

Effects of hydroxyl radical exposure on chemical composition of secondary organic aerosol formed from sabinene ozonolysis

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Sabinene, a bicyclic monoterpene with an exocyclic double bond, is a major monoterpene emitted from Japanese cedar. We investigated OH initiated aging of secondary organic aerosol (SOA) formed from sabinene ozonolysis using a laboratory environmental chamber. SOA mass concentration and f43 and f44 ratios of SOA were monitored by an Aerodyne high-resolution time-of-flight aerosol mass spectrometer, where f43 and f44 are the ratios of m/z 43 and m/z 44 to total SOA mass, respectively. SOA mass concentration increased immediately after SOA was exposed to OH radicals due to photochemical aging. The f43 ratio, attributed to alcohols, carbonyls, and peroxides, increased only immediately after the start of exposure, whereas the f44 ratio, attributed to carboxylic acids, continuously increased during the exposure. Offline SOA samples collected before and after the exposure to OH radicals were analyzed by a liquid chromatograph negative-mode electrospray ionization mass spectrometer. Major products present in the particle phase were monomeric products, $C_{8-10}H_{12-18}O_{3-6}$, and dimeric products, $C_{17-19}H_{26-32}O_{7-9}$. Monomeric products include sabinic acid, norsabinic acid, and sabinolic acid as reported in previous studies. As a result of exposure to OH radicals highly functionalized eight to nine carbon products increased, whereas dimeric products decreased. Formation of highly functionalized products will be explained by gas phase OH initiated reaction of sabinaketone and nine carbon lactones, major gaseous products formed from sabinene ozonolysis. Decrease in dimeric products will be explained by decomposition of dimeric products due to OH initiated oxidation in the particle phase.

Keywords: Air pollution, Fine particulate matter, Biogenic volatile organic compound, Highly oxygenated molecule, Volatility basis-set model, Intramolecular hydrogen shift