2.014 Reactive uptake of glyoxal by ammonium containing salt particles as a function of relative humidity.

Presenting Author:

Chak K. Chan, School of Energy and Environment, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China, chak.k.chan@cityu.edu.hk

Co-Authors:

Masao Gen, School of Energy and Environment, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China

Dandan Huang, School of Energy and Environment, City University of Hong Kong, Tat Chee Avenue, Kowloon, Hong Kong, China

Abstract:

Reactions between dissolved ammonia and carbonyls, which form light-absorbing species in atmospheric particles, can be accelerated by actively removing water from the reaction system. Here, we examine the effects of relative humidity (RH) on the reactive uptake of glyoxal (Gly) by aqueous particles of ammonium sulfate (AS), ammonium bisulfate, sodium sulfate, magnesium sulfate, ammonium nitrate (AN), and sodium nitrate. In-situ Raman analysis was used to quantify particle-phase Gly and a colored product, 2,2'-biimidazole (BI) as a function of uptake time. Overall, the Gly uptake rate increases with decreasing RH, reflecting the "salting-in" effect. The BI formation rate increases significantly with decreasing RH or aerosol liquid water (ALW). Compared to that at 75% RH, the BI formation rate is enhanced by factors of 2.9 x 10 at 60% RH and 3.3 x 10^2 at 45% RH for AS particles and 6.5 x 10 at 60% RH, 2.1 x 10^2 at 45% RH, and 4.6 x 10^2 at 30% RH for AN particles. These enhancement factors are much larger than those estimated from increased reactant concentrations due to decreases in RH and ALW alone. We postulate that the reduction in ALW at low RH increases the Gly uptake rate via the "salting-in" effect and the BI formation rate by facilitating dehydration reactions.