

Effects of Common Sample Salts and Various Salts on Softening of Cooked Vegetables

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Summary

Disks of Japanese radish roots were cooked in distilled water, 1% solutions of Common Sample Salts (No.1, No.2 and No.3) and 0.2M solutions of nine salts (acetate, sulfate and chloride of Na^+ , Mg^{2+} and Ca^{2+} , respectively). After boiling for 15 min or 30 min, the firmness of the disks was measured, and the amount of pectic substances remaining in the disks after cooking was determined. Molecular weights of pectic substances and the contents of metallic elements were also determined. The cell walls of the xylem parenchymatous tissues of the disks were also observed by quick-freeze, deep-etching electron microscopy and light microscopy.

As to the three kinds of Common Sample Salts, no significances were observed in the firmness, the amounts of pectic substances and the results of microscopic observations, though the molecular weights of pectic substances were the least in Salt No.1 and the contents of Ca^{2+} decreased in all disks cooked in Common Sample Salts. When the volumes of other salts were increased four times as large as those Salt No.2, the disks were firmer than those cooked in No.2 solution.

When the disks were cooked in 0.2M solutions of acetate, sulfate and chloride of Na^+ , Mg^{2+} and Ca^{2+} , respectively, the firmness of the disks varied in both of cations and anions. The degree of the firmness of cooked Japanese radish roots scaled from highest to lowest was as follows: $\text{Ca}^{2+} > \text{Mg}^{2+} > \text{Na}^+$ and chloride $>$ sulfate $>$ acetate. The amounts of the remaining pectic substances showed a similar tendency.

In the greatly-softened samples were observed an occurrence of a distinct separation of the middle lamella and a remarkable decrease in the fine granular substances cementing cellulose microfibrils in the primary cell wall. However, in the cell walls treated with CaCl_2 , the granular substances were well preserved, resulting in the suppression of the softening of the tissue. When the disks were cooked in 0.2M solutions prepared by mixing two salts at several different ratios, the presence of both Ca^{2+} and chloric ion increased the firmness of the disks.