



Birch leaves and branches as a source of ice-nucleating macromolecules

Laura Felgitsch (1), Teresa M. Seifried (1), Philipp Baloh (1), Julia Burkart (1), Maximilian Mayr (1), Mohammad E. Momken (1), Philipp Winkler (1), David G. Schmale III (2), and Hinrich Grothe (1)

(1) Institute of Materials Chemistry, TU Wien, Vienna, Austria (teresa.seifried@tuwien.ac.at), (2) Department of Plant Pathology, Physiology, and Weed Science, Virginia Tech, Blacksburg, Virginia, USA

Since 2012 it is known that birch pollen release ice-nucleating particles (INP) in a macromolecular size range [1]. However, little is known about the formation and release of INP from the rest of the birch tree. We investigated the ice nucleation activity (INA) of different parts of the tree, including leaves, primary wood and secondary wood. Primary wood is the new, green, photosynthetically-active branch wood. Secondary wood is the aged, brown wood, which is not photosynthetically-active. Samples were taken from ten different birch trees; nine in Tyrol, Austria, and one in Vienna, Austria. The INA of filtrated aqueous extracts of leaves, primary wood and secondary wood was measured with the Vienna Optical Droplet Crystallization Analyser (VODCA), a cryomicroscope for emulsion samples. INP in a submicron size range were observed in all of the samples. The concentrations of INP ranged from $6.7 \cdot 10^{-4}$ to $6.1 \cdot 10^{-9}$ extractable per mg milled sample. The mean freezing temperatures of all of the samples extended from -15.6°C to -31.3°C , whereas secondary wood showed both the highest concentrations of INP and the highest freezing temperatures. However, most of the samples showed freezing temperatures close to those of birch pollen extract (-17.1°C), indicating a connection between the INP from birch pollen, leaves, and wood. Infrared and fluorescence spectroscopy of all extracts (leaves, primary- and secondary wood, pollen) indicate the presence of similar chemical substances in all tissues tested. [2].

1. Pummer, B.G., Bauer, H., Bernardi, J., Bleicher, S., and Grothe, H., Suspendable macromolecules are responsible for ice nucleation activity of birch and conifer pollen. *Atmospheric Chemistry and Physics*, 2012. 12(5): p. 2541-2550.

2. Felgitsch, L., Baloh, P., Burkart, J., Mayr, M., Momken, M.E., Seifried, T.M., Winkler, P., Schmale III, D.G., and Grothe, H., Birch leaves and branches as a source of ice-nucleating macromolecules. *Atmospheric Chemistry and Physics Discussions*, 2017: p. 1-22.