Photochemical properties of photosensitizers in the tropospheric aqueous phase

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Abstract

The presence of light absorbing compounds in ambient aerosol particles (Teich et al., *Environ. Sci. Technol.*, 2016) establishes a new pathway to secondary organic aerosol formation due to their potential to act as photosensitizers (Monge et al., *PNAS*, 2012; Aregahegn et al., *Faraday Discuss.*, 2013). Photosensitized processes are known from other scientific fields like the surface water chemistry, where quenching reactions by dissolved organic matter are investigated (Canonica et al., *Environ. Sci. Technol.*, 1995; Canonica et al., *J. Phys. Chem.*, 2000). However, photochemical and kinetic data as well as the mechanisms for these photosensitized reactions in the particle/ aqueous phase are scarcely available.

In the present study, different photosensitizers such as imidazole-2-carboxaldehyde (2-IC), and 3'-methoxyacetophenone (3'-MAP) were investigated regarding their photochemical behavior and properties. Therefore, trapping reaction experiments were performed using a laser flash excitation-laser long path absorption setup to determine the quantum yields of the excited triplet states of the photosensitizers (ϕ(2-IC) = 0.85, ϕ(3'-MAP) = 0.78 at pH = 5 and T = 298 K). In addition, spectroscopic studies were conducted to observe the formation of the excited triplet state of the photosensitizers at a specific time after the laser pulse (t_{delay} = 200 ns – 500 µs) resulting in time-resolved absorbance spectra (λ = 200 – 800 nm). The obtained data will be included for further studies to evaluate the importance of particle-/ aqueous-phase chemistry of photosensitizers for atmospheric processes as well as the impact of photosensitized reactions on atmospheric particles possibly contributing to SOA formation.