

Comment on acp-2022-6

Anonymous Referee #3

Referee comment on "The positive effect of formaldehyde on the photocatalytic renoxification of nitrate on TiO₂ particles" by Yuhan Liu et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-6-RC3>, 2022

The author reported formaldehyde may have synergistic effect in photocatalytic renoxification of nitrate with TiO₂, in order to explain the difference between field data and modeling result. The article focuses on the significant synergistic effect, i.e., HCHO and TiO₂ have on photocatalytic reactions and providing one possible reaction pathway-NO₃--NO₃·-HCHO-HNO₃-NO_x. These findings improve the understanding of the role of reactions between organic components and nitrate in the chemical and physical properties of aerosol particles in low relative humidity region. It has significant implication in the research of atmosphere and air pollution, but some issues in the article must be improved. I recommend accept this article after resolve those issues. There are the comments I have for this work:

1. There are some misdescriptions in the manuscript. Like:

We suggested that the produced NO₃· contributed to the enhanced uptake of HCHO.

Therefore, we suggest that NO₃· production contributed to enhanced HCHO uptake. (Line 236, Page 12)

photochemical cycle of HO_x radicals in the atmosphere and the formation of (Line 448, Page 25)

2. Please explain why 4 wt.% KNO₃-TiO₂(1 wt.%)/SiO₂ underwent reaction to release NO_x, while 4 wt.% KNO₃-SiO₂ and 4 wt.% KNO₃-TiO₂ not in same condition.

3. In Figure S3, the concentration of HCHO and TiO₂ particles reached stable in 60 min after introduced into experimental chamber, but other experiments almost started in -30min, did HCHO and TiO₂ have been stable?

4. The BET of TiO₂ nanoparticles is huge, the uptake of HCHO in TiO₂ nano-particles can't be ignored. The photodegradation of HCHO on TiO₂ and 4 wt.% KNO₃-TiO₂ particles should start after adsorption and desorption balance.

5. In section 3.3.1, 4 wt.% KNO₃-TiO₂ particles release less NO_x than Equal amounts of 4 wt.% NH₄NO₃-TiO₂ particles at 293K and 0.8% relative humidity, which may be the result of the Relative molecular mass difference between KNO₃ and NH₄NO₃.

6. In section 3.3.4. more different initial concentration of HCHO should be test to find out from which content the positive effect become weakening.