Particle and gas phase analysis of carbonyl compounds formed during monoterpene oxidation in chamber experiments

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The oxidation of monoterpenes produces a number of multifunctional semivolatile and non-volatile products. Their condensation and coagulation processes lead to particle formation and growth.
The first generation oxidation products of monoterpenes are mainly carbonyl compounds. Although these carbonyl compounds are commonly found in both ambient and chamber experiment samples, their subsequent reactions in the atmosphere are not well characterised. To determine the yields of carbonyl compounds from monoterpenes and their first generation oxidation products, an analytical method using 2,4-dinitrophenylhydrazine (DNPH) as a derivatisation reagent for carbonyl compounds was adapted (Grosjean and Grosjean, 1995). The acid-catalysed derivatisation with DNPH leads to stable 2,4-dinitrophenylhydrazones, which can be analysed using high performance liquid chromatography (HPLC) coupled to mass spectrometry (MS). The use of HPLC/ESI-TOFMS (Electrospray Ionisation Time-Of-Flight Mass Spectrometry) offers several advantages over traditional HPLC/UV methods for determination of carbonyl compounds because of its high sensitivity and the determination of the exact chemical formula for the identification of unknown carbonyl compounds.
Aerosol chamber experiments were carried out in the “Leipziger Aerosol Kammer” (LEAK) which is made of Teflon foil and has a volume of 19 m^3. The secondary organic aerosol (SOA) formation from the ozonolysis of α-pinene and β-pinene was studied in the presence of ammonium bisulphate or a mixture of ammonium sulphate and excess sulphuric acid seed particles. The resulting compounds were sampled by a denuder/PTFE filter combination for the determination of the gas- and particle-phase products. Pinonaldehyde from the α-pinene ozonolysis and nopinon from the ozonolysis of β-pinene were quantified using synthesised standard compounds. The results from the present study are compared with the product yields reported in the literature (Yu et al., 1999).

Grosjean, E. and Grosjean, D. (1995), *Internat. J. Environ. Anal. Chem*., 61, 47-64.

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