

“Elucidate the Formation Mechanism of Particulate Nitrate Based on Direct Radical Observations in Yangtze River Delta summer 2019” by Zhai et al. conducted field measurements from May to June, 2019 at regional site in Changzhou, Jiangsu province in China. Authors continuously measured the nitrate, OH radical, N₂O₅, NO₂, O₃, and relative meteorological parameters to shed light on the particulate nitrate formation mechanisms. In the model simulation, the authors focused on the OH+NO₂ and heterogeneous uptake of N₂O₅ process, it is not clear if the author investigated the contribution of heterogeneous NO₂ uptake and its hydrolysis in forming nitrate. I recommend publication of this paper in Atmospheric Chemistry and Physics after addressing the following questions.

Line 75-77:

The author stated that NO₂ heterogeneous uptake is a minor pathway based on previous studies. Have the authors incorporated heterogeneous NO₂ uptake in the model? The previous model works reported that the mean contribution of heterogeneous NO₂ to nitrate formation is 6.3% ~19.0%, which increases to ~35.9% during extreme haze events (Chan et al., 2021; Qiu et al., 2019). From my perspective, heterogeneous NO₂ uptake can be an important process in a certain condition.

Line 255:

What does the “water-soluble ion” refer to?

Line 275-276:

Overall, NOR increases as the RH increases, which may indicate the liquid water content play a crucial role in nitrate formation. However, as I mentioned earlier, heterogeneous NO₂ uptake and subsequent NO₂ hydrolysis also rely on the high liquid water content. It is possible that heterogeneous NO₂ is also essential in forming nitrate. It would be better to incorporate this process in the model to evaluate its importance in the atmosphere further.

Line 282:

Can the author elaborate more on the NOR difference between PD and CD? From my perspective, particular factors should lead to such a discrepancy. Any suggestions?

Line 343:

Any suggestions on the increased ability of N₂O₅ uptake on a polluted day? Is it due to the different composition of particles on PD and CD? Need more elaboration.

Reference:

(1) Chan, Y.C.; Evans, M.J.; He, P.; Holmes, C.D.; Jaegl' e, L.; Kasibhatla, P.; Liu, X.Y.; Sherwen, T.; Thornton, J.A.; Wang, X.; Xie, Z.; Zhai, S.; Alexander, B. Heterogeneous Nitrate Production Mechanisms in Intense Haze Events in the North China Plain. *J Geophys Res Atmos* 2021;126:e2021JD034688.

(2) Qiu, X., Ying, Q., Wang, S., Duan, L., Zhao, J., Xing, J., Ding, D., Sun, Y., Liu, B., Shi, A., Yan, X., Xu, Q., Hao, J., 2019. Modeling the impact of heterogeneous reactions of chlorine on summertime nitrate formation in Beijing. China. *Atmos Chem Phys* 19, 6737–6747.