

Laboratory and Field Studies on SOA Formation from BVOC Precursors

H. Herrmann*, Y. Iinuma, O. Böge, T. Gnauk, A. Plewka and K. Müller

Leibniz-Institut für Troposphärenforschung
Abteilung Chemie
Permoserstr. 15
D-04318 Leipzig, Germany

Since recently the enhanced formation of secondary organic aerosol (SOA) compounds has been intensively investigated in a number of laboratory studies for the ozonolysis of terpenes as well as model compounds for atmospheric unsaturated volatile organics of biogenic origin. It has been observed that particle acidity might (i) enhance SOA formation and (ii) lead to the formation of higher molecular weight particle phase products by condensation reactions in aqueous acidic particles. Application of MS techniques has proven much detail on the nature of the particle phase oligomers.

In contrast to earlier laboratory studies very recent evidence from field experiments now exists that HO_x chemistry leads to the conversion of isoprene into polyalcohol derivatives which might considerably contribute to the organic particle phase constituent budget in regions with isoprene emission and active HO_x chemistry. However, the nature of the formation pathways remains unclear.

The state of the art in both the fields of SOA formation from terpenes as well as from isoprene will be reviewed. New results from the IfT chemistry department aerosol chamber on terpene ozonolysis in the presence of particle seed of different composition and acidity are presented. For the terpene systems, mainly the ozonolysis of α -pinene was investigated. Experiments with and without acidic particles and with and without OH scavengers were performed. The application of a newly developed particle sampling device based on condensation and impaction (C-GIS) is demonstrated for these laboratory experiments enhancing time-resolution of particle sampling. Extensive particle phase analytics were performed by capillary electrophoresis–mass spectrometry. The findings from our experiments are discussed in view of the existing literature.

On the field experiment side, evidence for the tetrol formation from isoprene oxidation is presented from a variety of aerosol characterisation campaigns of our group in Europe. As to the formation mechanism, again aerosol chamber studies are discussed which do suggest that the tetrol formation from isoprene is neither a pure gas phase process sequence nor involves solution phase oxidation of isoprene itself but is a combination of initial gas phase oxidation steps, phase transfer and subsequent solution phase reactions.

The implications of the processes studied are discussed in detail.