

Title:

A low resolution ^1H NMR study to investigate the protective mechanism of sorbitol during vacuum drying of a probiotic micro-organism

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A means of stabilizing starter and probiotic cultures and extend their shelf life is the drying. However, due to dehydration damage, drying leads to an inactivation of the cells. In order to improve the survival of cells after drying, protective agents such as sugars and polyols are added to the drying matrix. It is assumed that the sugar interacts with the phospholipid headgroups of biomembranes and therefore replaces the bound water during drying ("water replacement mechanism"). Due to this interaction the cell membrane is thought to stay in its preferred liquid crystalline state even at low water content and therefore a transient leakage during drying and rehydration is prevented. The release of bound water during drying should lead to increased proton mobility. Therefore, time domain NMR was used to shed more light on the protective effect of sorbitol during vacuum drying of the probiotic test microorganism *L. paracasei ssp. paracasei*.

Vacuum drying of cells with and without sorbitol was carried out and stopped after different

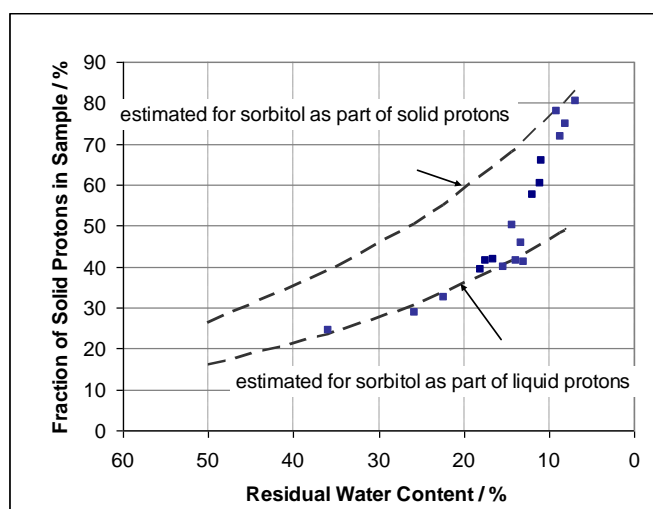


Fig. 1: Measured Fraction of solid protons in vacuum dried biological sample compared to estimated values for the cases that sorbitol is part of the solid or part of the liquid protons

It could be shown that during drying sorbitol protons undergo a transition from liquid to solid-like behaviour, therefore supporting the water replacement hypothesis for the vacuum drying of living cells.

times in order to achieve a range of residual water contents between 5 and 40 %. After drying the survival of cells as well as spin-spin and spin-lattice relaxation times were determined.

In both samples (with and without sorbitol) two distinct fractions of different proton mobility could be determined, relating to a solid and a liquid component. Furthermore, proton fractions were theoretically estimated for the cases that sorbitol is a part of the liquid or of the solid phase and compared to the experimental results (see Fig. 1).