Vishal Kedari.
Ph.D. (Scholar)

Reception of milk

➢ Introduction;

Milk may be delivered to the milk plant or dairy in cans or tankers. The milk in these containers has to be graded, emptied, measured by weight or volume, sampled and bulked to provide continuity of supply to the pasteuring equipment.

It is well known that the sanitary quality of milk on the receiving platform or dock depends on its background on the farm viz., healthy cows clean milk production, clean utensils, freedom from colostrum, prompt cooling and refrigerated transport. However, there is need for systematic and thorough inspection of all milk supplies everyday by conscientious and experienced milk graders.

➢ Points to be consider while reception of milk:

1. When the milk is received at the milk plant or dairy, it should be at 5^0C or below.
2. The milk should be clean, sweet, of pleasant flavor, free from off flavours and reasonably free from extraneous material.
3. Contamination with antibiotics, pesticides and other chemicals is highly undesirable.
4. No abnormal milk should be accepted.
5. Acid development is objectionable, for not only does it indicate an excessive bacterial count, but it also reduces the heat stability of milk.

➢ Milk reception operations:

The operation of receiving milk may be subdivided into:

A. Unloading
B. Grading
C. Sampling
D. Weighing
E. Testing

A. Unloading:

The motor truck carrying the filled milk cans is backed up (or brought aside) to the unloading platform. The milk cans are then unloaded manually.

B. Grading:

This refers to the classification of milk on the basis of quality, for price fixing purposes. It is well known that the quality of the finished product depends on that of the raw material used. The milk grader is the key man for the proper selection of the milk. The principle of grading is based on organoleptic (sensory) tests, such as those for smell (odour), taste, appearance and touch; acidity; sediment, etc. these are included under platform tests.

C. Sampling:

The importance of securing an accurate and representative sample of milk for subsequent chemical and bacteriological analysis cannot be over emphasized. While strict precautions regarding sterility of the stirrer, sampler, container, etc., are required for obtaining a bacteriological sample, dryness and cleanliness of the above equipment should suffice for a chemical sample.

D. Weighing:

This is an essential step in accounting for milk receipts and disposal, making payments for milk, etc.

E. Testing:

Apart from initially accepted or rejected lots of milk, there are always some of doubtful qualities. All the accepted lots have already been properly sampled; these, together with samples of the remaining two categories, have to be tested in the quality control laboratory for the verdict of acceptance or rejection.

Vishal Kedari.
Ph.D. (Scholar)

Quality control tests for milk and their significance

➢ (Platform tests)

Name of test	Purpose
Acidity	To determine final acceptance/ rejection of milk (on the basis of predetermined level)
Ethanol	To determine the heat stability of the milk.
Alcohol-Alizarin	To determine both heat stability and pH of the milk.
COB (clot on boiling test)	To determine the heat stability of the milk.
Dye-reduction test (MBR Or resazurin)	To determine the extent of bacterial contamination and growth in milk.
DMC (Direct microscopic count)	To identify the types of microorganisms present in milk.
SPC (standard plate count)	To determine the extent of bacterial contamination and growth in milk.
Lactometer	To detect adulteration of milk with water.
Freezing point	-do-
Fat and/or SNF	To make payment for milk received.

➢ Chilling/cooling of raw milk (on the farm or at the chilling centre):

Importance:

I. Milk contains some micro-organisms when drawn from the udder; their number increase during subsequent handling.
II. The common milk micro-organisms grow best between 20 and 40^0C.
III. Bacterial growth is invariably accompanied by deterioration in market quality due to development of off-flavours, acidity, etc.
IV. One method of preserving milk is by prompt cooling to a low temperature.
V. Freshly drawn (raw) milk should, therefore, be promptly cooled to5^0C or below and also held at that temperature till processed.

➢ **Methods of cooling:**

1. In can or can-immersion method:

From carrying-pails, the milk is poured directly into cans through a strainer. When the can is full, it is gently lowered into a tank/trough of cooling water.

(**Note:** the water level in the tank should be lower than the level of milk-in-cans, to prevent water entering into the milk.)

Advantages:

I. Not only is the milk cooled, but it also stays cool.
II. A much smaller mechanical refrigeration unit is required.

Disadvantages:

I. It cools the milk very slowly.
II. There is danger of milk contamination in case tank water enters milk-in-can.

2. Surface cooler:

I. This may be plain-conical, spiral or horizontal-tubular in shape, although the last named is now commonly used.
II. The milk is distributed over the outer surfaces of the cooling tubes from the top by means of a distributor pipe or trough and flows down in a continuous thin stream.
III. The cooling medium, mostly chilled water is circulated in the opposite direction through the inside of the tubes.
IV. The cooled milk is received below in a receiving trough, from which it is discharged by gravity or pump.

Advantages:

I. Transfers heat rapidly and efficiently.
II. It is relatively inexpensive.
III. Also aerates the milk, thus improving its flavour.

Disadvantages:

I. Requires constant attention for the rate of flow (which must neither be to slow nor too fast).
II. Greater chances of air borne contamination.
III. Cleaning and sanitization not very efficient.
IV. Slight evaporation losses.

3. In- tank or bulk-tank cooler:

I. This method is used in developed countries.
II. These are properly designed bulk milk tank coolers.
III. These are normally run by mechanical refrigeration system.
IV. System cools the milk rapidly to a low temperature (5^0C or below).
V. It also maintains this temperature during the storage period.

VI. Milk can be poured directly from the milking pail into the tank.
VII. Subsequently milk can be drawn into cans or pumped into a tanker, for dispatch to city dairy.

Advantages:

Permits collection of producer's milk' on alternate days.

Disadvantage:

It is relatively expensive in initial equipment.

4. Milk chilling centre's:

This centre's can provide the only alternative solution to the collection and chilling of village milk. They can profitably run by the producers themselves through their co-operative organizations.

Vishal Kedari.
Ph.D. (Scholar)

➢ Methods of cooling (in the dairy):

As soon as milk is received in the plant, it is chilled to 5^0C or below and stored cool till used, to prevent deterioration in its bacteriological quality during the interim period.

➢ **Methods:**

1. Surface cooler:

Either an individual unit or cabinet type. The latter consist of two or more individual units, compactly assembled and enclosed in a cabinet. It is usually larger than those used on the farm/chilling centre's.

2. Plate cooler:

I. Used for continuous cooling.
II. Used for large scale handling.
III. It consist of number of thin, flat, grooved, stainless steel plates, sealed at the edges with a gasket and clamped tightly within a press.
IV. The spaces between the plates are occupied alternatively by the milk and the cooling medium (chill water/brine).
V. Thus one side of each plate is exposed to milk and the other side to the cooling medium.
VI. Plates may be added to provide increased capacity at nominal cost.

Advantages:

I. Cooling (heat-exchange) is quick and efficient.

II. Not exposed to air borne contamination.

III. No evaporation losses.

V. Cleaning and sanitization is easy.

3. Internal tubular cooler:

I. Used for continuous cooling.
II. It consists of stainless steel tube about 2.5 to 5.0 cm. in diameter surrounded by a similar tube, forming a concentric cylinder.
III. Several such tubes may then be connected in a series to obtain sufficient cooling.
IV. The cooling medium flows counter to the milk flow.

Advantages:

I. Cooling is quite efficient.
II. Not exposed to air borne contamination.
III. No evaporation losses.

Disadvantages:

I. Cooling efficiency is lower than plate cooler.
II. Larger floor space is needed.

4. Jacketed vat/tank:

I. It is used for batch cooling, especially of small quantities.
II. It consists of tank within a tank, with a space between two being used for circulation of the cooling medium, by either pump or main pressure.
III. An agitator is provided to move the milk (which is in the upper tank) for rapid cooling.

Disadvantages:

I. Cooling efficiency is rather low
II. Too much agitation is required, which causes churning and impairs the creaming property of milk.

➢ Storage of milk:

I. Storage tanks are used in milk plants for the storage of raw, pasteurized or processed products, often in very large volumes.
II. Because of the longer periods of holding, storage tanks are among the most important items of equipment.
III. They must be designed for the ease in sanitation, preferably by the circulation- cleaning method.
IV. In addition the tanks should be insulated or refrigerated, so that they can maintain the required temperature throughout the holding period.
V. Agitation should be adequate for homogenous mixing, but gentle enough to prevent churning and incorporation of air.

➢ Objectives of the storage:

I. To maintain milk at a low temperature so as to prevent any deterioration in quality prior to processing/product manufacture.
II. To facilitate bulking of the raw milk supply, this will ensure uniform composition.
III. To allow for the uninterrupted operation during processing and bottling.
IV. To facilitate standardization of the milk.

➢ Types of the storage:

1. Insulated or refrigerated:

In the former there are 5 to 7.5 cm. of insulating material between the inner and outer linings; in the latter, the space between the two linings is used for circulation of the cooling medium. Another variation of the refrigerated type is the cold wall tank.

2. Horizontal or vertical:

While the former requires more floor space and less head space. Modern circulation cleaning methods have made very large vertical storage tanks practical.

3. Rectangular cylindrical or oval:

Of these, the first suffers from the disadvantages of having dead corners during agitation while the other to do not.

4. Built for gravity flow, air pressure or vaccume operation:

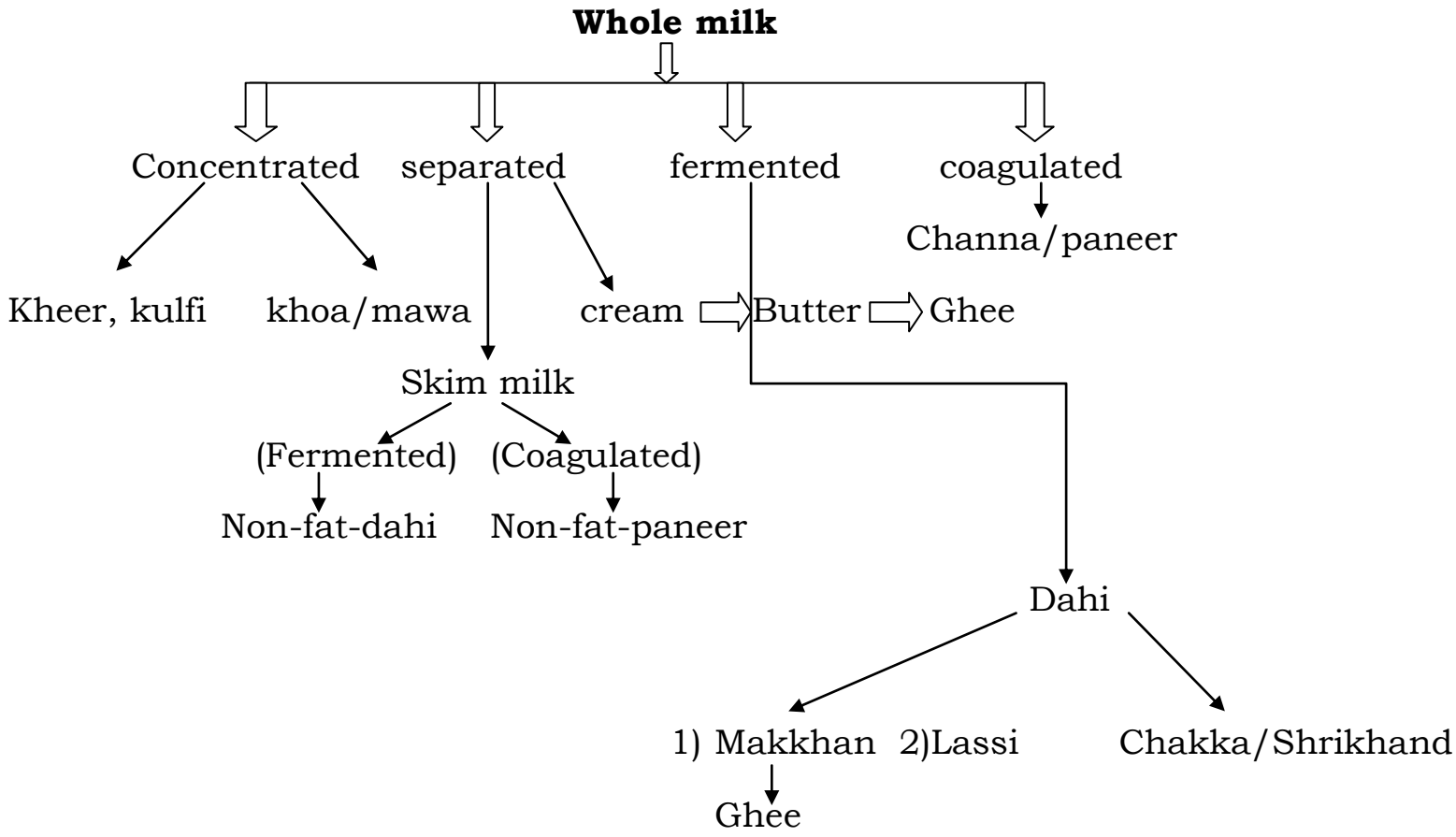
The first is the most common. However, air pressure is sometimes used to evacuate the product. This requires special construction of the storage of greater strength than necessary for normal operation under gravity flow (i.e. atmospheric pressure).

- **Parts of the storage tanks:**

I. Sight glass;
II. Light glass and lamp;
III. Ladder;
IV. Manhole;
V. Agitator;
VI. Outlet valve;
VII. Inlet;
VIII. Air vent;
IX. Safety valve;
X. Legs;
XI. Indicating thermometer;
XII. Volume-meter.

Vishal Kedari.
Ph.D. (Scholar)

Classification of milk products:



Vishal Kedari.
Ph.D. (Scholar)

➢ Present status of dairy industry in India:

1. India ranks first in milk production.
2. Total annual milk production in India has been estimated at 108.5 million tones (2008-09).
3. Today Indian dairy sector is generating estimating revenue of Rs. 68,000 crores with an annual growth rate of 4.5 percent.
4. The per capita milk availability of India is 258 g/day.
5. Livestock population of India viz, population of cattle is 185.2 million buffalo is 64.5 million, sheep is 61.5 million while that of goat is 124.4 million and poultry population of India is 489 million (including ducks, chickens and other birds.)(2003).
6. Total gross domestic product of India is 4,320,892 crore. In which the share of agriculture and livestock sector is given as follows;
    I. Total GDP-4,320,892 crore
    II. GDP (agriculture)- 7,18,278 crore
    III. GDP (livestock)- 1,89,990 crore
7. Percent share of agriculture and livestock sector to the national GDP is 16.62 and 4.40 percent, respectively.
8. Value of the output from livestock sector (2007-08) is given as follows,
    I. Milk-1,62,136 crore
    II. Meat group-40399 crore
    III. Eggs- 8630 crore
    IV. Wool and hair-361 crore
9. Due to the large human population daily per capita milk consumption works out to about 232g/day while that recommended by the medical authorities is 280 g.
10. The main reason for this acute shortage of milk is low milk yielding capacity of the Indian cow and acute shortage of feeds and fodder.
11. Lack of organized milk production and collection, restricted transport facilities (especially refrigerated) and shortage of processing and marketing organizations have greatly hampered the growth of market milk industry.
12. Index number of wholesale price of milk in India (2008-09 is 228.5 and dairy product is 248.4. (base value=100)(Yr.1993-04).

13. Poor quality milk, widespread adulteration and of quality consciousness among the great majority of consumers have further aggravated the situation.

Vishal Kedari.
Ph.D. (Scholar)

Importance of milk and its constituents:

1. Milk is an almost ideal food.
2. It has the high nutritive value.
3. It supplies body building proteins, bone forming minerals and health giving vitamins and furnishes energy giving lactose and milk fat.
4. Besides supplies certain essential fatty acids, it contains the above nutrients in an easily digestible and assimilable form.
5. All these properties make milk an important food for pregnant mothers, growing children, adolescents, adults, invalids, convalescents and patient alike.
6. Cow milk is important for avoiding the memory loss.
7. As the product “panchgavya” prepared from cow milk, which provides better health.
8. Milk is important for the normal growth, health and the energy supply.
9. Milk also provides a balanced diet for all the stages of the growth.

Vishal Kedari.
Ph.D. (Scholar)

Role of the milk and milk constituents:

Nutrients	Purpose
proteins	I. Essential for muscle building and repair II. Gives the body energy and heat.
carbohydrates	Provides body energy and heat.
Fats	Provides body energy and heat.
Minerals	Important for bone, teeth and body cells.
Vitamin A	Important for, I. Normal growth. II. Health of eyes (prevents night blindness). III. Structure and function of skin and mucous membrane.
Vitamin B_1 (Thiamine)	Important for, I. Growth. II. Aids appetite. III. Prevents beriberi, IV. Function of the nervous system.
Vitamin B_2 (Riboflavin)	Important for, I. Growth. II. Health of skin and mouth. III. Functioning of the eyes.
Niacin	Important for functioning of the stomach, intestine and nervous system.
Vitamin C	I. Aids in bone and teeth formation. II. Prevents scurvy.
Vitamin D	I. Aids in calcium absorption which strengthens bone. II. Prevents rickets.

Vishal Kedari.
Ph.D. (Scholar)

Physico-chemical properties of milk:

Sr.No.	Properties	Cow milk	Buffalo milk
1	**Acidity**	0.13 - 0.14%	0.14 - 0.15%
2	**$_{P}$H**	6.4 -6.6	6.7 -6.8
3	**Specific gravity (at 60^0 F)**	1.028 -1.030	1.030 -1.032
4	**Freezing point**	0.547^0C (31.02^0 F)	0.549^0C (31.01^0F)
5	**Boiling point**	100.17^0C	100.17^0C
6	**Colour of milk**	Yellowish creamy white	Creamy white
7	**Refractive index**	1.3440 – 1.3480 at 20^0C temp.	1.3440 – 1.3480 at 20^0C temp.
8	**Specific heat**	0.938 calories at 15^0C, 0.930 calories at 40^0C and 0.920 calories at 0^0C.	
9	**viscosity**	1.5 to 1.7 times more viscous than water. (water-1.005 centipoises at 20^0C)	

Vishal Kedari.
Ph.D. (Scholar)

Legal standard of milk and milk products:

Sr.No.	Particulars	Milk fat%	Milk SNF	Moisture
1	Caw whole milk	3.5 -4.0	8.5	-----
2	Buffalo whole milk	6.0	9.0	-----
3	Goat	3.5	9.0	-----
4	Standardized milk	4.5	8.5	-----
5	Recombined milk	3.0	8.5	-----
6	Tonned milk	3.0	8.5	-----
7	Double tonned milk	Not more than 1.5	9.0	-----
8	Skim milk	0.5	9.3	-----
9	Cream	25	6.80	-----
10	Table butter	Not less 80 %	-----	16% moisture & 1.5% curd
11	Ghee	99 to 99.5	-----	Water not more than 0.5
12	Khoa buffalo	37.1	-----	19.2

Energy supplied by the milk constituents:

Milk constituents	Energy
Milk fat	9.3 C/ gm
Milk proteins	4.1 C/gm
Milk sugar	4.1 C/gm

Vishal Kedari.
Ph.D. (Scholar)

Packaging of milk and milk products:

Introduction

Packaging is the technique of using the most appropriate containers and components to protect, carry, identify and merchandise any product. It constitutes a vital link between the manufacturer and eventual consumer for the safe delivery of the product through the various stages of manufacture, storage, transport, distribution and marketing. In order to deliver fresh, sound and convenient form of milk and to minimize the losses protective packaging is necessary to withstand the hazards of climatic changes, transportation, handling etc. The criteria by which a package is judged are usually the following:

1. It must protect and preserve the commodity from the time it is packed to the point of consumption.
2. It must be suitable for the chosen selling and distribution system.
3. It must be attractive to the consumer, easy to open, store and dispose.
4. It must cost no more than the market can bear.

Definition

Packaging means placing a commodity into a protective wrapper or container for transport or storage.

Functions

Package has a three fold functions of containing, protecting and merchandising:

a. To contain the product

Package should be large one with proper constructional features so as to avoid leakage and spoilage. It should be as compatible as possible with the product and finally it should have enough strength to withstand handling, transportation and storage hazards.

b. To protect the product

Protection of the product against contamination or loss and damage or degradation due to microbial action, exposure to heat, light, moisture and oxygen, evaporation etc.

c. To help in selling the product

The shape of the package should be favorable to dispensation and reclosure and to its disposal and reuse.

Present status of the packaging industry:

In developed countries packaging industry has met tremendous advances. With newer marketing systems like super markets, self services stores etc packaging technology in these countries has risen to great heights. Newer and better packaging materials, development of packaging machinery and appliances have all advanced in an integrated manner. In developing countries like India, packaging is still in its infancy.

Packing materials and forms

Following are the packing materials used,

A) Materials

a. Paper and paper based products

The papers are used commonly in the form of wrappers, cartons, boxes, bags etc. The merits of paper are its relative weightlessness,

low cost and easy disposal, its availability in various types etc while disadvantages are it is of low tear and wet-strength (unless treated or coated).

b. Plastics

A wide variety of rigid plastics can be used as thermoformed, such as bottles, cartons etc. Flexible plastic packaging films are used as wrappers/bags/pouches. These are of two types namely low polymers which include cellophane (coated with polyethylene) and high polymers which includes polypropylene, polystyrene, polyester etc. The merits of rigid plastic containers are its low cost and ease of fabrication, and demerits are lack of product compatibility, plastic deterioration, lack of resistance to high heat and fragility at low temperatures.

c. Aluminum foil

Aluminum foil has good barrier properties, is greaseproof, non-sorptive, shrink-proof, odorless and tasteless, hygienic, non-toxic, bright in appearance etc. The common thickness of this medium for use in products is 0.012 to 0.015mm. Disadvantages are it has low tear strength, is attacked by certain strong alkalis and acids, and it does not heat-seal by itself**.**

d. Timber

Timber is used in the form of box, tub or barrel. It should be free from odour, have an attractive appearance and necessary mechanical strength. It may be treated with casein-formalin, or spread with paraffin-wax or plastics, to make it more water resistant and prevent the passage of the timber-taint to butter.

e. Glass

Glass may be transparent or opaque. Used in the form of bottles, jars, jugs etc. Glass has the merits of strength, rigidity, and an

excellent gas and water vapour barrier while the disadvantage is of heavy weight and fragility.

f) Tinplate

This consists of a thin sheet (0.025mm thick) of mild steel coated on both sides with a layer of pure tin. Tinplates have the merits of good strength, excellent barrier properties while the demerits are of high cost, heavy weight, difficult reclosure and disposal. It is used in the form of cans.

g) Laminates

Laminations are made for following reasons: To further strengthen the film material; to improve barrier properties; to improve grease-resistance; to provide a surface that will heat-seal; etc. Some typical laminates are paper polythene, cellophane-polythene, and polyester-polythene.

B. Forms

a. Bottle

I. The glass bottle still continues to be the most frequently used package for milk in the world.

Advantages*:*

II. Light in weight, easy to handle and no danger of breakage.
III. Lower distribution cost.
IV. Effective sales message can be printed.
V. No exposure to sunlight.
VI. Tamper-proof.
VII. Filling machinery compact and occupies less space.

Disadvantages*:*

I. Difficult to remove cream.
II. Regular supply of special paper/film necessary.

III. Difficult to open.
IV. In some of the cases leakage may occur.
V. Costs higher per unit milk distributed.

a. Cartons

Cartons play a significant role in the bulk packaging of milk. Cartons are commonly used for liquid, frozen and coagulated milk products. They are commonly available either as performed containers or as precut blanks ready to be formed into containers.

b. Cup

It is made up of paper with wax or plastic coating on the inside. It is used for frozen and coagulated products.

c. Sachet/pouch

The bags may be formed from either a reeled or flat film. Generally it is a form/seal system. Ultra-violate light may be used to sterilize the film.

d. Can

This is a commonly used for all types of solid, semi-solid and powdered products. Recently aluminum cans have been introduced. Cans are the most convenient for gas packing.

e. Barrel

Commonly made of wood and coated with wax on inner surface. Used for bulk packaging of sweetened condensed milk, semi-solid buttermilk etc.

f. Collapsible tube

It is made up of aluminum and lacquered on the inner side. Its merits are low cost, light weightiness, is of handling, product

protection etc. It is used for semi-fluid products such as sweetened condensed milk, processed cheese spread etc.

Standardization in packaging

With rapid industrialization and improvement in transportation methods, packaging standards would have to be reviewed periodically so as to affect an economy in packaging-which is so vital, particularly in international trade.

Vishal Kedari.
Ph.D. (Scholar)

METHODS OF MILK PRESERVATION:

1. Milk is highly perishable item. The keeping quality of fresh milk is only 5-6 hours, unless proper steps are taken to preserve the quality.
2. The major cause for spoilage of milk is due to the action of micro organisms on lactose yielding lactic and other acids, causing increased acidity milk.
3. The milk with high acidity can't tolerate heat and so coagulates on heating. When the milk acidity reaches 0.6% acidity, milk coagulates at room temperature without heating.
4. The principle involved in the preservation of milk is only to destroy the micro organisms or obstructing the microbial growth, so that acidity development is stopped or slowed down. The various methods of

1. By Cooling the Milk:

The most of the micro organisms present in milk are mesophillic i.e. they grow well at 20 – 40oC. By cooling the milk to refrigeration temperature i.e. 5-10^{o}C, the multiplication of micro organisms can be restricted. Only psychrophils will grow, so the acidity development is at slower rate. This table shows the bacterial growth factor in milk at different temperature.

* multiply initial count with the above factor to get final microbial count. That is why milk should be cooled to 5oC to maintaining the quality.

2. By Heating:

By heating the milk, the micro organisms will be killed. The various micro organisms are destroyed at different temperatures. Pasteurization temperatures will kill cent percent pathogenic micro organisms and 98 – 99% of spoilage micro organisms. Boiling of milk will kill all the micro organisms, except spores. The effect of heat is discussed well in chapter 3.

3. **By addition of Chemicals:**
    1. Preservatives are the chemicals, which when added to milk at small concentrations will inhibit the microbial multiplication by interfering the metabolism path way of micro organisms or by neutralizing the acids produced.
    2. The various preservatives are sodium carbonate, sodium bicarbonate, Formaline / formaldehyde, Boric / Benzoic acids, salicylic acids etc.
    3. Antibiotics will also inhibit microbial growth. Microbial antibiotics like nisin, acidophillin etc will also inhibit microbial growth.

Lactoperoxidase System:

It is also known as cold sterilization. This system contains three components i.e. thiocyanate, Hydrogen peroxide – Lactoperoxidase. Milk contains natural Lactoperoxidase enzyme. Thiocyanate and hydrogenperoxides are added at 30: 70 ppm levels will activate the Lactoperoxidase system.

Vishal Kedari.
Ph.D. (Scholar)

INTERNATIONAL REQUIREMENT FOR EXPORT OF THE DAIRY PRODUCTS:

Key Areas of Concern in the Dairy Industry:

Most of the dairy plants in the Government, Cooperatives and Private Sector produce almost similar dairy products like varieties of milk, butter, ghee, skimmed milk powder and whole milk powder. There are 7 large-scale cheese manufacturers and 14 manufacturers are producing infant foods and malted milks. There is immense scope for the broadening of the products range and some of the products, which are likely to have considerable demand in the coming decade, have been identified. The cheese market, presently valued at about Rs.80 crore is growing at about 9% annually. There are more than thousand varieties of cheese, which have been listed out of which cheddar; mozzarella, Gouda and processed cheeses are being manufactured in India. Pizza is becoming a very popular item in the market. This segment alone commands 5% of the share in the cheese market and other area is fermented milk products. Dahi even though is an Rs.15000 crore markets, the share of the organized sector is only around 10%. This product has immense potential for growth. Varieties of milk shakes are also increasing wherein milk and fruit pulp are mixed in different proportions to produce different beverages. Some of the milk and fruit based beverages which are likely to have demand are a combination of milk with mango, banana, sapota, strawberry, papaya, etc. Some of these beverages can also be produced in dehydrated form and can be an excellent health food. There are varieties in traditional milk based sweets, manufactured in the country. The market size is around Rs.12000 crore. However, there are very few nationally known brands in this category. Many of the organized dairies are involved in the manufacture of varieties of milk based sweets: pedha, paneer, shirkhand, etc. These are now restricted to certain areas only but can go national. As the world is getting integrated into one market, quality certification is becoming

essential in the market. However, there are very few plants in the country, which have successfully obtained ISO, HACCP certification. There is scope for introducing newer plants adopting newer processes by the dairy industry in the country. Packaging of dairy products is also another very promising area. NRI and overseas investments can take place in manufacturing dairy processing equipment, fruit packaging equipment and equipments for biotechnology related dairy industry

(i) Competitiveness cost of production, productivity of animals etc.:

The demand for quality dairy products is rising and production is also increasing in many developing countries. The countries which are expected to benefit most from any increase in world demand for dairy products are those which have low cost of production. Therefore, in order to increase the competitiveness of Indian dairy industry, efforts should be made to reduce cost of production. Increasing productivity of animals, better health care and breeding facilities and management of dairy animals can reduce the cost of milk production. The Government and dairy industry can play a vital role in this direction.

(ii) Production, processing and marketing infrastructure:

If India has to emerge as an exporting country, it is imperative that we should develop proper production, processing and marketing infrastructure, which is capable of meeting international quality requirements. A comprehensive strategy for producing quality and safe dairy products should be formulated with suitable legal backup.

(iii) Focus on buffalo milk based specialty:

Dairy industry in India is also unique with regard to availability of large proportion of buffalo milk. Thus, India can focus

on buffalo milk based specialty products, like Mozzarella cheese, tailored to meet the needs of the target consumers.

(iv)Import of value-added products and export of lower value products:

With the trade liberalization, despite the attempts of Indian companies to develop their product range, it could well be that in the future, more value-added products will be imported and lower value products will be exported. The industry has to prepare them to meet the challenges.

(v) Provisions of SPS and TBT:

At the international level, we have to ensure that provisions of SPS and TBT are based on application of sound scientific principles and should become defactobarriers to trade.

Vishal Kedari.
Ph.D. (Scholar)

Classification and composition of milk products:

1. **Milk and whey drinks:**
    I. Flavoured milk.
    II. Whey drink.
2. **Milk based drinks:**
    I. Kheer.
    II. Palpayasam (Basundi).
    III. Palada.
3. **Frozen products:**
    I. Ice-cream.
    II. Kulfi.
4. **Coagulated milk products:**
    I. Channa.
    II. Paneer.
    III. Paneer pickle.
    IV. Rasogolla.
5. **Fermented milk products:**
    I. Dahi.
    II. Chakka.
    III. Cheese.
    IV. Yoghurt.
    V. Shrikhand.
6. **Concentrated milk products:**
    I. Khoa- (khoa based products):
        a) Burfi.
        b) Pedha
        c) Gulabjamun.

7. Fat rich dairy products:

I. Cream.
II. Butter.
III. Ghee.

8. Dried milk products:

I. Whole milk powder.
II. Skim milk powder.
III. Dairy whitener.
IV. Weaning food.
V. Infant formula.
VI. Butter powder.
VII. Cheese powder
VIII. Ice-cream mix powder.
IX. Malted milk powder.

Vishal Kedari.
Ph.D. (Scholar)

Pasteurization

History

The term pasteurization has been coined after the name of Louis Pasteur of France, who in 1860-64 demonstrated that heating wine at a temperature between 122 to 140^{0}F killed the spoilage organisms and help in its preservation. The application of this process gives rise to the new term pasteurization.

Definition

The term pasteurization, as a applied to market milk today, refers to the process of heating every particle of milk to at least 63^{0}C for 30min, or 72^{0}C for 15sec (or to any temperature-time combination which is equally efficient), in approved and properly operated equipment. After pasteurization, the milk is immediately cooled to 5^{0}C or below.

Objectives

To improve the keeping quality of milk by destroying almost all spoilage organisms and to render milk safe for human consumption.

Objections

i. Pasteurization encourages slackening of efforts for sanitary milk production;

ii. It may be used to mask low-quality milk;

iii. It reduces the "Cream line" or "Cream volume";

iv. It diminishes significantly the nutritive value of milk;

v. Pasteurized milk will not clot with rennet;

vi. Pasteurization may be carelessly done; it gives a false sense of security;

vii. It fails to destroy bacterial toxins in milk;

viii. In India this is not necessary as milk is invariably boiled.

Methods of pasteurization

1. In-the-bottle pasteurization

In this case bottles filled with raw milk and tightly sealed with special caps are held at 63 to 66^{0}C for 30min. Then the bottles passed through water space of decreasing temperature, which cool both the product and the bottle. In this case there is greater risk of bottle breakage also special types of water-tight caps required to be used. One of the advantages is that it prevents the possibility of post- pasteurization contamination.

2. Batch/Holding pasteurization/Low temperature long time method

In this case the milk is heated to 63^{0}C for 30min and promptly cooled to 5^{0}C or below and thus heating is done indirectly. The heat moves through a metal wall into the product for heating, and out of the product for cooling. The Pasteurizer may of 3 types.

i. Water-Jacketed vat

ii. Water-Spray type

iii. Coil-vat type

3. High temperature short time (HTST) pasteurization

In this case large volumes of milk are handled and it gives a continuos flow of milk which is heated to 72^0C for 15 sec and promptly cooled to 5^0C or below.

Advantages

I. Capacities to heat treat milk quickly and adequately, while maintaining rigid quality control over both the raw and finished product;
II. Less floor space required;
III. Lower initial cost;
IV. Milk packaging can start as soon as pasteurization begins, thus permitting more efficient use of labour for packaging and distribution;
V. Easily cleaned and sanitized;
VI. Development of thermopiles not a problem;

Disadvantages

I. Complete drainage is not possible;
II. Great accumulation of milk-stone in the heating section.
III. Pasteurization efficiency of high-thermoduric count raw milk is not as great as it is when the holder system is used.

1. Electric pasteurization

In this technique of pasteurization high voltage electricity is used for the further process,

2. Vacuum pasteurization

This refers to pasteurization of milk and there reduced pressure by direct steam. The equipment used is termed as 'Vacreator' and the process hence is known as 'Vacreation'

3. Stassanization

This method consists of tubular heat exchanger consisting of 3 concentric tubes. The principle of its operation is the heating of milk to the desire temperature by passing it between two water-heated pipes through the narrow space of 0.6 to 0.8 mm. The milk is heated to above 74^0C for 7sec and promptly cooled as usual.

4. Ultra high temperature pasteurization

This method consists of temperature-time combinations of 135 to 150^0C for no hold (a fraction of second). The success of this method depends on immediate aseptic packaging.

5. Uprization

Uprization term means 'Ultra- pasteurization' where in milk is heated with direct steam up to 150^0C for a fraction of second and thus the process is continuos.

6. Flash pasteurization

In earlier days, this term was used for what is today called 'HTST'.

The formulation of the standards of pasteurization includes following points.

Bacterial destruction

Mycobacterium tuberculosis, being considered the most heat resistant among packages, was chosen as the index organism for pasteurization.

Cream line reduction

The cream line is reduced progressively with increase in the temperature-time of heating.

Phosphatase inactivation

It includes the complete destruction of Phosphatase by pasteurization. The phosphatase test is used to detect inadequate pasteurization.

Thus the standards of pasteurization were made so as to insure complete distraction of pathogens, negative phosphatase test and least damage to the cream line.