Pasterization influence on milk fat phase

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Summary

The influence of heat treatment implemented by different types of heat plants (plate heat exchanger, infrared electroheating plant, “cavitation” plant) on milk fat phase was studied.

Influence on properties of treating product of any equipment introduced in industry has to be investigating. Changes of milk components and milk technology properties are determined when dairy equipment is applied. Mechanical treatment can have a very negative influence on milk fat phase. Its changes are undesirable for formation of dairy products properties, but they remains without attention of investigators very often. These changes are fat emulsion destabilization, fat oxidation, change of fat dispersion, lipolysis. They cause fat losses, quality reduction of dairy products, decrease of store period of products with high fat content.

The aim of our investigation was to study how the technological operation of pasteurization implemented by different types of thermal equipment influences on milk fat phase. Object of our investigation was milk fat phase before and after thermization in plate heat exchanger “Alfa-Laval”, infrared heating plant and ТЕК-М plant, in which heat is caused by hydrodynamic processes (cavitation). Such characteristics as fat content, average diameter of fat globules and their number in 1 ml of milk, destabilized fat content were determined in raw and pasteurized milk.

According to the results, fat content was decreased during the heat treatment of milk in different heating plants. Fat losses were on the average 0,02–0,26 % for all investigated equipment and temperature conditions. The most losses were fixed for heat treatment in plate heat exchanger at the pasteurization temperature 90 °C and residence time 18 s. Heat treatment resulted in significant modifications of fat dispersion – average diameter of fat globules decreased, their number increased. Dispergation degree of milk fat was increased with elevation in temperature of pasteurization. So, average diameter of fat globules in raw milk was 2,72 μm, in milk after pasteurization at 79 °C – 2,38 μm, in milk after pasteurization at 90 °C – 2,25 μm on the average for all investigated heat exchangers. Number of fat globules increased with decrease of their diameter. So, number of fat globules in 1 ml of raw milk was 2270, in milk after pasteurization at 79 °C – 2590, in milk after pasteurization at 90 °C – 2720 for about all investigated heat exchangers. Size distribution of fat globules

shows higher degree of fat globule dispergation in pasteurized milk than in milk before pasteurization. Percentage of fat globules with average diameter 1,25–2,5 μm was highest in raw milk (averages 42,1 %). Percentage of fat globules with average diameter >5 μm was relatively high (averages 6,3 %). Elevation in pasteurization temperature resulted to increase of number of globules with size <1,25 μm, their percentage was highest at 90 °C (averages 47,3 %). In the same time percentage of large globules (>5 μm) was averages 2,3 %. Destabilized fat content in raw milk was 1,05 %, in milk pasteurized at 79 °C – 1,44 %, in milk pasteurized at 90 °C – 1, 76 % on the average for all investigated heat exchangers.

Initial milk has differences on chemical composition, characteristics of fat dispersion and sanitary-hygienic indices in three cases of thermization. Temperature conditions 79 and 90 °C were common in three cases. That is why we have compared divisibility of changes but no absolute values for comparison of milk fat phase characteristics after pasteurization in different heat plants (table)/

According table data, we have observed the most losses of fat content after thermal treatment on plate heat exchanger. Though heat treatment in plant TEK-M led to highest degree of dispergation of fat phase, content of destabilized fat increased more rapidly in milk after pasteurization in plate heat exchanger, especially at high temperature treatment of milk. Heat treatment of milk it infrared electroheating plant was the most gentle for it – fat losses and accumulation of free fat were least, dispergation degree of fat globules – least among three investigated plants for milk pasteurization. We can suppose that use of such type of milk pasteurization is the most favourable for manufacture of high quality dairy products with high fat content.

Table – Comparison of different types of heat exchangers on characteristics of fat phase

Indicator	Change divisibility, разів					
	Plate heat exchanger		TEK		Infrared electroheating plant	
	79°C	90°C	79°C	90°C	79°C	90°C
Fat content	1,03↓*	1,07↓	1,01↓	1,03↓	1,01↓	1,01↓
Fat globules number per 1 ml	1,14↑	1,25↑	1,26↑	1,27↑	1,03↑	1,08↑
Average fat globules diameter	1,16↓	1,25↓	1,26↓	1,38↓	1,02↓	1,03↓
Destabilized fat content	1,9↑	2,75↑	1,24↑	1,27↑	1,03↑	1,06↑

*↓ – decreasing of index; ↑ – increasing of index

Thus, milk heat treatment implements significant influence on milk fat phase. Degree of milk changes depends on thermal equipment type and temperature conditions of heat treatment.