No. 1046

Effect of Salt on Water Dynamics in Food Protein

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Summary

1. Purpose The purpose of this study is elucidation of molecular mechanism about food preservation by salt. In order to effect of salt on dynamics of protein hydration water, the relationship between water activity and hydration water dynamics, and how salt regulates them were examined.

2. Methods The samples were globular soluble protein, Staphylococcal nuclease and hen egg lysozyme. The research methods were neutron scattering experiment, molecular dynamics simulation and water activity measurement.

3. Results It was found that, for hydration water molecules to exist as free water, they need to form network on protein surface [1]. The free water appears above water activity value of 0.8. This suggests that high value of water activity is due to free water with higher mobility. Even when hydration content increases in the protein with salt, dynamics of hydration water was not changed due to salt effect. As a result, water activity was not changed.

4. Discussions By addition of salt to hydrated protein、salt would be hydrated, and, as a result, salt would destroy water network on protein surface, which is high mobility free water. This would lead to lower water activity. The microbes under usual circumstance can inhabit only above water activity of 0.8. On the other hand, the microbes under the extreme circumstances, such as halophilic bacteria, can inhabit under water activity of 0.8. The water activity in the environment where halophilic bacteria inhabits would be lower due to salt. The bacteria would evolve to adapt the environment of the low water activity. This result is also biologically interesting.

5. Future subjects It is necessary to study the protein hydration and water activity with different salt and hydration water contents in order to understand effect of salt on protein hydration and water activity. In this study, it was also found that protein glass transition is closely related with hydration. It should be also important to examine the effect of salt on the glass transition.

Reference [1] Nakagawa H. *et al*. (2004) J. Phys. Soc. J. 73. 2. 491-495.