EGU21-8105, updated on 17 Sep 2021
https://doi.org/10.5194/egusphere-egu21-8105
EGU General Assembly 2021

Heterogeneous uptake of NH_3 on ambient $PM_{2.5}$ in Beijing and Shijiazhuang: Possible influence of aerosol acidity

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Ammonium salts (NH_4^+) is the important component of $PM_{2.5}$ and has a significant impact on air quality, climate, human health, and natural ecosystems. The contribution of NH_4^+ to $PM_{2.5}$ is increasing at urban sites. Ammonia (NH_3) with global emissions estimated at greater than 33 Tg(N) Yr^{-1} is the only precursor of particulate NH_4^+ in the atmosphere. Thus, it is important to understand the conversion kinetics from NH_3 to NH_4^+ in the atmosphere. However, the uptake coefficient of NH_3 (γ_{NH3}) on aerosol particles are scarce at the present time. In this work, we reported the γ_{NH3} on ambient $PM_{2.5}$ in Beijing and Shijiazhuang in China. The γ_{NH3} values on ambient $PM_{2.5}$ are (1.13±12.4)×10^{-4} and (6.88±40.7)×10^{-4} in Shijiazhuang and Beijing, respectively. They are significantly lower than those on sulfuric acid droplet (0.1-1), aqueous surface (~5×10^{-3}-0.1) and acidified secondary organic aerosol (~10^{-3}-~10^{-2}), while are comparable with that on ice surface (5.3±2.2 ×10^{-4}) and on sulfuric acid in the presence of organic gases (2×10^{-4}-4×10^{-3}). An annual increase of γ_{NH3} in the statistic sense is observed and the possible reason related to the aerosol acidity has also been discussed.