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Influence of ferrous and ferric ions in the aqueous phase on SOA formation in flow reactor experiments

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Aqueous-phase chemistry of fog and cloud waters plays an important role in the formation and aging of secondary organic aerosols (e.g. Ervens et al., 2011; Herrmann et al., 2015). Transition metal ions driving Fenton chemistry in aqueous aerosols are one of the main sources of OH radicals besides direct uptake from the gas-phase (Ervens et al., 2003). The most abundant transition metal in aqueous aerosols is iron released from natural sources like sea salt spray and mineral dust or anthropogenic emissions. The generation of OH radicals by Fenton chemistry might drive or inhibit atmospheric new particle formation in cloud and fog water, or above salt lakes (e.g. Kamilli et al., 2015; Daumit et al., 2016), thus, having a direct impact on the climate system.

A first set of experiments has been carried out in a flow reactor investigating the influence of ferric and ferrous iron on new particle formation under dark and humid conditions (RH > 70%). α -Pinene was used as an organic precursor molecule for secondary organic aerosol (SOA) formation by dark ozonolysis. Droplets of FeSO_4 , FeCl_3 and $(\text{NH}_4)_2\text{SO}_4$ (as control) were produced by nebulizing solutions of varying concentrations between 0.1 μM and 30 mM using a custom-built atomizer. Particle size distributions were measured using a scanning mobility particle size spectrometer (SMPS, Grimm Aerosoltechnik).

First results show a significant decrease in geometric mean diameter of the produced particle population with increasing FeCl_3 concentration. This effect neither occurs when nebulizing FeSO_4 nor $(\text{NH}_4)_2\text{SO}_4$. These results imply that Fe^{3+} might inhibit growth of SOA under dark conditions.

More data analysis is ongoing and further experiments are planned to better understand the influence of iron on aqueous-phase SOA.

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