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Particle mass yield in secondary organic aerosol formed by the dark ozonolysis of α -pinene

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Abstract. The yield of particle mass in secondary organic aerosol (SOA) formed by dark ozonolysis was measured for 0.3–22.8 ppbv of reacted α -pinene. Most experiments were conducted using a continuous-flow chamber, allowing nearly constant SOA concentration and chemical composition for several days. For comparison, some experiments were also conducted in batch mode. Reaction conditions were 25°C, 40% RH, dry (NH₄)SO₄ seed particles, and excess 1-butanol. The organic particle loading was independently measured by an aerosol mass spectrometer and a scanning mobility particle sizer, and the two measurements agreed well. The observations showed that SOA formation occurred for even the lowest reacted α -pinene concentration of 0.3 ppbv. The particle mass yield was 0.09 at 0.15 $\mu\text{g m}^{-3}$, increasing to 0.27 at 40 $\mu\text{g m}^{-3}$. Compared to some results reported in the literature, the yields were 80 to 100% larger for loadings above 2 $\mu\text{g m}^{-3}$. At lower loadings, the yields had an offset of approximately +0.07 from those reported in the literature. To as low as 0.15 μm^{-3} , the yield curve had no inflection point toward null yield, implying the formation of one or several products having vapor pressures below this value. These observations of increased yields, especially for low loadings, are potentially important for accurate prediction by chemical transport models of organic particle concentrations in the ambient atmosphere.

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