Photochemical properties of photosensitizers in tropospheric aqueous solution

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Processes leading to the formation and growth of secondary organic aerosol (SOA) are one of the most poorly understood topics in atmospheric science.[1] Models are still underestimating SOA masses in comparison to measured SOA masses from field studies.[2] This discrepancy leads to the assumption that there are still processes missing which can lead to SOA formation. Recently, photosensitized particulate-phase chemistry is in discussion to be one of these missing processes.[3-5]
In the present study, different photosensitizers like imidazole-2-carboxaldehyde (2-IC), 4-benzoylbenzoic acid (4-BBA), and 3,4-dimethoxybenzaldehyde (DMB) were investigated regarding their transient behavior and photochemical properties. Time-resolved absorbance spectra (λ = 200 – 800 nm) of the excited triplet states of the photosensitizers were measured using a laser flash photolysis-laser long path absorption (LFP-LLPA) setup to observe their formation at a specific time after the laser pulse (t_{delay} = 100 ns – 300 µs). Additional, trapping reaction experiments were performed using LFP-LLPA to determine the quantum yields of the excited triplet states of the photosensitizers ($\phi(^3$2-IC*) = 0.9 at pH = 5 and T = 298 K) and consequently, their absolute molar absorption coefficients from the above-mentioned absorbance spectra can be calculated. 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.

Literature:

[1] B. Ervens, Atmos. Chem. Phys. 2011, 11, 11069-11102. [2] M. Hallquist, Atmos. Chem. Phys. 2009, 9, 5155-5236. [3] M. E. Monge, PNAS 2012, 109, 6840-6844. [4] K. Z. Aregahegn, Faraday Discuss. 2013, 165, 123-134. [5] S. Rossignol, Environ. Sci. Technol. 2014, 48, 3218-3227.