

# Formation of Highly Oxygenated Multifunctional compounds and Secondary Organic Aerosol from OH- and O<sub>3</sub>-oxidation of $\alpha$ -pinene under different environmental conditions

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## INTRODUCTION

Organic compounds are ubiquitous in the atmospheric aerosol (Zhang et al., 2007). A large fraction of this organic material originates from the conversion of Volatile Organic Compounds (VOCs) to less volatile forms by oxidation: this part is called secondary organic aerosol (SOA) (Zhang et al., 2007). Much research in recent years has focused on the formation of SOA from VOCs, but no comprehensive description of its formation exists yet. To address this, we measured the formation of SOA from oxidation of different VOCs as a part of the SOA Formation from Forest Emissions Experiment (SOAFEE) campaign, utilizing the environmental chamber of the Pacific Northwest National Laboratory (PNNL) in the state of Washington, USA. One of the aims of the campaign was to characterize the formation of SOA from oxidation of monoterpenes under different environmental conditions.

## METHODS

We investigated the oxidation products formed in monoterpene oxidation under different conditions. These conditions included the initiation of the oxidation reaction by OH radical and ozone, with termination of the radical reactions by HO<sub>2</sub>, RO<sub>2</sub> and NO radicals. We measured both the gas and particle phase with a multitude of different instruments, both from the University of Helsinki and from other institutions. The experiments were conducted in a Teflon bag chamber operated in a continuous flow mode, with a residence time of roughly three hours. During the experiments we injected ammonium sulfate seed aerosol into the chamber, along with different VOCs and oxidants. We controlled UV and visible lights separately to alter the photolysis rates of different species, and in this way change the oxidant composition in the chamber.

We measured the molecular compositions and concentrations of different Highly Oxidized Multifunctional organic compounds (HOMs) formed using a nitrate ion Chemical Ionization Atmospheric Pressure interface Time-Of-Flight mass spectrometer (CI-API-TOF, Jokinen et al., 2012). This study focuses on the formation of HOMs under different conditions, as they can readily condense to form aerosol. We also measured the concentrations of reactant monoterpenes and

concentration of formed aerosol mass, along with measurements of the aerosol size distribution, the volatility of the resulting particles and their activity as cloud condensation nuclei (CCN).

## RESULTS AND CONCLUSIONS

We found clear differences in the HOMs formed under different conditions. As an example, during ozone oxidation, upon adding NO<sub>x</sub> to the chamber we observed the appearance of HOMs containing nitrogen, presumably organonitrates. We will present further results, and compare the data to the ambient data measured in the Hyytiälä station. In this way we expect to further our understanding of the relative contributions of different oxidation pathways to SOA formation in the ambient boreal atmosphere.

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