Practical Exercise 3

Straining, filtration and clarification of milk

Objective

To improve the aesthetic quality of milk by removing visible foreign matter in order increase consumer acceptability

Principle

Filtration and straining removes suspended foreign particles like dirt, fly, straw, hair etc. by the straining process while clarification removes the same by centrifugal sedimentation.

Strainer and straining of milk

Even after maintaining strict hygienic conditions, milk may contain some foreign matter like dirt, fly, straw etc. Funnel shaped strainer made of SS-304 is suitable for pouring of milk from producer's vessel to milk cans or balance tank. At the funnel's conical bottom, there is a removable type stainless steel 40 mesh strainer for filtering extraneous matter in the milk (Figs. 3.1). The SS filter is round in shape and is properly fixed at the periphery by SS strip ring. The filter rests in a grooved step in the funnel. Typical dimensions of the funnel type strainer are mentioned below:

Top Diameter :320 mm

Bottom Diameter :127 mm +/- 2 mm

Height :190 mm +/- 2 mm

Strainer Diameter :127 mm +/- 5 mm

Material of Construction : AISI 304

Thickness of the sheet :1.2 mm

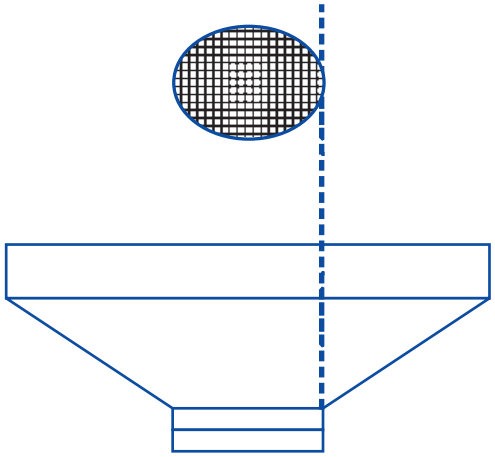

Fig.3.1. Schematic diagram of Strainer

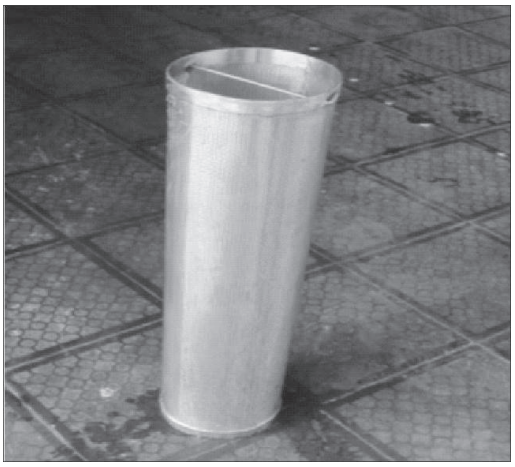

Fig.3.2. In-line strainer

Filter and filtration of milk

Filtration of milk ensures that sediment or other extraneous matter is removed from the milk. It is a cloth or pad of the desired pore size which can retain the smallest particle. A frame or support is kept to compress and hold the margins of the cloth or pad so that milk can only pass through the pores the cloth or pad is also supported by perforated metal which will not tear or break under the pressure of the milk. The filter is designed in such a way that cloths or pads can be changed quickly and all parts are easily accessible for washing. Filtration can also be done at farm by in-line filter installed in the automatic milking system. Forcing milk through an in-line filter (Fig. 3.2) by a pump is the most common method of filtering milk in modern milking plants. The in-line filters are of tube in tube type (Table 3.1). The milk filter media consists of a nylon filter bag/pad supported on a perforated stainless steel (SS) filter element. Filter element is held in an SS casing with a blank nut/clamp lid, milk distributor, inlet and outlet connections. In-line filters should be installed before the chiller. This allows the milk to be warm when filtered and facilitates the passage of milk fat through the filter. Filters should be cleaned periodically in 8-10 hours depending upon the deposits. Usually two filters are installed in parallel to facilitate cleaning of filter while other is in use (Fig. 3.3). One of the biggest drawbacks

of filter is the drop in flow rate over time because a thicker and thicker filter layer builds up. Therefore use of in-line filters is for removal of course impurities.

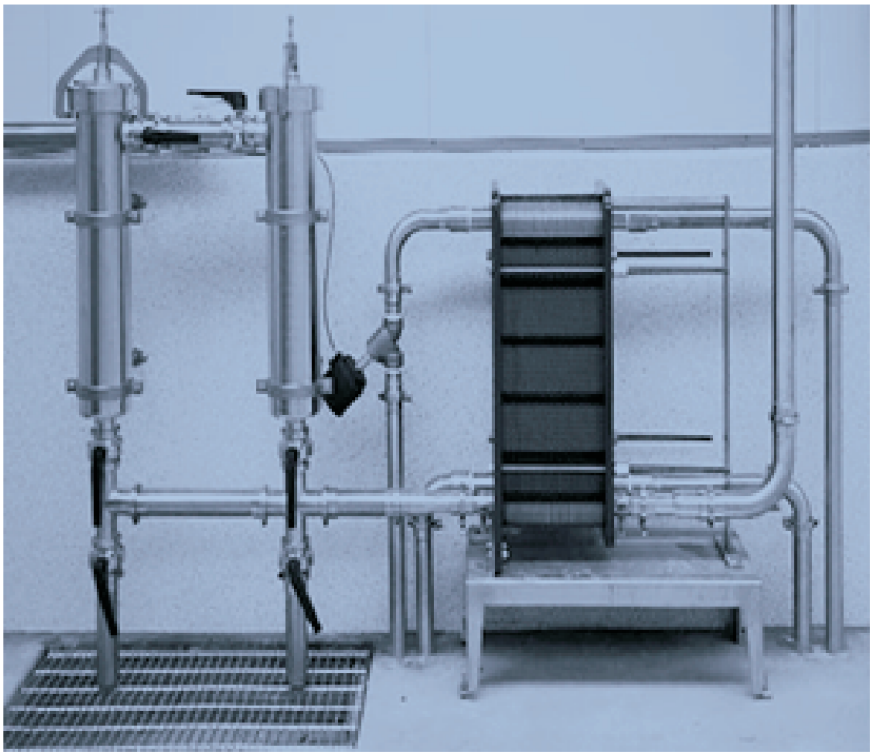

Fig.3.3. In-line milk filters

Table 3.1. Details of in-line filter for filtration of milk

Parameters	Milk plant capacity	
	5000 litre/hour	10000 litre/hour
Diameter of in-line filter	75-80 mm	100-110 mm
Inlet pipe size	38 mm	51 mm
Outlet pipe size	51 mm	63 mm
Type of filtering element	SS-304 perforated screen (1-1.5 mm holes)	SS-304 perforated screen (1-1.5 mm holes)
Diameter of filtering element	63 mm	70 mm
Length of filtering element	225-250 mm	225-250 mm
Provision of cleaning	Blank nut/Clamp	Blank nut/Clamp

Clarifier and clarification of milk

Filtration is for removal of material lighter than milk such as wood, cellulose, packaging material residue etc., whereas clarification is done to remove components heavier than milk. Milk clarification is the process of removing undesirable foreign matter such as dirt, curd particles, blood corpuscles, epithelial cells, bacteria sediment, sludge etc from the milk. To some extent bacteria also get removed as slime during the clarification process. However, clarification cannot be considered an effective means of bacteria removal.

Clarifier is similar to that of centrifugal cream separator, however, it has only one outlet compared to cream separator which has two outlet one for one for cream and another for skim milk. The discs in the clarifier bowl are smaller in diameter to allow accumulation of large slime and the milk distribution holes are at the outer edge of the discs in clarifier.

The clarifier consists of conical discs stacked over each other which rotate inside the clarifier bowls. Milk is introduced into the separation channels at the outer edge of the disc stack, flows readily inwards through the channels towards the axis of rotation and leaves through the outlet at the top (Fig. 3.4). Particles, which are denser than the continuous milk phase, are thrown back to the perimeter. The sludge gets collected in the space around the disc and milk being lighter moves up towards the outlet. The amount of solids that collect will vary however it must be manually removed from the centrifuge at regular intervals. From the studies it has been established that warm clarification of milk, e.g. at 50 to 55°C is preferred to cold clarification.

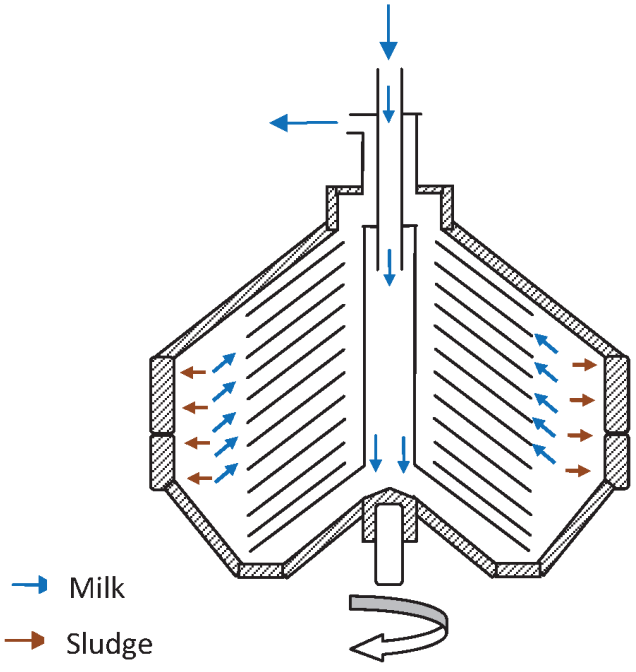

Fig.3.4. Schematic diagram of clarifier

Fig.3.5. In-line modern clarifier

Modern clarifiers are of self-cleaning type which allows for continuous operation (Fig.3.5). The clarifier bowl has discharge ports which open up periodically. These discharge ports remain closed under pressure. Release of pressure opens the port and sludge is evacuated from the space. Such removal of sludge results in about 0.05-0.10% of milk being lost.

REVIEW QUESTIONS

1. What do you mean by straining, filtration and clarification of milk?
2. How clarifier is different from cream separator?
3. What are the parts of strainer and clarifier?
4. What are the disadvantages of clarification of milk?
5. Will you suggest straining/filtration/clarification of milk? Why if yes or not?