

Heterogeneous reaction of OH on organic particles

(based on data from Kessler, S. H. et al., *J. Phys. Chem. A*, 2012)

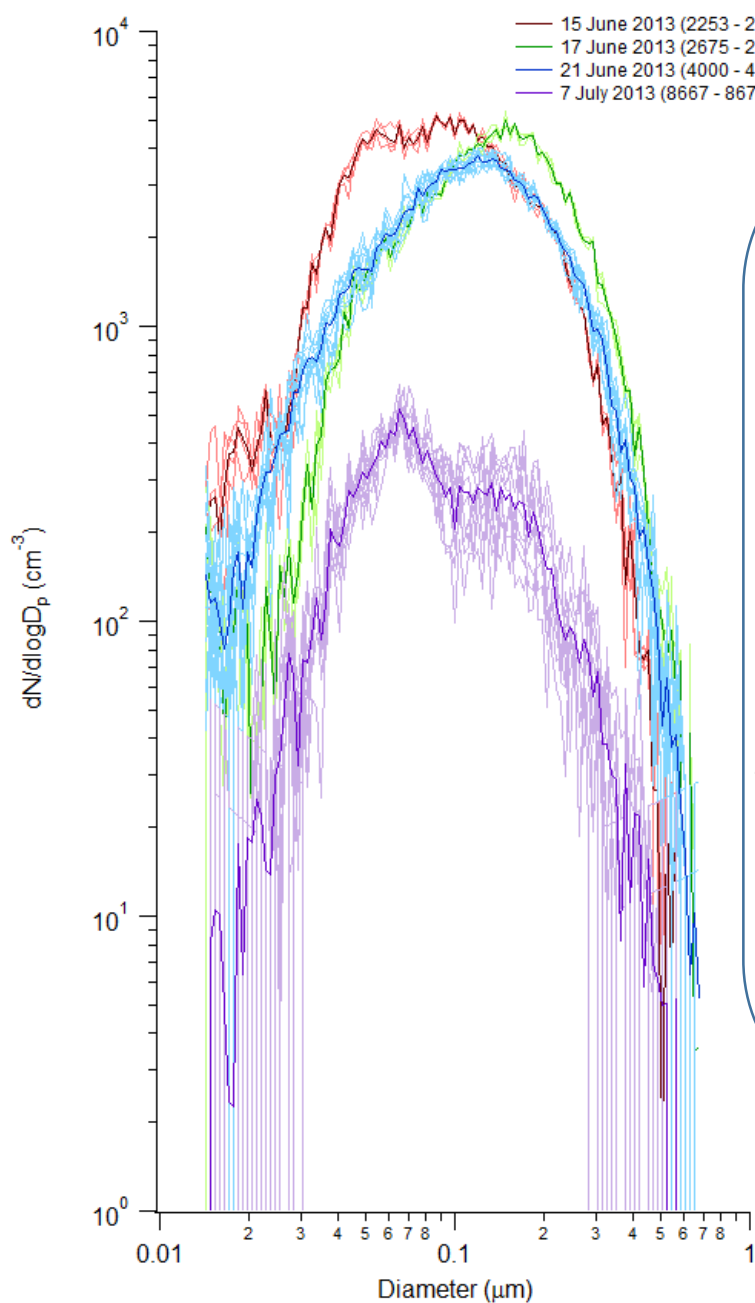


Figure 1. Ambient size distributions from Look Rock, TN during Summer 2013 Southern Oxidant and Aerosol Study (SOAS). Light traces are individual scans from the SMPS; dark traces are averaged scans.

Calculations

$$\frac{dN}{d\log D_p} \rightarrow dN \rightarrow dV \rightarrow \frac{dV}{d\log D_p}$$

$$\frac{dV}{d\log D_p} \rightarrow \frac{dmass}{d\log D_p} \rightarrow \frac{dmol}{d\log D_p} \rightarrow \frac{datom}{d\log D_p}$$

$$\frac{\# \text{ reactions}}{s} = k * \gamma * [OH]$$

$$\# \text{ reactions} = \frac{\# \text{ reactions}}{s} * t$$

$\# \text{ reactions} = \# \text{ H atoms lost} = \# \text{ O atoms gained}$

$$\frac{datom}{d\log D_p} \rightarrow \frac{dmol}{d\log D_p} \rightarrow \frac{dmass}{d\log D_p} \rightarrow \frac{dV}{d\log D_p}$$

$$\frac{dV}{d\log D_p} \rightarrow dV \rightarrow dN \rightarrow \frac{dN}{d\log D_p}$$

	Citric Acid ^a	Squalane ^b
k (cm ³ molec ⁻¹ s ⁻¹)	4.30 x 10 ⁻¹³	1.85 x 10 ⁻¹²
γ	0.37	0.54
[OH] (molec cm ⁻³)	3.00 x 10 ⁶	1.19 x 10 ⁸

^aValues from Kessler, S. H. et al., *J. Phys. Chem. A*, 2012

^bValues from Che, D. L. et al., *Phys. Chem. Chem. Phys.*, 2010

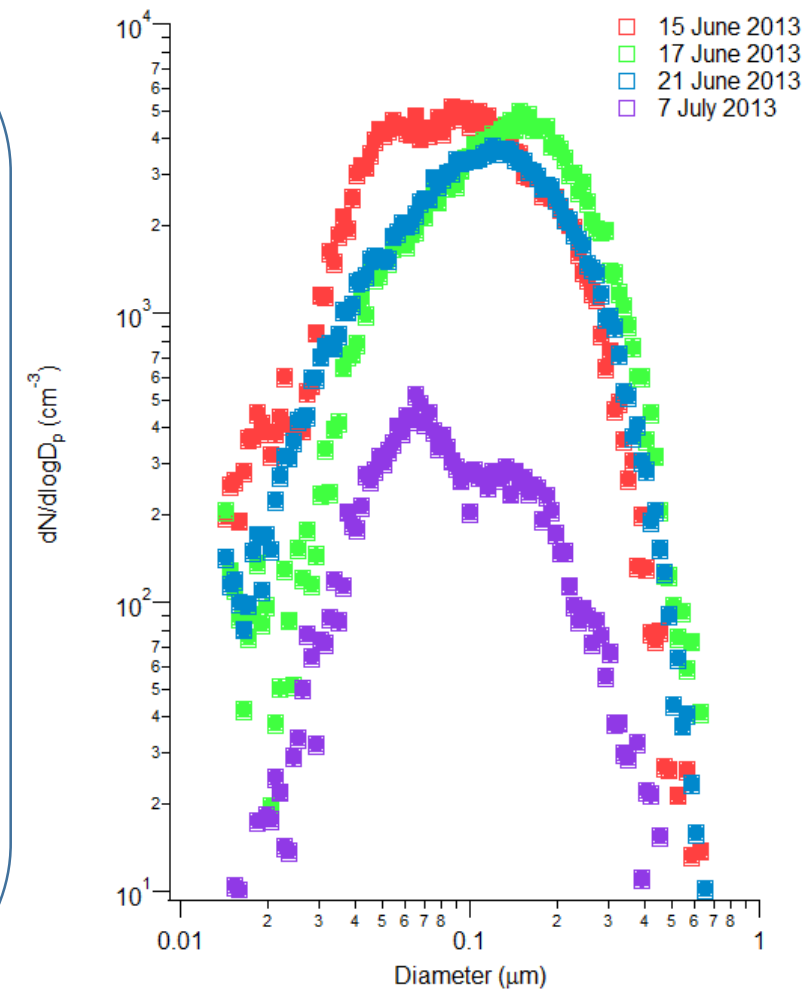


Figure 2. Reacted size distributions. Open squares and filled circles represent citric acid and squalane particles, respectively.

- Assumptions**
- Entire particle composed of citric acid or squalane
 - Entire particle available for reaction
 - Only H on C atoms available for abstraction
 - Particle p remains constant
 - Number of reactions = number H lost = number O gained

Comparison to gas-phase condensation on organic particles

(using an aerosol condensation model written by Lynn M. Russell)

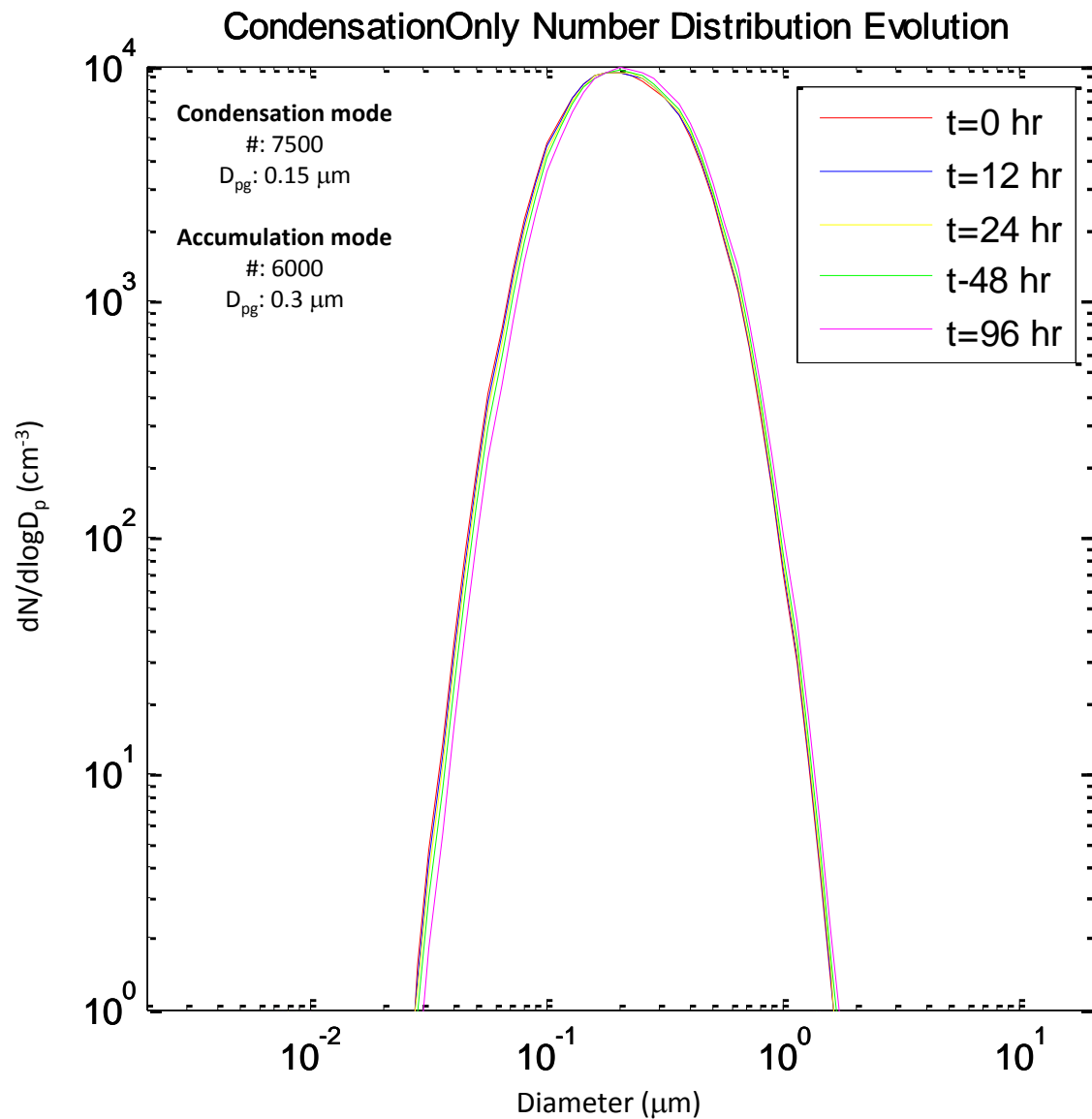


Figure 3. Simulated aerosol size distribution from an aerosol condensation model, representative of ambient SMPS size distributions from Look Rock, TN during June 2013 Southern Oxidant and Aerosol Study (SOAS). Different colors represent changes in the distribution over time as a result of formic acid vapor condensation to the particles.

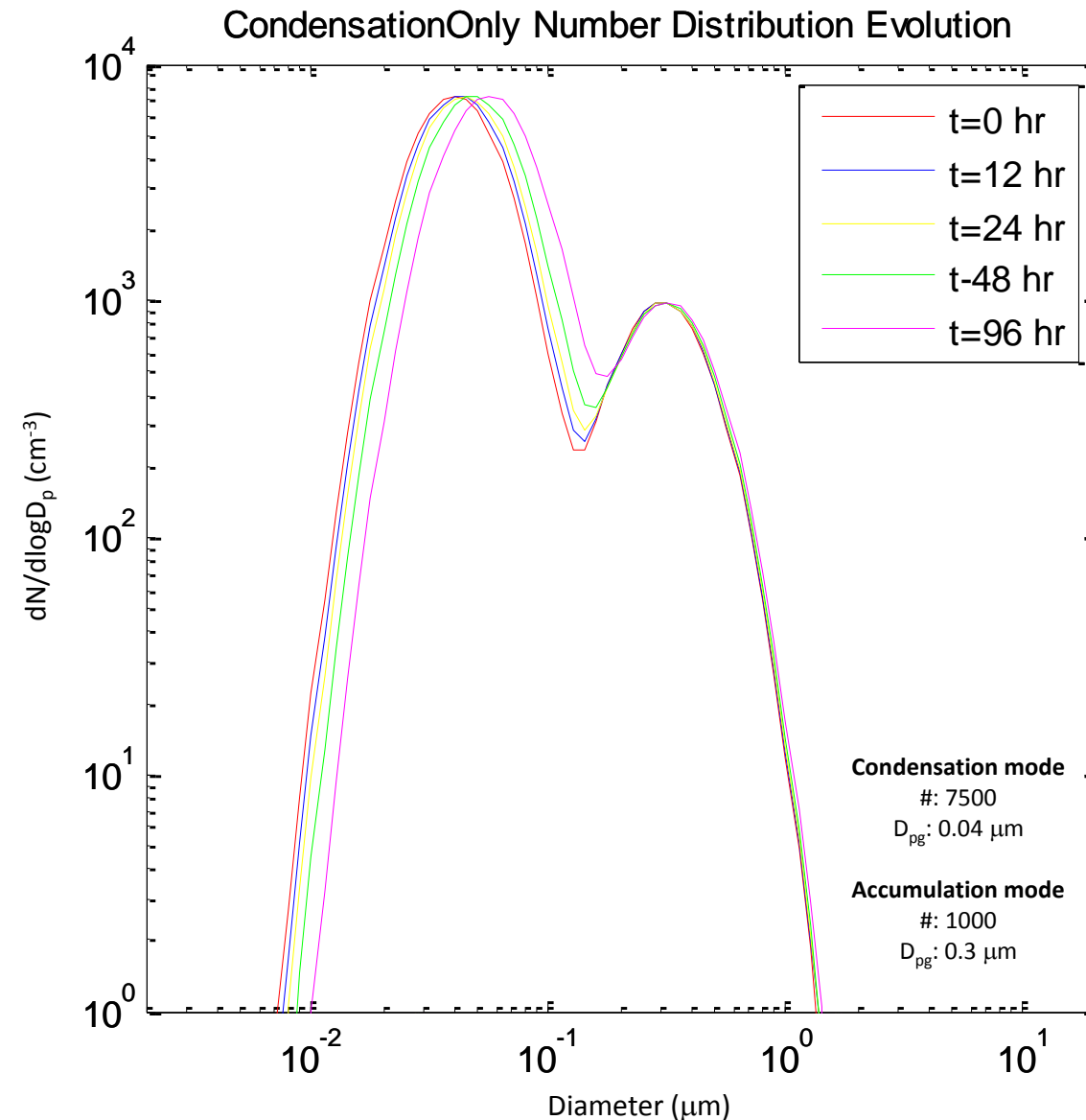


Figure 4. Simulated aerosol size distribution from an aerosol condensation model, representative of ambient SMPS size distributions from Look Rock, TN during July 2013 Southern Oxidant and Aerosol Study (SOAS). Different colors represent changes in the distribution over time as a result of formic acid vapor condensation to the particles.