



Formation of halogen-induced secondary organic aerosol (XOA)

J. Ofner (1), K. Kamilli (2), A. Held (2), and C. Zetzsch (1)

(1) Atmospheric Chemistry Research Laboratory, University of Bayreuth, Germany, (2) Junior Professorship in Atmospheric Chemistry, University of Bayreuth, Germany

Reactive halogen species (RHS) are released to the atmosphere from sources like photo-activated sea-salt aerosol and salt lakes. RHS seem to interact with SOA precursors similarly to common atmospheric oxidizing gases like OH radicals and ozone. Aerosol formation from reaction of RHS with typical SOA precursors was studied by Cai et al. (2006, 2008) using an aerosol mass spectrometer. No data is available on bromine-induced aerosol formation from organic precursors. The potential interaction of RHS with secondary organic aerosol (SOA) has recently been studied by Ofner et al. (2011).

A 700 Liter aerosol smog-chamber was used to generate halogen-induced secondary organic aerosol (XOA). The chosen precursor concentration of 10 ppb for the biogenic precursors and 2 ppb for molecular chlorine and 10 ppb for molecular bromine are close to natural conditions. XOA formation in the smog chamber was initiated using a solar simulator. To follow the aerosol formation process, the aerosol size distribution, the ozone and NO_x mixing ratios and the decay of the aerosol precursor were measured and compared to the calculated photolysis of the molecular halogen species.

Even very low precursor and RHS concentrations form XOA particles with a mode at about 20 nm and a number concentration up to 10^4 particles cm^{-3} . While the XOA formation from chlorine is very rapid, the interaction of bromine with the organic precursors is about five times slower. The present study compares the XOA formation potential of photolyzed chlorine and bromine with several typical SOA precursors and relates the formation to the calculated photolysis of the RHS. The formation of XOA at atmospherically relevant concentrations in an aerosol smog-chamber suggests natural XOA formation at marine sites, where organic precursor emissions (biogenic or anthropogenic) are close to RHS emitting sea-salt aerosol or salt lakes. The formation of XOA then interacts with the halogen-release cycles by slowing them down.

References:

Cai, X., and Griffin, R. J.: Secondary aerosol formation from the oxidation of biogenic hydrocarbons by chlorine atoms, *J. Geophys. Res.*, 111, D14206/14201-D14206/14214, 2006.

Cai, X., Ziembka, L. D., and Griffin, R. J.: Secondary aerosol formation from the oxidation of toluene by chlorine atoms, *Atmos. Environ.*, 42, 7348-7359, 2008.

Ofner, J., Balzer, N., Buxmann, J., Grothe, H., Schmitt-Kopplin, Ph., Platt, U., and Zetzsch, C., Halogenation processes of secondary organic aerosol and implications on halogen release mechanisms, *ACPD*, 2011, submitted.