

Wang et al. reported their field observation of chemical composition in particulate matter (PM) in Beijing. Based on the data together with measured meteorological parameters, they estimated condensational loss rate of nitrate precursor gases for nitrate formation and aerosol liquid water. In addition, they discussed the interplay between increased particulate nitrate and aerosol particle liquid water, suggesting that particulate nitrate increased the aerosol liquid water and the aerosol liquid water promoted condensational loss of nitrate precursor gases (N_2O_5 and HNO_3), i.e., increasing particulate nitrate. This study has highlighted an increasing importance of particulate nitrate during a polluted episode in wintertime in Beijing, and would be an important contribution to the understanding of recent change in chemical composition of PM. I would recommend this manuscript for publication in ACP after addressing the following issues.

Specific comments:

Lines 85-86: The statement on “via well chemical pathways” is a bit misleading for the oxidation of SO_2 because sulfate production mechanisms from the SO_2 oxidation during haze episodes in Beijing are still ongoing debate (Cheng et al., 2016; Gen et al., 2019).

Cheng et al., *Science Advances* 2.12 (2016): e1601530.

Gen et al., *Environmental Science & technology*, (2019): 53, 8757-8766.

I can understand that nitrate mass fraction in secondary inorganic components has increased. However, I am not sure why the absolute mass concentration of nitrate can increase despite the reduction of NO_x over North China. More discussion on this point deserves to appear in the introduction.

The authors need to explain how they estimate the uptake coefficient of N_2O_5 because they discussed factors affecting the coefficients.

Lines 268-270: I think that this depends on RH. Need to verify it.

Lines 312-313: It can be understood that in their calculation the authors ignore the interaction between dissolved organic components and the activity of NO_3^- . However, small organic acids affect the aerosol hygroscopicity. Can the authors provide the potential impact of such small organic acids on their calculation?

Molar fraction of nitrate over total of $\text{HNO}_3 + \text{NO}_3^-$ highly depends on particle pH (e.g., Nah et al., 2018). The authors attributed a strong positive correlation between particulate nitrate and aerosol liquid water to the feedback loop between them, but no particle pH effect has been discussed. Can you exclude the possibility that increased particle pH would lead to an increase in particulate nitrate?

Nah et al., *Atmospheric Chemistry and Physics* 18.15 (2018): 11471-11491.

If the mutual effect of both nitrate and aerosol particle liquid water is the determine factor for increasing nitrate, why did the mass concentration of ammonium nitrate reach a plateau at aerosol liquid water of $> 20 \mu\text{g}/\text{m}^3$?

Finally, an increase in RH also leads to increasing aerosol liquid water. As shown in Fig. 1, the increased nitrate is coincident with the elevated RH during the haze period. How do the authors discriminate the mutual effect from this elevated RH effect?

Minor comments:

Lines 109-113: Is the discussion about $\text{NO}_3^-/\text{SO}_4^{2-}$ in China?

Line 123: Need to be more explicit about how the reactive uptake of precursors and the thermodynamic equilibrium of ammonium nitrate change. Enhancing or increasing?

Line 279: theoretical calculations of what?

Line 293: Please use either liquify or liquefy for consistency.

Line 346: HNO_3 instead of particulate nitrate?