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Effect of NO_x level on secondary organic aerosol (SOA) formation from the photooxidation of terpenes

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Abstract. Secondary organic aerosol (SOA) formation from the photooxidation of one monoterpene (α-pinene) and two sesquiterpenes (longifolene and aromadendrene) is investigated in the Caltech environmental chambers. The effect of NO_x on SOA formation for these biogenic hydrocarbons is evaluated by performing photooxidation experiments under varying NO_x conditions. The NO_x dependence of α-pinene SOA formation follows the same trend as that observed previously for a number of SOA precursors, including isoprene, in which SOA yield (defined as the ratio of the mass of organic aerosol formed to the mass of parent hydrocarbon reacted) decreases as NO_x level increases. The NO_x dependence of SOA yield for the sesquiterpenes, longifolene and aromadendrene, however, differs from that determined for isoprene and α-pinene; the aerosol yield under high-NO_x conditions substantially exceeds that under low-NO_x conditions. The reversal of the NO_x dependence of SOA formation for the sesquiterpenes is consistent with formation of relatively low-volatility organic nitrates, and/or the isomerization of large alkoxy radicals leading to less volatile products. Analysis of the aerosol chemical composition for longifolene confirms the presence of organic nitrates under high-NO_x conditions. Consequently the formation of SOA from certain biogenic hydrocarbons such as sesquiterpenes (and possibly large anthropogenic hydrocarbons as well) may be more efficient in polluted air.

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