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Identification of Ice-Nucleating Macromolecules from Pollen Washing Water

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Pummer et al., 2012 found evidence that ice-nucleating particles from birch and conifer pollen are in the macromolecular size category, which has gained attention and verification by the scientific community of atmospheric ice nucleation. Moreover, the abundance of ice-nucleating macromolecules (INMs) is not limited to pollen, as Felgitsch et al., 2018 reported INMs to be extractable from branches, leaves and bark of birches. Furthermore, Seifried et al., 2020 demonstrated the atmospheric relevance of INMs, which are accumulated near the surface of trees, showing that INM are washed out by rain-droplets during rainfall events. However, the chemical composition of INMs still remains poorly understood.

To address atmospheric aerosol measurements to specific INMs, the biochemical identification of INMs is inevitable. To construct a concept, we analyzed birch pollen washing water (BPWW) regarding fluorescence and infrared (IR) spectroscopy. We found that the fluorescent bands of proteins are present in BPWW, however quenched by Quercetin-3O-sophoroside, a strong UV-light absorbing substance. Furthermore, BPWW shows intense IR bands in various regions of sugars. However, after a salting out, filtration and purification procedure, the IR spectra of ice nucleation active solutions show characteristic amide bands suggesting (glyco-)proteins to be one type of INMs from pollen.

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