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Influence of photooxidation and oligomerisation on the hygroscopicity and volatility of a-pinene SOA

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Secondary organic aerosol (SOA) formation and aging was investigated in a reaction chamber by irradiation of a-pinene in the presence of NOx. Due to continued oxidation processes as well as oligomerisation of the oxidation products within the particles, physical properties of the particle are expected to change as a function of irradiation time. All experiments were performed at low precursor concentrations in order to mimic atmospheric conditions as closely as possible. Experiments at higher precursor concentrations had shown that with higher total organic aerosol mass concentrations an increased fraction of more volatile components partitioned to the aerosol, thus changing both chemical composition and physical properties substantially. The change in the hygroscopic properties of these particles as a function of particle size and age was measured using a Hygroscopicity Tandem Differential Mobility Analyzer (HTDMA) which allowed measurements at relative humidities up to 95%. In addition, SOA particles of known sizes were pre-heated and the hygroscopic properties of the remaining particle fraction were measured using a Volatility-Hygroscopicity Tandem Differential Mobility (VHTDMA) system. Experiments were performed both in the presence and absence of ammonium sulphate seed aerosol. Results show that the chemical transformation in the aerosol leads to an increase in the hygroscopic growth factors of the SOA with irradiation time.