



Learning Science via Standards



Packaged Pasteurized Milk



IS 13688

GM/L-XXXXXXXXXX

Lesson 25
July 2023



Nurturing Young Minds as Ambassadors of Quality and Standards



Foreword

Everything around us, whether natural phenomena or manmade products can be explained through science. The product which are used in our daily life are outcome of conscious efforts by the mankind to fulfil and exceed the needs of the present and demands of the future. Students are taught science as part of their school curriculum, to enable them to understand the various scientific laws and principles and also to inculcate the habit of exploring the world through the lens of science. Quality characteristics of any product or service are decided based on the stated and implied needs and are generally described in a document called 'Standard'. Science and standards are inseparable and integral aspect of any product.

Bureau of Indian Standards (BIS), the national standards body of India, is mandated for establishment and promotion of standards and creating a quality ecosystem in the country. This is achieved through developing Indian Standards on products and services through the active involvement of relevant stakeholders and dissemination of information of such standards for their use and implementation across all sectors of economy. Academia, as an important stakeholder of BIS, has been contributing towards development of standards through research activities and providing inputs related to technological advancements in product development, their characteristics and use as well as methods of tests. BIS, on its part has also been promoting standards in academia through a variety of programmes. This has since been institutionalized in the form of "Standards Clubs" which are being established in educational institutions across India to nurture the young minds as ambassadors of quality and standards and prepare them for dealing with these aspects in future.

In this initiative of BIS, called "Learning Science via Standards", a series of Lesson Plans are made elaborating the various scientific concepts, laws and principles to help students understand their practical applications via standards. The series comprises of a variety of subjects for insights into the scientific laws and principles and relating them to the quality characteristics of products used in day-to-day life. First 10 Lesson Plans in the series are released on the occasion of World Consumer Rights Day on 15 Mar 2023. Second Set of 10 Lesson Plans were released on 10 Jun 2023 by Hon'ble Minister of State during the Governing Council Meeting of BIS.

The Lesson Plans are expected to serve as a useful tool for the teaching fraternity for imparting knowledge on scientific laws and principles through their practical applications in activities and products around us and facilitate an interactive learning experience for the students.



Packaged Pasteurized Milk

Milk is a natural liquid that comes from healthy milk-producing animals. It should not have anything added or removed from it, and it should not contain colostrum, which is the early form of milk. If the milk's fat or non-fat content is adjusted, it can still be called "milk" as long as it meets the specific requirements for that type of milk.



Packaged pasteurized milk has a rich history that traces back to the origins of milk consumption itself. For centuries, milk has been an essential part of the human diet, providing vital nutrients and sustenance. However, ensuring the safety and quality of milk posed significant challenges until the development of pasteurization.

The process of pasteurization, pioneered by Louis Pasteur in the 19th century, revolutionized the milk industry. Pasteurization involves heating milk to a specific temperature and then rapidly cooling it to eliminate harmful bacteria, ensuring a safer product for consumers. This breakthrough in milk processing allowed for its preservation and extended shelf life, opening doors to mass production and distribution.

As technology advanced, the dairy industry embraced the concept of packaged pasteurized milk. This innovation involved collecting milk from healthy milch animals, subjecting it to pasteurization, and then packaging it in containers that maintained its freshness and quality. The inclusion of machinery, equipment, and appliances for milk collection, pasteurization, cooling, and bottling facilitated the efficient production and storage of milk.

Over time, the production and consumption of packaged pasteurized milk have evolved. The introduction of adjusted milk, which is milk with modified milk fat or milk solid-not-fat content, expanded the range of milk products available to consumers. Additionally, recombined milk, made by combining preserved milk fat and milk-solids-non-fat, and reconstituted milk, created by adding water to dried or concentrated milk, further diversified the market.

Today, packaged pasteurized milk continues to be a staple in households worldwide, ensuring a safe and reliable source of essential nutrients. From its humble origins to its evolution driven by technological advancements, packaged pasteurized milk has become an integral part of our modern food industry, delivering the benefits of milk while prioritizing safety and convenience for consumers.

1. Types of Milk: Exploring Milk Varieties

By understanding the various types of milk, we can appreciate the diverse options available to meet different preferences and nutritional needs. Each type of milk has its own composition and characteristics, providing consumers with a range of choices to suit their individual requirements.



a) Species Identified Milk: Species identified milk refers to milk obtained from specific animals such as buffalo, cow, goat, sheep, or camel. The fat and solids-not-fat (SNF) content of this milk should adhere to the respective composition standards for each species.

b) Mixed Milk: Mixed milk is a combination of different species identified milk. The fat and SNF content of mixed milk should have a percentage of 4.5 and 8.5 respectively. It should remain homogeneous for about 6 hours without any deposition of solids.

c) Full Cream Milk: Full cream milk is milk that has been standardized to contain a minimum fat percentage of 6.0 and a minimum solids-not-fat percentage of 9.0 through the adjustment of fats or milk solids. It should remain homogeneous for about 6 hours without any deposition of solids.



d) Standardized Milk: Standardized milk is milk that has been adjusted to have a fat percentage of 4.5 and a solids-not-fat percentage of 8.5. It should remain homogeneous for about 6 hours without any deposition of solids.



e) Toned Milk: Toned milk is milk that has been standardized to have a minimum fat percentage of 3.0 and a minimum solids-not-fat percentage of 8.5 by adjusting or adding milk solids and milk fat. It should remain homogeneous, and deposition of solids may occur.

f) Double Toned Milk: Double toned milk is milk that has been standardized to have a minimum fat percentage of 1.5 and a minimum solids-not-fat percentage of 9.0 through the adjustment or addition of milk solids and milk fat. It should remain homogeneous, and deposition of solids may occur.

g) Skimmed Milk: Skimmed milk is milk from which most of the milk fat has been mechanically removed. It should not have more than 0.5 percent fat and the solids-not-fat should not be less than 8.7 percent. It should remain homogeneous, and deposition of solids may occur.

h) Recombined Milk: Recombined milk is a product made by combining preserved milk fat and milk solids-not-fat, with or without the addition of potable water, to achieve the desired characteristics and composition of a specific type of milk. The milk solids-not-fat used in recombined milk must come from dried or concentrated milks only.

j) Reconstituted Milk: Reconstituted milk is a product obtained by adding potable water to dried or concentrated milk



in the appropriate amount to restore the desired water-to-solids ratio and achieve the desired characteristics and composition of a specific type of milk.

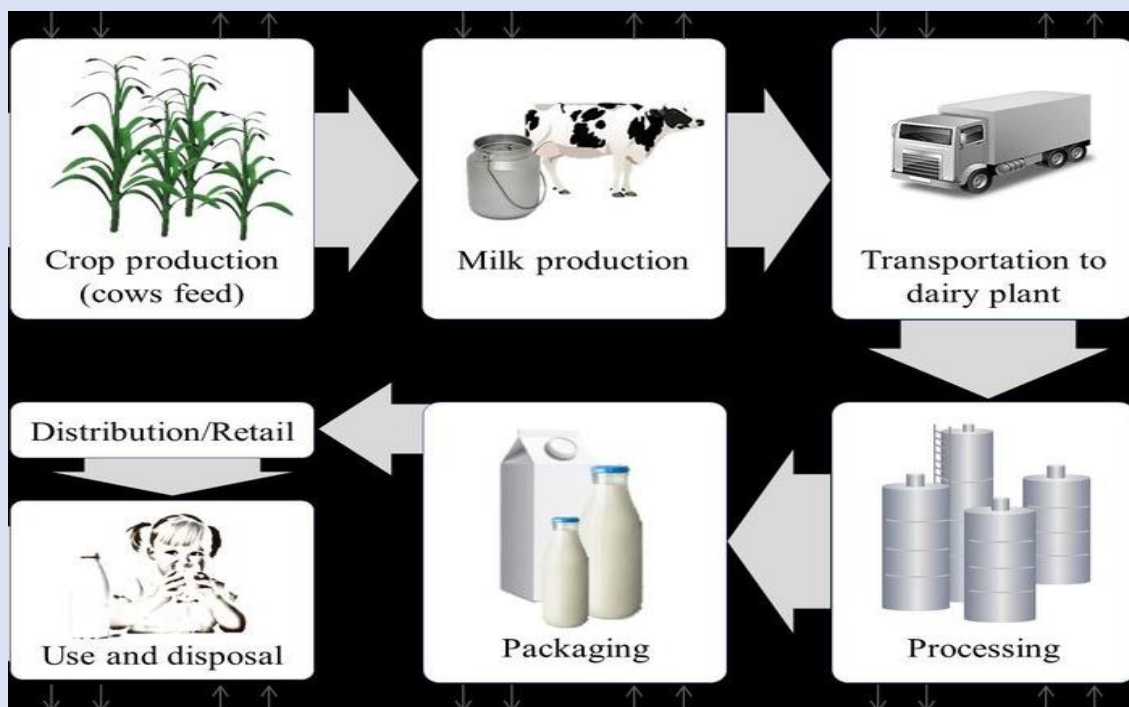
2. Sources and Production Process of Milk

Cow's milk is the primary source of commercial milk production, accounting for approximately 85% of global milk production according to FAO (Food and Agriculture Organization) estimates in 2011. While milk can be produced by females of all mammal species, cows are the most commonly utilized for commercial milk production.

Milk production begins with the consumption of feed by milk-producing animals, typically provided by farmers. The milking process can be done manually or with the assistance of milk extractors, either manually operated or automatic.

The raw milk is collected at community collection centres, and individual farmers or primary milk producers transport their milk to local dairies or processing plants. At the processing plant, the collected milk undergoes primary processing.

To make it suitable for retail sale, the milk is packaged in various sizes of pouches or bottles, such as 100ml, 500ml, and 1000ml. These packaged milk products are then dispatched to market retailers using transportation trucks equipped with temperature-maintaining provisions.



3. General Properties of Milk:

Milk is an emulsion or colloid of butter fat globules within a water-based fluid that contains dissolved carbohydrates and protein aggregates with minerals.

a) **pH:** The pH of milk ranges from 6.7 to 6.9.

b) **Lipids:** Milk fat is secreted in the form of a fat globule surrounded by a membrane. Each fat globule is composed almost entirely of triacylglycerols and is surrounded by a membrane consisting of complex lipids such as phospholipids, along with proteins.

c) **Milk Solid-Not-Fat (SNF):** The substances in milk other than water and butterfat are termed as Solids-Not-Fat (SNF). It is a residual component left after the complete evaporation of water from milk. SNF in milk includes lactose, vitamins, calcium, minerals, fat, protein and other nutrients. These contribute significantly to the nutritive value of milk.

d) **Proteins:** Normal bovine milk contains 30–35 grams of protein per liter of which about 80% is arranged in casein micelles. Total proteins in milk represent 3.2% of its composition.

e) **Caseins:** The largest structures in the fluid portion of the milk are "casein micelles": aggregates of several thousand protein molecules with a superficial resemblance to a surfactant micelle, bonded with the help of nanometer-scale particles of calcium phosphate. Each casein micelle is roughly spherical and about a tenth of a micrometer across. There are four different types of casein proteins: α s1-, α s2-, β -, and κ -caseins. The ratio of caseins to whey proteins varies greatly between species; for example, it is 82:18 in cows and around 32:68 in humans.

f) **Salts, minerals, and vitamins:** Minerals or milk salts, are traditional names for a variety of cations and anions within bovine milk. Calcium, phosphate, magnesium, sodium, potassium, citrate, and chloride are all included. Vitamins A, B₆, B₁₂, C, D, K, E, thiamine, niacin, biotin, riboflavin, folates, and pantothenic acid are all present in milk.

g) **Calcium phosphate structure:** The trapped calcium phosphate is in the form of $\text{Ca}_9(\text{PO}_4)_6$; whereas others say it is similar to the structure of the mineral brushite, $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$.

h) **Sugars and carbohydrates:** Milk contains several different carbohydrates including lactose, glucose, galactose, and other oligosaccharides. Lactose is a disaccharide composite of two simple sugars, glucose and galactose. Bovine milk averages 4.8% anhydrous lactose, which amounts to about 50% of the total solids of skimmed milk.

i) **Miscellaneous contents:** Other components found in raw cow's milk are living white blood cells, mammary gland cells, various bacteria, vitamin C, and a large number of active enzymes.

Activity1: Exploring Milk Consumption Habits Across Age Groups

Objective: Engage students in a discussion about milk consumption habits among different age groups.

Instructions:

- i. Divide students into small groups.
- ii. Assign each group an age group for discussion purpose (e.g., infants, children, adolescents, young adults, middle-aged adults, older adults).

- iii. Discuss variations in milk consumption patterns within the assigned age group.
- iv. Explore specific nutritional needs and benefits of milk for that age group.
- v. Consider cultural and regional factors influencing milk consumption.
- vi. Identify challenges and considerations related to milk consumption in that age group.
- vii. Groups present their findings to the class.
- viii. Encourage open discussion and allow for questions and additional insights.
- ix. Summarize main points and highlight the importance of milk in different stages of life.
- x. Emphasize the significance of a balanced diet and milk as a valuable nutrient source.

Note: Teacher guidance and support during group discussions is essential.

Activity2: Exploring the Health Benefits of Milk

Objective: The objective of this activity is to engage students in a discussion about the health benefits of milk, promoting awareness of its nutritional value and importance in a balanced diet.

Instructions:

- i. Divide the students into small groups of 3-4 members.
- ii. Provide each group with a set of index cards or small pieces of paper.
- iii. Instruct each group to brainstorm and write down as many health benefits of milk as they can think of on separate index cards.
- iv. Encourage the groups to think about the various nutrients present in milk and how they contribute to overall health.
- v. After 5-10 minutes of brainstorming, gather all the index cards from each group.
- vi. Shuffle the index cards and distribute them randomly among the groups.
- vii. Instruct each group to read the health benefits listed on the index cards they received and discuss the importance of each benefit.
- viii. Encourage the groups to share personal experiences or examples related to the health benefits of milk.
- ix. After 10-15 minutes of discussion, reconvene as a whole class.
- x. Ask each group to share one health benefit from their index cards and explain why it is significant.
- xi. Facilitate a class discussion on the collective health benefits of milk, emphasizing the following points: a) Calcium and strong bones b) Protein for



muscle growth and repair c) Vitamins and minerals for overall health d) Benefits for dental health e) Role in hydration and electrolyte balance

xii. Allow students to ask questions and share additional health benefits they may have thought of.

xiii. Summarize the main health benefits of milk discussed during the activity.

xiv. Conclude the activity by reinforcing the importance of including milk in a balanced diet for overall health and well-being.

Note: The teacher should provide guidance and support during the group discussions, ensuring that students stay focused on the topic and promoting active participation from all group members.

4. Pasteurization

Pasteurization is a mild heat treatment developed by Louis Pasteur in 1860. Pasteurization of milk is the process of heating milk of different classes to at least 63°C (sixty three degree centigrade) and holding at such temperature continuously for at least 30 minutes or heating it to at least 71.5°C (seventy one point five degree centigrade) and holding at such temperature continuously for at least 15 seconds or an approved temperature time combination that will serve the purpose of enhancing its shelf life. Pasteurization is used to kill harmful pathogenic bacteria such as *M. paratuberculosis* and *E. coli* by heating the milk for a short time and then immediately cooling it.

a) Heating of milk – Hot water, or occasionally low-pressure steam, is used as the heating medium to heat milk. A certain amount of heat is transferred from the heating medium to the milk so that the temperature of the latter rises and the temperature of the heating medium drops correspondingly.

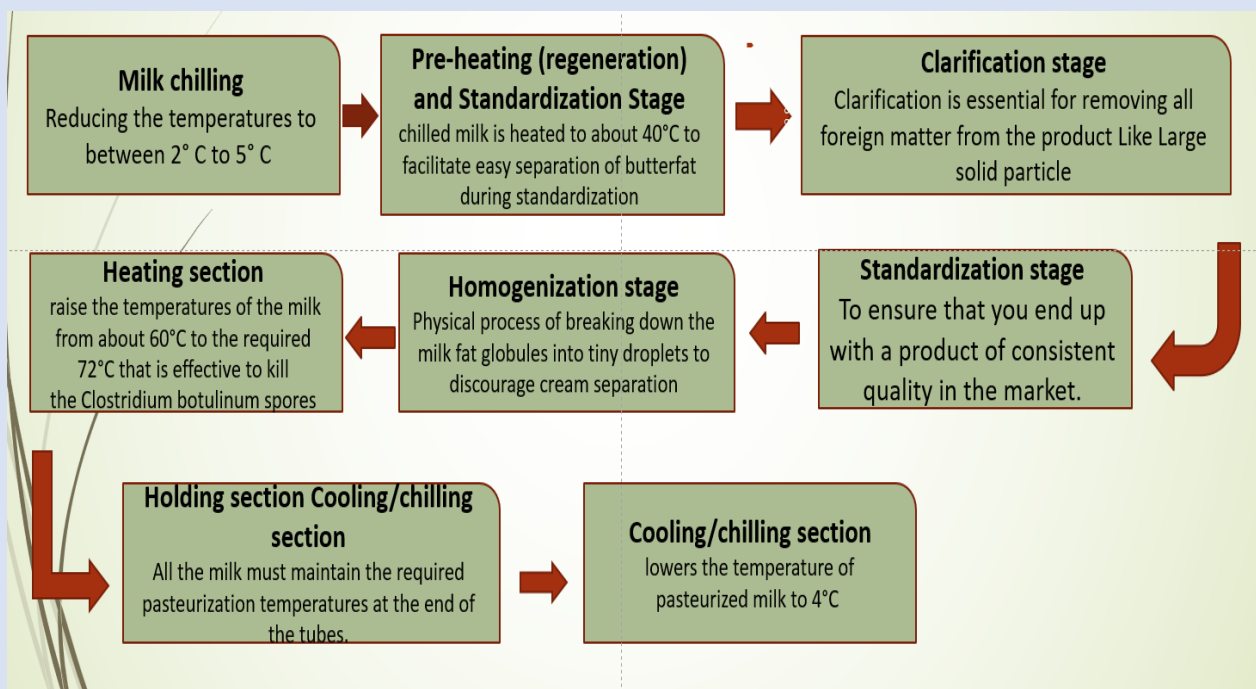
b) Cooling of milk – Directly after arrival at the dairy, the milk is often cooled to a low temperature (5°C or lower), to temporarily prevent growth of microorganisms. Following pasteurization, the milk is also cooled again to about 4°C. If naturally cold water is at hand, it may be utilized for pre-cooling after pasteurization and regenerative heat exchange. In all cases, heat is transferred from the milk to the cooling medium. The temperature of the milk is reduced



to the desired value and the temperature of the cooling medium rises correspondingly. The cooling medium may be cold water, ice water, brine solution or an alcohol solution, such as glycol.

c) Steps of Pasteurization

Starting with raw milk, the steps of pasteurization include heating the milk to a specific temperature (usually around 72°C or 161°F) and holding it at that temperature for a set time (typically 15 to 30 seconds). Afterward, the milk is rapidly cooled to a safe temperature for packaging and distribution as described below:



d) Methods Used in Milk Pasteurization

i) High-Temperature Short Time (HTST) Pasteurization/Flash pasteurization: Flash pasteurization involves heating milk to 71.7°C for 15 seconds to kill *Coxiella burnetii*, which is the most heat-resistant pathogen in raw milk. Flash pasteurized milk will keep for between 16 and 21 days.

Advantages

- This is useful for handling large quantity of milk.
- The capacity can be increase by increasing the number of plate heat exchanger.
- The energy required for heating and cooling is saved by the regenerative process of this method.

Disadvantages

- This not suitable for handling small quantity of milk.
- Gaskets used between the plates must be given constant attention.
- Complete drainage is not possible as approximately 10% milk retained in between the plates.

ii) Low-Temperature Long Time (LTLT) pasteurization: Every particle of milk is subjected to a temperature of 63°C for 30 min followed by prompt cooling to 5°C or below. It has 3 types:

- a) Water jacketed type: Steam or hot water passing through double jacket of vat. Foam heater is used to prevent surface cooling
- b) Water spray type: Spraying of the hot water
- c) Coil vat type: Heated and cooling by horizontal and vertical turning coil

Advantages

- It is useful for handling small quantity of milk.
- It does not involve sophisticated equipment.
- Technically trained persons are not required as its operation is easy.
- Milk is not wasted during this process.

Disadvantages

- There is possibility of outside contamination.
- Time taken for pasteurization is too long as there is no regenerative heating and cooling. Hence growth of thermophilic organisms is encouraged.
- Automatic control to check the operation is not possible.
- This occupies more space and in place-cleaning is not convenient.
- It can not handle large quantity of milk and operation cost per litre of milk handle is more.

iii) Ultra-High Temperature (UHT) Pasteurization: This is a completely closed pasteurization method. The product is never exposed even for a fraction of a second during the entire process.

It involves heating milk or cream to between 135°C to 150°C for one to two seconds, then chilling it immediately and aseptically packaging it in a hermetic (air-tight) container for storage.

e) Significance of Pasteurization

- i) Main objective of milk pasteurization to destroy pathogenic bacteria that could have a public health concern. By destroying these microorganisms, the product becomes safe for public consumption.
- ii) Secondly, pasteurization eliminates destructive bacteria and enzymes that could cause spoilage of the product. This leads to the prolonged shelf life of the milk.
- iii) There is a need to ensure that the product can keep for longer periods without expensive storage equipment. Pasteurization will eliminate spoilage bacteria and enzymes and extend the shelf life of the product.

4. Pasteurization of Milk: Science Laws and Concepts

Pasteurization is a crucial process in milk processing that involves heating milk to eliminate harmful microorganisms while preserving its quality and nutritional value. This activity aims to explore the science laws and concepts underlying the process of pasteurization:

a) Germ Theory of Disease: Louis Pasteur's Germ Theory of Disease forms the foundation for pasteurization. According to this theory, microorganisms are responsible for causing diseases. Pasteurization aims to kill or deactivate these microorganisms in milk, reducing the risk of bacterial infections and ensuring the safety of the consumed product.

b) Heat Transfer Principles

- i) **Thermal Conductivity:** Thermal conductivity refers to the ability of a material to conduct heat. In pasteurization, milk's thermal conductivity plays a crucial role in facilitating the transfer of heat from the heat source to the milk, ensuring efficient and uniform heating.
- ii) **Heat Conduction:** Heat conduction involves the transfer of heat from a higher temperature region to a lower temperature region through direct contact. In pasteurization, heat is conducted through the milk to achieve and maintain the desired temperature required to destroy harmful microorganisms effectively.
- iii) **Heat Transfer by Convection:** Convection is the process of heat transfer through the movement of a fluid or gas. In pasteurization, convection ensures that heat is evenly distributed throughout the milk, preventing localized heating and ensuring thorough microbial inactivation.

c) Temperature-Time Relationship: The temperature-time relationship is a critical aspect of pasteurization. Different pasteurization methods, such as high-temperature short-time (HTST) or low-temperature long-time (LTLT), have specific temperature and time requirements. These parameters are carefully selected to achieve the necessary microbial reduction while minimizing the impact on milk quality.

d) Microbial Inactivation

- i) **Thermal Death Time (TDT):** Thermal Death Time refers to the minimum time required at a specific temperature to achieve microbial inactivation. Understanding the TDT of various microorganisms allows for the determination of optimal pasteurization conditions to effectively eliminate harmful bacteria.
- ii) **Coagulation and Denaturation of Proteins:** During pasteurization, heat treatment causes the proteins in milk to undergo denaturation, altering their structure. This denaturation leads to the coagulation of proteins, contributing to microbial inactivation and further ensuring the safety of the milk.

e) Quality Preservation: In addition to microbial safety, pasteurization plays a crucial role in preserving the quality of milk. By controlling the temperature and time during pasteurization, the process helps extend the shelf life of milk, maintain its nutritional integrity, and prevent spoilage.

f) Regulatory Standards: To ensure consumer safety and product quality, regulatory standards and guidelines are in place for pasteurization. These standards outline the required temperature and time parameters, as well as the microbial reduction targets, that dairy producers must adhere to.

Understanding the science laws and concepts involved in pasteurization provides insights into the importance and effectiveness of this milk processing technique. By applying principles of heat transfer, considering the temperature-time relationship, and incorporating microbial inactivation mechanisms, pasteurization ensures both safety and quality in the production of milk for consumers.



Question 1: Can you name the principle involved in pasteurization?

Heat Transfer - Heat transfer is the flow of heat (thermal energy) due to temperature differences and the subsequent temperature distribution and changes. Two substances must have different temperatures in order to transfer heat from one to the other. Heat always flows from the warmer substance to the colder. The heat flow is rapid when the temperature difference is great. During heat transfer, the difference in temperature is gradually reduced and the rate of transfer slows down, ceasing altogether when the temperatures are equalized.

Question 2: What are different modes of heat transfer?

Heat can be transferred in three ways: by conduction, convection and radiation.

- Conduction means transfer of thermal energy through solid bodies and through layers of liquid at rest (without physical flow or mixing in the direction of heat transfer). For example, heat conduction to a teaspoon in a cup of hot coffee. Heat is transferred by conduction to the handle, which then becomes warmer.
- Convection is a form of heat transfer that occurs when particles with a high heat content are mixed with cold particles and transfer their heat to the latter by conduction. Convection consequently involves mixing. If the teaspoon is rinsed with running cold water, heat is transferred from the spoon to the water, which is heated in the process. The heated water is replaced by cold water, which in turn absorbs heat from the spoon. Heat transfer by convection continues until the spoon and the running water have the same temperature.
- Radiation is the emission of heat from a body that has accumulated thermal energy. The thermal energy is converted into radiant energy, emitted from the body and absorbed by other bodies that it strikes.

Question 3: Explain the significance of the Germ Theory of Disease in the process of milk pasteurization?

The Germ Theory of Disease is significant in milk pasteurization as it forms the basis for the process. According to this theory, microorganisms are responsible for causing diseases. In pasteurization, the aim is to eliminate or deactivate these microorganisms present in milk to ensure its safety for consumption. Understanding the Germ Theory of Disease helps us recognize the importance of pasteurization in preventing the transmission of harmful pathogens through milk.

Question 4: Describe the temperature-time relationship in different methods of milk pasteurization?

Answer: The temperature-time relationship is a critical factor in milk pasteurization. Different methods, such as High-Temperature Short Time (HTST) and Low-Temperature Long Time (LTLT) pasteurization, have specific temperature and time requirements. HTST pasteurization involves heating milk to 71.7°C for 15 seconds, while LTLT pasteurization subjects milk to 63°C for 30 minutes. These temperature-time combinations are carefully chosen to achieve microbial reduction while minimizing the impact on milk quality. Understanding this relationship helps determine the appropriate pasteurization method for different milk products.

5. Properties of Pasteurized milk

Properties of Pasteurized milk can be categorized into 3 groups as following:

a) **Physical Properties:** Pasteurized milk should be free from suspended particles, filth, foreign matter, sediments. It should not smell acidic and stale. It should be free from Barny, cowy, feed, lacks freshness/stale cooked, garlic/onion, oxidized – light induced, oxidized – metal induced, salty, astringent, fruity/fermented, malty, bitter, unclean, rancid.

b) Chemical Properties:

- i) Pasteurized milk should contain fat and SNF as per the type of milk.
- ii) Neutralizer – A good quality pasteurized milk should not contain neutralizer as Neutralizers are chemical substances, which are alkaline in nature and added to milk in order to regulate the acidity of milk. In milk, sodium hydroxide, sodium carbonate and sodium bicarbonate are added by adulterators to neutralize the developed acidity in milk.
- iii) Phosphatase Test – A good quality pasteurized milk should give negative result to Phosphatase test. NOTE – Phosphatase test is done to check the alkaline phopohatase in the milk. Alkaline Phosphatase is an indigenous milk enzyme. The enzyme activity is destroyed at pasteurization temperature and has been adopted as an index of the efficiency of pasteurization.
- iv) Arsenic – Arsenic is introduced in milk from milk producing animals by the intake of arsenic contaminated water or through their feed. Safety limit for arsenic in pasteurized milk is 0.1 ppm (0.1 mg/L).
- v) Lead – Lead is naturally present in normally all components of the environment and lead may contaminate milk through cattle feed. Safety limit for arsenic in pasteurized milk is 0.02 ppm (0.02 mg/L).
- vi) Aflatoxin M1 – Aflatoxin M1 is the mycotoxin found in milk and is converted normally from aflatoxin B1 present in feed although. The aflatoxin M1 content in milk should not exceed 0.5 ppb.

c) Microbiological Properties:

Salmonella spp and Listeria Monocytogenes have potential to cause food poisoning. Therefore, should not be present in pasteurized milk.

6. Fat Analysis in Milk using the Gerber Method

The Gerber method is a widely used technique for determining the fat content in milk. It is based on the principle of fat separation by centrifugation. Here's a short description of the method:

Scientific Principle: The Gerber method utilizes the principle that fat is less dense than other components of milk, allowing it to separate and form a distinct layer upon centrifugation. Determining milk's fat content is vital for nutritional labeling, quality control, pricing, process



optimization, and adulteration detection. It informs consumers about energy and taste, ensures regulatory compliance, enables fair pricing and trade, optimizes product quality, and identifies adulteration. This maintains trust, consistency, and fairness in the dairy industry.

7. Interesting Fact about Packaged Pasteurized Milk

- a) **Extended Shelf Life:** Packaged pasteurized milk has a longer shelf life compared to raw milk. The pasteurization process destroys harmful bacteria, extending the milk's freshness and allowing it to be stored for a longer period.
- b) **Standardization:** Packaged pasteurized milk goes through a process of standardization, where the fat content is adjusted to meet specific requirements. This ensures consistent fat levels in the milk, allowing consumers to choose milk with their desired fat content.
- c) **Fortification:** Many packaged pasteurized milk products are fortified with essential vitamins and minerals, such as vitamin D and calcium. This fortification enhances the nutritional value of the milk, providing additional health benefits to consumers.
- d) **Homogenization:** Packaged pasteurized milk often undergoes homogenization, a mechanical process that breaks down and disperses fat globules evenly throughout the milk. This prevents the separation of cream, resulting in a smooth and consistent texture.
- e) **Different Varieties:** Packaged pasteurized milk is available in various forms to cater to different consumer preferences. Options include whole milk (with higher fat content), low-fat milk, and skim milk (with minimal fat content). Additionally, flavored varieties like chocolate or strawberry milk offer diverse taste options.

8. Questionnaire

1. In high temperature short time method of pasteurization, milk is heated at temperature:
 - a) 72°C for 15 sec
 - b) 62°C For 15 sec
 - c) 72°C For 30 min
 - d) 62°C For 30 min

2. The difference in UHT pasteurized milk and extended shelf life treated pasteurized milk is of:
 - a) Temperature of heating
 - b) Holding time
 - c) Microbial filtration
 - d) None of the above

3. What is the index organism to find the efficiency of pasteurization?
 - a) *Clostridium botulinum*
 - b) *Mycobacterium tuberculosis*
 - c) *Coxiella burnetti*
 - d) Both b & c

- 4 Temp-time combination of UHT milk is _____
 - a) 135°C to 140°C for 1 to 4 seconds
 - b) 100°C to 110°C for 1 to 4 seconds
 - c) 95°C to 110°C for 3 to 6 seconds
 - d) 75°C to 95°C for 2 to 4 seconds

- 5 _____ denatures enzymes that cause milk to spoil.
 - a) Pasteurization
 - b) Homogenization
 - c) Both a & b
 - d) None of the above

6. Absence of which enzyme indicates that pasteurization of milk is complete?
 - a) Urease
 - b) Alkaline phosphatase
 - c) Lipase
 - d) Protease

7. Purpose of pasteurization is _____?
 - a) To reduce pathogenic bacteria to a safe level
 - b) To increase shelf life
 - c) To reduce fat content in milk
 - d) Both a & b

8. Major component of milk is _____?
 - a) Fat



- b) Solid not fat (SNF)
- c) Water
- d) Minerals

9. Which pasteurization method is used by Indian dairy industries ?

- a) Low Temperature Long Time Pasteurization
- b) High Temperature Short Time Pasteurization
- c) Ultra High temperature Pasteurization
- d) None of the above

10. Which method is used to determine fat content in the milk?

- a) Pasteurization Method
- b) Gerber Method
- c) Homogenization Method
- d) None of the above

11. Gerber method uses which principle to determine fat content of milk?

- a) Archimedes principle
- b) Buoyance Force
- c) Centrifugal force
- d) None of the above

12. Which Instrument is used normally for checking adulteration of milk?

- a) Hydrometer
- b) Lactometer
- c) Calorimeter
- d) Thermometer



Lesson Plan Subjects

Published

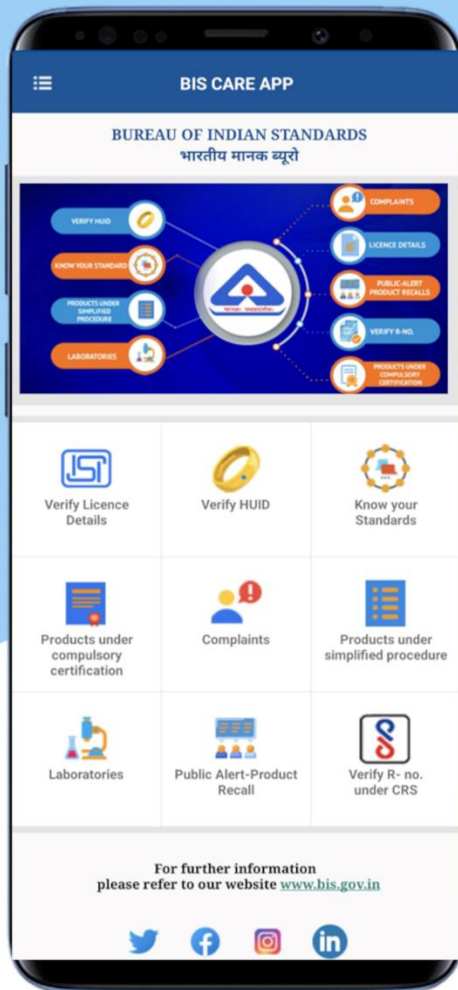
1.	Caustic Soda	16.	Headphones
2.	Football	17.	Milk Powder
3.	Cement	18.	Pressure Cooker
4.	Gas Stove	19.	Plywood
5.	Geyser	20.	Multipurpose dry batteries
6.	Helmet	21.	Ballpoint Pen
7.	LED Bulb	22.	Bicycle
8.	LPG Cylinders	23.	Electric Iron
9.	Cement Ash Brick	24.	Loudspeakers
10.	Paints	25.	Pasteurized Milk
11.	Boric Acid	26.	Paver Blocks
12.	Ceiling Fan	27.	Plugs and Socket
13.	Cables	28.	Solar Flat Plate Collectors
14.	Ceramics Tiles	29.	Precast Concrete
15.	Rear View Mirrors	30.	Stainless Steel

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31.	Drinking Water	42.	PVC Pipes
32.	Electric Mixer	43.	Refrigerator
33.	Family Sized Biogas Plant	44.	Solid and Hollow Block
34.	Fire Extinguisher	45.	Steel Bar
35.	Power Threshers	46.	Submersible Pump set
36.	Conduits	47.	Thermometer
37.	CNG Cylinders	48.	Tyres for buses and trucks
38.	Hearing Aids	49.	Vacuum Flask
39.	Microwave Oven	50.	Water Meter
40.	Water Storage Tank	51.	Wheel Rim
41.	Weighing balance	52.	Geosynthetics



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- Check the authenticity of electronic products with R-Number  by using 'Verify R-Number under CRS'
- Register complaints regarding quality of Product of misuse of  mark by using 'Complaints'
- You can also access products under compulsory certification of BIS & Products under simplified procedure of licensing.

How to use BIS Care App

- Go to Google play store/Apple app store
- Install BIS Care App
- Register your mobile number



BUREAU OF INDIAN STANDARDS
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