**Kinetic Modeling of Relevant Atmospheric Sulfur and Nitrogen Containing Compounds to Understand Particle Formation**

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Secondary organic aerosols (SOAs) form from the atmospheric oxidation of organic compounds that are released into the atmosphere, mainly through photooxidation and OH radical reactions. Reduced sulfur- and nitrogen-containing organic compounds are of special interest due to their abundant release into the atmosphere through agriculture and the burning of fossil fuels and due to their correlation with the formation of SOAs. In this study, kinetic modeling of the atmospheric oxidation mechanisms of dimethyl disulfide (DMDS), dimethyl sulfide (DMS) and trimethylamine (TMA) simulates aerosol chamber experiments to interpret the ionic content of detected particles. The kinetic models were built as systems of differential equations for the atmospheric photooxidation mechanisms of the parent gas compounds. Then, gas phase data from chamber experiments of the corresponding compound in the presence of H2O2 as the oxidant source was simulated to benchmark our models. Experimental data shows a large difference in the production of sulfate ion (SO42-) between DMS and DMDS, as well as a dramatic decrease in SO42- formation when different amines are present, which may indicate rapid aerosol formation or aqueous-phase reactions. Modeling the gas phase data allows accurate prediction of SO2 formation. Observations from modeled data show prompt SO2 formation from DMDS; SO2 production is much slower for DMS. Photolytic dissociation of DMDS appears greatly favored due to its S-S bond, while DMS favors OH addition pathways. Gas-phase data of TMA chamber experiments show a high production of formaldehyde, which suggests that its photooxidation follows a CH3 abstraction.