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# THE TECHNOLOGICAL PROCEDURE OF MILK PROCESSING

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***Abstract:*** *In this article are presented notions regarding the technological flux of producing the pasteurized milk. There are presented the most important stages of the technological process of producing the market milk and their purposes.*
***Keywords:*** *milk technological process, technological procedures, technologic flux*

## 1. INTRODUCTION

The reason why it is of high importance to maintain the initial quality of the milk is its chemical composition - the bacteria inside the milk can destroy the germs only in the first two hours after the milking, the temperature being the main factor that determines the rapid growth of microorganisms in the milk.
Usually, the technological process of obtaining drinking milk, ready for consumption, begins immediately after the milking in the moment when it undergoes some specific normalizing processes followed by the actual processing. [2]
The raw milk delivered to the processing plant must meet the following requirements:
1. to come from farms declared free of tuberculosis and brucellosis;
2. to come from females that do not show symptoms of diseases which can be transmitted to humans through the consumption of raw milk;
3. to have a high degree of freshness with a maximum of 20° T when it comes to acidity, so it can resist to the heat treatment;
4. to have normal organoleptic characteristics (color, taste, smell);
5. to come from females that do not suffer of any visible disease, infection of the genital or digestive system (enteritis with diarrhea or fever) or udder inflammation;
6. to come from females that do not show any wounds on the udder that could affect the milk;
7. to come from females that give less than 2 liters of milk per day.
8. to come from females that have not been under treatments with substances, excepting the milk collected after the waiting period, established by the present veterinary health legislation. [5]
The technological process of obtaining drinking milk includes the following main operations:

- Transport and collection
- Cooling
- Cleansing of the milk from impurities
- Milk normalization
- Homogenization
- Pasteurization
- Packing
- Storing.

The deodorizing is done only when the milk has foreign odors (farmyard manure etc.)

## 2. MATERIAL AND METHOD

### Technologic scheme of milk processing

**Fig. 1** Milk transporting [8]

Collecting and transporting

Qualitative and quantitative reception

**Fig. 2** Milk reception [8]

Cooling

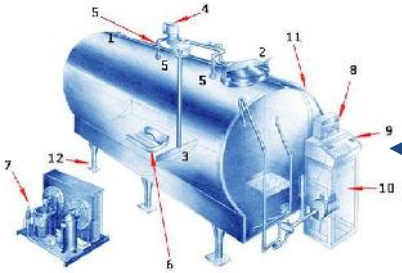

**Fig. 3** Tank for cooling milk [7]

Cleansing of impurities

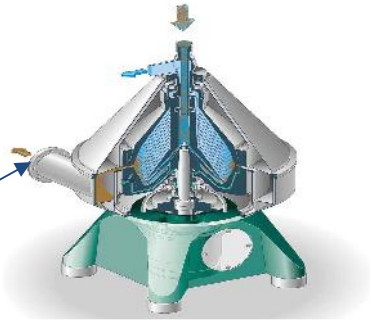

**Fig.4** Centrifuge separator machine [6]

Normalization

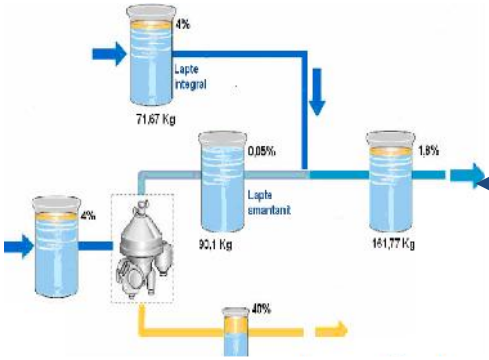

**Fig. 5** Normalization process [7]

Homogenization

**Fig. 6** Milk homogenizer [7]

Pasteurization

**Fig. 7** Plate pasteurizer [6]

Packaging

**Fig. 8** Packaging machine[8]

Storaging

**Fig. 9** Milk storage[6]

## 2.1. Collecting and transporting

**Milk collection points** have a reduced capacity (50-500 kg of milk per collection) and do not allow the cooling, therefore, they do not permit milk storing. The collection point is placed in a central place for the farmers and it facilitates the collection of milk from a smaller region – a village, half a village or a limited number of farmers. In most of the cases, the collecting of milk is performed in the morning or in the evening after the milking and in a well-established time schedule: in the morning with ½ - 1½ hours before the pasturage and in the evening with ½ -1½ after the animal's return at the farm. The collection points have the role of collecting the milk that will later be transported in other places which allow either the cooling, either the processing, shortly after the milking. Practically, the milk should arrive at the collection point two hours after milking. Beside the general conditions that it should meet, the minimal inventory of a collection point must have:

- Special machines to establish the quality of the milk;
- Tanks for milk storing (preferably stainless steel, but one can also use plastic or aluminum containers). [3]

**The milk collection centre** has a greater capacity (1.000-10.000 kg of milk), a larger inventory and it usually allows the filtration, cooling and storing of the milk in proper conditions and for longer periods of time. The collection centre is placed into a building especially designed for such purposes, with well-established circuits meant to assure high hygienic conditions to the milk, but also to the farmers or persons that come to take the milk. The main idea on which the collection centre works is that the milk should arrive to the centre in a maximum of 2 hours after the milking. A centre which is well equipped must permit the cooling of the milk from the initial temperature at which it has been brought to 4°C in a maximum of 3 hours since the collecting. Aside the general conditions that it should meet, a milk collection centre should have:

- Equipment for cooling or adequate means of cooling the milk and an installation (milk tank) for cold storage;
- Machines for establishing the milk's quality.

The milk collection centre must have three circuits:

- The milk's circuit– independent of the centre's design, it has to allow reception, quality testing (permanent or through samples) and measurement of quantity, cooling, storing in milk tanks and pumping the milk in the tank of the transporting vehicle.
- The circuit of the farmers from which the milk is being collected – this circuit must not permit unwashed cans to leave the collection centre.
- The supply circuit which must be separated from that of the farmers and that of the milk which can be found in open recipients. [3]

The raw milk is transferred from the farms to the processing plant with the help of isothermal tanks. The transportation from the producer to the processing farms must be done in the shortest time possible and in conditions meant to preserve the qualities of the raw milk. The way in which the transportation is organized influences the development of the technical process and the quality of the finished products. The milk should be collected from the farms and from the collection centres once or twice a day (corresponding to each milking) and the arrival should be rhythmic, in relation with the capacity of reception, pasteurization and storing.
The tanks are usually divided into two or three separated chambers. In some of the cases, the tanks are filled with the help of void which allows the avoidance of using the pump and it also simplifies the conducts which are a serious source of milk contamination. The tank itself, but also its accessories must be built and assembled in a way which allows an easy and efficient washing. Unlike the use of plastic containers in milk transportation, the use of isothermal tanks presents great advantages like the following:

- it keeps an almost constant temperature of the milk;
- it simplifies the work and reduce the time of loading and unloading;
- it assures higher hygienic conditions; [4]

The only disadvantage is that by introducing inside of a milk tank small quantity of contaminated milk, the entire milk is contaminated. The milk is transported to processing plants or the factories by cans or tanks at specific hours. The transportation must be done in hygienic conditions. When the milk is transported in plastic cans, by car they are covered with wet mats in order to prevent the milk from warming. When it arrives to the processing plant it should not exceed the temperature of 10-13°C.

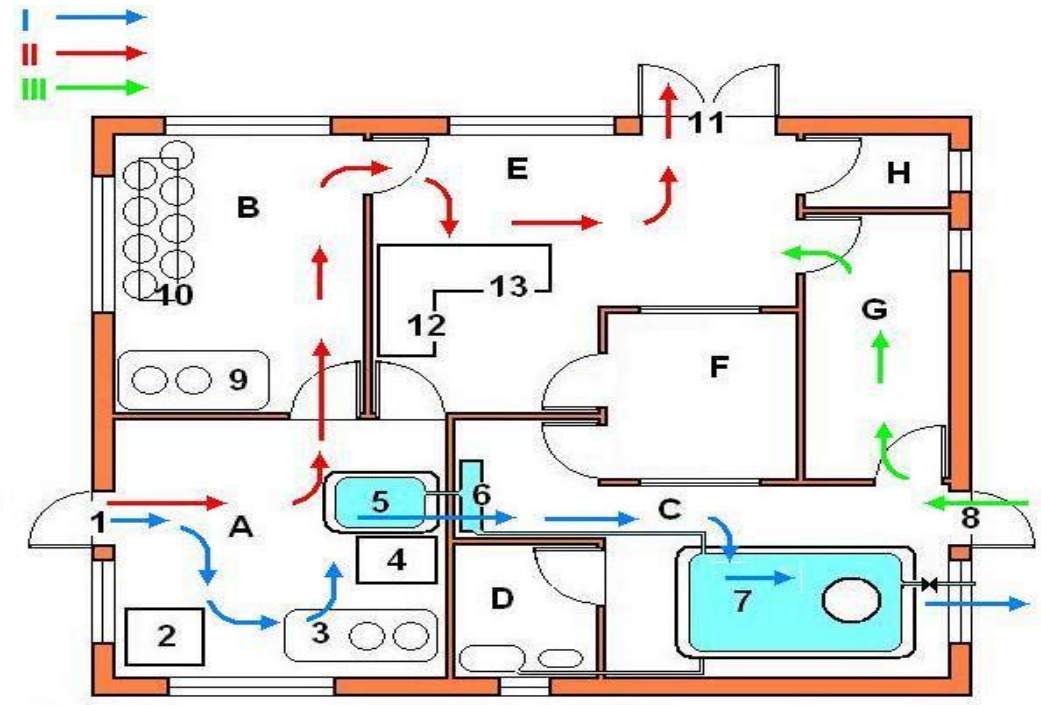


**Fig.10** Sketch of a collection point – collection milk centre [2]

A – reception room;
B – cans washing rooms;
C – tank room;
D – space for cooling instalation;
E – store and desk for registering the delivered milk;
F - centre manager's desk;
G - space for storing the goods sold in the store;

1 - entry for the farmers that bring the milk in plastic cans;
2 – place for milk samples;
3 – place for milk tests;
4 - scale;
5 – temporary milk tank;
6 – unit of milk pre-cooling;
7 – tank for milk cooling and storing;
8- access door for the hoses of tank trucks which retrieve the milk and for supplying the farmer's store with necessary goods;
9- room for washing the cans;
10 – rack for draining and drying the washed cans;
11 - exit door;
12 – shelves for supplying the farmers;
13 – registers containing records the quality and quantity the milk delivered to the centre

## 2.2. Qualitative and quantitative reception

**Qualitative reception**
Considering the fact that the quality of raw milk has a decisive influence in obtaining a high quality product, a great attention is given to the determination of the raw milk's quality.
Qualitative reception includes the following analyzes:

- sensory analysis of milk which is interested in aspect, color, consistency, smell and taste;
- physico-chemical analysis of milk, when are determined the milk's temperature, density, acidity, fat content, total dry matter, non-fat milk solids, degree of contamination with mechanical impurities.
- The microbiological analysis which means the determination of the standard plate count (SPC) and the somatic cells count (SCC). [2]

**Quantitative reception**
The quantitative reception can be done through the following methods:

- gravimetric
- volumetric

Gravimetric measurement – with the help of a weight machine with maximum load of 30 tons.
Volumetric measurement – discontinuous, done by measuring the volume of the milk from the reception tank with the help of a graduated rod or in continuous flux, with a machine for volumetric measurements (meter and galactometer debit) –to avoid measurement errors it is avoided the air penetration in the transportation pipelines. After reception, the milk can be directly sent to processing and in the opposite case it is cooled and stored until the fabrication, after it has been previously cleaned. [2]

**Fig.11** Volumetric measurement of milk [8]


**Fig.12** Gravimetric measurement of milk [6]

## 2.3. Cooling

The rapid and efficient cooling of the milk is essential for preserving the milk's quality. The milk is coming out of the udder with a temperature of 35°C and the milked milk must be immediately cooled. The milk shows a natural resistance against the bacteria immediately after the milking, but only the fast cooling at a temperature between 4°C and 6°C blocks and minimizes the further development of microorganisms. The freshly milked milk, and the milk in general, is an excellent nutritive environment for the growth of microbes, the main factor being the lactic bacteria that exist in the milk or that get inside the milk during or after the milking. The process of cooling the raw milk right after the milking is one of the steps towards respecting the European norms regarding the quality and hygiene of the milk, norms also adopted by România. The freshly milked milk kept at room temperature of 20-25°C, would especially become the perfect environment for the evolution of lactic bacteria, acidifying it or turning it into sour milk, like farmers say. This type of bacteria that enjoy the sugar within the milk (lactose), do not come from inside the udder, but from its skin and its nipples, from the surface of instrument and pots used at milking, from dust, but also from the clothes and hands of the milkers.
Therefore, even though we apply all the correct measures of cleaning the instruments used, a part of the germs will still reach the milk, either in the time of milking, either when the raw milk is being handled. That is why we have to find the way of stopping the growth of germs or of destroying them. The germs are eliminated only by boiling the milk or by raising its temperature until it reaches at least 75°C. However, this thing is almost impossible to be done in the Romanian farms and the solution is to apply a method that at least keeps the germs from multiplying and from producing the acids that affects the milk by turning it into sour milk. This thing can be done through cooling, by bringing the freshly milked milk at the temperature of 4-5°C. [1]

## 3. CONCLUSION

1. The technology of obtaining the market milk must assure the achieving of a product “ready for consumption”, being pasteurized and normalized at a constant fat content.
2.A great attention is given to the determination of the raw milk’s quality, considering the decisive role that the raw milk has when it comes to obtaining a high-quality product.
3. It is important to keep the initial quality of the milk because by its chemical composition the bacteria inside the milk can assure a rapid destruction of the germs only in the first two hours after the milk, the temperature being the main factor that determines the rapid growth of the microorganisms inside the milk.

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