# Uptake of $^{13}$N-labeled $N_2O_5$ to citric acid aerosol particles

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Dinitrogen pentoxide is a significant reactive intermediate in the night time chemistry of nitrogen oxides. Depending on atmospheric conditions it can act either as a $NO_3$ radical reservoir or as a major $NO_x$ sink by heterogeneous hydrolysis on aerosol surfaces. As such, it can influence tropospheric ozone production and therefore the oxidative capacity of the atmosphere. Furthermore it's suspected of being a non negligible source of tropospheric Cl, even over continental areas [1,2].

We used the short-lived radioactive tracer $^{13}$N delivered by PSI's PROTRAC facility [3] in conjunction with an aerosol flow tube reactor in order to study $N_2O_5$ uptake kinetics on aerosol particles. $^{13}$NO is mixed with non labeled NO and $O_3$ in a gas reactor where $N_2O_5$ is synthesized under dry conditions to prevent hydrolysis on the reactor walls. The resulting $N_2O_5$ flow is fed into an aerosol flow tube reactor together with a humidified aerosol flow. By using movable inlets we can vary the length of the aerosol flow tube and thus the reaction time. The gas feed from the reactor is then directed into a narrow parallel plate diffusion denuder system that allows for selective separation of the gaseous species present in the gas phase. Aerosol particles are trapped on a particle filter placed at the end of the denuder system. The activity of $^{13}$N labeled species trapped on the denuder plates and in the particle filter can be monitored via scintillation counters. Aerosol uptake measurements were performed with citric acid aerosols in a humidity range of 27-61.5% RH. The results obtained from our measurements have shown that the uptake coefficient increases with humidity from $1.65\pm0.3\mathrm{x}10^{-3}$ ($\sim$27% RH) to $1.25\pm0.3\mathrm{x}10^{-2}$ (45% RH) and $2.00\pm0.3\mathrm{x}10^{-2}$ (61.5% RH). Comparison to literature data shows that this is similar to values reported for some polycarboxylic acids (like malonic acid), while being higher than some others [4]. The increase is likely related to the increasing amount of water associated with citric acid at higher humidity that promotes hydrolysis of $N_2O_5$.

**References**

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4. IUPAC Subcommittee on Gas Kinetic Data Evaluation., Data Sheet VI.A3.8 $N_2O_5$ + $H_2O$ (aqueous organic aerosols), 2009.