

RESEARCH OF CALCIUM SALTS INFLUENCE ON THE STRENGTH OF KAPPA CARRAGEENAN GELS

Bidyuk D.¹, Ph.D., lecturer,
Garncarek B.², Ph.D., lecturer,
Gurskyi P.¹, Ph.D., professor,
Marenkova T.³, teacher,
Mikhailova A.⁴, student,

Pertsevoi F.³, Doctor of Technical Science, professor

¹Kharkiv Petro Vasylenko National Technical University of Agriculture

²Wrocław University of Economics

³Sumy National Agrarian University

⁴Institute of Oriental Studies and International Relations «Kharkiv collegium»

Taking into consideration modern tendencies of growth of the consumption level of jelly products based on kappa carrageenan, the actual task that stands before domestic manufacturers is the rational use of gelling agent regulation of structural and mechanical indicators of the finished product, expanding its range and reducing its costs. The one possible way of solution of outlined problem is a qualitative change of functional and technological properties of kappa carrageenan through its interaction with synergists-substances.

Gels based on this heteropolysaccharide have some well-known disadvantages, syneresis, fragile texture, low strength are among them. They have negative impact on the quality and shelf life of ready jelly products. Among synergists-substances that can eliminate defined disadvantages, some soluble organic and mineral calcium salt that belongs to a class of food additives should be highlighted. In the presence of these salts kappa carrageenan forms the most stable gel. The mechanism of gelation of kappa carrageenan and increasing its strength in the presence of Ca^{2+} ions comes down to the formation of bridges between adjacent double helices of polysaccharide macromolecules with the help of electrostatic links between neighboring sulfate groups. Thus, the ability of gelation of kappa carrageenan and the strength of its gels structure can be enhanced through the adding calcium salts in the compounding mixture. This will help to save a certain amount of kappa carrageenan as a precious raw material, to obtain the structure with predetermined structural and mechanical properties without compromising the quality of ready jelly products.

We explored the effect of molar concentration of sour-milk calcium, calcium acetic and calcium citrate on the strength of gels with kappa

carrageenan concentration of 0,6% by the standard method (pic.).

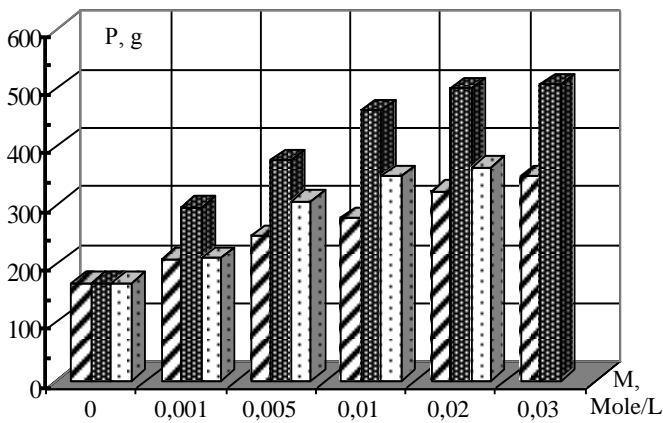


Figure – The dependence of the strength of kappa carrageenan gels and molar concentration of calcium salts: ▨ – fermented calcium; ▩ – calcium acetic; ▨ – calcium citrate

Taking into account that the first two salts in molecules contain one atom of calcium, and the third – 3 atoms the mass of salts in the calculation of their molar concentrations was recalculated to the same calcium content. To make kappa carrageenan solute to be pH $3,25 \pm 0,25$, that is typical for jelly products, calcium citrate was used, which was added together with a corresponding salt into a cooled to a temperature of $50 \dots 60^\circ \text{C}$ kappa carrageenan solute.

Analysis of the obtained data revealed that fermented calcium and calcium acetic with the molar concentration of $0,001 \dots 0,03 \text{ M}$ helps to increase the strength of the gel of kappa carrageenan respectively in 2,1 and 3 times relatively to control (without salts) – from $166,6 \pm 6,6 \text{ g}$ to $348,6 \pm 6,4 \text{ g}$ and $505,6 \pm 19,8 \text{ g}$, calcium citrate with the molar concentration of $0,001 \dots 0,02 \text{ M}$ (has limited solubility in such terms) – 2,2 times – from $166,6 \pm 6,6 \text{ g}$ to $364,8 \pm 13,3 \text{ g}$.

From the results of researches it is also could be seen that the kappa carrageenan gels get maximum strength with the molar concentration of salts of $0,01 \dots 0,03 \text{ M}$ depending on their type. The obtained experimental data is the basis for development of recipes for jelly products with minimum necessary salt content, the use of which will save kappa carrageenan and reduce the cost of the ready product.