

## **Supporting Information:**

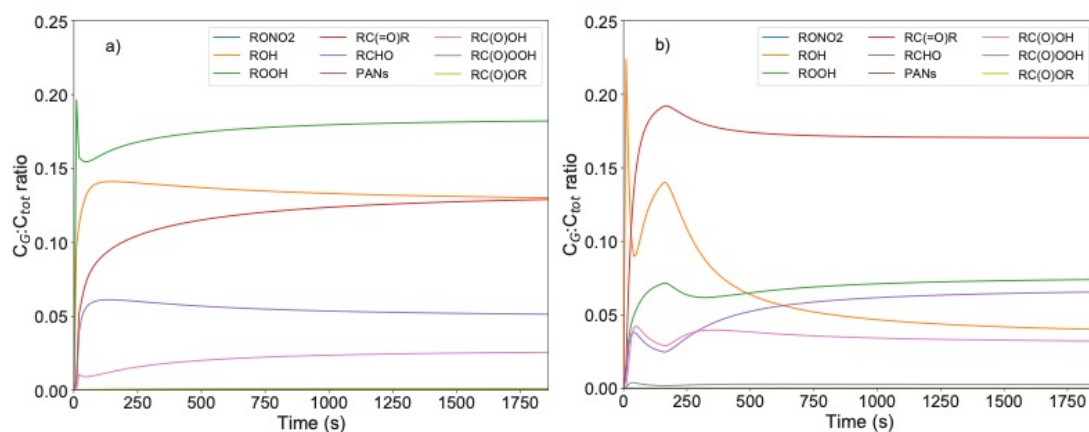
### **Estimation of Secondary Organic Aerosol Viscosity from Explicit Modeling of Gas-Phase Oxidation of Isoprene and $\alpha$ -pinene**

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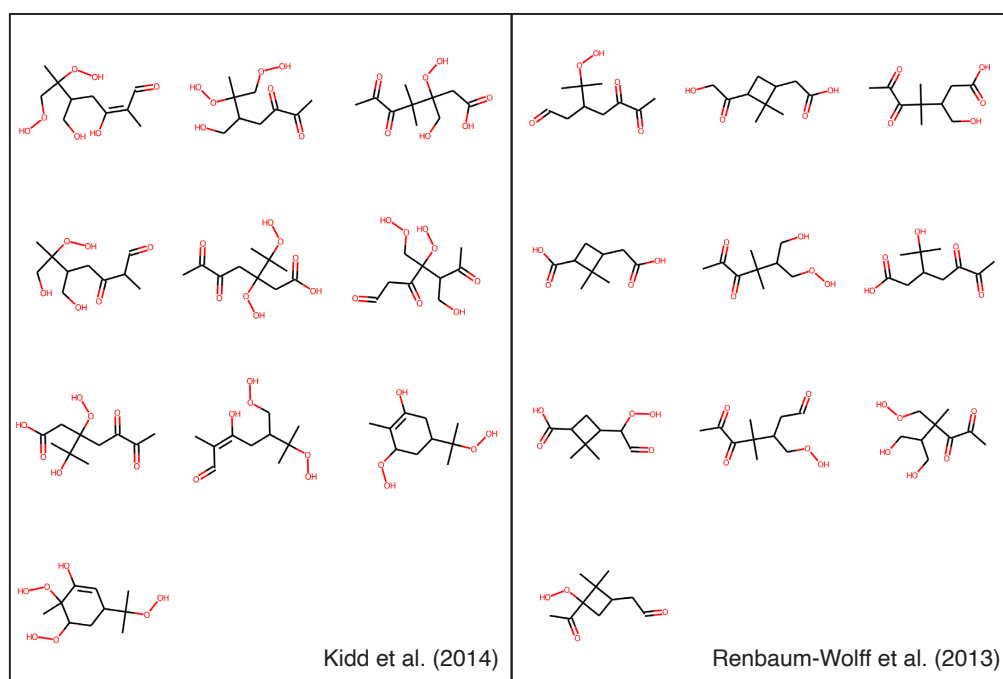
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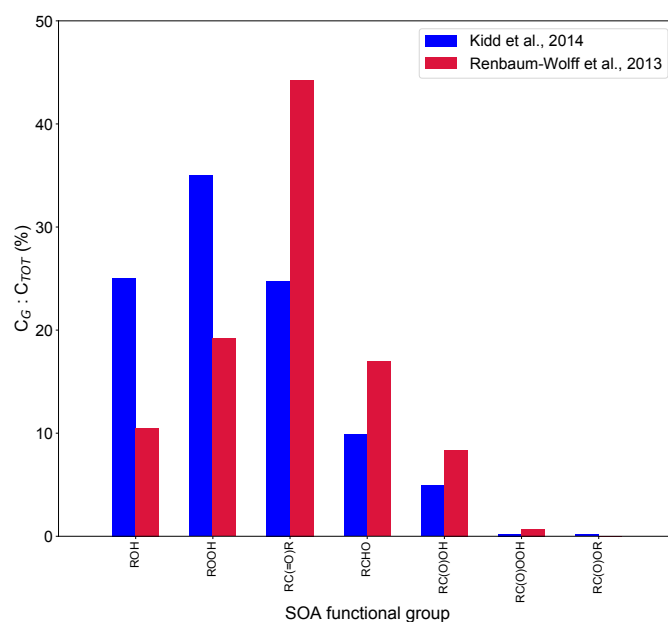
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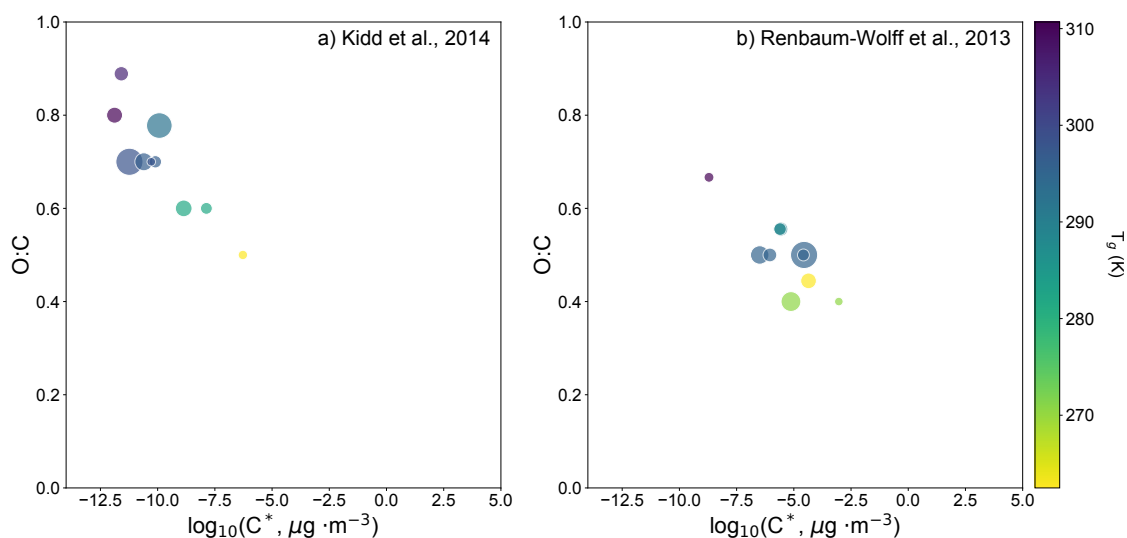
**Figure S1:** Time evolution of SOA compounds with different functional groups for simulations of experiments by (a) Kidd et al. (2014) and (b) Renbaum-Wolff et al. (2013) by considering effective mass accommodation coefficient  $\alpha_{eff}$ . The simulations were conducted at RH = 0.5%.



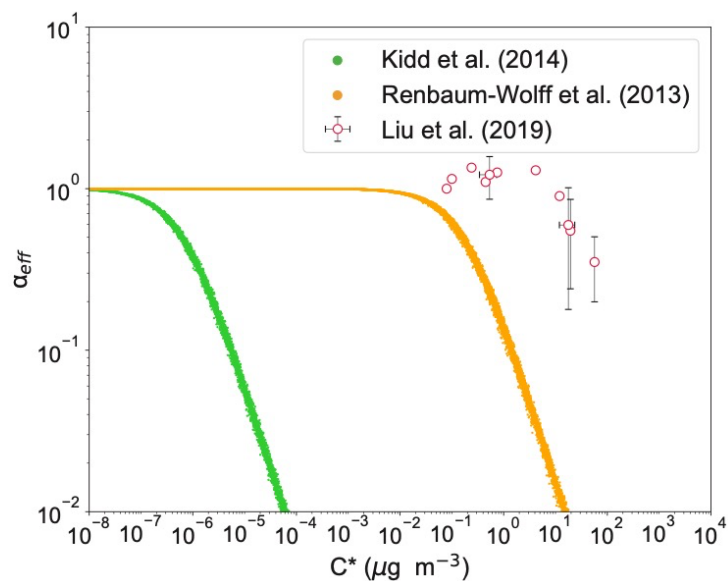
**Figure S2:** Ten major compounds in the particle phase at the end of the simulations of Kidd et al. (2014) and Renbaum-Wolff et al. (2013). In both panels species concentrations decreases from the top row to the bottom row and from left to right. The simulations employed the effective mass accommodation coefficient  $\alpha_{eff}$ . The simulations were conducted at RH = 0.5%.



**Figure S3:** Functional group distributions in particle-phase SOA compounds in simulations of Kidd et al. (2014) (blue bars) and Renbaum-Wolff et al. (2013) (red bars). The simulations employed effective mass accommodation coefficient  $\alpha_{\text{eff}}$ . The simulations were conducted at RH = 0.5%.



**Figure S4:** Chemical composition of SOA derived from oxidation of  $\alpha$ -pinene from simulations of (a) Renbaum-Wolff et al. (2013) and (b) Kidd et al. (2014) plotted in the 2D-VBS framework of volatility and O:C ratio. The simulations employed effective mass accommodation coefficient  $\alpha_{\text{eff}}$ . Markers represent the 10 most abundant particle-phase compounds from each simulation. The markers are color-coded with  $T_g$ . The marker size is scaled with particle-phase concentration in each simulation. The simulations were conducted at RH = 0.5%.



**Figure S5:** Simulated effective mass accommodation coefficients ( $\alpha_{\text{eff}}$ ) of  $\alpha$ -pinene SOA compounds plotted against their effective saturation mass concentration ( $C^*$ ) for simulations of Renbaum-Wolff et al. (2013) (orange) and Kidd et al. (2014) (green).  $C^*$  is assumed to be equal to  $C^0$  with ideal mixing conditions. The markers represent measured mass accommodation coefficients for SOA generated by  $\alpha$ -pinene ozonolysis by Liu et al. (2019). The simulations were conducted at RH = 0.5%.