

## Prediction of Optimum Cooking Condition and Changes in NaCl of Nimono with Refrigerated Storage

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### Summary

The concentration of NaCl in *Nimono* affects its palpability. The amount of NaCl in the seasoning liquid varies due to NaCl diffusion from the seasoning liquid into the solid food and water evaporation. *Nimono* is frequently refrigerated, which also affects the NaCl concentration. However, no studies have predicted the NaCl concentrations in solid food and seasoning liquid simultaneously. In this study, the changes in the NaCl concentrations in the seasoning liquid and solid food during heating, cooling, and refrigerating were simulated and the optimal conditions for preparing refrigerated *Nimono* were predicted.

Japanese radish (cylindrical with a height of 2 cm and radius of 3 cm) was quartered, heated from room temperature in 1% NaCl, and boiled for 0–30 min. Potatoes were cut into 2 cm cubes, heated from room temperature in 1.4% NaCl, and boiled for 8.1 min. They were then cooled rapidly and refrigerated. The NaCl concentration of the solid food was predicted using 3D diffusion equation and the amounts of NaCl diffused into the solid food from the solution was calculated. The concentration of solution was predicted using predicted value of the amounts of NaCl diffused into solid food and experimentally measured amount of water evaporation. The seasoning time to optimize the NaCl concentrations in the potato and radish, was predicted. The analysis was performed with COMSOL Multiphysics.

The predicted and experimental NaCl concentrations in the solution and solid food agreed closely. In the early stage, the NaCl concentration in the seasoning liquid decreased as it was more significantly affected by diffusion into the solid food than evaporation. However, evaporation became more significant later in the process, including during cooling, thus increasing the NaCl concentration in the solution. During refrigeration, the NaCl concentration in the solution decreased in the absence of evaporation. Thus, the seasoning time for 2-cm-cubed Japanese radish and potato were determined to be 91.7 and 160.4 min, respectively.