6-1 Freezing activity and fluorescence measurements of ice nucleating macromolecules from birch trees

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Ice nucleating particles (INPs) are known to trigger freezing in supercooled micro-sized droplets, as present in clouds. Field measurements in clouds detected biological particles in situ with the ability to act as INPs [1]. Further, atmospheric dust particles attribute their high ice nucleation activity often to biological INPs (BINPs) absorbed on their surfaces [2], [3]. Moreover, other studies showed a burst in the concentration of BINPs in aerosols during and after rainfall [4]. Thus, BINPs seem to play an important role in atmospheric processes. However, the detection is still a challenge due to low concentrations in aerosols, complex matrices of biological samples and unknown chemical structures of ice nucleating molecules. Birch pollen, suspended in water, release ice nucleating macromolecules (INMs) active at -18 °C [5]. Beside pollen, also aqueous extracts of woods and leaves from birch trees show freezing activities [6]. This study focusses on the investigation of samples from different parts of birch trees. Determination of the ice nucleation activity was carried out using the Vienna Optical Droplet Crystallisation Analyzer (VODCA) setup. Fluorescence measurements were performed to figure out peak maxima, characteristic for known chemical compounds and correlations between ice nucleation activity and fluorescence intensity. Results indicate a correlation between the concentration of INMs in leaves and fluorescence intensity. Therefore, fluorescence spectroscopy needs to be considered as a potential method to detect INMs in bioaerosols and tissues from living organisms.

References:

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