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Macromolecular biomaterials causing heterogeneous ice nucleation

Biological materials from plants, bacteria and fungi are dispersed in the environment. This can be whole organisms or just fragments. When these particles get airborne, they are termed bioaerosols and are in the size range between hundred nanometers and a few micrometers. Here we present the particularity that macromolecules from these bioaerosols can be washed of in aqueous solution and that these macromolecules can exist independently from the mother grain, e.g. in water droplets or on the surface of dust particles. In general, ice nucleation of bioaerosols is a topic of growing interest, since their impact on ice cloud formation and thus on radiative forcing, an important parameter in global climate, is not yet fully understood. We have focused on birch trees, which exhibit an elevated ice nucleation activity and we proof the size of these molecules, their stability against oxidation and their chemical origin. Further we find evidence that these macromolecules can be found on the whole surface of many parts of the tree (pollen, leaves, primary and secondary wood) but with different concentrations. An interesting point remains the mechanisms of heterogeneous ice nucleation, in which the biomaterials play a crucial role. Spectroscopy and microscopy have been applied to solve these processes and get a fundamental understanding of how ice nucleation in trees is prevented or triggered, respectively. Obviously, this is a survival mechanism on molecular level.

Speaker Biography

Hinrich Grothe is an associate professor with tenure in the Institute of Materials Chemistry at TU Wien, Austria. He was trained in chemistry at the Leibniz University of Hannover, Germany, where he earned a PhD in low-temperature chemistry. His current research interests involve understanding ice nucleation in clouds triggered by biological particles such as pollen, bacteria, and fungi. He is also interested in aerosol chemistry and cloud glaciation processes. He is an important contributor to the European Geosciences Union (EGU) where he is the science officer of the section Atmospheric Chemistry & Aerosols. Each year, he organizes a session at the EGU General Assembly on atmospheric ice nucleation. He has also organized several workshops for early career professionals about the microphysics of ice clouds. His goal is to find nature's perfect ice nucleus.

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