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Study of a New Cooking Method Using a Vacuum Packaging Treatment to Salt Vegetables

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Summary

When ingredients are put into a special-purpose bag filled with seasoning liquid and undergo vacuum packaging using a chamber-type vacuum packaging machine, the air is flow out, and the seasoning liquid evenly permeates inside the ingredients. This is due to the pressure gradient in the decompression process that returns the samples to atmospheric pressure, during which seasoning liquid flows into pores inside the ingredients.

In this study, the effect of seasoning vegetables employing the vacuum packaging treatment (hereinafter referred to as the VP treatment), using seasoning liquid and the properties of the vegetables seasoned by this method were examined to establish a new cooking method to salt fresh vegetables without eliminating the semi-permeability of the cell membrane.

Samples were shaped, put into a special-purpose bag filled with NaCl solution, and processed by the VP treatment. As a control, samples were packaged in a polyethylene bag filled with NaCl solution under atmospheric pressure. After the packaging treatment, the samples were removed from the bag at a set time and used for the measurement. The sample's mass, mechanical property in unconfined compression tests (measured by a rheometer), NaCl concentration (measured by a potentiometric titrator), and effective porosity (the portion of pores inside the samples for effective permeation of the seasoning into ingredients) were measured. Furthermore, sample tissue was observed using a confocal laser scanning microscope and an X-ray CT scanner.

The mass change in Japanese radish samples, treated with NaCl solutions (0.5–1.5%) equivalent to hypertonic from hypotonic for Japanese radish intracellular fluid , was a little with the control treatment for any solution. However, with vacuum packaging treatment, there was a significant increase, indicating successful permeation of the solution into the intercellular spaces, as confirmed by microscopic observation. Owing to the successful permeation of the NaCl solution, NaCl concentration levels in samples that underwent the vacuum packaging treatment exhibited higher levels than those in the controls, showing greater effectiveness in salting fresh vegetables than the conventional methods. Japanese radish samples were processed by the vacuum packaging treatment using a 3% NaCl solution, assuming the preparation of asaduke pickles (lightly salted pickles), and the sample ingredients reached the optimal NaCl concentration level (1.1–1.4%) within three hours after treatment. In contrast, those of the control reached only 0.8% in the same timeframe, exhibiting a cooking time-reducing effect of the vacuum packaging treatment. Moreover, the post-processing mass decrease in the vacuum packaging treatment indicated a significantly low value; it was one-fourth of the control, which demonstrates the dehydration-suppressing effect from solution permeation. Although the mechanical property measurement found that the vacuum-packaged samples slightly lost texture firmness immediately after processing from deaeration, they maintained the initial texture quality afterward and, in three hours, were firmer than the control. Samples of eggplant, turnip, and cucumber were also processed by the vacuum packaging treatment. The NaCl concentration levels were higher in eggplant than in cucumber, and the differences in effective porosity between them

(40% in eggplant and6 % in cucumber) corresponded to the respective salt concentrations. These analyses demonstrated the significance of the portion and status of pore inside ingredients in the vacuum packaging treatment. The results also showed the effectiveness of vacuum packaging in seasoning fresh vegetables with salt without eliminating the cell membrane's semi-permeability, suggesting the possibility of establishing a new cooking method to salt ingredients while maintaining a firm texture by permeating the seasoning liquid.