Supporting of

Enhanced secondary organic aerosol formation from the photo-oxidation of mixed anthropogenic volatile organic compounds

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Calculation of Vapor Wall Loss

$$\bar{c} = \sqrt{\frac{8RT}{\pi M_w}} \tag{1}$$

30 where R was the ideal gas constant (i.e., 8.314 J mol^{-1} K^{-1}), T was the temperature, M_w was the molecular weight.

$$D_{gas} = D_{CO_2} \times \frac{M_{w CO_2}}{M_w} \tag{2}$$

where D_{CO2} was 1.38×10^{-5} m^2 s^{-1}, M_w was set to 300 g mol^{-1} here.

$$k_n = \frac{\lambda}{R_p} = \frac{6D_{gas}}{D_p \bar{c}} \tag{3}$$

where K_n was the Knudsen number, R_p was the particle radius, and λ was the gas mean free path.

35 $$\bar{F}_{FS} = \frac{0.75\alpha(1+k_n)}{k_n^2 + k_n + 0.283 k_n \alpha + 0.75\alpha} \tag{4}$$

where α was the mass accommodation coefficient onto particles, and it was set to 0.002 in this work (Zhang et al., 2014).

Table S1. $\bar{\tau}_{g-p}/\tau_{g-w}$ values for the VOCs used in this work.

VOC	AS Seed (Yes or No)	Temperature (°C)	$\bar{\tau}_{g-p}/\tau_{g-w}$
1,3,5-TMB	No	35	2.64-4.42
n-dodecane	No	35	4.25-7.34
Mix	No	35	0.19-0.85

40 **Table S2. Initial concentrations of the conducted experiments.**

Date	Precursor	Concentration (ppb)	TMB/Dode	NO$_x$ (ppb)	ΔVOCs/NO$_x$
2019.0927	n-dodecane	22	--	210	1.26
2019.1009	n-dodecane	20	--	214	1.12
2019.0925(Li et al., 2021)	1.3.5-TMB	178	--	197	8.13
2019.1014(Li et al., 2021)	1.3.5-TMB	170	--	250	6.12
2019.0903(Li et al., 2021)	1.3.5-TMB	105	--	211	4.48
2019.0907	Dod+TMB	28+168	6	231	8
2019.0921	Dod+TMB	22+155	7	212	7.83
2019.0919	Dod+TMB	20+182	9.1	218	8.61

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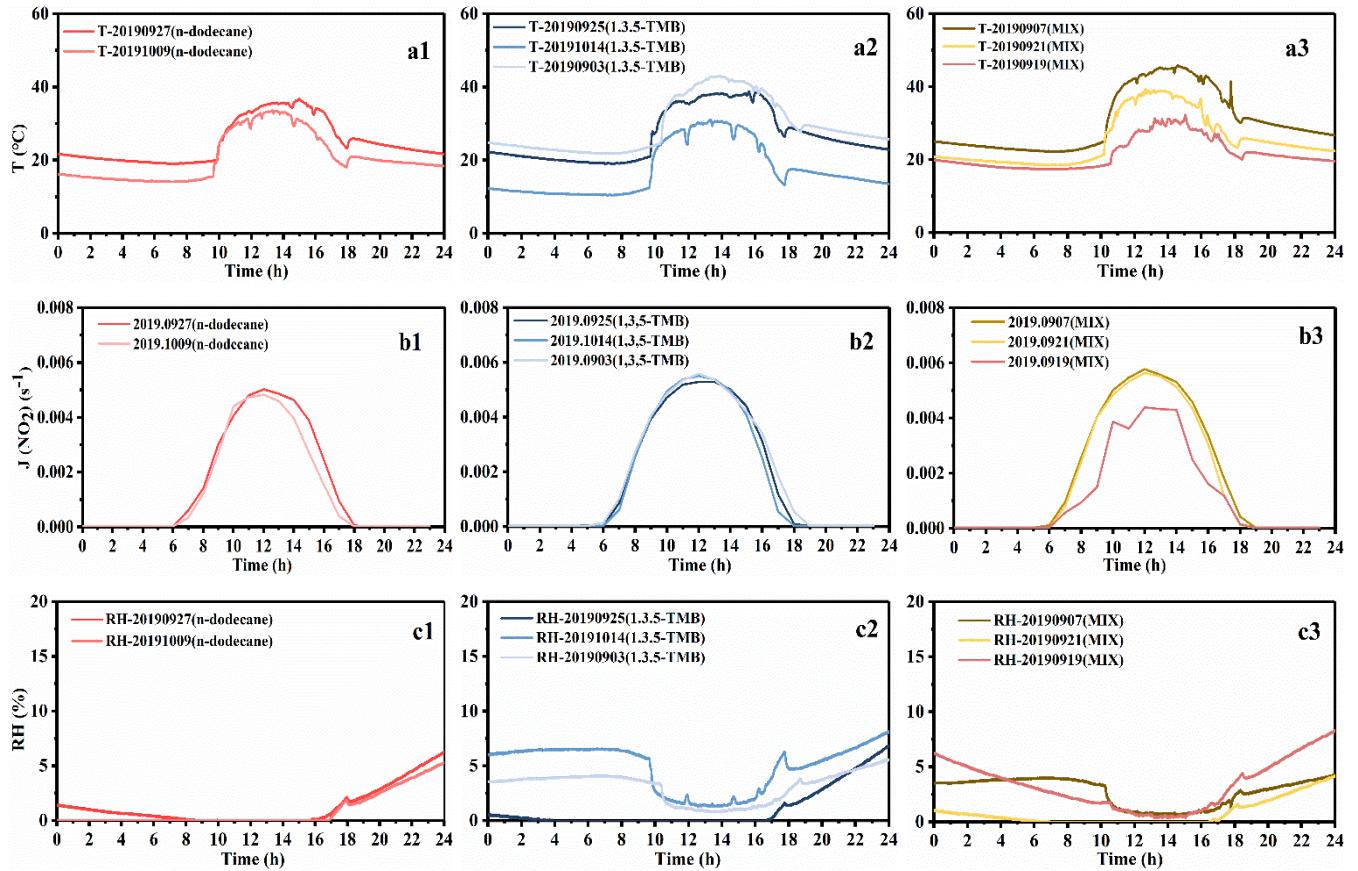
Figure S1. The temperature (T, a), the NO₂ photolysis rate of the experiments (J(NO₂), b), and relative humidity (RH, c); the data of 1.3.5-TMB was referred to Li et al. (2021)) in summer.
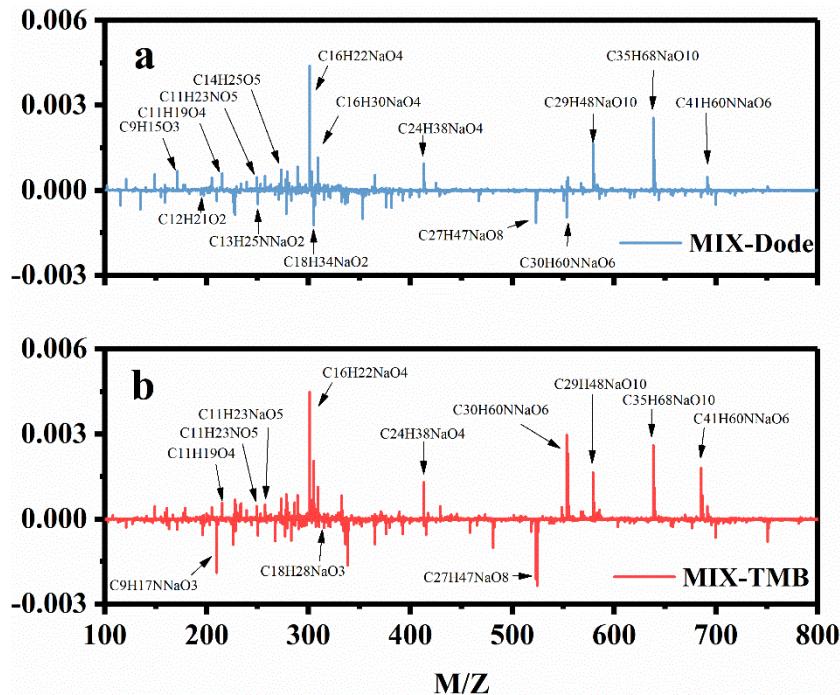
Figure S2. Results of mass spectra difference in (a) mixed AVOCs SOA minus *n*-dodecane SOA, and (b) mixed AVOCs SOA minus 1,3,5-TMB SOA. The Y-axis is the relative intensity normalized by dividing by the total signal strength of the mass spectra.

References

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Zhang, X., Cappa, C. D., Jathar, S. H., McVay, R. C., Ensberg, J. J., Kleeman, M. J., and Seinfeld, J. H.: Influence of vapor wall loss in laboratory chambers on yields of secondary organic aerosol, Proc. Natl. Acad. Sci. USA 111, 5802-5807, 2014.