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INFLUENCE OF TECHNOLOGICAL PARAMETERS OF LOW-CALCIUM BUTTERMILK COPRECIPITATE ON ITS RHEOLOGICAL CHARACTERISTICS

The necessity of development of obtaining technologies of low-calcium buttermilk co-precipitates with a complex of necessary technological properties is proved in the article. The influence of the buttermilk pasteurization parameters on the degree of transition of solids, protein and fat to the coagulate process was determined.

Keywords: *buttermilk, protein, pasteurization, low-calcium co-precipitate, supreme shear stress.*

Relevance of the research topic: The traditional technology of industrial dairy processing does not allow using all components of milk in dairy products such as butter, sour cheese, cheese and others. While their production one inevitably will receive protein-carbohydrate dairy raw materials (PCDRM) in the form of skim milk, buttermilk and whey.

One of the PCDRM types formed during the milk processing is the buttermilk obtained during the production of butter [4]. In the total volume of PCDRM produced, the buttermilk is characterized by a relatively low specific gravity, which, in our opinion, explains the insufficient attention to the development of issues for their further use in human nutrition.

Of great interest in these raw materials are protein substances that determine the biological value of buttermilk [2]. However, existing technologies of buttermilk processing are far from fully exploiting their nutritional potential, in particular, the protein complex.

Formulation of the problem: The development of methods and regimes of the buttermilk proteins co-precipitation process, technologies of obtaining of low-calcium co-precipitates from this raw material with a complex of necessary technological properties for the subsequent use in technologies of restaurant industry foods is an important task.

Analysis of recent researches and publications: The research of chemical composition, nutritional value of dairy raw materials and the development of technologies of protein foods were of interest of many domestic and foreign scientists: V. Belitser, P. F. Dyachenko, M. M. Lipatov (senior), A. G. Khrantsov. In Ukraine, these issues were researched by S. S. Gulyaev-Zaitsev, G. V. Deinychenko, V. M. Kozlov, G. E. Polishchuk, G. B. Rudavska, N. A. Tkachenko, T. I. Yudina etc [1, 4–5].

The quality of the food depends largely on the cooking technology. Since products of different quality can be obtained from the same raw material, it is necessary to study the influence of technological factors on the consistency of the finished product.

Presenting main material: In the first stage of the study, the influence of the parameters of the buttermilk pasteurization on the degree of transition of solids, protein and fat to the coagulate process was determined.

In order to establish the optimum temperature interval for the buttermilk heating, as well as to study the effect of different temperatures on the physic-chemical and organoleptic parameters of the obtained coagulate - low calcium co-precipitate - the buttermilk were heated to temperatures in the range of 80. . . 95 ° C for 10 min. Pre-prepared acidic serum was added in small portions with a thin stream, the mixture was gently stirred. Serum was taken in the amount of 30% of the buttermilk volume. The mixture was allowed to rest for 10 min, and the released coagulate was filtered through lavalan tissue and left for self-pressing for 1,0 to 1,5 hours. As an objective indicator of the low-calcium co-precipitate consistency the supreme shear stress (SSS) was used.

The results of the obtained protein masses studies are presented in Fig. 1.

The analysis of the obtained data shows that the temperature of buttermilk pasteurization significantly affects the main characteristics of the resulting protein mass. Thus, with pasteurization temperature increase from 80 to 95 °C, the degree of released solids increases by 10,2 %, of protein – by 10,1 %, of fat – by 7,7 %. The increase in the degree of S, P and F transition is also evidenced by the decrease in their mass particles in the formed serum.

As the temperature of buttermilk pasteurization increases, the moisture content of the protein mass decreases. Increasing the pasteurization temperature has a negative effect on the clot's water-binding capacity. In our view, this is due to the fact that the influence of high temperatures (above 90 °C) leads to the denaturation of serum proteins and their aggregation with casein [3]. The influence of lactic acid on the protein globules (after mixing the buttermilk and whey) accelerates the syneresis of the gel, which is accompanied by intense moisture squeezing from polymers of milk-protein mass. Moreover, the higher the temperature, the syneresis process is more intense, so the consistency becomes denser.

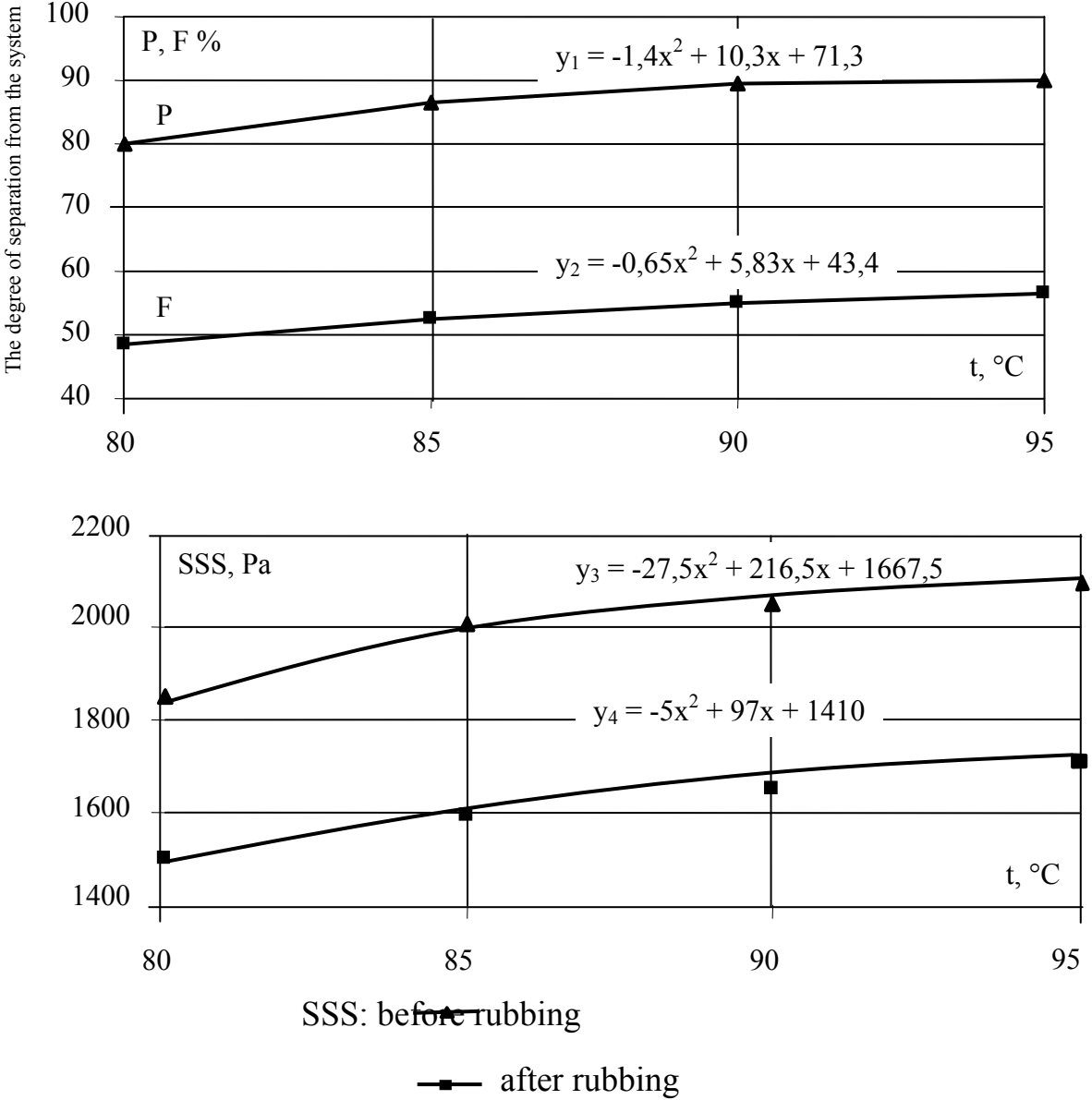


Figure 1. The influence of pasteurization temperature on the precipitation process and the characteristics of the coagulate

According to the above, the consistency of the obtained low-calcium co-precipitate changes from paste-like to granular. The SSS of the product rises with pasteurization temperature increase from 1850 Pa to 2100 Pa. Wiping of the low-calcium co-precipitate improves its consistency, reducing SSS by 18. . . 19%.

It should also be noted that the analyzed temperature range has no significant effect on the active acidity of the protein masses and on some organoleptic indicators (taste, smell).

The influence of the duration of buttermilk pasteurization at 95 °C on the main characteristics of the obtained protein masses is presented in Fig. 2.

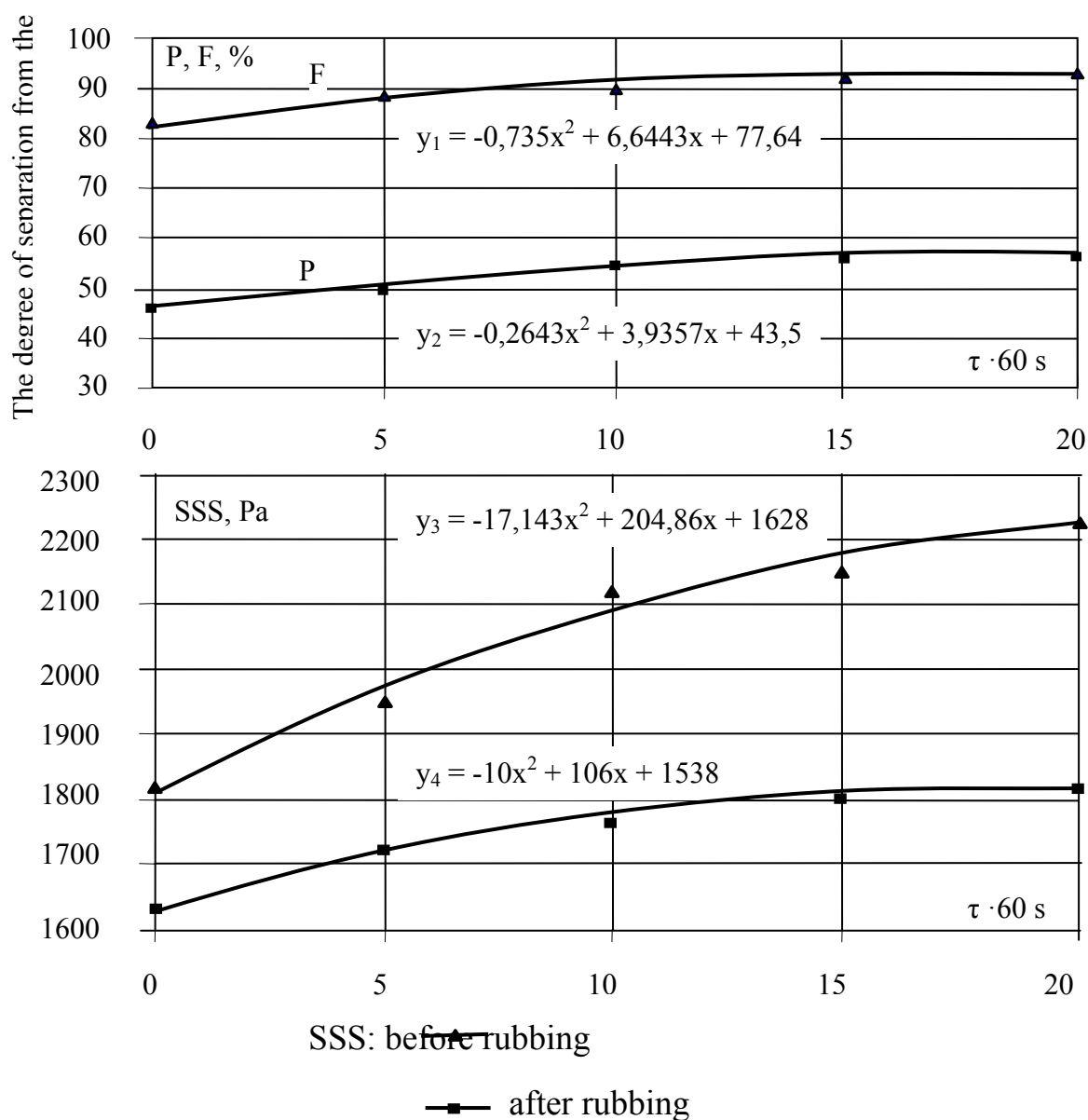


Figure 2. The influence of the duration of buttermilk pasteurization on the precipitation process and the characteristics of the coagulate

According to the obtained data, with increasing the pasteurization duration the degree of solids and protein separation from model systems increases. The most intensive increase in the degree of released solids and protein is observed in the range $(10 \dots 15) \cdot 60$ s, after which the rate of increase in the degree of released solids and macromolecular compounds is significantly reduced. Thus, with increasing the duration of buttermilk pasteurization from 0 to $10 \cdot 60$ s, the degree of released solids increased by 7,4%, of proteins – by 7,1%, of fat – by 8,5%, and the subsequent pasteurization of buttermilk for $10 \cdot 60$ s (from 10 to $20 \cdot 60$ s) leads to an increase in the rate of released solids by 3,5%, of proteins – by 2,8%, of fat – by 1,8%.

The decrease in humidity of co-precipitate, as already noted, is apparently a consequence of the intense syneresis process due to the increase in the duration of high-temperature effects on the buttermilk proteins during their precipitation with acidic serum.

With the duration of buttermilk pasteurization more than $(10 \dots 15) \cdot 60$ s, sensory indicators of the resulting protein quality, such as taste and smell, are significantly disimproved. The sugary taste and odor of pasteurization are formed as a result of the intense melanoidin reaction, since the temperature of $93 \dots 95^\circ\text{C}$ is the limit for its onset, which significantly disimproves the quality of the obtained coagulate.

Conclusions: Therefore, the most optimal modes of buttermilk pasteurization, which contribute to the maximum release of solids and proteins and do not disimprove the qualitative indicators of low-calcium co-precipitate, are pasteurization temperature $93 \dots 95^\circ\text{C}$ and duration $(10 \dots 15) \cdot 60$ s.

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