2.146 Quantification and the Impact of SO2 on the New Particle Formation in the Ozonolysis of α-pinene .

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Abstract:

The new particle formation from the ozonolysis of a-pinene as a function of initial ozone concentration ($[O_3]_i$) was studied using a scanning mobility particle sizer spectrometer (SMPS) to monitor the size distribution of the produced submicrometer particles at room temperature. The applied initial concentration of a-pinene (≥ 15.4 ppm) was much higher than $[O_3]_i$ (40 - 120 ppb), while RH was controlled at < 1 %, 36 % and 54 %. The generated particles showed a positive correlation to $[O_3]_i$ at $[O_3]_i$ ≥ 50 ppb in both number and mass concentration likely due to the produced low volatility products reaching the saturation point at $[O_3]_i$ ~ 50 ppb. For a given $[O_3]_i$, the mass concentration of particles showed a slightly decreasing trend with RH likely due to a potential oxidant, HO_2, forming $HO_2 \bullet H_2O$ to reduce the overall oxidation of the system. With the addition of 6.3 ppm of SO_2, a significant increasing of small particles in number concentration suggested a strong nucleation enhancement likely induced by the low volatile organic species with H_2SO_4 from the reaction of SO_2- with OH radical. By a model simulation, 0.35 ppb of H_2SO_4 was generated and had significant nucleation rate, faster than that estimated from the H_2SO_4-H_2O binary system. Overall, this study illustrated the new particle formation from the ozonolysis of a-pinene at different environments and suggested the importance of radicals, which can be applied to secondary organic aerosols derived from other biogenic organic species. The nucleation and condensation processes from the model simulations might provide the possible physical and chemical parameters required for the regional models to better estimate the number and mass concentration of aerosols generated from the interaction between the natural and anthropogenic sources in real atmosphere.