DEPARTMENT OF FOOD SCIENCE
FACULTY OF LIFE SCIENCES
UNIVERSITY OF COPENHAGEN

Instant infusion pasteurization of whole milk and skim milk: Influence on viscosity and particle size

Hougaard, A.B.*, Ipsen, R.

Department of Food Science, Faculty of Life Sciences, University of Copenhagen, Rolighedsvej 30, DK-1958 Frederiksberg C, Denmark
**abhg@life.ku.dk*

Introduction

Milk needs to be heat treated in order to ensure consumer safety and obtain a reasonable shelf life. The standard treatment for fresh milk products is high temperature short time (HTST) pasteurization in a plate heat exchanger at 72℃ for 15 seconds. Ho wever, new technologies for heat treatment of milk are under investigation with the aims of obtaining gentler treatment; preservation of freshness; longer shelf life; and development of novel products. Instant infusion pasteurization is a technology characterized by short heating, holding and cooling times that might create possibilities for fulfillment of at least some of these aims.

The objective of this study was to investigate the effects of instant infusion pasteurization in different time-temperature combinations on the resultant viscosity and particle sizes. Experiments were performed both on whole milk and on skim milk.

Results

The instant infusion pasteurization did not affect the viscosity of skim milk (SM), whereas when measurements were made on the skim milk fraction (SMF) of instant infusion pasteurized whole milk an increase in viscosity was observed as treatment temperature increased (Fig. 1). Changing the holding time for instant infusion pasteurization of whole milk had less influence on the viscosity of SMF than the temperature changes.

The viscosity of the SM was generally lower than the viscosity of the SMF of whole milk, which may be attributed to differences between the two batches of milk and differences between the industrial and the laboratory skimming process.

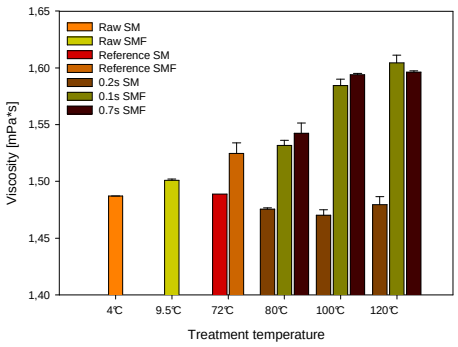

Figure 1: Viscosity of instant infusion pasteurized skim milk (SM) and skim milk fraction (SMF) of whole milk and the corresponding raw and reference samples.

The z-average diameter showed the same tendencies as described for the viscosity with no changes in SM samples and increasing particles size in SMF samples (Fig. 2). As for the viscosity measurements, differences in level were seen between the SM and SMF samples, with SM showing generally lower particle sizes than SMF.

The intensity size distributions for some of the SMF samples are shown in Fig. 3 and it is evident that a broadening of the distribution towards greater particle size appeared when the temperature was increased to 120℃. It may also be noted that the size distribut ions retain a unimodal form also when the particle size increase.

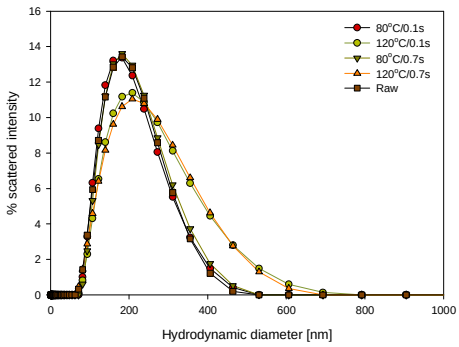

Figure 3: Intensity size distributions for samples of the skim milk fraction of whole milk, instant infusion pasteurized at 80℃ and 120℃ compared to raw milk.

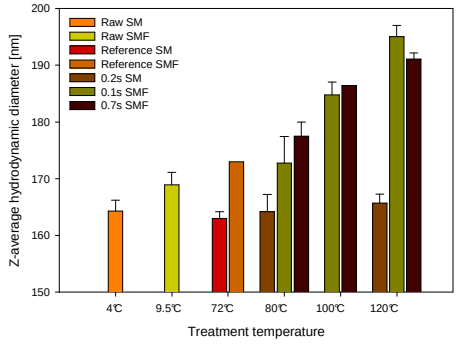

Figure 2: Z-average hydrodynamic diameter of particles in instant infusion pasteurized samples of skim milk SM and the skim milk fraction (SMF) of whole milk along with control and reference samples.

Concluding remarks

Instant infusion pasteurization of whole milk led to changes in some physical properties of milk samples, as increasing viscosity and particle sizes were observed in the skim milk fraction with increasing treatment temperature. On the other hand, no similar changes were seen in instant infusion pasteurized skim milk. This indicates that the changes are related to the fat fraction. It may be suggested that the fat is retained in the skim milk fraction after skimming in increasing amounts as treatment temperature increases, either as separate relatively small fat particles or as interaction products with other milk constituents.

Experimental

Instant infusion pasteurization was performed on raw whole milk with two holding times (0.1s and 0.7s) combined with three different temperatures (80℃, 100℃, and 120° C). All samples were cooled overnight and skimmed by centrifugation, and the skim milk fraction (SMF) was used for the analyses. Instant infusion pasteurization was also performed on skim milk (SM) using a 0.2s holding time and temperatures of 80℃, 100℃, and 120℃. Unpa steurized skim milk was obtained from a commercial dairy. The instant infusion pasteurized samples were compared to untreated milk (raw) and HTST pasteurization (reference) of the same whole milk and skim milk. Particle size was analyzed using dynamic light scattering and viscosity was determined using a glass capillary viscometer.

Financed by DARCOF