



Ice Nucleation Activity and Fluorescence Measurements of Ice Nucleating Particles from Birch Trees

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The impact of clouds on the Earth's radiation budget, the planetary albedo, precipitation and thus global climate strongly depends on the clouds' aggregation state. Cloud glaciation and hence the formation of ice clouds occurs either through homogeneous ice nucleation, involving only water molecules, or via heterogeneous ice nucleation, which includes the presence of ice nucleating particles (INP). The influence of biological INP (BINP) on the process of cloud glaciation and to what extent the biosphere acts as a source of BINP are mechanisms which are not yet fully understood and require further research.

BINP can originate from various sources. Among them are certain plants including birch trees [1]. Little is known about the release and atmospheric transport of BINP from birch trees. New information is needed to (1) determine the relative concentrations of BINPs in different birch tissues and (2) investigate the compound(s) responsible for ice nucleation throughout the birch tree.

Two field campaigns were conducted in spring 2016 and spring 2018. Tissues from nine birch trees located in an alpine region in Tyrol, Austria were sampled. Ice nucleation activity of aqueous extracts of different parts of the tree was determined using a cryo-microscopy method known as VODCA (Vienna Optical Droplet Crystallization Analyzer). Fluorescence spectroscopy was used to determine the chemical composition of the birch tree samples and BINP. Results for extracts of birch leaves indicated a link between ice nucleation activity and fluorescence intensity. Consequently, fluorescence spectroscopy could assist monitoring the distribution of BINP from birch trees in the environment.

[1] Felgitsch L, Baloh P, Burkart J, Mayr M, Momken ME, Seifried TM et al. Birch leaves and branches as a source of ice-nucleating macromolecules. *Atmospheric Chemistry and Physics*. 2018;18(21):16063-79. doi:10.5194/acp-18-16063-2018.