

Atmos. Chem. Phys. Discuss., referee comment RC1
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Review of the manuscript by Worthy et al.

Anonymous Referee #1

Referee comment on "The effect of $(\text{NH}_4)_2\text{SO}_4$ on the freezing properties of non-mineral dust ice-nucleating substances of atmospheric relevance" by Soleil E. Worthy et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-245-RC1>, 2021

The manuscript presented the effect of ammonium sulfate (AS) on ice nucleation ability of a set of non-mineral dust substances via immersion freezing. This study investigated the immersion freezing of bacteria, fungi, sea ice diatom exudates, sea surface microlayer, and humic substances in dilute AS solution. For comparison, the effect of AS on immersion freezing of four types of mineral dust were also investigated. The manuscript showed that there is no significant change for most of the tested non-mineral dust substances, except for bacteria *X. Campestris*; for the tested mineral dusts, there is an increase in the median freezing temperatures, ranging from 3 K to 8 K. This study provides additional data sets for the better understanding in the ice nucleation potential of different types of substances and the effect of additional AS. The manuscript is well written and suitable for the publication in this journal. A few issues and comments need to be considered before publication.

Comments:

1, Line 170-200, for mineral dusts, the weight percentages of dust in the solution used here are not the same, can the authors comment on why different concentrations were used for preparing the droplets? What are the potential effects of AS on the freezing temperature of droplets with different concentrations of dust?

2, In Figure 2 to Figure 5, the frozen fraction for the Blank and Blank+AS data presented in different figures are somehow different. Were these blank experiments done at different time periods? In Line 228-231, it was mentioned that only the heterogeneous freezing temperatures have been corrected, have the blank data also been corrected?

3, In Section 3.2, as mentioned in several places that the results presented in this study are consistent with previous studies, e.g., Line 300, 316, 322. I would suggest to summarize these data and present in a table. This table or summary may further support the claim that freezing temperature response of unknown substances to additional AS

could be used as a "fingerprint" for the presence of mineral dust.

4, For Figure 2-5 and Figure 7, for comparison purpose, it is great to show the data for different trials and see the variations, but the author may need to consider summarizing the data from different trials, I think that is the final form of data sets which readers may use.