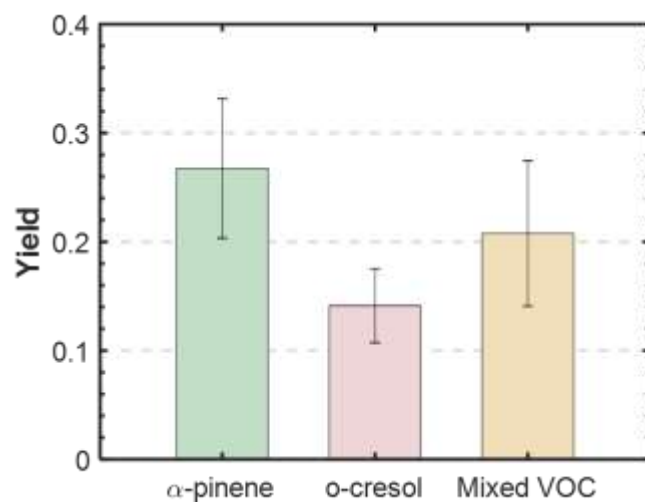


Fig. S18: SOA particle yields (\pm measurement error) obtained in each system. The SOA yields were estimated as the mass of SOA particles formed for each unit mass ($\mu\text{g m}^{-3}$) of VOC consumed (i.e., $Y=\Delta M/\Delta\text{VOC}$). The SOA particle mass formed was obtained from the AMS and the resulted mass was corrected for particle losses to the chamber walls based on the decay rate of ammonium sulfate particles in experiments conducted in the dark. The mass of VOC consumed were obtained from the FIGAERO-CIMS and the GC-MS for the *o*-cresol and α -pinene, respectively. The VOC consumed was computed based on the decay of the raw signal and the initial VOC amounts injected to chamber. All the reported SOA particle yields here were calculated at the maximum SOA particle mass in each experiment.