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Secondary organic aerosol formation from *m*-xylene, toluene, and benzene

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Abstract. Secondary organic aerosol (SOA) formation from the photooxidation of *m*-xylene, toluene, and benzene is investigated in the Caltech environmental chambers. Experiments are performed under two limiting NO_x conditions; under high-NO_x conditions the peroxy radicals (RO_2) react only with NO, while under low-NO_x conditions they react only with HO_2. For all three aromatics studied (*m*-xylene, toluene, and benzene), the SOA yields (defined as the ratio of the mass of organic aerosol formed to the mass of parent hydrocarbon reacted) under low-NO_x conditions substantially exceed those under high-NO_x conditions, suggesting the importance of peroxy radical chemistry in SOA formation. Under low-NO_x conditions, the SOA yields for *m*-xylene, toluene, and benzene are constant (36%, 30%, and 37%, respectively), indicating that the SOA formed is effectively nonvolatile under the range of M_o(>10 μg m^{-3}) studied. Under high-NO_x conditions, aerosol growth occurs essentially immediately, even when NO concentration is high. The SOA yield curves exhibit behavior similar to that observed by Odum et al. (1996, 1997a, b), although the values are somewhat higher than in the earlier study. The yields measured under high-NO_x conditions are higher than previous measurements, suggesting a "rate effect" in SOA formation, in which SOA yields are higher when the oxidation rate is faster. Experiments carried out in the presence of acidic seed aerosol reveal no change of SOA yields from the aromatics as compared with those using neutral seed aerosol.

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