A Study on the Solution of Cold Damages by Finding Optimal Conditions of Antifreeze Protein

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In this study, we explored the optimal conditions for maximizing anti-freeze protein(Hereinafter AFP) activities and applied them to bio structures of living things and foods in order to solve various damages of organisms caused by cold weather damages and abnormal cold wave worldwide. We developed a new activity measurement method to measure the amount of time that the specimen does not fall down when turning over the vial repeatedly as ice crystals are formed after the AFP is added to change the composition of the buffer. We confirmed activities of AFP as the variables of pH, electrolyte concentration, and hydrophilicity of the solute. pH as the first optimal condition factor showed maximum activity at pH 3, and we analyzed the results at the molecular level in relation to the active position. As the application in living things was impossible in pH 3, we compared the activity of AFP in buffers according to the electrolyte concentration, the second factor. The maximum activity of the electrolyte concentration was shown at 2M, which mechanism was similar to pH, and that was found to be a practical method to replace the pH reduction when analysed by electrical polarization. Finally, the active measurement based on hydrophilicity of the solute showed that activity was decreasing as hydrophilicity was getting stronger. Through the application experiments by using gelatin and ice cream in which AFP is added, we found that the structural breakdowns and volume loss rates were low in the gelatin, and the smoothness increased in the ice cream due to decreased air gap.

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