

Atmos. Chem. Phys. Discuss., author comment AC4
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Additional information on RC1

Kimmo Korhonen et al.

Author comment on "Particle emissions from a modern heavy-duty diesel engine as ice nuclei in immersion freezing mode: a laboratory study on fossil and renewable fuels" by Kimmo Korhonen et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-111-AC4>, 2021

We present additional information to our response to the following comments in RC1:

- The homogeneous reference curve was obtained by testing the ice nucleation activity 350 nm monodisperse ammonium sulfate particles (L212), whereas the combustion particles are polydisperse aerosols with diameters mainly below 100 nm (Fig. 1). How do the authors justify using their alternative method to compare ice nucleation from such aerosol populations that significantly differ in size? Why not using e.g. the frequently applied ice nucleation active surface site density (INAS)? - E.g. Fig. 3b: Why does the red line not go all the way up to unity? See also your statement on L223-226. Why is there no uncertainty for this red curve? In Fig. 3a, no data points are depicted for any of the AF curves at temperatures above -38 °C. However, for AF curves depicted in Fig. 3a calculated with the alternative method, data points show up at $T > -38$ °C. Is this an artefact resulting from extremely low AF (in Fig 3a, presumably below the detection limit of SPIN), showing up in Fig. 3b? Similar comments apply to Figs. 4-6 and to your statement on e.g. L315-317.

Additional information:

The INAS density analysis has been provided in the revised manuscript, and its formulation in Appendix A, not Supplement S1 as it was written in the original response. Adding such information to an appendix instead of a supplement complies better with ACP manuscript preparation instructions.

L365: "slight potential as active INPs"; I suggest to tune this statement down. In the end your observed heterogeneous ice nucleation activity is extremely weak and in the atmosphere such combustion particles will not be able to compete with more efficient INPs such as e.g. mineral dust.

Correction: the statement has been removed from the revised manuscript.

Panel 2b:

- Please add "engine-out curve"

During the revision process, we discovered that the experiment (Eng-out+BP on HVO fuel)

was mislabelled as such and we had to omit it from the revised manuscript. The corresponding information and supportive data have been corrected throughout the revised text, including Tables 1 and 2 and discussion. The revised figure is also more accessible to readers with color vision deficiencies.