Experiments on the atmospheric degradation of Aldrin in the aerosol-borne state in the LOw-Temperature Aerosol Smog Chamber, LOTASC

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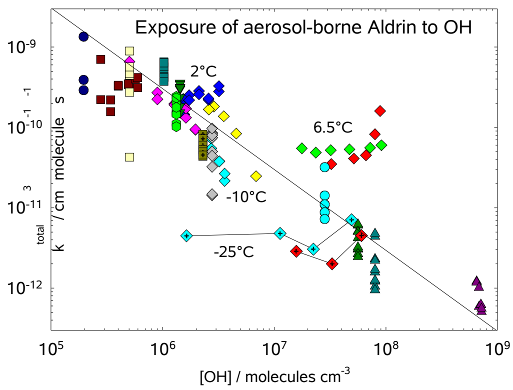
Aldrin is a persistent organic pollutant, banned by the Stockholm convention on POPs. It is a semivolatile compound with a strong tendency to volatilize from the aerosol into the gas phase. The LOTASC with its cooling capabilities is a tool for suppressing this volatilization in order to determine the OH reactivity in the aerosol-borne phase. An inert, fused-silica aerosol material (Aerosil 380, Degussa) was coated by a sub-monolayer of Aldrin and dispersed as agglomerated particles (500 nm mean diameter, consisting of primary particles with 7 nm diameter) into the LOTASC, where it was exposed to OH radicals at known concentrations. The OH radicals were produced by photolysis of methyl nitrite or H_2O_2 or by the reaction of ozone with hydrazine or olefins in the dark. Time profiles of OH were determined from the consumption of hydrocarbons and known rate constants. The figure below shows the second-order removal rate constant of Aldrin as a function of the average OH-level in the chamber.



Interestingly, it follows a 1/[OH] dependence instead of being constant. This may be understood either in terms of steric hindrance of the penetration of OH into the pores of the agglomerates (where it must react with adsorbed Aldrin) or as a Langmuir-Hinshelwood mechanism (reversible adsorption of OH on the surface of the SiO_2 and subsequent surface reaction). Furthermore, one may discuss a depletion of Aldrin on the outer surface of the agglomerates, replenished by slow migration of Aldrin in the pores from the center to the periphery. This example illustrates only a few of the many open questions in heterogeneous atmospheric chemistry of aerosol-borne compounds.