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Fundamental Analysis of New Fermented Pickles Using Bittern (Magnesium Chloride)

Tomoka Kurotobi[1], Kenji Tayama[2]

[1] Hiroshima Shudo University, [2] Prefectural University of Hiroshima

Summary

While Japanese people are required to reduce salt intake, it has been reported that the 1975 Japanese diet, which includes fish, potatoes, fruits, mushrooms, seaweed, soybeans, vegetables including pickles, and large amounts of soup stock, is preferable in terms of longevity. Therefore, we searched for a method to make low-salt fermented pickles with a long shelf life in a short period of time. First, we investigated *Komagataeibacter xylinus*, bacteria that can grow at pH 3, and found that the addition of 32 mM $MgCl_2$ to the medium significantly delayed the lag phase of growth. This inhibitory effect exceeds NaCl and KCl at the same molar concentration. Umami taste (3 mM monosodium glutamate (GluNa)) was enhanced by the addition of 7.4 mM $MgCl_2$. We also confirmed that the coexistence of these two substances increases the taste intensity of 51 mM (0.30%) NaCl. When these three components coexisted, the overall taste intensity could be increased by adding 0.05% lactic acid or acetic acid. Therefore, we started a trial production of fermented pickles with $MgCl_2$, taking into consideration that the concentration ratio of each of these components could be maintained in the pickling solution.

Using Komatsuna and Chinese cabbage, we investigated various sources of lactic acid bacteria, as well as GluNa sources and nutritional sources that promote the growth of lactic acid bacteria, and used a small amount of vinegar for preservative purposes. Vegetables were soaked in 5% NaCl at twice the weight of the vegetables for 3 days, and then fermented at 30℃ for 4 days in the same weight of the main pickling solution (containing $MgCl_2$ and lactic acid bacteria). The following results were obtained: (1) Treatment of vegetables at 65℃ for 20 minutes is preferable as a countermeasure against germs, (2) Commercially available lactic acid bacteria drink from Japanese company is good as a source of lactic acid bacteria, (3) Commercial consomme powder was easily available as both a GluNa source and a lactic acid bacteria nutrient source, (4) Lactic acid bacteria growth was $2 \times 10^7 \sim 3 \times 10^8$ CFU/mL, (5) Sodium ion concentration in vegetables is $1.0 \sim 1.3 \times 10^4$ ppm, allowing for low salt content, (6) At the end of pickling, the pH of the solution is 3.4 ~ 4.4, the salt equivalent concentration is 3 ~ 4% (W/V), the total of L-lactic acid and acetic acid is 0.3 ~ 0.4% (W/V) (Glu was 0.1 ~ 0.3%, $MgCl_2$ $6H_2O$ was added at 0.75%), it was easy to judge that the growth of food-poisoning bacteria would be difficult, (7) Evaluation by students confirmed that the food was fully edible. In addition, when agar melt was added to this pickling solution so that the agar concentration was 0.2%, it was found that sourness of the pickles was enhanced, and the physical properties of this solution could not be analyzed using conventional methods. It was found that it is difficult to analyze fine agar particle suspensions.

As described above, we have established a basic method to easily produce a prototype of low-salt fermented pickles from leafy vegetables, with Chinese cabbage being a typical example, in one week and have a long shelf life.