10 Preparation of cheese milks

10.1 Milk storage

Milk storage is an important feature of cheesemaking. It is a necessary part of the cheesemaking routine to ensure that tanks and ancillary equipment be used effectively and kept clean. Except for the smallest quantities of milk or those milks used for cheese while still warm, most milks are subject to storage for longer or shorter times; even during transportation, milk is accepted as being in storage. With the advent of larger cheese factories, and especially those concerned with collecting milk ex-farm in bulk cold tanks, the storage of milk has become a most important stage in the process. The advent of a 5-day working week for creamery workers makes the storage of milk even more important.

The bacteriology of raw milks has been discussed in Chapter 6 and Table 6.2 and Figure 6.2 show the possible growth of bacteria in cold-stored milks. Later, the bacteriology of heat-treated milks will be dealt with (see Figure 10.6); these milks often find temporary storage in tanks. Cheese milk ripening in storage tanks by starter, before transfer to cheese vats, is also used in some systems. Apart from these uses, the storage of milk provides time for bacteriological and chemical testing, mixing of milks from other collecting areas, standardization of the milks and any other treatments as necessary.

It is essential that the tanks be constructed of such materials and in such a conformation that they are easily cleaned. Furthermore, the tanks, pipelines and pumps must not add to the bacterial population of the milk. The tanks must be properly insulated against heat loss or gain and, in some instances, they may be required to have a refrigeration system built-in for cooling the contents (e.g. starters). It should be possible to mix the milk in the tanks, at whatever level of filling, to avoid cream separation.

Cleaning-in-place (CIP) systems are essential for cleaning milk silos, which may be from 70 to 200 000 litres capacity. The tanks should be cleaned every time they are emptied, and not refilled with more milk, since contamination of the second filling of milk can occur from the first milk drainage. The tanks should be rinsed with water to remove as much soiling as possible and then washed with suitable detergent solutions, rinsed and disinfected. Detergent solutions are compounded for different duties from a mixture of chemicals, in many instances alkaline. CIP systems are covered by Romney (1990). The detergents used should be those normally and easily available in
the area of the cheese plant and, therefore, they will vary in composition from country to country.

The use of heat in the large tanks must be limited to that required for efficiency of cleaning, since the body of a tank can take up excess heat which has to be removed before cold milk can be stored in the tank again. Disinfection of these tanks by steam is only carried out in extreme cases, as stresses set up in the metal of a tank may cause deformation of the tank; therefore, chemical disinfection is commonly employed. Those tanks which have a refrigeration system attached need to have the refrigerant removed before hot cleaning is practised.

The heat retained by tanks after normal cleansing does not cause an appreciable increase in the temperature of well-cooled milk, 4°C, when the tanks are filled, but can cause an unacceptable increase in partially filled tanks. A temperature of 5°C seems to be the critical temperature for short-term storage of milk. This is illustrated in Figure 10.1; the optimum temperature for storage would be 4°C.

The usual method of mixing in the large tanks has been by mechanical rotary blade type mixers. The mixer must be capable of moving the mass of milk from top to bottom to prevent cream separation; the position and direction of the mixer is important. To prevent damage to the milk by over-mixing in overnight storage, the mixers should be set to operate intermittently for short periods rather than continuously. Mixing by means of

![Plate count graph](image-url)

**Figure 10.1** Numbers of bacteria in a clean farm milk supply when stored for 24 h at various temperatures (plate count on yeast mol milk agar incubated at 37°C).