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Experimental determination of uptake coefficient of isoprene-derived peroxy radical onto deliquesced NaCl particles

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Although uptake coefficients of peroxy radicals (hydroperoxy, HO_2, and organic peroxy radicals, RO_2) onto aerosols has been required to evaluate an impact of heterogeneous radical loss process on the tropospheric ozone formation, unlike the uptake coefficient of HO_2 for which many reports are available, those for RO_2 has been limited due to experimental difficulty. Using a combination of laser photolysis radical generation and laser induced fluorescence radical detection (LP-LIF) is a new approach for determination of the uptake coefficient of peroxy radicals onto particles and applicable to RO_2. [1,2]

In this study, the performance of LP-LIF was validated by measuring the uptake coefficient of $C_5H_8(OH)OO$ (referred to as ISOPOO), derived from the OH oxidation of isoprene, on deliquesced NaCl particles. The measured radical loss rate of ISOPOO showed a linear dependence on particle surface area concentration and a positive dependence on the amount of reactive coexisting ions added to the particles, which was qualitatively consistent with the predictions of the kinetic model. The uptake coefficient of ISOPOO into deliquesced NaCl particles was 0.11 ± 0.02. When ascorbic acid was added to NaCl particles as an anti-oxidant (5%wt of NaCl), the uptake coefficient increased to 0.45 ± 0.02.

Although further investigation on the processes of the uptake is required to make a conclusion, it is possible that self-reaction of ISOPOO in the particles may contribute to the uptake. In that case, the uptake coefficient may be smaller than the experimental value in the tropospheric condition where the radical concentration is lower than the experimental conditions. The uptake coefficient with ascorbic acid is expected to be close to the accommodation coefficient since the reaction in the particles is expected to be sufficiently fast and not be a rate determining step. It is suggested that RO_2 may contribute to the suppression of ozone production as well as the incorporation of HO_2 into the aerosol.

[1] Kohno et al. (2021), *Int. J. Chem. Kinet.* 53, 571-582.

[2] Sakamoto et al. (2022), *J. Jpn. Soc. Atmos. Environ.* (Japanese) 58, 35-45.