Photochemical properties of photosensitizers in tropospheric aqueous solution

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Abstract
The formation and presence of light absorbing compounds in the tropospheric particle/ aqueous phase and their potential to act as photosensitizers establish a new pathway for secondary organic aerosol (SOA) formation. The photosensitization processes are known from other fields of science like surface water chemistry. However, photochemical and kinetic data as well as the mechanisms are sparsely available for these photosensitized reactions in the particle/ aqueous phase of the atmosphere.
In the present study, the photochemical behavior and properties of different potential photosensitizers such as imidazole-2-carboxaldehyde (2-IC), 3,4-dimethoxybenzaldehyde (DMB), and 2-hydroxy-5-methylacetophenone (HMAP) were investigated using a laser flash excitation-long pathway absorption (LFE-LPA) setup. Trapping reaction experiments were performed to determine the quantum yields of the excited triplet state of photosensitizers (ϕ_T(2-IC) = 0.85 at pH = 5 and T = 298 K). Spectroscopic studies were carried out to measure time-resolved absorbance spectra (λ = 200 – 800 nm) of the excited triplet state of the photosensitizers as well as to observe their formation at a specific time after the laser pulse (t_{delay} = 200 ns – 360 µs). The received data will be included into 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.