

CHEESE VATS AND PRESS- CONSTRUCTION DETAILS.

Cheese is protein rich food. It is coming under western dairy products. Now a days the paneer and cheese is consumed by the Indian people. So the Indian dairy is manufacturing this products. In the following text details of cheese making equipments are described.

Cheese Making Equipment

Cheese is a concentrated milk product of great importance. It commonly includes the steps

- (a) Setting the milk to develop some acidity,
- (b) Coagulation by an enzyme to facilitate cutting,
- (c) Cutting the coagulum for easy expulsion of whey,
- (d) Cooking or heat treatment to shrink the curd and drain the whey,
- (e) Consolidation and shaping,
- (f) Curing or maturing the green cheese for short or long periods of time.

The traditional process of cheese making consists of

1. Standardization, clarification and pasteurization of milk to get uniform quality of cheese.
2. Homogenization of milk to help in greater access of lipase enzyme to fat, allowing faster fat hydrolysis necessary to secure blue cheese flavour, wherever necessary.
3. Formation of coagulum involving use of favourable starter culture (0.5 to 1.0%) at 30 to 31 °C for development of acidity (0.01 to 0.02%) and to assist curd formation by rennet added at the rate of 165 ml/1000 kg milk in about 30 min.
4. Careful cutting of the curd into uniform size to promote whey removal.
5. Raising temperature of curd to 35 °C in about 30 min and holding for about 45 min to firm the curd and removal of whey.
6. Dipping or whey drainage and retaining maximum solids.
7. Cheddaring, a characteristic step for cheddar cheese, by cutting the curd into slabs, turning every 15 min and piling every 30 min to get 3 to 4 high piles of curd to develop proper body in the curd when acidity of whey is 0.5% lactic acid (pH about 5.2).
8. Milling the curd into pieces to help in filling into hoops for pressing.

9. Salting to get about 1.5% of salt in finished cheese for flavour development and stoppage of acid production.
10. Pressing hoops for about 12 to 16 h for removal of whey and getting final desired moisture content in cheese, and cheese blocks waxed to cover external surfaces.
11. Curing under controlled conditions of temperature and humidity to develop characteristic body and flavour in cheese.

Equipment

cheese equipment consists of cheese vats, cheese knives, agitator, curd strainers, curd mill, cheese hoop and press.

Cheese vat

The cheese vat used for coagulation and cooking are made of either SS or with SS lining rectangular design. The vats are jacketed, allowing space for circulation of water between the inner and outer container. A steam pipe is fitted at the bottom in between outer and inner tank for uniform distribution of heat to the inner tank. The outer tank may be MS construction. The inner tank should not have any sharp corners and the welded joints should be properly ground and polished for effective cleaning. Fittings such as jacket drain valve, overflow connection, SS gate valve to draw whey with longitudinal central ridge to allow whey to flow towards whey valve with steam and water inlet connections are fixed on the vat. The vats are supported suitable on adjustable legs.

Agitator

The agitator is used for moving the curd after cutting, fork type motor driven agitator which reciprocates back and forth from one end of the vat to the other end is generally used in large vats. The stroke of this agitator is adjustable between two stops. A paddle type agitator or wooden rake is used in small units.

Cheese knives

Uniformity in the size of the pieces is the aim of proper cutting. For this purpose, two kinds of knives are used. One knife cuts the curd into horizontal layers and the other vertically across these layers from top to bottom, slicing them into small

cubes. The blades are thin wire which gives effective cutting. In some the blades are thin and sharp of metal construction, cuts the curd with least possible breaking. The distance between the blades usually varies from 6 to 17 mm.

The curd is cut first with horizontal knife lengthwise of the vat, then crosswise with vertical knife and finally lengthwise with the same knife. The knives may be of SS construction or tinned brass.

Gate Strainer: Whey is removed from the vat through a gate strainer which holds back the curd. It is semicircular in design with perforation which can be fitted to the vat outlet.

Curd mill: The mill, spike-toothed or circular blade type cuts the curd into small pieces of uniform size and should do it without crushing or squeezing the milk fat from the curd. The mill could be hand operated or motor driven. If power curd mill is used, it should not be run too rapidly to prevent uneven curd cutting which will result in poor cheese texture.

Cheese hoop: Different designs and capacities of hoops are available, to give shape to the curd and compact the same. They are round or rectangular (Wilson type) with followers.

Cheese press: The cheese press is used to press the cheese in the hoops. The loaded cheese hoops are placed in the press and pressure applied. The hand operated cheese press consists of a frame having two or three vertical columns, pressing plates fitted to sleeves moving on the vertical columns, a simple or compound lever attachment or hand wheel with spindles and proportional weights for applying pressure. The press could be vertical or horizontal, mechanical or hydraulic type depending upon whether the force is applied by mechanical action or hydraulic pressure. The pressure on the cheese should be uniform and there should not be any buckling of the hoops during pressing.

Mechanization in Cheese Making

Mechanization is a system in which most of the stages in cheese making are carried out by machinery instead of manual labour. The present day cheese making systems involve handling milk ranging from 2,50,000 to 10,00,000 l/day. With increasing cost of labour and conventional horizontal vats it is very difficult for cheese makers to cut the coagulum and handle the curd as required for the conventional cheddar process. When the volume of milk increases it is logical to reduce manual work and drudgery. The adaptation of mechanical principles in

cheese making has grown with the trend of automation in dairy industry. Mechanization in the major stages of making cheese is given below.

1. Curd making

Use of banks of rectangular jacketed cheese vats of about 15000 l capacity using built in swinging stirring units to stir curd-whey mixture after cutting coagulum manually is an accepted practice. Mechanical cutting is now widely used and nylon thread is replacing SS wire in many cases. Vats are fitted with pneumatic or hydraulic tilting gears for emptying the contents.

Besides horizontal enclosed cheese processing tanks, totally enclosed round ended vertical cheese vats with built-in-stirring units usually made of two frame assemblies with angle of the blade in the knife agitator frame is so designed that the assembly acts as cutting knife in one direction and as agitator in the opposite direction. The knives have rotary or linear movement depending on the type of vats. The vertical vats economise space. In enclosed vats many operations like filling, adding starter, renneting, cutting, stirring, scalding and emptying are controlled automatically.

Curd/whey separation and texturing of curd

For the separation of curd pieces from whey various devices are used, viz., troughs with perforated linings, vibrating mesh separator to separate fine particles of curd from whey, rotating screens or simple screens.

The curd conditioning is done by (a) pumping or gravity flow of curd/whey mixture, (b) transfer of curd pieces by vibrating belt or conveyor belt. The stretching and squeezing are affected by belts running at different speeds.

The curd is converted into fibrous slab in cheddar towers where the curd is forced down by the pressure of the succeeding curd into a square bottom cross section, or in a cheddar box with regular turning through 90° every 15 min. milled, salted and filled in moulds and carried on long moving belts.

Hooping, moulding and pressing

The milling of cheddared curd is done by power driven mill and the use of block shaped perforated SS or light non-corrodible plastic moulds. The feeding of the milled curd is done by vibrations, and automatic weighing machine.

The pneumatic, hydraulic or mechanical spring press has replaced the lever type of presses. The demand of close textured cheese has led to the technique of vacuum pressing of cheese. This system sucks out air between the curd particles and eliminates open texture in cheese. The press consists of a chamber of rectangular cross-section fitted with piston at the bottom for compression and extrusion of the pressed curd at the top. The top removable lid can be replaced by cutters to get blocks.. The height of the extruded curd is adjusted to get required size of the block. Vacuum is applied on all the sides of the curd block (about 80 kPa). This is followed after about 10 min, a pre-pressing pressure of about 3,400 kPa for 10 min, raised to about 9,500 kPa leads to a final pressure of 480 kPa on the cheese. The press time varies. Normally, it is 1.5 h under vacuum and 6.5 h under normal pressure.

For brine salting multitier crates are used for lifting, immersing and taking back of small cheese blocks from brine bath. For retail use cheese blocks are cut by using mechanical cutters from variously shaped blocks and film packed with suitable materials.

Several mechanical cheese making systems are available for cheddar, hard and semi-hard varieties and soft cheese.

Continuous Cheese Making

In this system milk is fed at one end of the machine and continuously converted to coagulum, curd and cheese during the passage through the machine. Basically the process consists of application of heat to cold renneted milk in such a manner that curd is formed continuously and then cut for removal of whey and finally ending with cheese.