

## Effect of Salt Addition on the Inhibition of Ice Crystal Recrystallization of Antifreeze Protein

Tomoaki Hagiwara

Department of Food Science and Technology,  
Tokyo University of Marine Science and Technology

### Summary

During frozen storage, ice crystals in food grow and coarsen. This is called “recrystallization”. As the result, structure of food is destroyed, resulting in quality deterioration. Recently, antifreeze proteins (AFP) have been attracting attention as substances that effectively inhibit the ice recrystallization. AFP, a type of protein existing in certain organisms that live in cold regions, binds to the surface of ice crystals and strongly inhibits recrystallization. The addition of AFP to food is expected to be a promising method for inhibiting ice recrystallization.

In many frozen foods, salt is added for flavoring or shelf life extension. In this study, the effect of salt addition on the inhibition by AFP was investigated.

A 40 % sucrose solution containing a certain concentration of AFP was used as a model food containing AFP, and salt was added to it (final salt concentration; 3%). The ice recrystallization at -10°C was recorded by a microscope digital camera. The average radius of the ice crystals was determined by image analysis, and the recrystallization rate constant was obtained. Three types of AFPs were examined: AFP type I, AFGP, and AFP type III.

In the absence of AFP, the recrystallization rate constant increased by 3.4 times with the addition of 3% salt. This means that the salt accelerated the progress of ice recrystallization. In the absence of salt, under the conditions of 10 mg/mL AFP type I, 20 mg/mL AFP type III, and 0.1 mg/mL AFGP, the recrystallization rate constants were reduced by more than 80 %. With the addition of 3% salt to the solution containing AFP, the ice recrystallization was still suppressed. Furthermore, the recrystallization rate constant was smaller than that of the sample solution containing AFP without salt. These results indicated that the recrystallization inhibition ability by the AFPs was not lost but rather enhanced by the addition of 3% salt.