

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2022-590

Anonymous Referee #2

Referee comment on "The shifting of secondary inorganic aerosol formation mechanisms during haze aggravation: the decisive role of aerosol liquid water" by Fei Xie et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-590-RC1>, 2022

Comment on "The shifting of secondary inorganic aerosols formation mechanism during haze aggravation: The decisive role of aerosol liquid water"

The aerosol liquid water plays a profound role in secondary inorganic aerosols. reported. Fully understanding ALW and its roles are fundamentally important in atmospheric physicochemical processes, especially the liquid chemical transformation of SO₂ and NO_x. The manuscript gave measurement results of the secondary inorganic aerosol properties under different aerosol liquid water content. The results are interesting and the manuscript can be published after denoting the following comments.

Major Comments:

1 This manuscript is submitted as a full research paper to the ACP. The data acquisition and analysis method should be placed in the main manuscript but not in the supplement. At the same time, some calculating methods and definitions were not described in the manuscript.

2 The subfigures in figure 3, figure 5, and some others in the supplementary materials should be in parallel with the main one. I recommend these figures be reorganized.

3 Section 3.1 noted that 2019). The calculated results (Supplement, S2.2) showed the "predominant chemical species of ammonium gradually varied from the coexistence of

ammonium sulfate ((NH₄)₂SO₄) and ammonium nitrate (NH₄NO₃) to the coexistence of ((NH₄)₂SO₄), NH₄NO₃ and ammonium chloride (NH₄Cl) with haze aggravation". I'm not convinced by this conclusion. The author should provide the SIA ratios (including Cl⁻) under different pollution levels. As shown in Fig.S3, the Cl⁻ also exists during the clean periods. The variation of ph under different pollution levels should also be given.

4 The author concluded that the process in lines 216 to 218 from the fact that HONO and PANS elevated with the haze aggravation. However, I think the variation of the ratio of HONO/PM_{2.5} and PANS/PM_{2.5} under different pollution levels should be the proxy of their conclusion. The increase of HONO and PANS with the pollution levels can be attributed to the accumulation of pollution precursors and this pollution cannot be diluted.

Minor Comments:

1 Line 24, the NOR, SOR, and NTR were not defined in the abstract.

2 Line 30-32, I got what the author means, but I think it should be noted that the NH₃ should also be concerned during the severe haze stage.

3 Line 58, it is not clear why "Therefore, it is urgent to fully understand the

chemical regimes and behavior of reactive gases during different pollution stages and propose reasonable strategies." Some explanations should be given.

4 Line 76, the heating season at this place is not appropriate, as it is not mentioned before in the introduction.

5 The S1.1.1, S1.1.2, and S1.1.4 should be placed in the main manuscript.

6 Line 129, the definition of different classified pollution levels should be placed in the main manuscript as the following parts referred to the definition many times.

7 Line 154, how was the conclusion get from figure 2?

8 Line 196-197, please explain why the ratios (PM1.0/PM2.5 and PM2.5/PM10) can be used as the proxy of the hygroscopic growth of particulate matter.

9 line 208, the method of calculating the ϵ (NO_3^T) should be given.

10 Line 235, the number of points should be given.

11 Figure 7, the 3D plot is not necessary as the fill color can give the results.

Some minor comments on the supplements:

1 I'm not smart enough to get the meaning of the caption in Figure S9(a).

2 S2.2, the first two lines were not clear.