STRUCTURAL AND MECHANICAL CHARACTERISTICS OF STRUCTURED PROTEIN PRODUCTS BASED ON BLOOD PLASMA

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Experimental data concerning the complex of structural and mechanical characteristics inherent in raw and thermally processed structured protein products (SPP) were received by the use of "Kramer Shear Press" measuring cell and summarized in table 1. In any case the correlation of components (the blood plasma: powdered protein containing substance) was equal to 0.87-0.13. For the test samples of SPP with sCa (lg^{-1} of count concentration of Ca ions) in limits of 3.10-3.15 were chosen. The thermal processing of SPP was carried out as soon as tins ¹ 3 were filled with raw structure forming mixture, closed, and incubated in the "Roter Zwerg" autoclave till $71^0 + 1^0$ C in the geometric centre of the sample was achieved.

Shear stress and shear cut indices (Tab. 1) measured on SPP versions not subjected to the thermal processing were analyzed and showed that SPP made on the basis of the blood plasma and granulated micellial mass of the Polyporus fungus mixture were characterized by the higher "firmness". The next was a structured mass of the Polyporus fungus mixture were characterized by the higher "firmness". The next was a structured product made on the basis of the blood plasma destabilized with Ca ions. Values of the shear stress and shear cut were lower when SPP were made on the basis of the aerated blood plasma. However, it would be the wrong to consider that lower values of the shear stress and shear cut of some kind of SPP comparing to others were only the result of the lower stability of individual space protein structures. As a matter of fact comparable SPP versions differ from each other by its density, i.e. they contain equal quantity of the dry matter per volume unit including the protein substance formed different space structures. To understand the contribution of such a factor into the evaluation of structural and mechanical characteristics, shear stress and shear cut values measured for individual SPP versions were divided into the summary mass of cylindrical samples placed into the cubic section of "Kramer Shear Press" measuring cell. After having analyzed values resulted (named by authors as "specific") you would make easily sure that mass unit values of non-thermoprocessed structured protein products made on the aerated blood plasma yield only to similar values of SPP shear stress made on the basis of the blood plasma and granulated micellial mass of the Polyporus fungus mixture as soon as SPP made on the basis of non-aerated blood plasma destabilized by Ca ions.Moreover SPP made on the basis of the aerated blood plasma give the highest value of the specific shear cut.

Data of the analysis shown in Tab.1 concerning absolute and specific indices of the shear stress and shear cut of SPP made on the basis of the blood plasma showed that as a result of thermally processing the SPP structure became two times as stable. Unlike non-thermoprocessed SPP versoins, those SPP which were made on the basis of non-aerated plasma destabilised by Ca ions had the highest shear stress and shear cut values after the thermally processing. If taking into account the specific shear stress value, SPP made on the basis of the blood plasma and granulated micellial mass of the Polyporus fungus mixture had a more stable structure. Moreover the thermoprocessed SPP made on the basis of the destabilized (by $CaCl_2$) blood plasma and sodium caseinate mixture was less "firmer".

Analysis of specific shear cut values allowed to conclude that thermoprocessed SPP made on the basis of the blood plasma aerated had the most stable structure. The clot structure of the initial thermoprocessed blood plasma seemed to be the less stable in relation to the shear-compression effects created by shears of "Kramer Shear Press" measuring cell. Following above SPP, it is necessary to mention thermoprocessed SPP made on the basis of the blood plasma and bone protein isolate mixture.

From the point of view of the potential use of SPP made on the basis of the blood plasma for directed controlling structural and mechanical characteristics of cooked minced meat products, the comparison of resultant values shown in Tab. 1 with absolute and specific values of the shear stress and shear cut of cooked minced meat products shown in Tab. 2 occured to be of the great practical interest. Usually such kind of cooked minced meat products contain the beef and fat or semi-fat pork. On this stage of the experiments we used "Berkel" test cutter for grounding presalted (2.4% NaCl) beef and fat or semi-fat pork with addition of

35,25 and 20% of water correspondingly. Finely comminuted meats were filled into "Belkosin" casing (dia. - 60 mm) and thermally processed by heated air-stream-mixture (80°C) in "IWKA" cooking and roasting chamber up to 71+1°C in the centre of control sample.

The analysis of data given in Tab. 2 showed that thermally processed minced beef samples were more firm in comparison with minced fat pork samples which were the most tender. SPP made on the basis of the blood plasma and milk protein diafiltration concentrate mixture occured to be very similar to thermoprocessed minced beef products by its specific indices and particulary by the specific shear cut and index. At the same time it should be quite logical to compare consumers organoleptic perception of the chewing food consistency not only by the equality of the food mass in his mouth, but also by the food filling equivalence. Proceeding from the complex of absolute and specific indices summarized in Tables 1 and 2, it must be admitted that SPP made of non-aerated plasma destabilized by $CaCl_2$, plasma and milk proteins diafiltration concentrate mixture, plasma and granulated micellial mass of the Polyporus fungus mixture occured to be more similar to cooked minced beef products. Concerning consumers perceptions the consistency of thermoprocessed structured products made on basis of the plasma and soya protein isolate mixture or the plasma and cotton protein isolate mixture may be considered as similar to the consistency of minced semi-fat pork products. Taking into account the complex of absolute and specific indices, thermoprocessed structured products made on the basis of the plasma and bone protein isolate mixture, the plasma and sodium caseinate mixture, and the aerated blood plasma occured to be more simiar to minced fat pork products.

Summarizing the whole above mentioned material of the test, it is possible to make a number of particular and general conclusions:

- To provide predetermined chemical or amino-acid content, it is advisable to use some quantities of different SPP versions in receipts of cooked meat products contained the beef, the fat or semi-fat pork. In order to provide adequate structural and mechanical properties of ready meat products SPP quantity added may be positively corrected. In particular , when you need to prepare any minced meat product of low energy value and with characteristic consistency similar to the minced meat products contained the high fat of semi-fat pork level, it is recommended to mix the beef with SPP made on the basis of the plasma and sodium caseinate (Fig. la) mixture or the plasma and bone protein isolate (Fig. lb) mixture.
- In case if it is supposed to prepare a minced pork product with characteristic consistency similar to that of the minced meat products contained the high beef level, then it may be recommended to mix the minced pork with SPP made on the basis of the plasma and the micellial micomass of the Polyporus fungus (Fig. lc) mixture or the plasma and the milk protein diafiltration concentrate mixture.
- Finally, if you need to make lower the energy value of any minced meat product without changing its traditionally characteristic consistency, it is recommended to that of substitute the semi-fat pork contained in its receipt for SPP made on the basis of the plasma and soya protein isolate mixture of the plasma and cotton protein isolate (Fig. ld) mixture.

Fig. 1. Macrostructure of thermally processed structured protein products based on blood plasma:

a - with sodium caseinate; b - with bone protein isolate;
c - with micellial micomass of the Polyporus fungus;
d - with cotton protein isolate

Table 1. Structural and mechanical characteristics of structured protein products based on blood plasma.

Table 2. Structural anf mechanical characteristics of finely minced thermoprocessed meat.