Reply on RC1:

In this paper, in-situ Raman technique was used to research the photochemistry in nitrate-glycine mixed particles at various RHs. The apparent nitrate photolysis rate constants and percentages GC decay were obtained. The phase transition behaviors of nitrate-glycine were obtained, which showed the role of molecular interaction in determining the physicochemical properties and chemical reactivity of particles. In AN+GC mixed particles, the glycine photochemistry is negligible, and nitrate photochemistry is weak. But in SN+GC mixed particles, products of nitrate and glycine photochemistry, HNO_2/NO_2^-, amide, ammonia or/and amine are detected, and the apparent nitrate photolysis rate constant is 4.5-folds higher than that of AN+GC particles.

Authors' Response: Thank you so much for the constructive comments. Kindly please find our responses below accordingly.

Questions and comments:

In line 57, the word "behaviors" should be deleted.

Authors' Response: The word "behaviors" has been removed.

In line 134, the number "1/2" in equation (6) should be removed.

Authors' Response: As WGR is the water-to-glycine mole ratio, and the dry solute contains 1:1 (mole ratio) glycine and nitrate, the equation was revised to:

$$WGR = 2 \times \frac{n_w}{n_{dry}} = 2 \times [\frac{(d_{wet})^3}{(d_{dry})^3} \times \frac{\rho_{wet}}{\rho_{dry}} - 1] \times \frac{M_{dry}}{M_w} \quad (5)$$

In line 136, "Equation 9" does not exist, it should be changed to "Equation 7".

Authors' Response: Sorry for the confusion. The equation number has been corrected.

In line 139, "/" in equation (7) is misleading, it is better to change it to "or".

Authors' Response: Agree. We have changed it to "or"

In this paper, the mole ratio of 1:1 for glycine and nitrate is used in all the experiments, but the photochemistry of pure glycine solution and pure nitrate solution are not studied. If the photochemistry of pure species is missing, how can we conclude that there exists an interaction between glycine and nitrate in the mixed particles affecting their photolysis?

Authors' Response: The absorption of glycine is below 260 nm, and we found no glycine decay in pure GC particles without nitrate under the light. The nitrate photolysis rate constant in SN+GC particles was comparable to pure SN particles without glycine (1.2×10^{-5} s^{-1}), which indicates that glycine has a minor suppression effect on SN photolysis. We have clarified this point in the revised manuscript.

> **Line 86-89:** Glycine absorbs light at below 260 nm, but it can form light-absorbing meso-clusters in droplets and trigger photosensitization to degrade themselves at 532 nm, the Raman excitation wavelength in our experiments (Ishizuka et al., 2023). However, this mechanism plays a minor role in our system as no glycine decay in GC droplets without nitrate at 80%RH was found.

> **Line 193-194:** The efficiencies of nitrate photolysis in the two mixed systems were different. The fitted apparent nitrate photolysis rate constant of SN+GC particles at 80% RH was 9×10^{-6} s^{-1} ($R^2 = 0.95$), 4.5-folds higher than that of AN+GC particles (Figure S7). The nitrate photolysis rate constant in SN+GC particles was comparable to SN particles without glycine (1.2×10^{-5} s^{-1}), which indicates that glycine has a minor suppression effect on SN photolysis.

In line 232, the viewpoint "The apparent nitrate photolysis rate constant J shows good correlation with the percentage GC decay (R2=0.99, Figure4b), which may suggest that nitrate photolysis is the key driver for the glycine decay" is proposed. But photolysis rate constant J is determined by illumination intensity, and according to Eq.2, J is independent on solute concentration. In Figure 4b, various apparent nitrate photolysis rate constants are displayed and the illuminant of 300nm LED lamp is used in the experiments, so what is the definition of apparent nitrate photolysis rate constant in this paper? Is the x-axis label wrong in Figure 4b? And should it be change to nitrate photolysis rate instead?

Authors' Response: As explained in Equation 2, J is the first-order nitrate photolysis rate constant. It reflects the efficiency of photolysis, which is affected by the light intensity, the quantum yield, and the absorption cross-section of the chemical species. The correlation between J and percentage GC decay indicates how the efficiency of nitrate photolysis influences the decay of glycine under different experimental conditions.

> **Line 112-113:** The apparent nitrate photolysis rate constant J (s^{-1}) was estimated as Eq. 2. J depends on the light intensity, quantum yield, and absorption cross-section of nitrate (George et al., 2015).

Reference

George, C., Ammann, M., D'Anna, B., Donaldson, D. J., and Nizkorodov, S. A.: Heterogeneous photochemistry in the atmosphere, Chem Rev, 115, 4218-4258, 10.1021/cr500648z, 2015.

Ishizuka, S., Reich, O., David, G., and Signorell, R.: Photo-Induced Shrinking of Aqueous Glycine Aerosol Droplets, Atmos. Chem. Phys. Discuss., 2023, 1-16, 10.5194/acp-2023-6, 2023.