

# Particle phase composition of low-NO<sub>x</sub> isoprene SOA: Effect of seed acidity and relative humidity

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Secondary organic aerosol (SOA) formation from isoprene oxidation has been an emphasis in the last couple of years. Observed SOA yields are small but in terms of the large source strength, estimated contributions to total SOA mass from biogenic volatile organic compounds (BVOC) oxidation are high (Heald *et al.*, 2008; Hallquist *et al.*, 2009).

So far, most of the studies concentrated on SOA formation from isoprene oxidation under high NO<sub>x</sub> mixing ratios. Determined SOA yields are in the range of 1 – 5 % (Kroll *et al.*, 2006). Amongst others, it has been shown that increasing seed acidity promotes but increasing relative humidity inhibits particle mass generation. Moreover, these dependencies of particle mass correlate with the presence of 2-methylglyceric acid, an important isoprene SOA marker compound (Claeys *et al.*, 2004; Surratt *et al.*, 2006; Zhang *et al.*, 2011).

Lately, oxidation and mass generation at low NO<sub>x</sub> mixing ratios became foci of interest. Gas phase oxidation mechanisms differ significantly as C<sub>5</sub> hydroxyhydroperoxides (ISOPOOH) are main primary products. Further oxidation leads to the formation of C<sub>5</sub> epoxydiols (IEPOX) and low volatility organic compounds (LVOC) which are considered to be SOA precursor compounds (Paulot *et al.*, 2009; Krechmer *et al.*, 2015). Thus, formation of the important SOA components 2-methyltetrols and their sulfate esters is explained by the gas-particle partitioning of IEPOX. Observed SOA yields vary significantly depending on seed acidity with maximum values of 29 % for highly acidic primary particles caused by an increased uptake of IEPOX (Surratt *et al.*, 2010).

For the present study, experiments on low NO<sub>x</sub> isoprene oxidation with OH radicals were performed in the aerosol chamber LEAK. The impact of seed properties on SOA formation was investigated by varying seed acidity and relative humidity. Besides the characterization of organosulfates and organic peroxides, particle phase analysis aimed to further study the role of small carbonyl compounds and carboxylic acids in mass formation.

The results show, that particle phase composition is strongly dependent on seed acidity. Carbonyl compounds, carboxylic acids as well as organosulfates show highest contributions to particle mass in presence of highly acidified seed. These findings correlate with higher SOA yields in presence of acidic (7 – 13 %) compared to neutral (4 – 8 %) seed particles. Besides organic peroxides, dicarboxylic acids were found to add

significantly to the particle mass with major contribution by oxalic acid (see Fig. 1). Fractions of carboxylic acids range from 1 – 8 % with far higher contributions at high relative humidity indicating that they are formed from multiphase processes. In contrast, small carbonyl compounds did not contribute substantially to SOA mass as fractions were found to be less than 1 %.

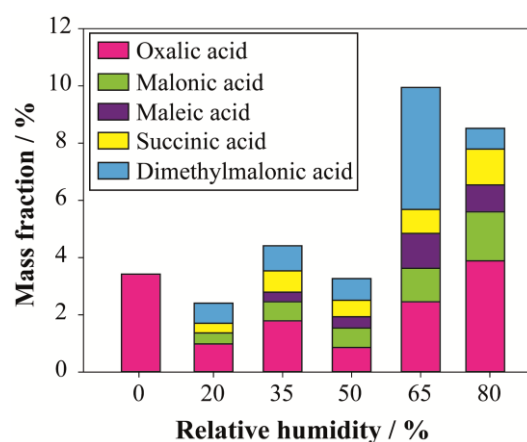


Figure 1. Contribution of individual dicarboxylic acids to total organic mass measured for acidic seed and for varying relative humidity.

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