



The uptake of HO₂ radicals to organic aerosols

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HO_x (OH + HO₂) radicals are responsible for the majority of the oxidation in the troposphere and control the concentrations of many trace species in the atmosphere. There have been many field studies where the measured HO₂ concentrations have been smaller than the concentration predicted by model calculations [1,2]. The difference has often been attributed to HO₂ uptake by aerosols. Organics are a major component of aerosols accounting for 10 - 70 % of their mass [3]. However, there have been very few laboratory studies measuring HO₂ uptake onto organic aerosols [4].

Uptake coefficients (γ) were measured for a range of aerosols using a Fluorescence Assay By Gas Expansion (FAGE) detector combined with an aerosol flow tube. HO₂ was injected into the flow tube using a moveable injector which allowed first order HO₂ decays to be measured along the flow tube both with and without aerosols. Laboratory generated aerosols were made using an atomiser or by homogeneous nucleation. Secondary organic aerosols (SOA) were made using the Paul Scherrer Institute smog chamber and also by means of a Potential Aerosol Mass (PAM) chamber. The total aerosol surface area was then measured using a Scanning Mobility Particle Sizer (SMPS).

Experiments were carried out on aerosols containing glutaric acid, glyoxal, malonic acid, stearic acid, oleic acid and squalene. The HO₂ uptake coefficients for these species were measured in the range of $\gamma < 0.004$ to $\gamma = 0.008 \pm 0.004$. Humic acid was also studied, however, much larger uptake coefficients ($\gamma = 0.007 - 0.09$) were measured, probably due to the fact that these aerosols contained elevated levels of transition metal ions. For humic acid the uptake coefficient was highly dependent on humidity and this may be explained by the liquid water content of the aerosols. Measurements were also performed on copper doped aerosols containing different organics. An uptake coefficient of 0.23 ± 0.07 was measured for copper doped ammonium sulphate, however, this was reduced to 0.008 ± 0.009 when EDTA was added in a 1:1 ratio with copper and 0.003 ± 0.004 when oxalic acid was added in a 10:1 ratio with copper. SOA aerosols were also investigated at PSI and HO₂ uptake coefficients of $\gamma < 0.004$ and $\gamma = 0.004 \pm 0.003$ were measured for alpha-pinene and trimethylbenzene derived SOA respectively.

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