BOUND WATER FREEZING IN LICHENS FROM THE GENUS UMBILICARIAE BY PROTON RELAXATION AND BY DSC

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Foliose lichens from the genus Umbilicariae may resist extremely low temperatures in their habitat [1-5]. Antarctic lichen *Umbilicaria aprina* reveals the lowest detected photosynthetical activity [1].

One of molecular mechanisms to survive extremely low temperature is spontaneous dehydration of lichen thallus [6]. This suggests that drought [7] and cold resistance can have similar molecular mechanism. The formation of molecular glass may by the way for cell to survive deep dehydration [8,9].

The understanding of the molecular mechanism of the metabolic activity recovery during rehydration of thallus requires the knowledge on a number and distribution of water binding sites, sequence and kinetics of their saturation, and the formation of tightly and loosely bound water fractions at different steps of hydration process.

The thalli of Umbilicariae lichens were collected in Schirmacher Oasis, Queen Maud Land, Continental Antarctics. All the reported data were obtained *in vivo*, with the vitality of the photobiont no lower than (66±5)%.

Proton FID is a superposition of the solid signal (described by Abragam function with the line halfwidths equal to 38 kHz) and one (for low hydration), or two liquid signal components coming from tightly bound ($T_2^* \approx 80$ μs) and loosely bound water fraction ($T_2^* \approx 800$ μs).

The freezing point of bound water detected by DSC decreases with the increasing hydration level, suggesting that the heterogeneous nucleation is responsible for ice nucleation in Umbilicariae thalli. Freezing temperature is ca. 10^0C lower than melting temperature. The performed freeze-thawing cycles showed that after 5th cycle the thermal response of the thallus remains unchanged.

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