THE RESEARCH OF PHYSICAL AND STRUCTURAL-MECHANICAL PROPERTIES OF FRUIT-BERRY JELLY SAMPLES BASED ON «LEAP – Ca^{2+}» SYSTEM

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Abstract. *The peculiarities of ionotropic gel formation process in the medium of based on «low-esterified amidated pectin (LEAP) - Ca^{2+}» system are described in the article. The structural-mechanical properties of culinary product samples – fruit-berry jelly – depending on natural source of calcium ions – ultra-fine-ground powder of egg shell are analyzed . The practicability of using "LEAP-Ca^{2+}" system to produce jelly with a fixed acid index (pH) is proved.*

Keywords: *low-calorie dessert, jelly, low-esterified amidated pectin, egg shell, gel formation.*

Introduction.

Nowadays people are under constant nervous an psychological pressure. It. In its turn, inhibits metabolical processes as the result of which harmful decomposition products of nutrients half-decay acummulate in the organism. It causes diseases of various degree of severity.

All said above has conditioned development o food products which activate elimination of toxicants. The main actovators of these processes are non-digestible sacharides which are low-calorie.

Sweet dishes are very popular with different society levels that is why making their low-calori analogs including those of jelly structure is very perspective in developing food and restaurant industry. We have proved [1] that on condition that "*LEAP-Ca^{2+}*" system is used it is possible to meke jelly samples which are maximum close to gelatin-based analogs.

The analysis of the present information as to egg shell calcite participation in gel formation process with LEAP shows that there is no data about physical and structural-mechanic characteristics of model gel samples which proves novelty of the idea to make such a composition and food product on its base. Due to the lack of information about rheological properties of «*LEAP-Ca^{2+}*» system which defines the technological process to produce sweet low-calorie food (by analogy with jelly) a number of researches have been done which have allowed to establish how every component of the recipe composition influences the technological properties and quality indices of the finished product.

The work goal is to establish definite criteria to estimate fruit-berry jelly samples based on "*LEAP-Ca^{2+}*" system by their physical-chemical, structural-mechanical and organoleptic properties.

The research methods and materials.

The structural-mechanical characteristics of the model systems were researched with a modified scale of Kargin-Sagalova the working principle of which is based on pressed deformation under the influence of the punch with a Teflon attachment. The rheological indices were designed with a computer program vesi_Kargina.xls by comparative analysis of the kinetics deformation curves [2, 3].

The main research results.

Taking into account that the finished product (fruit-berry jelly) has pH 3,3±0,2, citric acid was taken 0,18 g for 100 g of the finished product where 0,11gr was used to neutralize calcite which contained in 0,1 g of egg shell powder (ESP), the rest – 0,07 g – served as addition to citric acid formed as the result of ionotropic gel formation reaction to obtain pH 3,3±0,2 of the system. Based on the achieved results in order to determine the rational ESP concentration to establish optimal ration LEAP : ESP: citric acid the research of the structural-mechanical properties of the jelly samples within ESP 0,05…0,2 % concentration diapason was done(figure 1) [4].

The analysis of matrix gel fluidity depending on ESP 0,05…0,2 % content (figure 1) shows that with increase of calcium containing component the general deformation of the samples reduces within $(11,75…9,63)\times10^{-3}$ which proves fluidity decrease. It is conditioned by the fact that the number of «gel-points» and also where chemical bound is formed between calcium ions and carboxyl

groups located nearby grows and gel carcass strengthens. It is supported by the results to determine elasticity and plastic viscosity modules (figure 2).

It is probable that chemical and technological potential of the system components should be realized at most and thermo-dynamic balance is achieved due to these modules indices.

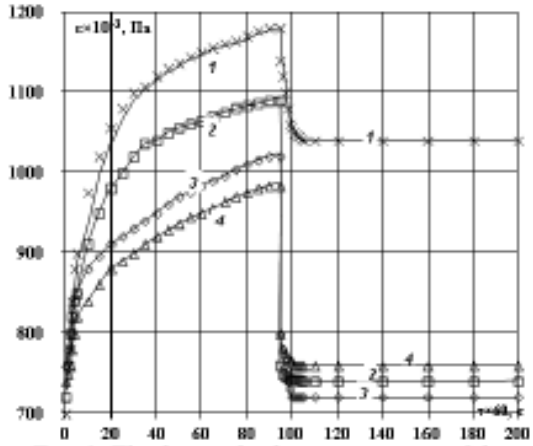

Fig. 1. Fluidity and relaxation curves of the researched samples depending on ESP content (ω_{ESP}=0,05…0,2%; ω_{LEAP}=1%, $\omega_{citric\ acid}$ = 0,18 %): 1, 2, 3, 4 – 0,05 %; 0,1 %; 0,15 %; 0,2 % ESP correspondingly

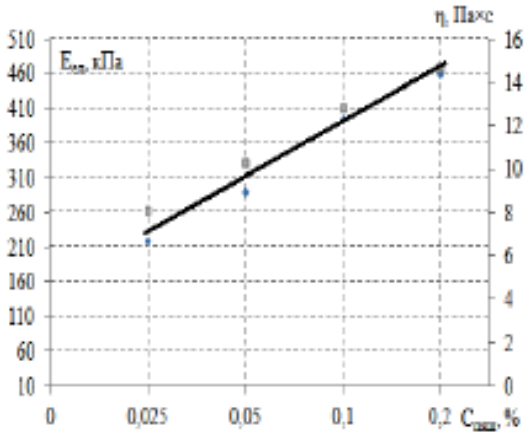

Fig. 2. Dynamics of high elastic module by ESP concentration

Every free charged particle is united by different chemical bonds and water molecules with intermolecular attractive force are kept in gel net. But exceeding calcium ions number on condition of invariable LEAP concentration results in losing transparence and compacting of gel net and later is accompanied by releasing of fluid phase. ESP concentration at which transparent, soft and elastic gel which resist syneresis for a long time is formed is within 0,05…0,1 % diapason. During the experiment research it has been noted that calcium content within 0,1…0,15 % allows to obtain transparent elastic gel which are not disposed to fast syneresis [5]. Increasing amount of ESP to 0,2 % though it was registered strengthening of the force which could resist the load but at the same time gel was more rough and fragile.

The analysis of texture characteristics and comparative estimation of rheological properties of the designed samples allows to identify the made product as an interconnected system with intrinsic plastic viscosity, inverse and non-inverse thixotropy, elasticity and rheopexy of model high-molecular hydrocolloid solutions, and to recommend it for industrial produce.

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