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Ice nucleation of bioaerosols – a resumee

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The role of biological particles for ice nucleation (IN) is still debated. Here, we present a summary of investigation and comparison of different ice nuclei. Apart from the bacterial ice nucleation proteins in Snomax, we further investigated a broad spectrum of pollen and fungal spores in the search for ice nucleation activity. Apart from Snomax, only few samples showed vital IN activity, like Fusarium avenaceum spores and Betula pendula pollen.

Chemical characterization accentuated the differences between bacterial and pollen ice nuclei. Exposure to natural stresses, like UV and NO_x, led to a significant decrease in IN activity. Furthermore, the releasable fraction of the pollen material, which includes the ice nuclei, was extracted with water and dried up. These residues were investigated with Raman spectroscopy and compared with the spectra of whole pollen grains. Measurements clearly demonstrated that the aqueous fraction contained mainly saccharides, lipids and proteins, but no sporopollenin, which is the bulk material of the outer pollen wall.

Fungal spores of ecologically, economically or otherwise relevant species were also investigated. Most species showed no significant IN activity at all. A few species showed a slight increase in freezing temperature, but still significantly below the activity of the most active pollen or mineral dusts. Only Fusarium avenaceum showed strong IN activity. Cultivation of Fusarium and Trichoderma (close relatives of Fusarium) at different temperatures showed changes in total protein expression, but no impact on the IN activity.