Photosensitization : A novel pathway to SOA generation and property change in tropospheric particles

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Despite the importance of aerosols in atmospheric chemistry, climate and air pollution, our ability to assess the impact of aerosols on atmospheric physics and chemistry is still limited due to insufficient understanding of many processes associated with sources of particles, their chemical composition and morphology, and evolution of their composition and properties during their atmospheric lifetime. Indeed, atmospheric aerosols can be viewed as a complex conglomerate of thousands of chemical compounds forming a system that evolves in the atmosphere by chemical and dynamical processing including chemical interaction with oxidants.

Multiphase processes have also been shown to produce light absorbing compounds in the particle phase. The formation of such light absorbing species could induce new photochemical processes within the aerosol particles and/or at the gas/particle interface. A significant body of literature on photo-induced charge or energy transfer in organic molecules from other fields of science (biochemistry and water waste treatment) exists. Such organic molecules are aromatics, substituted carbonyls and/or nitrogen containing compounds – all ubiquitous in tropospheric aerosols. Therefore, while aquatic photochemistry has recognized several of these processes that accelerate degradation of dissolved organic matter, only little is known about such processes in/on atmospheric particles.

This presentation will discuss photosensitization in the troposphere as having a significant role in SOA formation and ageing as studied by means of laser transient absorption spectroscopy, flow tube and simulation chamber experiments, all coupled to advanced analytical techniques. We will provide kinetic and mechanistic information on how photosensitization may introduce new chemical pathways, so far unconsidered, impacting both the chemical composition of the atmosphere and can thus contribute to close the current SOA underestimation.