Ice-binding proteins in psychrophilic bacteria – isolation, characterization and applications in food

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Ice binding proteins (IBPs) are polypeptides produced by organisms living in cold environments to prevent ice crystal growth or recrystallization. Several food-spoiling microbes can grow at refrigerator temperatures (2-6°C), therefore temperatures close to or below zero are preferred for long-time storage. However, decreasing the temperature to the melting point is challenging as it might cause freezing damage due to the time-spatial temperature fluctuations.

A solution to the problems related to ice formation in chilled and frozen products might be the addition of IBPs. Our collaboration partner has recently screened 60 psychrophilic bacterial cultures, isolated and found a strain (*Pseudomonas fluorescens*) capable of secreting IBPs. The main goal is to investigate the potential of using *Pseudomonas fluorescens* IBP for improving the quality and storage time of frozen foods. For that purpose, the growth and excretion of IBPs by the respective strain of *Pseudomonas* are characterized, the protein is isolated, its DNA and protein sequence are established, and the mechanisms of action in food storage conditions are evaluated.

Preliminary experiments have shown that the protein is stable at a variety temperatures and in the neutral pH range. The strain requires organic nitrogen to produce IBPs and the addition of L-Asparagine or L-Proline to the culture broth appears to have a positive effect in the production of IBPs. The incorporation of *Pseudomonas fluorescens* culture broth containing IBPs improved the quality of frozen wheat dough stored at -20°C for 8 weeks. It exhibited higher yeast survival rates and better yeast vitality. Additionally, the bread prepared from the frozen dough had better specific volume, porosity, and softness. Although, additional experiments should be conducted, this shows that the protein has the potential to be used to improve the quality of frozen dough products.