Response to Reviewers:

Thanks for the reviewer's comments on our manuscript entitled " A comprehensive study on hygroscopic behaviour and nitrate depletion of $NaNO_3$ and dicarboxylic acid mixtures: Implications for nitrate depletion in tropospheric aerosols". The reviewers' comments are helpful for improving the quality of our work. The responses to the comments and the revisions in manuscript are given point-to-point below.

Comments:

1. Line 140: Sentence "These scenarios confirm the nitrate depletion and HNO3 release from NaNO3/OA mixtures in the vacuuming process."

   Consider rephrasing to clarify that this nitric acid release is assumed to take place in the present study's experiments, while it is not directly observed (the major comment from the first round of reviews). For example, wording like:

   "These observations, together with direct and indirect evidence from several past studies, confirm the release of HNO3 and associated nitrate depletion from NaNO3/OA aerosol particles, which is expected to occur during the vacuuming process employed."

   Author reply: Thanks for the reviewer's suggestion. We have adopted reviewer's advice and revised our manuscript accordingly. The sentence "These scenarios confirm the nitrate depletion and HNO_3 release from $NaNO_3$/OA mixtures in the vacuuming process." has been revised to "As already indicated, the release of HNO_3 and associated organic acid salts formation have been detected in several previous studies, thus herein, these observations can demonstrate the HNO_3 release and nitrate depletion in $NaNO_3$/OA mixtures, which is expected to occur in the vacuuming process.".

2. Line 315: revise the second sentence: "There are two probable causes for no chloride depletion observed in the fast drying process. One is the minimization of HNO3 release caused by rapid water evaporation (Ma et al., 2013)."

   This is about chloride depletion, so presumably it should be HCl not HNO3 in the second sentence.

   Author reply: Thanks for the reviewer's suggestion. We have adopted reviewer's advice and

revised our manuscript accordingly.

3. Line 453: the added sentence requires revision: "In atmospheric environment, insoluble materials such as mineral dust inclusions constantly induce the heterogeneous nucleation of aerosols at relatively high RH, and thus displacement reactions between MA or GA and nitrate rarely contribute to the nitrate depletion in mineral dust and sea salt aerosols."

I am unsure what you mean by "heterogeneous nucleation of aerosols" in this context (do you rather mean nucleation of solid salt phases?). Obviously, if you have mineral dust inclusions, there is no need for "aerosol nucleation". Also, the terms "constantly" and "nucleation" are contradictory; nucleation is a discrete, event-based process (perhaps you mean frequently instead of constantly).

Author reply: Thanks for the reviewer's suggestion. The "heterogeneous nucleation of aerosols" did indicate the crystallization of mixed droplets in the atmosphere, which contained organic and inorganic components and small amounts of mineral dust inclusions. The insoluble mineral dust inclusions could provide heterogeneous surfaces and induce the heterogeneous nucleation of atmospheric aerosols at relatively high RH (Ma et al., 2021). For clarity, we have revised the sentence "In atmospheric environment, insoluble materials such as mineral dust inclusions constantly induce the heterogeneous nucleation of aerosols at relatively high RH, and thus displacement reactions between MA or GA and nitrate rarely contribute to the nitrate depletion in mineral dust and sea salt aerosols." into "In atmospheric aerosols, insoluble materials such as mineral dust inclusions frequently induce the heterogeneous nucleation of aerosol droplets at relatively high RH, and thus displacement reactions between MA or GA and nitrates may rarely contribute to the nitrate depletion in aerosols.".

Reference:

Ma, S. S., Pang, S. F., Li, J., and Zhang, Y. H.: A review of efflorescence kinetics studies on atmospherically relevant particles, Chemosphere, 277, 130320, https://doi.org/10.1016/j.chemosphere.2021.130320, 2021.