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Pesticides aging in the atmosphere: Heterogeneous reaction of cypermethrin with ozone

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Pesticides are highly toxic compounds that unlike other pollutants are intentionally introduced, in large quantities, to the environment. The vast majority of them are applied to agricultural lands, but they are also widely used in urban areas as herbicides, insecticides and fungicides. Pesticides may be promoted into the atmosphere during their application via drift of aerosols, as well as by volatilization or dust erosion from treated surfaces after application. In the atmosphere, semi-volatile pesticides may remain as pure aerosols or become adsorbed upon background aerosols. During transport, they undergo chemical degradation processes due to their interaction with atmospheric oxidants or solar radiation. Quantification of the reaction rate constants and degradation products will contribute for better risk assessment and environmental fate evaluation of these hazardous materials. Here, we will focus in the investigation of the heterogeneous oxidation reaction of cypermethrin, a common used insecticide, with gaseous ozone. The reactions are monitored in real time using novel apparatus that combines ATR/FTIR and Long path IR gas cell for simultaneous monitoring of the condensed and gas phases. Kinetic results for the oxidation of cypermethrin indicate that its atmospheric half-life with regard to ozone is of the same order of magnitude as other known degradation processes in the soil and water compartments. Possible mechanism of the ozonolysis and its environmental implication will also be discussed.