

Investigation of Microcrystalline Cellulose as Ice Nucleus in Immersion Freezing Processes

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Clouds play an important role in the earth's climate system. So it is crucial to research the microphysical processes in a cloud and to understand their behaviour like cloud albedo, lifetime or precipitation properties. In all these processes, aerosol particles play a crucial role by acting as cloud condensation nuclei for liquid droplets and/or as ice nuclei for the formation of ice particles. Previous research in our group has been related to biological ice nucleation [1, 2]. Here, we present a proxy for many biological macromolecular substances, i.e. microcrystalline cellulose. Several types of microcrystalline cellulose were analysed and investigated due to their physico-chemical properties. Immersion freezing experiments were carried out in a unique reaction gadget [Figure 1]. In this device a water-in-oil suspension (with the cellulose suspended in the aqueous phase) was cooled till the freezing point and observed through a microscope. The results of the immersion freezing experiments of the different cellulose types showed variable ice nucleation activities depending on their type and their concentration [Figure 1]. Further analysis methods as scanning electron microscope (SEM) and small angle x-Ray scattering (SAX) were carried out to completely describe the cellulose and their ice nucleation activity.

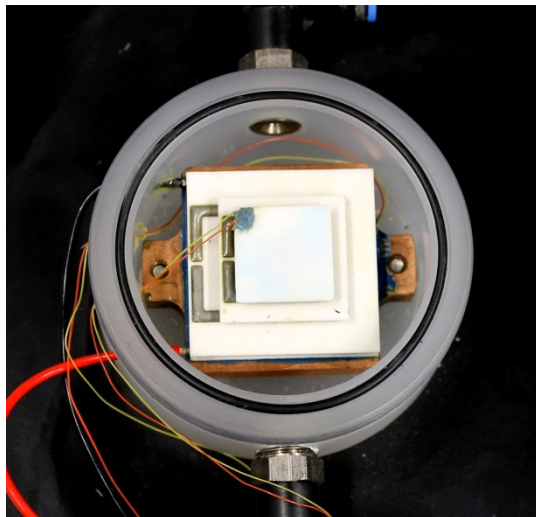


Figure 1 Cooling device with Peltier element and thermocouple

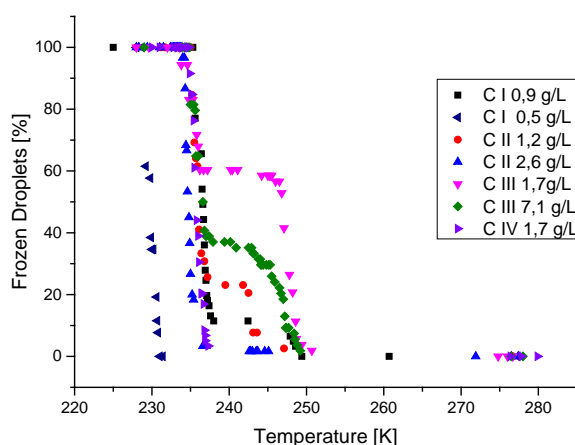


Figure 2 Immersion freezing of different cellulose types and concentrations

[1] S. Augustin, H. Wex, D. Niedermeier, B. Pummer, H. Grothe, S. Hartmann, L. Tomsche, T. Clauss, J. Voigtländer, K. Ingatus, and F. Stratmann. Immersion freezing of birch pollen washing water. *Atmospheric Chemistry Physics* 2013, 13, 10989-11003

[2] B. Pummer, L. Atanasova, H. Bauer, H. Bernardi, I. S. Druzhinina, J. Froehlich-Nowoisky, H. Grothe. Spores of many common airborne fungi reveal no ice nucleation activity in oil immersion freezing experiments. *Biogeosciences*, 2013, Volume 10, 8083- 8091