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Atmospheric Measurement Techniques Discussions

Interactive comment on "Development of the drop Freezing Ice Nuclei Counter (FINC), intercomparison of droplet freezing techniques, and use of soluble lignin as an atmospheric ice nucleation standard" *by* Anna J. Miller et al.

Anonymous Referee #3

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The authors present the development of a drop Freezing Ice Nucleation Counter (FINC), a droplet freezing technique (DFT), for the quantification of INP and INM concentrations in the immersion freezing mode. The authors used an NX-illite suspension and an ambient aerosol sample for an intercomparison (INP) study and propose herein the use of a water-soluble biopolymer, lignin, as a suitable ice nucleating (INM) standard.

The manuscript is well-written and fits into the journal Atmospheric Measurement Techniques. The paper should be published after revisions.

Main Comments

In general, I appreciate the idea of defining a standard for INM. However, I have doubts that lignin is a very suitable standard. As discussed by the authors, lignin is a biopolymer with an undefined molecular composition. Therefore the molecular formula in figure 5 makes only little sense. Instead, a mass spectrum (as a Van-Krevelen-Diagram) of the sample might give more information and gives the reader the possibility to compare other lignin samples to your standard.

In fact also your comparison of batches investigated concerning ice active mass site density (nm) in figure 6, is not very convincing since the nm values vary by an order of magnitude. This is quite a lot in comparison to other standards like K-feldspar or aged Snomax.

Of course is it a good idea to use a commercial product of reproducible characteristic. However, a product from pulp and paper industries is not guaranty for a steady composition. A NIST standard, e.g. Lignin CAS Registry Number: 8068-05-1, might be better suited. You should discuss these arguments in the paper.

In this context, I appreciate very much your discussion of aging of lignin, which I found very convincing.

Minor Comments

Fig.1: Add size bars to fig.1b and fig.1d. The reader who hasn't seen the set-up in reality, otherwise cannot judge the dimensions.

You might consider a table with similar droplet freezing experiments (see e.g. Table 1 in Häusler et al. Atmosphere, 9, 140, https://doi.org/10.3390/atmos9040140, 2018) discussing the pros and cons.

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