

2.161 Condensible vapours from alpha-pinene oxidation: experimental characterization of formation processes and volatility.

Early Career Scientist

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Abstract:

Atmospheric oxidation of volatile organic compounds (VOC) typically produces organic peroxy (RO₂) radicals. Their autoxidation can quickly lead to high oxygen contents and low volatilities (Ehn et al., 2014). These products, highly oxygenated molecules (HOM), can efficiently condense onto particles, producing secondary organic aerosol (SOA), a major component of tropospheric aerosol. Reactions of RO₂ radicals with each other can produce dimers (Berndt et al., 2018), which have been implicated in biogenic nucleation

(Kirkby et al., 2016). Presence of anthropogenic pollutants, such as nitric oxide (NO), can perturb the autoxidation process, suppressing the formation of dimers and forming organic nitrates (Ehn et al., 2014). To evaluate the aerosol formation potential from oxidation reactions in different conditions, it is essential to know the volatilities of the HOM formed. However, due to their exotic structures, estimating their volatility through commonly used group contribution methods is insufficient (Kurtén et al., 2016). Using state of the art instrumentation, we determined the relative volatilities of HOM formed in the ozonolysis of the monoterpene alpha-pinene. In line with previous research, we found dimers to be of very low volatility. In contrast, organic nitrates were of a relatively high volatility for their molecular mass. Due to the differing volatilities, understanding the detailed formation pathways of HOM is important in assessing their particle formation potential. However, our understanding remains limited: therefore, we tracked the behaviour of multiple RO₂ radicals and the respective dimer and other HOM products in high time resolution. As a result, we were able to map out the effect of RO₂ and NO loadings on the formed HOM, and hence particle formation potential, providing new insight on the anthropogenic impact on biogenic SOA formation.

References

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