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Catalytic transformations of organic matter in tropospheric aerosols - Importance for aerosol optical properties and gas-phase chemistry

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This presentation will report the recent discovery of several classes of compounds that are ubiquitous in tropospheric aerosols and act as powerful catalysts for the transformations of organic matter in these aerosols. These catalysts are efficient in all types of aerosol material (water, salt solutions, organic solutions) and activate various classes of reactions. This first presentation will focus on the aldol condensation of carbonyl compounds, for which the products, mechanisms, and rate constants obtained in our experiments with the different catalysts will be presented. For typical tropospheric aerosol compositions, these catalysts were found to be as efficient as concentrated sulfuric acid (10 – 15 M).

A confirmation for the occurrence of these reactions in the atmosphere is that their products account both for the molecular properties and quantities of the light-absorbing "fulvic" compounds found in a wide range aerosols and fog droplets but unexplained until now. These products would increase the absorption index of aerosols, including those that would be otherwise transparent to light. In particular, these reactions should significantly modify the radiative forcing of sulfate aerosols compared to current estimates.

These reactions would also act as important sinks for gas-phase carbonyl compounds that are highly soluble in aerosol particles, such as glyoxal. The reactive uptake for glyoxal determined from our experiments accounts for the hitherto unexplained depletion of this compound in the atmosphere Mexico City, and further confirms the oc-

currence of these reactions in aerosols. Glyoxal being an efficient precursor of ozone, these reactions would thus have significant impacts on gas-phase chemistry and the cycle of ozone.