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Product study of α-pinene and limonene ozonolysis: Influence of temperature on product distributions

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The influence of temperature on product distributions in the reactions of α-pinene and d-limonene with ozone was investigated in the AIDA aerosol chamber. The experiments were carried out in a range of temperature between -30 ºC to +30 ºC. Capillary electrophoresis systems coupled to electrospray ionisation-ion trap mass spectrometry (ESI-ITMS) or ESI-Time of Flight (ESI-TOF) mass spectrometry was used to study oxidation product distributions as a function of temperature. The particle phase concentrations of most of oxidation products in both terpene and ozone reactions were much higher under sub zero temperature regimes than under room temperature regimes. For the α-pinene ozone reaction, cis-pinic acid was the most abundant single oxidation product followed by a compound with $C_{10}H_{16}O_4$under all temperatures studied. Major oxidation products in the limonene ozone reaction were $C_{10}H_{16}O_4$ (hydroxylimononic acid or limononic peroxyacid) followed by $C_9H_{14}O_5$ (hydroxylimonic acid or limonic peroxyacid). The particle phase concentrations of ketolimononic acid ($C_9H_{14}O_5$) and limonalic acid or norlimononic acid ($C_9H_{14}O_3$) were significantly higher in the low temperature experiments.

The difference in the sum of particle phase oxidation products between low temperature and room temperature experiments was much larger for α-pinene experiments than for limonene experiments. These results suggest that even most of predominantly gas phase compounds such as pinonaldehyde were partitioned into the particle phase under a sub-zero temperature. The role of temperature on the formation of oligomeric

compounds from high volatility compounds needs to be further investigated.