

**Theory lectures**

<b>Lecture No</b>	<b>Topic to be covered</b>	<b>Weightage per cent</b>
1	Present status of dairy industry in Maharashtra and India	6
2	Definition and composition of milk	7
3	Physiochemical properties of milk	9
4	Microbial quality of raw milk Factors affecting composition of milk	6
5	Physico chemical and microbial standards for different types of milk .	7
6	Nutritional importance of milk and its constituents.	9
7,8 and 9	Reception and processing (platform test, chilling standardization, homogenization, pasteurization, storage and marketing) of milk.	10
10, 11 and 12	Classification and composition of milk products (heat coagulated, heat and acid coagulated, evaporated, fermented frozen and fat riched products)	10
13	ISI, PFA and AGMARK standards for milk products	7
14	International requirement for export of dairy products.	6
15	Preservation of milk and milk products by Bio, Herbal Chemical and Physical preservatives in use	7
16	Utilization of dairy by products whey and high acid milk	8
17	Packaging of milk and milk products with modern techniques	8

**Books recommended :**

1. Milk and its properties - Shrivastava, S.M. (1993) Kalyani publishers, 1/1 Rajinder nagar, Ludhiana
2. Milk and milk Products – Winton and Winton (1993)
3. Milk Testing – Davis J.G. Agrobios (India)
4. Chemistry of Milk and Milk Products – Singh V.B (1965), Asian Publishers, New mandi, Muzaffarnagar.
5. Dairying in India – Gupta, H.A. (1997) Kalyani Publisher, 1/1 Rajinder nagar Ludhiana.
6. Outlines of Dairy Technology -Sukumar De (2000) Oxford University Press, New Delhi.

## LECTURE NO.1

### Present Status of Dairy Industry In Maharashtra And India

1) Estimated population: 127.29 million tones

2) Milk production:

→ World: 678 million tones

→ Milk production in India (Year-wise)

year	Production(million tonnes)	Per capita availability(gms/day)
1991-92	55.7	178
1992-93	58.0	182
1993-94	60.6	187
1994-95	63.8	194
1995-96	66.2	197
1996-97	69.1	202
1997-98	72.1	207
1998-99	75.4	213
1999-2000	78.3	217
2000-01	80.6	220
2001-02	84.4	225
2002-03	86.2	230
2003-04	88.1	231
2004-05	92.5	233
2005-06	97.1	241
2006-07	102.6	251
2007-08	107.9	260
2008-09	112.2	266
2009-10	116.4	273
2010-11	121.8	281
2011-12	127.3	

**Milk production in India (State -wise)**

State	production (000 tonnes)	Ranks
Uttar Pradesh	18095	I
Rajasthan	9375	II
Punjab	9168	III
A. P.	7939	IV
Gujarat	7533	V
Maharashtra	6978	VI
Haryana	5367	633

**Important species in milk production:**

Sr. No.	Year	Contribution (%)		
		Buffalo	Indigenous cow	Crossbreed
1	1994	56	27	15
2	2003	58	23	19
3	2012	56	19	25
		Goat and sheep : 2 to 3 %		

**Milk consumption pattern – State-wise 2006-2007**

State	Consumption (gms/day)	Ranks
All India	246	
Punjab	961	
Haryana	633	II
Rajasthan	408	III
Gujarat	374	IV
Himachal P.	370	V
Uttarakhand	358	VI

J & K	325	VII
A. P.	269	VIII
Uttar Pradesh	267	IX
Madhya P.	259	X
Tamil Nadu	232	XI
Sikkim	230	XII
Karnataka	200	XIII
Maharashtra	182	XIV

### **Milk Utilization Pattern (I)**

Liquid Milk	46%
Ghee / Butter	33%
Curd/ dahi (shrikhand, lassi etc )	7%
Khoa (peda, burfi, gulabjamun etc)	7%
Chhana / Paneer (rasogolla, rasmalai etc)	3%
Western Products (Powder, Cheese etc.)	4%

### **Milk Handling or User Pattern**

#### Household Sector (47%)

- For drinking
- For conversion into milk products as curd, ghee, Butter
- Non-organized Sector (38%)
  - Meeting the urban demand for liquid milk
  - Production of mithais & other traditional products
- Organized Sector (15%)
  - Processes milk into pasteurized liquid milk
  - Western products

### **Milk Marketing Scenario: State wise Market Shares 2004-05**

State	Urban HH Demand(LLPD)	Milk Sales(LLPD)		
		Co-ops	Pvt (Organised)	Loose
Maharashtra	74	26(35%)	13 (18%)	35(47%)

U.P	66	4 (6.4%)	1 (1.5%)	61(92%)
Tamil Nadu	50	13(27%)	9 (18%)	28 (55%)
Gujarat*	46	22(48%)	5 (11%)	19 (41%)
Delhi	44	21(48%)	5 (11.4%)	18 (41%)
Rajasthan	38	9(23%)	1 (2%)	28(75%)
Punjab	34	5(15%)	1 (3.0%)	28(82%)
Karnataka	34	16(48%)	5 (15%)	13 (37%)

(Fig. In parenthesis denotes market share) \* Gujarat (Amul) is selling around 8.0 LLPD outside Gujarat in 2004-05. Source :

### **7) Milk Processing Facility:**

Current processing capacity 100 Million LPD

Capacity Utilization : 65-68 %

Privat sector : 3% e,g Chitale etc

\* Only 15% is processed in country

### **6) Share of Dairy Cooperatives in milk industry:**

Three tier structure of Dairy Cooperatives: Anand pattern,

1. Primary Village Societies (1.22 lakhs) eg. Ambewadi village co-operative society
2. District/Tehsil Processing Unions (198) e.g. Kolhapur Zilla co-operative milk union (Gokul), Jalgaon Zilla co-operative milk union (Vikas)
3. State Milk Federations (23) eg. Maharashtra cooperative milk marketing federation (Mahanand). Karnatka CMMF (Nandini), A.P (Vijaya), GJ (Amul)  
NCDFI (National Cooperative Dairy Federation of India, at Anand)

### **7) Cooperatives/ private produce and market products such as:**

Milk, Butter, Ghee, Cheese, Skim Milk Powder, Whole Milk Powder, Yogurt, Butter Milk, Lassi, Sweetened Condensed Milk, Paneer, Malted Milk Food, Shrikhand, Ice Cream, Chocolates etc.

Share and growth rate:

Share of Agriculture in GDP : 16-17%

Share of Livestock Sector in Agril. GDP: 27%

Share of Livestock Sector in GDP: 6 %

Share of milk industry in Livestock Sector GDP: 70%

Growth rate:

Growth rate of Indian economy: 9%

Growth rate of Indian agriculture: 2%

Growth rate of livestock sector 4%

### **8) Market:**

- Country turn over : Total Value : Rs 90,000 Cr

Material cost of Dairy Products as percentage of Sale price

Product	Raw material cost as % of sale price
Market Milk (Bulk Vending)	90
Market milk (Packaged)	80
Milk Powder/Butter	70
Paneer	58
Bengali sweet	42
Peda/Burfi/Kalakhand	52
Gulab Jamun	33
Rasagoola	33
Shrikhand	43
Curds	60
Misti-Doi	40

### **9) Import and Export of Dairy Products: India**

Export: Skim milk powder (SMP); Whole milk powder (WMP); Other powder; Butter; Butter oil;

Traditional dairy product (shrikhand, Gulabjamun, Rasogolla)

Imports: SMP; Butter oil

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Share in world trade market of dairy is only 0.5 %

### **10) Employment Generation**

- Nearly 5,65,000 employment is created in about 1.13 lakh villages
- Estimated employment in animal husbandry sector is 11.44 million in principal status and 11.01 million in subsidiary status
- Self employment to rural people, especially to the landless and widows
- Dairy farming provides regular and remunerative payment

### **11) Challenges Ahead:**

- Lack of proper packaging and labeling system
- Market Intelligence to understand the mind set of entrepreneurs
- Distribution net work
- Consumer perception/Brand Building
- Cold chain facilities
- Inadequacy of quality raw material for large scale production

### **12) Way Forward:**

- New Products in response to consumer preference
- Need to improve product shelf life and packaging
- Consolidation of distribution and retail net work
- Establishment of High Tech cold chain parlours- example Mother Dairy, Delhi
- Mechanised Vending Machines for milk derivatives at strategic points

### **13) Market for Indigenous Products**

- Projected domestic demand for major traditional products: 250,000 tones.
- Some 25 million Indians living abroad are in upper income group.
- In North America alone, this market is estimated at US \$500million.
- A large variety of Indian Dairy Products are sold in the super markets in North America, UK and South Africa produced by small scale entrepreneurs.
- A Canadian firm, IDP Foods, Inc. is the largest producer of Indian Dairy Products.
- Australians are also looking into the prospects of making them.

### **14) Leading Institute related to Dairy industry:**

National Dairy Research Institute, Karnal, Sub centre at Bangalore, Kalayani (WB)

National Dairy Development Board, Anand

National Cooperative Dairy Federation of India, at Anand

SMC College of Dairy Science, Anand

Central food Technological Institute, Mysure

### **15) Leading Dairy plant in country:**



Anand Milk union limited (AMUL), Mother Dairy , Delhi; Nestle Food products; Shyadri agro products

ltd. (Dynamics) Baramati. Haldiram and KC Das etc

**16) New Dairy products in market:**

Probiotic Ice cream (Amul), Set curd (Nandini), Good and long life UHT milk, Mastidahi, Flavoured Milk (Amul cool) and Chhas and Shrikhand (pasteurized), Drinking Yoghurt, Ready to reconstitute basundi, Kheer, Rasmali, payyasam etc

## LECTURE NO.2

### Composition of milk:-

#### Defination:-

Milk is clean lacteal secretion which is obtain five days after calving; from mammary gland of animal.

#### Composition of milk:-

	Species	Water	Fat	Protein	Lactose	Ash
1.	Cow	86.6	4.6	3.4	4.9	0.7
2.	Buffalo	84.2	6.6	3.9	5.2	0.8
3.	Goat	86.5	4.5	3.5	4.7	0.8
4.	Sheep	79.4	8.6	6.7	4.3	1.0
5.	Human	87.7	3.6	1.8	6.8	0.1

#### **NOTE:-**

- ❖ Water is more in human milk i.e 87.7%
- ❖ Fat content is more in sheep milk i.e 8.6%
- ❖ Protein content is more in sheep milk i.e 6.7%
- ❖ Lactose content is more in human milk i.e 6.8%
- ❖ Ash content is more in sheep milk i.e 1.0%
- ❖

#### 1.Physical state of milk-

- ❖ It is depend on constituent of milk. Fat is present in a form of fat globule which is present as oil in water type of emulsion in. Protein is present in colloidal state. Lactose is present in solution form.

#### 2.Acidity-

- ❖ Milk is amphoteric in nature. It means that it turns red litmus blue and blue litmus red.
- ❖ There are two types of acidity.
- ❖ 1.Apperent- Due to presence of citrate and phosphate in milk.
- ❖ 2.Developed- Due to presence of bacterial action produced by bacteria.
- ❖ Combination of these two acidity known as Titratable acidity.
- ❖ Titratable acidity of,

- ❖ Cow milk- 0.13 to 0.14%
- ❖ Buffalo milk- 0.14 to 0.15%
- ❖ 3.pH-  
pH of milk is measured by use of digital pH meter.
- ❖ pH of,
- ❖ Cow milk- 6.4 to 6.6
- ❖ Buffalo milk- 6.7 to 6.8
- ❖ 4.Density and specific gravity-
- ❖ Density is ratio of mass to the volume.
- ❖ Specific gravity is the ratio of density of milk to density of water. It is measure by Lactometer.
- ❖ Specific gravity of,
- ❖ Cow milk- 1.028 to 1.030
- ❖ Buffalo milk- 1.030 to 1.032
- ❖ Addition of water or cream lower the specific gravity. Addition of skim milk or removal of fats increase the specific gravity.
- ❖ 5.Freezing point of milk-
- ❖ It is the point at which the milk is get freezed.
- ❖ Freezing point of,
- ❖ Cow milk is -0.547°C
- ❖ Buffalo milk is -0.549°C
- ❖ 6.Boiling point of milk-
- ❖ Milk boils at a temperature slightly above the water. Boiling point of milk is about 100.17°C.
- ❖ 7.Viscosity-
- ❖ Viscosity is the resistance of flow of any liquid.It is measured in centipose by viscometer. Viscosity of milk is ranges from 1.5-1.7 centipose.
- ❖ 8.Color of milk-
- ❖ Color is blend of individual effect produced by
- ❖ A-1.collidal casein particals.
- ❖ 2.dispersed fat globules.
- ❖ B-carotene & to some extent the xanthophylls which imparts yellowish tint.
- ❖ Cow milk-pale yellow.
- ❖ Buffalo milk-creamy white.
- ❖ Whay-greenish yellow.
- ❖ 9.Flavour-
- ❖ This is composed of smell & taste.
- ❖ Sweet taste-due to lactose content.
- ❖ Salty taste-mineral content.

## LECTURE NO.3

### Microbial quality of raw milk and microbial standards for different types of market milk.

#### Sources of contamination in milk.

Following are the sources of contamination(dirt/ dist/ microbes etc.)of milk

1. Animal: Animal itself a source of contamination if it becomes ill are with not cleaned body. To control this ....
  - ✓ Animal must free from pathogen
  - ✓ Animal must be properly checked
  - ✓ Udder of animal should clean with wet cloth
  - ✓ Also scrubbed, dry to remove loose hairs and specks of dungs.
2. Surrounding stall: a place where animal is tied/ fed/ milked also need to clean for that...
  - ✓ There should not stable air as it an imp source of contamination
  - ✓ Milking should not be immediately after feeding of silage.
  - ✓ The temp, humidity, dirt, should controlled , sprinkled water if more dust.
  - ✓ Control fly- carry contagious diseases
3. Handling equipment: To avoid the contamination from handling equipment one has to....
  - ✓ Should clean and free from pathogen
  - ✓ Always rinse after use
  - ✓ Also washed with warm water containing suitable detergent
  - ✓ Dom shaped equipment should be preferred
  - ✓ Strainers and cloths must be washed and dry.
4. Personal hygiene and health of milker: it becomes more harmful and common source of contamination so needs to take precaution like...
  - ✓ Should undergo periodical checkup
  - ✓ Maintain good personal hygiene
  - ✓ Clip nail regularly
  - ✓ Wear cap and wash hand before milking

Table -1: Microbiological requirements for burfi as per BIS requirements.

Characteristic	BIS Requirements(IS:5550:1970.Reaffirmed 1999)	
	Mawa burfi	Other types
Standard place count per g, Max	30000	30000
Yeast and mould count, per g, Max	10.0	10.0

Table- 2: Microbiological requirements for Khoa as per PFA and BIS

Characteristic	Requirement for khoa	
	PFA	BIS(IS:4883-1980,reaffirmed

		1999)		
		Pindi	Danedar	Dhap
Total plate count	Not more than 50,000/g			
Coliform count, per g, Max	90	90		
E.coli	Absent in 1g			
Salmonella	Absent in 25g			
Shigella	Absent in 25g			
Staphylococcus aureus	Not more than 100/g			
Yeast and mould count	250 per g, max	50 per g, max		
Anaerobic spore count	Absent in 1g			
Listeria monocytogenes	Absent in 1 g			

Table- 3: Microbiological requirement for packed gulubjamun BIS

Characteristic	Requirements for gulabjamun (IS:11602:1986, reaffirmed 1997)
Bacterial count per g, max	3000
Coliform count per g max	50
Yeast and mould count per g, max	50

Table- 3a: Microbiological requirement for sugar syrup as per BIS

Characteristic	Requirements for sugar syrup
Bacterial count, per g, Max	5000
Coliform count, per g, max	50

Table- 4: Microbiological requirements for channa\* as per PFA & BIS

Characteristic	Requirements for channa			
	PFA		BIS (IS:5162:1980, Reaffirmed 1999)	
	Channa	Skim milk channa	Channa	Skim milk channa
Total plate count	Not more than 50,000/g		-	
Coliform count, per g. Max	90		-	
Salmonella	Absent in 25 g.		-	
Shigella	Absent in 25 g.		-	
Staphylococcus aureus	Not more than 100/g		-	
Yeast & mould count, per	250		-	

g.Max		
Anaerobic spore count	Absent in 1 g.	-
Listeria monocytogenes	Absent in 1 g.	-
E. coli	Absent in 1 g.	-

\*Shall be sold in sealed pack only.

Table-5: Microbiological requirements for Paneer as per BIS

Characteristics	Requirements for Paneer		
	PFA		BIS (IS:10884-1983, Reaffirmed 1999)
	Paneer	Low fat Paneer*	Paneer
Total plate count	Not more than 50,000/g		Not more than 50000/g
Coliform count, per g. Max	90		90
Salmonella	Absent in 25 g.		-
Shigella	Absent in 25 g.		-
Staphylococcus aureus	Not more than 100/g		-
Yeast & mould count, per g.Max	250		250
Anaerobic spore count	Absent in 1 g.		-
Listeria monocytogenes	Absent in 1 g.		-
E. coli	Absent in 1 g.		-

\*Shall be sold in sealed pack only.

Table-6:Microbiological requirements for Chakka & Shrikhand

Characteristics	Requirements for Chakka & Shrikhand					
	PFA*			BIS(IS:9532-1980, Reaffirmed 1999)		
	Chakka*	Skim milk chakka	Shrikhand**	Chakka	Skim milk chakka	Shrikhand
Total plate count	Not more than 50000/g			-	-	-
Coliform count, per g. Max	10			10	10	10
Salmonella	Absent in 25 g			-	-	-
Shigella	Absent in 25 g			-	-	-
Staphylococcus aureus	Not more than 100/g			-	-	-
Yeast & mould count, per g.Max	10	10	50	20	20	50
Anaerobic spore	Absent in 1 g.			-	-	-

count				
Listeria monocytogenes	Absent in 1 g.	-	-	-
E. coli	Absent in 1 g.	20	20	50

\*Chakka when sold without any indication shall conform to the standards of chakka.

\*\*As per PFA, in case of fruits shrikhand, it shall contain milk fat (on dry basis)% by wt.-not less than 7.0 & milk protein (on dry basis)% by wt.-not less than 9.0

Table-7: Microbiological requirements for Dahi as per BIS PFA

Characteristic	Requirements for Dahi	
	PFA	BIS(IS 1917 Reaffirmed 1999)
Total plate count	Not more than 10,00,000/g.	-
Coliform count,	10/g, Max	10 per g, Max
Salmonella	Absent in 25 g	-
Shigella	Absent in 25 g	-
Staphylococcus aureus	Not more than 100/g	-
Yeast & mould count, per g. Max	100/g, Max	100 per g, Max
Anaerobic spore count	Absent in 1 g	-
Listeria monocytogenes	Absent in 1 g	-
E. coli	Absent in 1 g	-

The following culture shall be used in the preparation of Dahi

- Streptococcus lactis*, *Streptococcus diacetylactis*, *Streptococcus cremoris*, single or in combination with or without *Leuconostoc species*; &
- Also as above along with species of *Lactobacillus* such as *Lactobacillus bulgaricus*, *Lactobacillus acidophilus* and *Lactobacillus casei* and *Streptococcus thermophilus*.

Table-8: Microbial requirements of Kulfi as per PFA & BIS specifications

Characteristic	Requirements for Kulfi				
	PFA			BIS(IS:10501-1983, Reaffirmed 1999)	
	Ice-cream	30% Ice-cream	60% Ice-cream	Kulfi	Fruits, Nuts & Chocolate kulfi
Total colony count per g. (standard plate count), max	250,000			250,000	250,000
Coliform count, per g. Max	10			100	100
Salmonella	Absent in 25 g			-	-
Shigella	Absent in 1 g			-	-

Staphylococcus aureus	Absent in 1 g	-	-
Yeast & mould count, per g.Max	Absent in 1 g	-	-
Anaerobic spore count	Absent in 1 g	-	-
Listeria monocytogenes	Absent in 1 g	-	-
E. coli	Absent in 1 g	-	-
Phosphatase test of mix	-	Negative	Negative

Microbiological requirements	
SPC	250,000 per g, max
Coliform count, per g. Max	10 per g, max
Salmonella	Absent in 25 g
Shigella	Absent in 1 g
Staphylococcus aureus	Absent in 1 g
Yeast & mould count, per g.Max	Absent in 1 g
Anaerobic spore count	Absent in 1 g
Listeria monocytogenes	Absent in 1 g
E. coli	Absent in 1 g

### **Factors Affecting composition of milk:**

- 1) Species
- 2) Breed
- 3) Stage of Lactation
- 4) Age
- 5) Milking interval
- 6) Season
- 7) Portion of Milking
- 8) Yield
- 9) Health of the animal at parturition
- 10) Feed
- 11) Individuality of the cow
- 12) Completeness of milking
- 13) Irregularity of milking
- 14) Disease and Abnormal condition
- 15) Excitement
- 16) Administration of drugs/ hormones

#### **1)Species :**

Each species yields milk of a characteristic composition.

Table of composition of milk of different species



Sr. No	Particulars	Water {%}	Fat {%}	Protein {%}	Lactose {%}	Ash {%}
1	Jersey	85.09	5.37	3.92	4.93	0.71
2	Red Sindhi	86.07	4.90	3.42	4.91	0.70
3	Gir	86.44	4.73	3.32	4.85	0.66
4	Holstein friesian	87.44	3.40	3.22	3.87	0.68

It is clear from the table that human milk is lower in protein and fat whereas higher in lactose than cow milk.

## **2) Breed :**

It is a well known fact that the breed is one of the important factors influencing the composition of milk.

Holstein Friesian contains lower percentage of fat and protein, while Jersey cow milk contains higher fat and protein.

Jersey milk is intensive yellow in colour as compared to Holstein Friesian.

## **3) The stage of Lactation :**

The first secretion after calving i.e. colostrum which is very different from milk in composition. It is lower in water, sugar and fat and higher in protein and ash than normal milk. After 1-2 months it finally becomes normal and continues to normal and increases near the end of lactation.

Sr. No	Constituents	Colostrum %	Milk %
1	Total solid	28.31	12.90
2	Fat	3.37	4.00
3	Protein		
4	Casein	4.83	
5	Albumins	15.85	3.10
6	Lactose	2.48	5.00
7	Minerals/Ash	1.78	0.70

## **4) Age :**

The fat percentage of milk increases from 2<sup>nd</sup> to 3<sup>rd</sup> lactation and remains same until the advanced age begins.

The milk fat percentage declines slightly as the cows grow older.

Ex. Fat % of Jersey cow is 5.2 at the age of 6-8 years and 4.5 % at the age of 15 years.

## **5) Milking intervals :**

The fat content of milk of a particular cow may show considerable variation from milking to milking.

When the animals are milked twice a day, morning milk has different composition than evening milk. Such variation is due to interval between two milkings and the environmental differences.

## **6) Protein of milking :**

The first milk drawn from milk during milking is low in fat.  
{ less than 1.0% } as compared to last milk drawn.

### **7} Season :**

The percentage of fat and SNF show slight but well defined variation during different season of the year.

Cows receiving the same ration through out the year shows tendency to decline fat and SNF during summer and increased again in winter.

### **8} Yield :**

For individual cow fat percent is depend on the yield of milk yield of milk is inversely proportional to the fat percent of milk.

### **9} Health of the animal at parturition :**

Health of animal at parturition has significant effect on the composition of milk.

Those animal which are in good condition at parturition. Produce more milk with higher total fat. Animals which are weak at calving produce milk with less fat.

### **10 } Feed :**

It affect the composition of milk to great extent.

When animals fad concentrate especially oil cake or cotton seed, they produce milk with higher fat and SNF

Animals receiving green fodder only produce more milk with less fat percent.

### **11 } Individuality of the cow:**

Animals belonging to a particular breed and maintained under identical condition produce milk with different composition.

It is due to individual variation . It could be due to genetic variation.

Sr. No	Particular	TS %	Fat %	Protein %	Sugar%
1	Holstein Friesion cow	12.12	3.23	3.0	5.05

### **12} Completeness of Milking :**

If the cow is completely milked, the test is normal if not it is usually lower.

### **13 } Irregularity of milking :**

Frequent changes in the time and interval of milking result in lower tests.

So adopt uniform milking interval.

### **14} Disease and Abnormal condition :**

These tend to alter composition of milk especially when they result in a fall in yield.

### **15 } Excitement :**

Both yield and compoition of milk are liable to transient fluctuation during the period of excitement for any reason.

### **16 } Administration of drugs / hormones :**

Certain drugs may effect temporary change in fat. Infection/ feeding of hormones result in increase both yield and fat.

## LECTURE NO.4

### Nutritional Importance of Milk :

Milk is an almost ideal food. It supplies body – building proteins, bone – forming minerals and health – giving vitamins and furnishes energy – giving lactose and milk fat. All those properties make milk an important food for pregnant mothers, growing children, adolescents, adults, invalids convalescents and patients alike.

- 1) Proteins: - Milk proteins are complete proteins of high quality i.e. they contain all essential amino – acids fairly in large quantities.
- 2) Minerals: - Milk is an excellent source of Calcium and Phosphorus, both are essential for bone formation.
- 3) Vitamins: - Milk is good source of vitamins A, vitamins D, Thiamine, Riboflavin etc.
- 4) Fat: - Milk fat plays a significant role in the nutritive value, flavor and physical properties of milk and milk products. Milk fat imparts a soft body, smooth texture and rich taste to dairy products.
- 5) Lactose: - The principal function of lactose is to supply energy. Lactose also helps to establish a mildly acidic reaction in the intestine and facilitates assimilation.
- 6) Energy Value: - The energy giving milk constituents and their individual contributions are as follows:

Milk fat – 9.3 C/gm

Milk Proteins – 4.1 C/gm

Milk Sugar – 4.1 C/gm

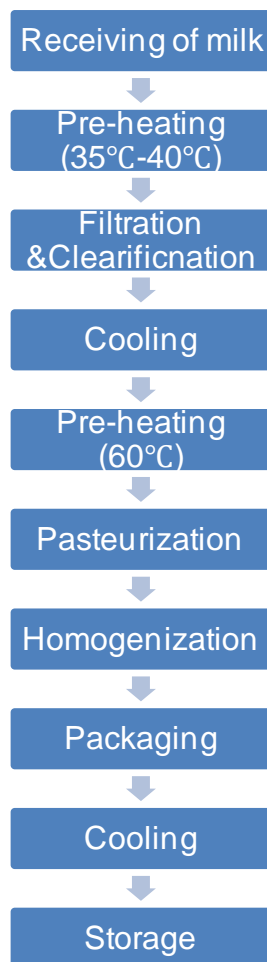
- 7) A balanced diet is essential for proper health and growth. The role of milk and milk products in providing the nutrients required for balanced diet is indicated.

Nutrients	Purpose
1) Proteins	Essential for muscle building & repair, give the body energy and heat.
2) Carbohydrates	Body energy & heat
3) Fats	Body energy & heat
4) Minerals	Bone, teeth, body cells
5) Vitamin A	Growth, health of the eyes, structure & function of skin & mucous membrane
6) Vitamin B1 ( Thiamine )	Growth, aids appetite, prevents beriberi, function of the nervous system
7) Vitamin B2 (Riboflavin)	Growth, health of skin & mouth, functioning of eyes
8) Niacin	Functioning of stomach, intestine & nervous system

9) Vitamin C	Aids bones & teeth, prevents survey
10) Vitamin D	Aids in Calcium absorption which strengthens bones, prevents rickets

### Milk Processing:

India is the country in production of milk and milk products is high. Though production is high spoilage is also high. There is a lot of reason responsible for spoilage of milk and milk product. In order to overtake the spoilage problem concept of milk processing is get introduced.



#### Receiving of Milk: -

a) Unloading: -

Milk cans are back up to the platform.

b) Grading: -

This refers to the classification of milk on the basis of quality, for price – fixing purposes.

c) Sampling: Process of taking representative sample of milk for for subsequent chemical and bacteriological analysis.

d) Weighing:-

Important step in accounting for milk receipts and disposal , making payments for milk etc.

e) Testing:-

Milk is tested for maintaining the quality of milk.

**Pre-heating: -**

Pre-heating is done at 35-40°C. The milk is pre heated for efficient filtration/clarification.

**Filtration & Clarification:-**

Filtration remove the suspended foreign particle by the straining process. Clarification remove the suspended foreign particle by the centrifused sedimentation.

Types of filters and clarifiers:-

- 1) Operated with cold milk
- 2) Operated with warm milk

**Cooling:-**

Cooling is done to prevent deterioration in its bacteriological quality during the interim period.

- 1) Surface Cooler
- 2) Plate Cooler

**Pre-heating: -**

Pre-heating is done at 60°C

**Pasteurization:-**

It refers to the process of heating every particle of milk to at least 63°C for minutes and 72°C for 15 seconds. After pasteurization milk is immediately cool at 5°C

**Objectives: -**

1. Destruction of cent percent pathogenic micro organism to save the milk for human consumption.
2. To improve keeping quality of milk.

**Disadvantages: -**

Diminishes unsanitary milk production  
Used to make low quality of milk  
Reduces nutritive value of milk  
Reduces cream volume of milk

**Methods: -**

**In Bottle Pasteurization:-**

In this , method bottles are filled with milk, tightly sealed with special clips and 63-66°C for 30 minute and cool it in water spray.

Batch Pasteurization:-

In this method, milk is heated at 63°C/145°F for 30 minutes and cool it below 5°C.

High Temperature Short Time Pasteurization:-

In this method, milk is heated at 72°C/161°F for 15 seconds and cool it below 5°C.

Parts of HTST Pasteurization:-

Float Control Balance Tank :- Maintain the constant head of milk for feeding the raw milk pump; also receives any sub-temperature milk diverted by FDV .

Pump :- Either a rotatory positive pump between the regenerator and heater or centrifugal pump with flow control device to ensure constant output.

Generation Heating Section:- The cold incoming milk is partially or indirectly heated by hot outgoing milk . This adds to economy of HTST process , as the incoming milk requires less heating by hot water to raise its temperature for holding.

Holding Section:- The holding tube or plate ensure that the milk is held for specific time , not less than 15 second , at pasteurization temperature of  $72^{\circ}\text{C}$  or more

Flow Diversion Valve:- This routes the milk after heat treatment. If the milk has been properly pasteurized , it flows forward through the unit ; that which is unpasteurized is automatically diverted back to FCBT for the reprocessing .

Generation Cooling Section:- The pasteurized hot outgoing milk is partially and indirectly cooled by the incoming cold milk . This again adds to the economy of the HTST process .

Automatic Control Devices:-

These include:-

Steam pressure controller:- Maintains a constant hot water temperature for heating milk accurately to the required pasteurization temperature .

Water temperature controller:- Regulate the amount of steam entering the hot water circulating system

Milk temperature recorder :- Record the temperature of milk leaving the holding tube . This is an electric contact instrument that operates either a FDV or a milk pump .

### **Advantages:-**

Less Floor space required

Lower initial cost

Milk packaging starts as soon as pasteurization

Reduces milk losses

Pasteurizing capacity can be increased at nominal cost

Process can be interrupted & restarted

Clean sanitised method

### **Disadvantages:-**

Not adaptable for handling small quantity

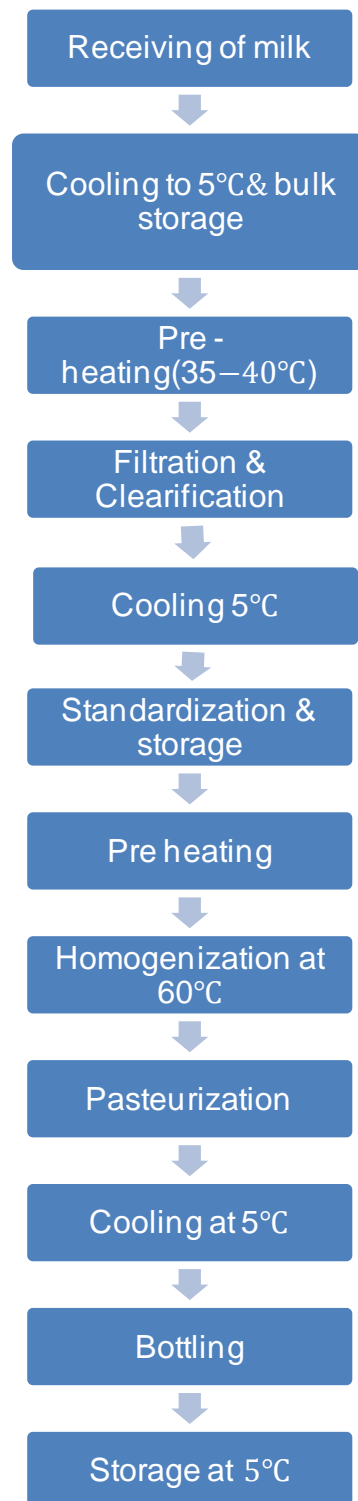
Complete drainage is not possible

Greater accumulation of milk stone in heating section

Product sanitary control is so narrow.

### **Homogenization:-**

It refers to process of forcing the milk through homogenizer with object of sub dividing the fat globule



### **Merits:-**

No formation of cream layer.  
Fat in the milk does not churn .

More palatable and brighter appearance .  
Produces soft curd and is better for digestion  
Low susceptible to oxidised level

**Demerites :-**

Increase cost of production.  
From return milk fat recovery is difficult .Sediment appears to a greater degree.

**Packaging:-**

Packaging can be defined as it is a tool that protect and contains our goods with the aim of minimizing the environmental impact on our cons

**Functions:-**

To protect the product from damage and contamination by micro-organism.  
To keep the product together to contain it .  
To identify the product through the labelling .  
Protection during transport.  
Stacking and storage .  
Provide convenience .  
Keep the product safely for consumption .  
Contributing to the product image structural and graphic design.  
Environmental protection .  
Increasing the shelf life

**Packaging material :-**

- |      |                         |
|------|-------------------------|
| 1.   | Metal / tin cans        |
| 2.   | Films.                  |
| 3.   | Earthen pots.           |
| 4.   | Corrugated boards.      |
| 5.   | Glass bottles.          |
| 6.   | Glass jars.             |
| 7.   | Paper carton board.     |
| 8.   | Plastics.               |
| i)   | HDPE                    |
| ii)  | LDPE                    |
| iii) | Polypropylene           |
| iv)  | Polystyrene             |
| 9.   | Multilayer sheet/ films |

**Cooling :-**

Cooling is done to prevent deterioration in its bacteriological quality during the interim period.

- 1) Surface Cooler
- 2) Plate Cooler

**Storage:-**Storage tanks are used in Milk plants for storage of milk.

**Objective:-**

- i) To maintain milk at a low temperature
- ii) To allow uninterrupted operation during processing & bottling
- iii) to facilitate bulking of raw milk supply, which will ensure uniform composition
- iv) to facilitate standardization of the milk.



### **Types**

- i) Insulated
- ii) Horizontal or Vertical
- iii) Rectangular, Cylindrical or Oval

### **Standardization of Milk:-**

It is the operation of adjustment that is to raise to lower the fat or SNF contain of milk to the desired level of milk. Standardization of milk is done by Pearson's Square Method

Type of Milk	Fat (%)
1) Standardized Milk	4.5%
2) Tonde Milk	3%
3) Double Tonde Milk	1.5%

Ingredients used in standardization

- |    |                  |
|----|------------------|
| 1) | Milk             |
| 2) | Cream            |
| 3) | Skim Milk Powder |
| 4) | Butter           |
| 5) | Butter Oil       |

## LECTURE NO.5

### Fermented Milk Product :-

Fermented milks refer to those milks which have been made by employing selected micro-organism to developed the characteristic flavor or body and texture.

Fermented milk product :

#### 1)Dahi :

Dahi is product obtain from pasteurized or boiled milk by harmless lactic acid or other other bacterial culture. It should have same percentage of fat and solid-non fat of the milk from which it is prepared.

Dahi may contain addition sugarcane (in case of sweet dahi)

#### Requirement for Dahi: -

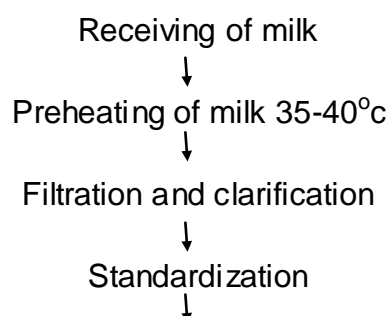
Characteristics	Sweet dahi	Sour dahi
Acidity, lactic acid (%wt)(maximum)	0.7	1.0
Yeast and mould count per gm(maximum)	100	100
Coliform count per gm (maximum)	10	10
Phosphate test	-ve	-ve

#### Classification of dahi :

Dahi for direct consumption is classified into:

- 1) Whole milk dahi
- 2) Skim milk dahi
- 3) Sweet (or mildly sour) dahi
- 4) Sweetened dahi

#### Standard method for preparation of dahi :-



Preheating 60°C

Homogenization

Pasteurization

cooling 20-25°C

inoculation of starter culture @ 1-2%

incubation @ 27°C for 12-16 hrs



Dahi obtain

### **Uses of dahi :**

A) Whole milk dahi :

- 1) Used direct consumption
- 2) Preparation of chakka, shrikhand and makkhan and lassi

B) Skim milk dahi :

- 1) Used for heart patient
- 2) It is low in fat and cheap but nutritious hence suitable for low income group of people

### **Quality of dahi:**

Colour:

Yellowish creamy white for cow milk and creamy white for buffalo milk

Appearance :

Smooth and glossy surface, cream layer on top and free from extraneous matter.

Flavour :

Mild, pleasant smell, clean acid test, free from off flavours

Body :

Small and firm, free from gas hole and whey pocket

Acidity :

% lactic acid 0.75 - 0.85.

## **CHAKKA AND SHRIKHAND**

Shrikhand semi-soft, Sweetish sour, whole milk product prepared from lactic fremented curd. The curd is partially strained through a cloth to remove the whey thus produce solid mass called chakka. This chaaka is mixed with required quantity of sugar to yield shrikhand

### **Composition of Shrikhand :**

The composition of chakka will depend on initial composition of milk, the degree of fermentation and the extent of whey remove this 3 factor along with amount of sugar added, influence the composition of shrikhand

### **Composition of chakka(%)**

Product	Moisture	Fat	Protein	Lactose	Ash	Sugar	Lactic acid
Chakka	59.6	22.4	10.3	4.4	1.0	-	2.3

### **Method of preparation :**

- 1) Take fresh, sweet, standardized buffalo milk to 6.0%
- 2) Pasteurized it at 71°C for 10 min and cool to 28 to 30°C
- 3) Then inoculated @ 2.0% with lactic culture and mixed well
- 4) Incubate the mixture at 28 to 30°C for 15 to 16 hours
- 5) When the curd is set firmly and developed acidity 0.7 to 0.8 %, broken curd
- 6) Place the broken curd muslin cloth bag and hung it for removal of whey for it to 10 hrs, during this period the position of curd may altered or squeezed it to facilate drainage.
- 7) The solid mass obtain is called as CHAKKA.
- 8) The clean good quality crystal or ground sugar in req. quantity i.e. 35 to 45 % of weight of chakka is added and mix it uniformly by kneading chakka
- 9) Add colour and flavour and mix it properly and uniformly

## **LASSI**

Lassi is also called as chhas or matha

Lassi refers to desi butter milk, which is by-product obtain when churning curdled whole milk with indigenous device for the production of desi butter

Composition of Lassi (%)

Water	Total solid	SNF	Protein	Lactose	Ash	Fat	Lactic acid
96.2	3.8	3.0	1.3	1.2	0.4	0.8	0.44

Take Well Prepared Required quantity of dahi



Add 10% sugar in the dahi



Mix dahi well in the container



Add required flavour if required



Add dry fruits if needed



Store Lassi in cool place

Lassi obtain

### Uses:

- 1) As beverage in summer by addition of ice, salt, sugar
- 2) As starter culture
- 3) As a coagulant

## **Heat Desiccated Product**

### **MANUFACTURE OF KHOA**

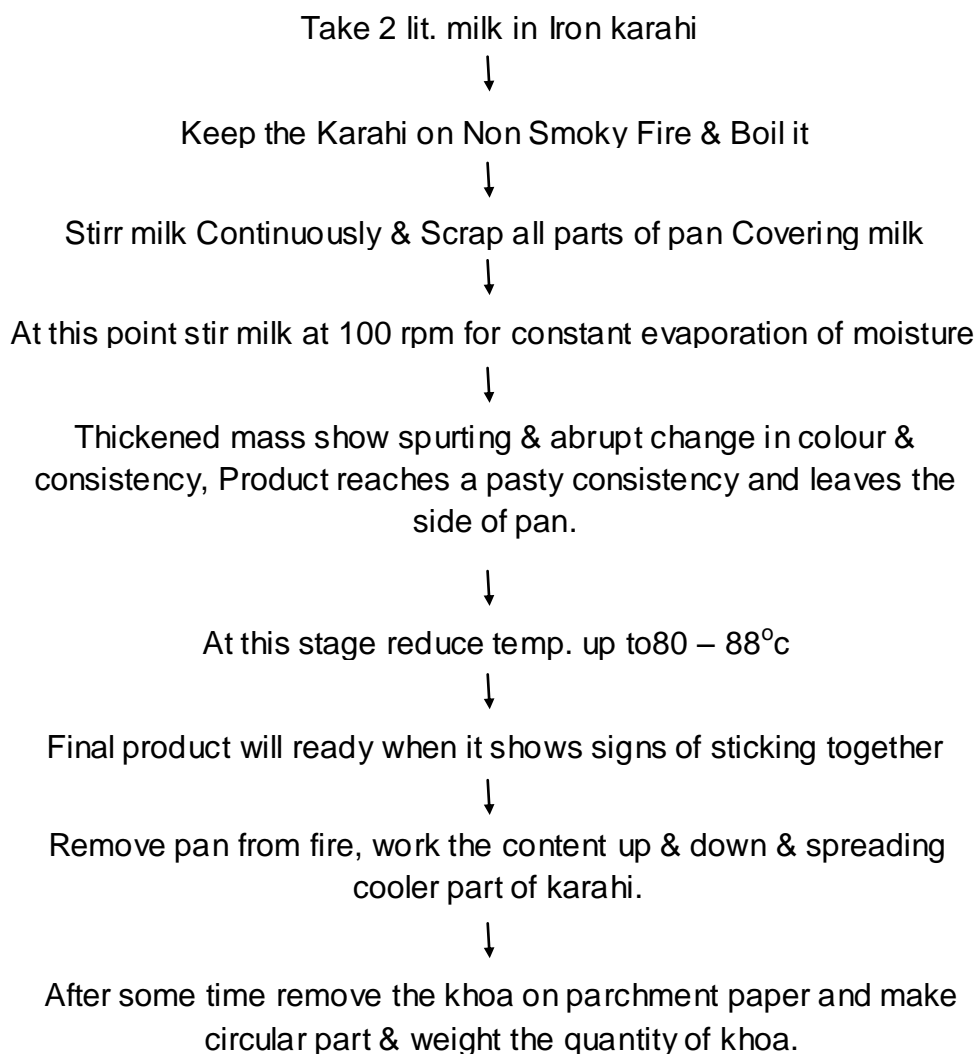
#### **Khoa**

Khoa refers to the partially dehydrated whole milk product prepared by continuous heating of milk in karahi over a direct fire, with continuous stirring scrapping using khunti till it reaches semi-solid consistency. Thereafter, the pan contents are removed from the fire and worked up into a solid mass or khoa fat. As per Indian standards khoa should contain not less than 20% milk fat.

Chemical composition of khoa(%) :

Type of milk	Moisture	Fat	Protein	Lactose	Ash	Iron ppm
cow	25.6	25.7	19.2	25.5	3.8	103

buffalo	19.2	37.1	17.8	22.1	3.6	101
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### **Physical quality of khoa:**

It includes colour appearance, body, and texture, flavour and suitability for sweets. Good quality khoa should be compact mass, light yellow colour (cow milk) and dull white colour (buffalo milk) slightly heated flavour. Free from oiliness or acidity. Smooth texture and firm body. It should not have visible water droplet or show signs of oozing fat. If khoa is made of buffalo milk it should have uniform whitish colour with tinge brown, slightly oily or greasy appearance, soft body, smooth granular texture, rich nutty flavour, mild cooked and sweet taste and highly suitable for sweet making. If khoa is made from cow milk, it should be straw or pale yellow colour.

### **Yield of khoa:**

The yield of khoa is variable. It is influenced by type of khoa, type of milk, quality of milk, the extent of dehydration and losses during handling. Normally the yield of khoa with 28% moisture ranges from 17 to 19% from cow milk and 21 to 23% from buffalo milk.

Keeping quality of khoa:

The higher storage temperature the lowers the keeping quality. At 37°C for 7 days, 24°C for 10 days and 5 to 10°C for 25 days. At room temperature 24 to 30°C is characterized by a rancid flavour, while at low temperature it has stale flavour.

### **MANUFACTURE OF PEDHA**

Pedha is popular khoa based Indian sweets but its organoleptic quality is different from burfi.

Pedha have a hard and granular texture in comparison to burfi. Its shape is round. Two types of pedha viz. plain and brown are available in market.

Procedure:

1. Plain pedha::

- Prepared tha khoa according to method described above. Alternatively procure good quality Pindi type khoa from market.
- Heat broken pieces of khoa in khrahi up to 60°C then add Powder sugar @30% of khoa, knead the hot mixture properly with a wooden kneader. Prevent browning of product.
- Make circular balls of appropriate size.

2. Brown pedha ::

- Prepared the khoa according to method described in above. Alternatively produce good quality pindi type khoa from market.
- Take khoa in a clean karahi. Brake into small pieces and heat up to 80°C. then add half of the total shifted sugar and continue heating till light brown colour develops.
- Leave the brown pedha mass for cooling in the karahi.
- Make circular balls of about 25 gms each by rolling the brown mass in hands.
- Package in appropriate packaging material.

### **MANUFARCTURE OF GULABJAMUN**

Gulabjamun is popular khoa based Indian sweets prepared in all of the country. It is also prepared from dry mix available in various brands. Like other sweets, gulabjamun preparathion is largely in the hand of Halwais. So far PFA has not recommended any standard for gulabjamun. According to BIS specification the proportion of free syrup in a gulabjamun pack shall not exceed 60% of the declared net mass.

Procedure of Gulabjamun

- 1) Take 750 gm dhap type of khoa of freshly quality having moisture in range of 40-50%.
- 2) To this add 250 gm maida and 5g baking powder. blend this obtain homogenous dough.

3) If required small amount of water may also be added

Procedure of making fresh dough

- 1) Make smooth balls of about 10-15 g from the dough by rolling it between the palm .for improving the quality, cashew nut or kishmish in the centre of dough and then roll in into ball.
- 2) Take ghee in karahi. Start heating the ghee. When temperature reaches 140°C stop heating and slowly add gulabjamun balls from the side of karahi. Alternatively, remove karahi from burner.check the temp. it should not go below 120oC.after adding all ball again start heating ghee.
- 3) Deep fry the ball to deep brown colour.it take about 15-20 min for proper cooking of balls during frying maintain the temp. of frying 125°C.
- 4) On proper frying transfer the balls to hot sugar syrup of about 60% consistency.
- 5) After proper soaking balls, this normally required 15-20 min and indicated by sinking at the bottom, transfer them to packaging containers.

Preparation of sugar syrup:

- 1) Take a equal quantities of sugar (1 kg+1 lit water) in a container.
- 1) Boil the dirt that collects on the surface with a strainer,
- 2) For better refining of sugar syrup add about 50ml of raw milk to boiling syrup.
- 3) The milk will coagulate and entrap all impurities. Remove the froth with strainer.
- 4) Finally filter the sugar in another clean containers through muslin cloth
- 5) Check the concentration of sugar with refractometer.

### **PREPARATION OF RASGOLLA**

Rasgolla is the popular traditional Indian sweets prepared from channa.

This soft, sweetest ball of channa soaked in sugar syrup has delighted the test buds of millions of sweat loving clientele more than hundred years. There are various types of rasgolla sold in the market .They include ordinary type ,spongy type, covered with syrup and diabetic rasgolla.

Procedure:

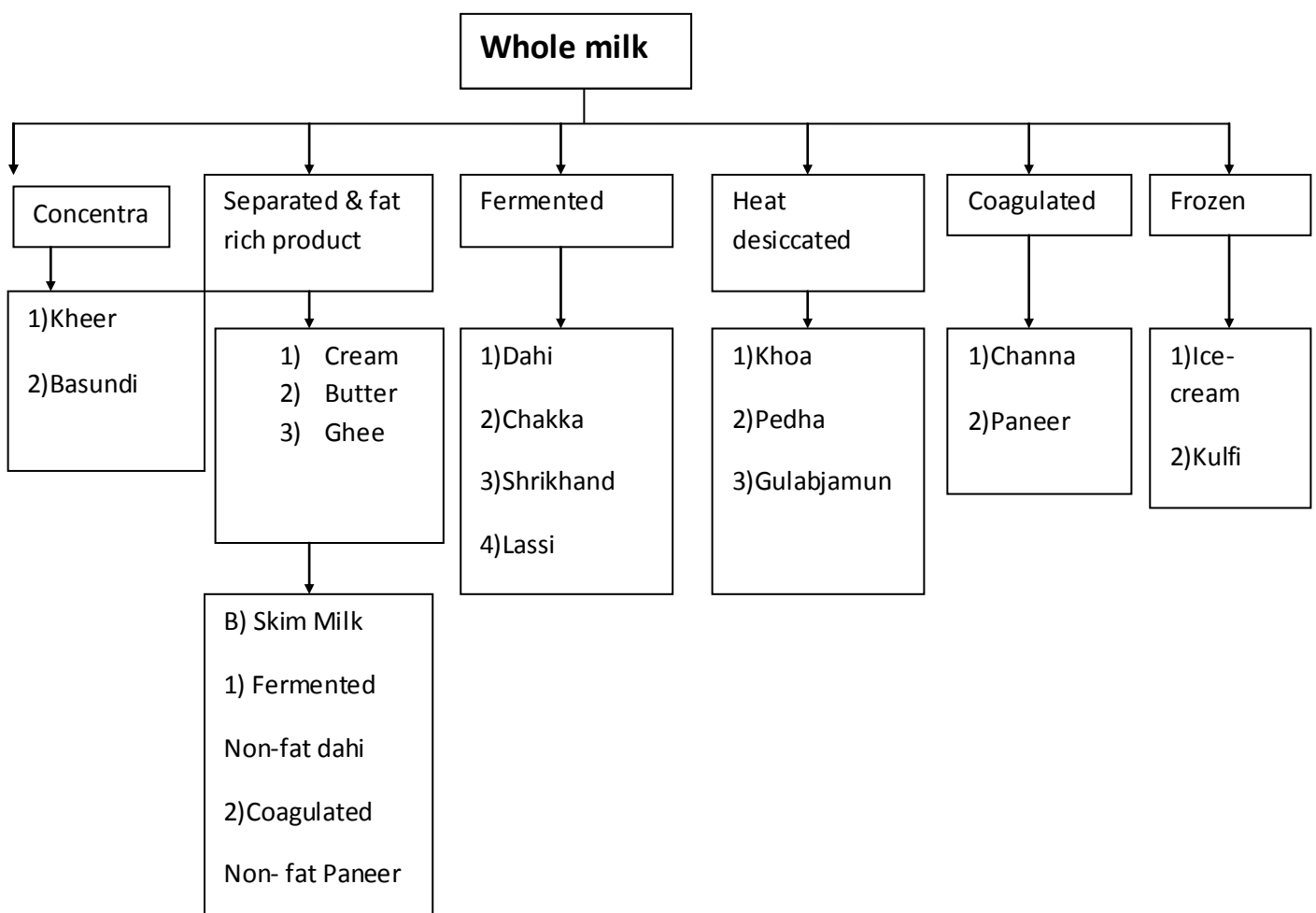
- 1) Prepare soft, spongy and good quality channa
- 2) Knead channa to a smooth paste
- 3) Prepare small balls of about 10-12 gm weight
- 4) Cook these balls in sugar syrup having 50-60% sugar concentration for 15-20 min
- 5) During cooking add small amount of water to maintain sugar concentration.
- 6) After cooking soak rasgolla balls in 40-45% sugar syrup for about 1-2hr.
- 7) cool rasgolla balls at room temperature
- 8) Pack Rasgolla in suitable packages



9) Store rasgolla at refrigerator temperature

## Composition and classification of milk product

### (1) Fermented (2) Heat Desiccated



### Condensed milk and Evaporated milk :-

#### Sweetened Condensed milk:-

**Definition:-** It is a product obtained from cow milk or buffalo milk or combination by partial removal of water. It contained not less than 9% milk fat not less than 31% total milk solids and not less than 40% cane sugar.

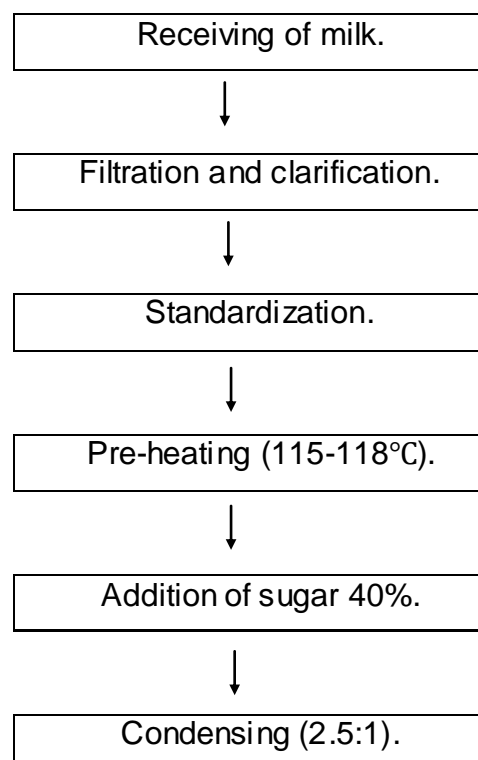
### **Evaporated milk :-**

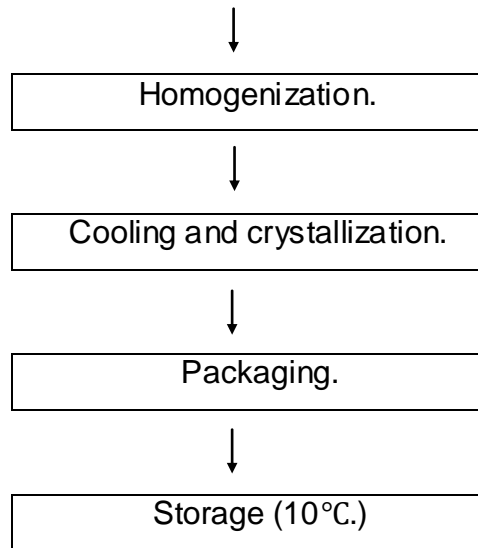
**Definition:-** It is a product is obtained from cow milk or buffalo milk combination by partial removal of water. Evaporated milk should not contain less than 8% milk fat and not less than 26% milk solids.

### **Indian standard specification for condensed milk:-**

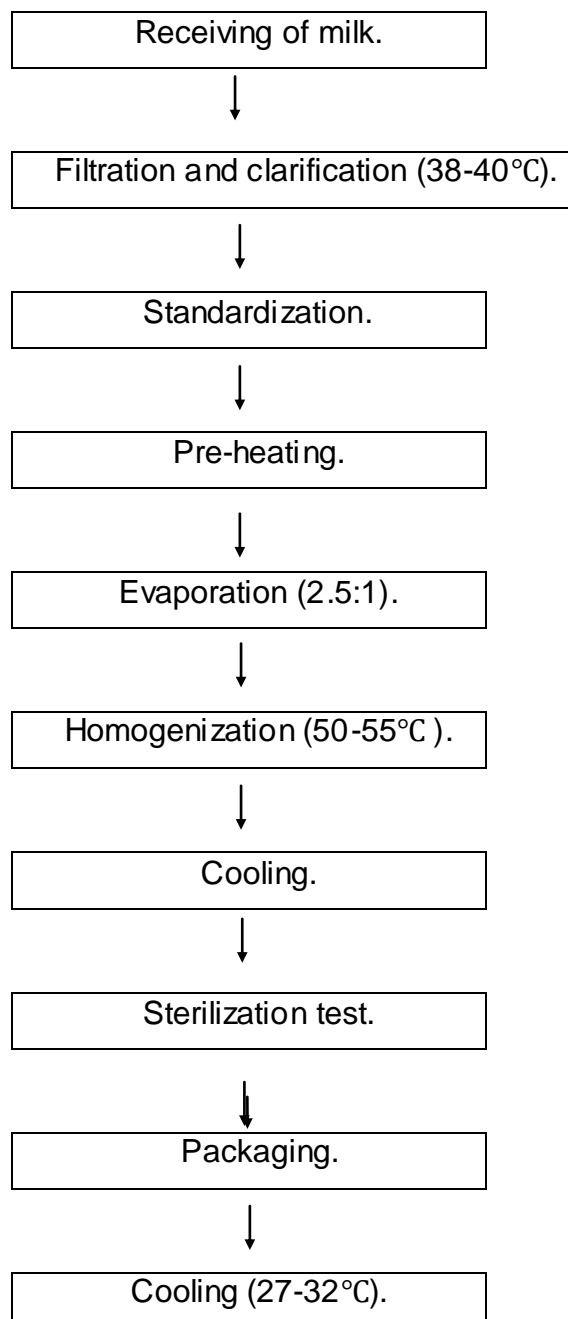
SR NO.	Characteristics	Condensed milk	Sweet condensed skim milk
1)	Total milk solids.	21%	26%
2)	Fat.	Not less than 9%	Not less than 0.5%
3)	Sucrose.	40%	40%
4)	Acidity.	0.35%	0.35%
5)	Bacterial count.	500%	500%
6)	Coliform count.	-ve	-ve
7)	Yeast and mould count.	10%	10%

### **Flow diagram for manufacture of condensed milk:-**





**Flow diagram for manufacture of evaporated milk: -**



↓  
Storage (10°C).

**Uses :-**

**Condensed milk:-**

For reconstitution of into sweet milk drinks.

In tea or coffee.

Used in ice-cream preparation.

Used in candy and confectionary.

**Evaporated milk:-**

Used for reconstitution in milk.

For feeding infants.

Used in ice cream, tea, and coffee.

**Coagulated milk products:-**

Their are two coagulated milk products.

**A)Channa:-**

**Definition:-** It refers to milk solid obtained by acid coagulation boiled hot whole milk subsequent drainage of whey. The acid is commonly used is citric acid or lactic acid. Channa is product obtained from cow or buffalo milk or combination with citric or lactic acid.

**Composition:-**

Sr no.	Type of milk	Moisture	Fat	Protein	Lactose	Ash
1	Cow	53.4%	24.8%	18.4%	2.1%	2.1%
2	Buffalo	51.6%	29.6%	14.4%	2.3%	2.0%

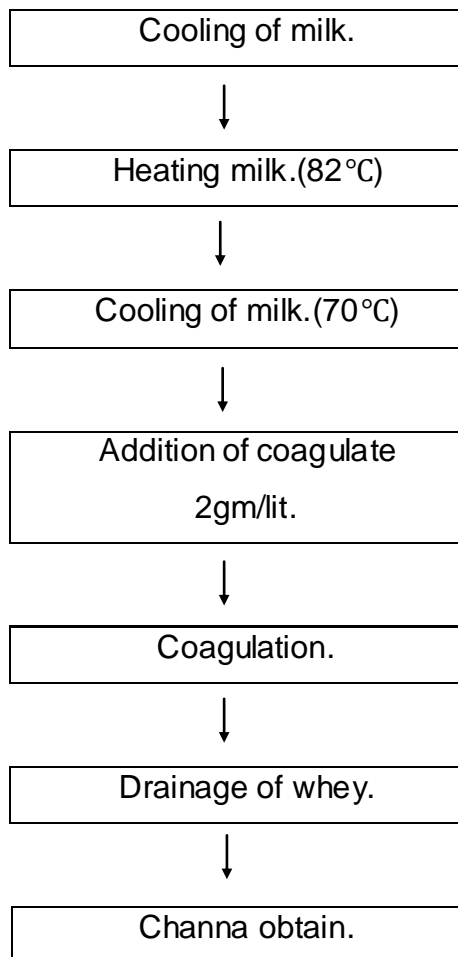
**Procedure for chaanna :-**

Receiving of milk.



Boiling of milk.





#### **Requirement good quality of channa:-**

- 1) cow milk is suitable.
- 2) pH of coagulant should be 5.4
- 3) Temperature of coagulation should be 82°C and coagulated should be effected about 0.5 to 1 min.

#### **Physical quality of channa:-**

Characters	Cow milk	Buffalo milk
Colour	Light yellow	Whitish
Appearance	Moist surface	Greasy surface
Body	Soft	Slightly hard
Texture	Smooth	Slightly coarse
Flavour	Mildly acid	Mildly acid
Suitability	Highly suitable	No suitable
Yield	16-18%	22-24%

### **Defect of channa making:-**

- 1) Flavour - sour, rancid, smoky, stale.
- 2) Body texture - hard body, coarse texture.
- 3) Appearance - dry surface, visible dirt and mouldy surface.

### **Uses:-**

- 1) Rasgulla and Sadesh making and direct consumption.

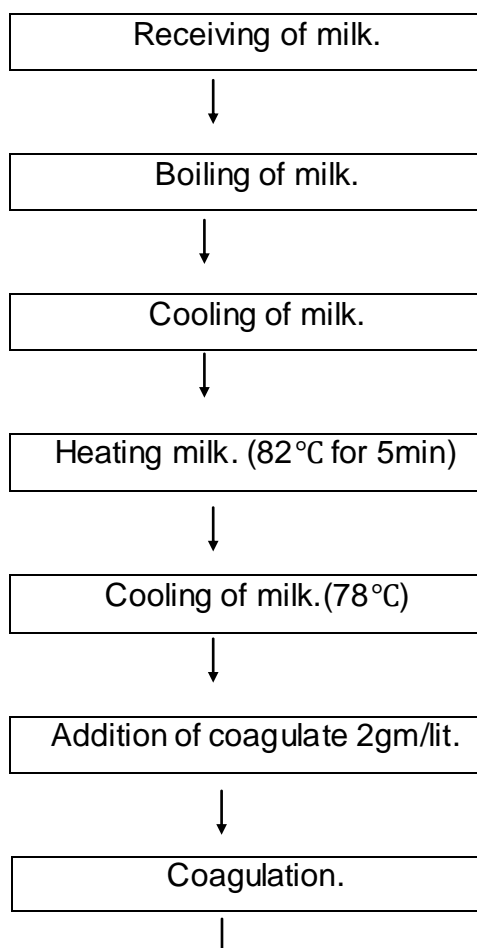
### **B) Panner:-**

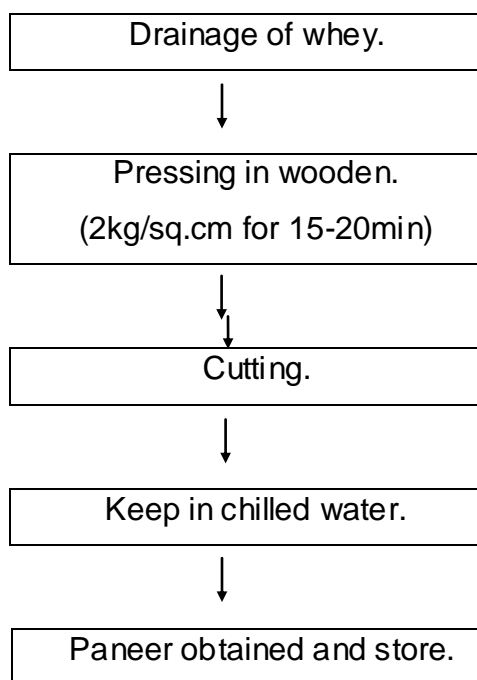
**Definition:-** Paneer refers to the indigenous variety of acid coagulated milk solids. Paneer is nutritious and wholesome dairy product. It is used as base material for the preparation of large number of culinary dishes. Good quality paneer manufactured from cow milk.

### **Composition:-**

Sr no.	Type of milk	Moisture	Total solids	Fat
1.	Cow	71.2%	28.8%	13.5%
2.	Buffalo	71.1%	28.9%	13.1%

### **Procedure for paneer:-**





#### **Yield:-**

cow milk-28.5%

buffalo milk-34.0%

**keeping quality:-** 1-2 days at 5-10°C.

**Use:-** for direct consumption.

### **Frozen dairy products**

#### **1) Ice-cream:-**

**Defination:-** Ice crem may be defined as a frozen dairy product made by suitable blending and processing of cream and other milk products together with sugar and flavor and its colour, with the incorporation of air during the freesing process.

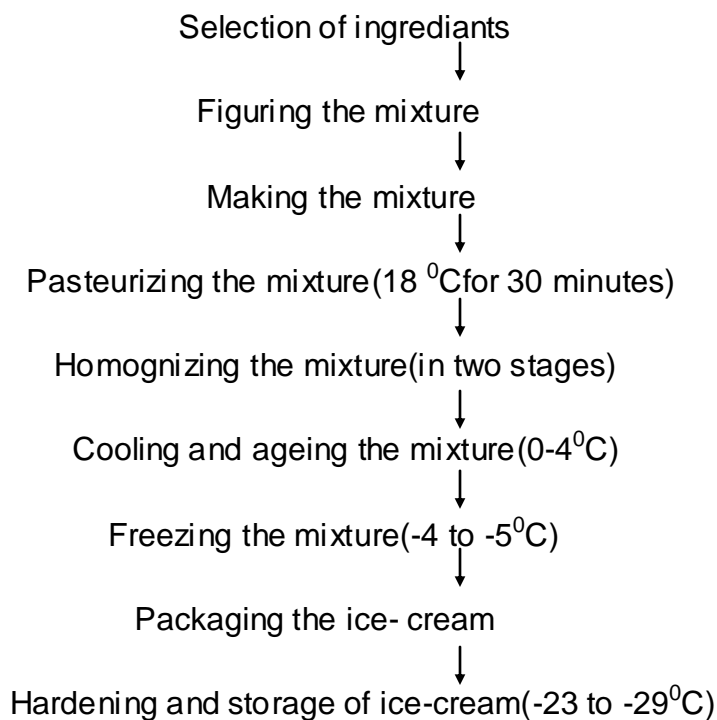
**Composition:-** Appropriate composition of commercial ice-cream in percentages is

Type of ice-cream	Milk fat	Milk S.N.F	Sugar	Stabiliser& emalsifer	Total solid
Economy Ice-cream	10	10 to11	13-15	0.30 to 0.50	33 to 37
Good Average Ice-cream	12	11	15	0.30	37.5to39.0

#### **Classificaton of cream:**

- 1) Plain
- 2) Chocolate
- 3) Fruit
- 4) Nut
- 5) Milk ice or milk lollies
- 6) Ices
- 7) Sherbet
- 8) Novelties
- 9) Soft ice-cream

### **Flow diagram of manufacture of ice-cream**



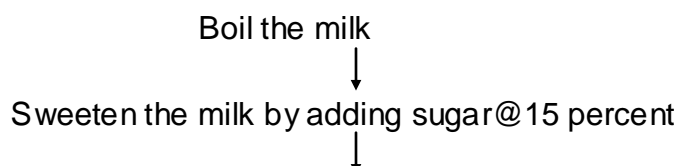
**Over run in Ice cream:-** The amount of air whipped into the ice cream is commonly expressed as percent over run. Over run is the increased in volume of the ice cream over the volume of the mix expressed as percent of the volume of the mixture.

$$\text{Percent over run} = \frac{\text{volume of ice cream} - \text{volume of mixture}}{\text{Volume of mixture}} \times 100$$

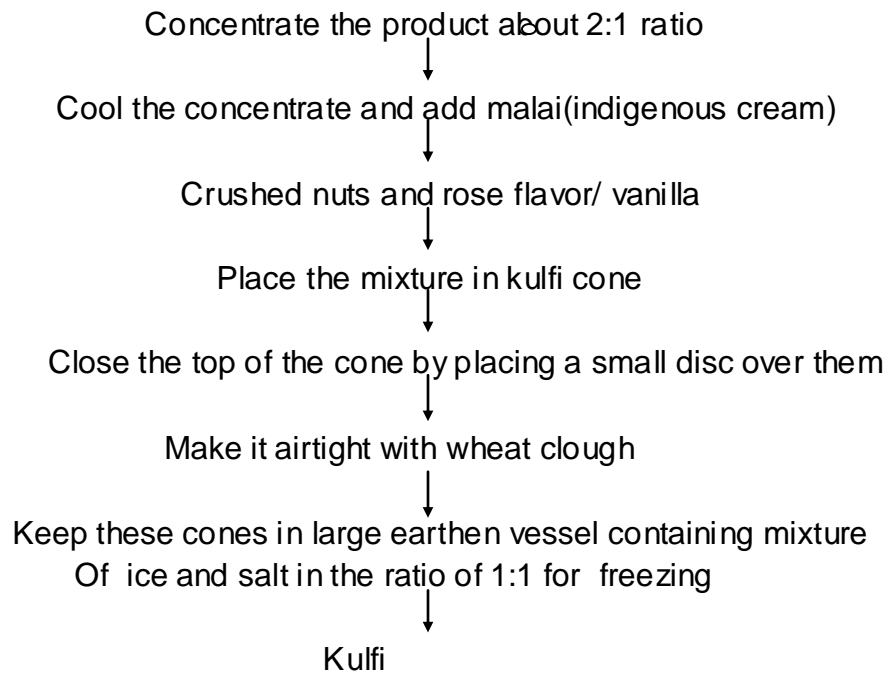
### 2) **Kulfi:-**

**Defination:-** It is defined as the frozen desert characterized by slight whitish to brownish appearance, compact body, icy texture and nutty, cooked, caramelized flavor.

### **Flow diagram of Kulfi**







## **Fat Rich Dairy Product**

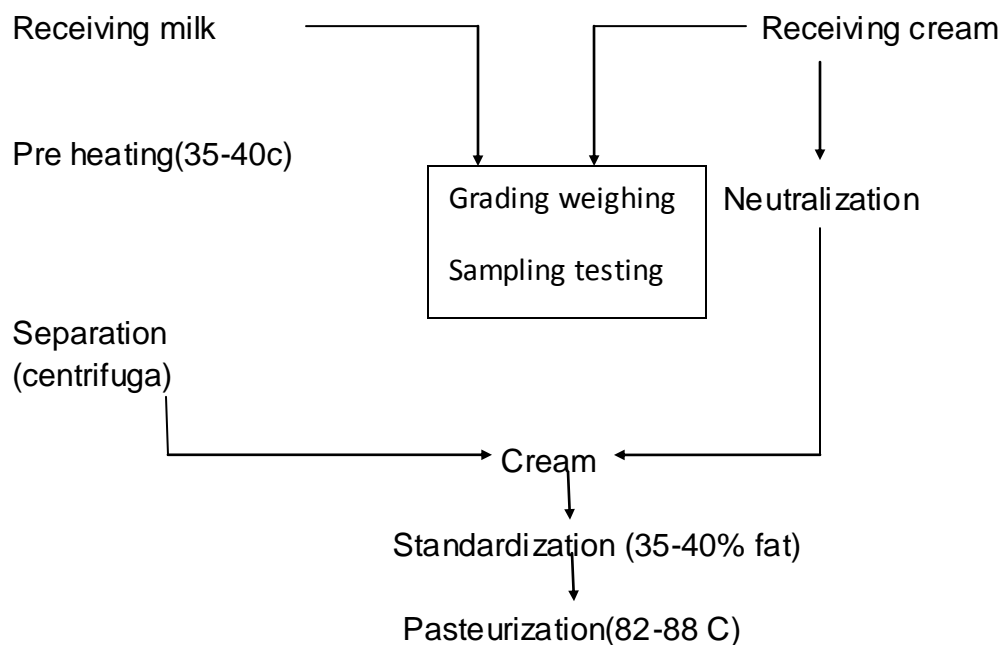
### **1)Butter:-**

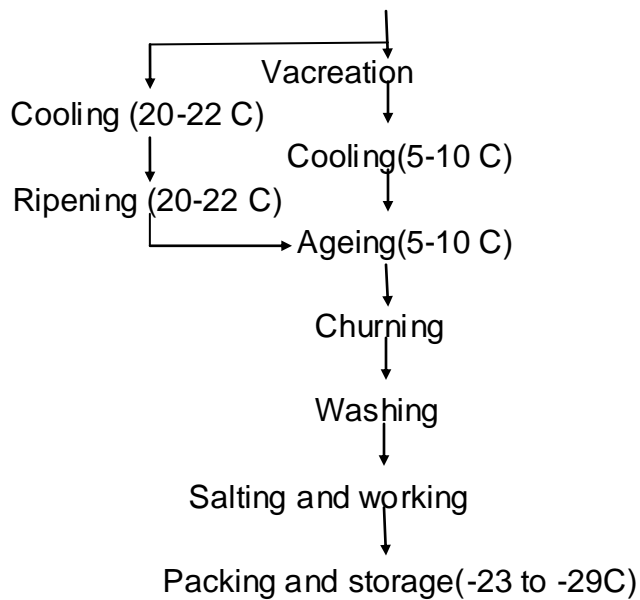
**Defination:-** Butter is defined as a fat concentrate product obtained by churning, crem, gathering fat into a compact mass and working it.

### **Composition:-**

Constituents	Percentage
Butterfat	80.2
Moisture	16.3
Salt	2.5
Curd	2.0

### **Flow diagram of manufacture**





## **2)Ghee:-**

**Definition:-** Ghee may be defined as butterfat prepared from butter or cream.

### **Procedure:-**

collect cream or butter of fresh and rancid flavor free into cattle or iron pan.

Start heating content of kettle allowing steam.

It start melting at 30 C by the temp reaches 64 C all the cream or butter gets melted. Butter is stirred during melting.

Temperature increases upto 94 C and remains till most of the water is evaporated at this stage foam will formed on the surface.

The contents of boiling pan become much thicker and bubbles are form.

The curd particals begin to form in to lumps as the temp approaches to 110 C Much of the curd is carried upto the surface where it forms its scum.

Curd particles begin to the bottom of the pan. At this stage temp is about 120 C

Scum disappars from the surface and the general apperance is of a clean yellowish liquid with white curd. Particles floating near the bottom of a pan.

As the temp rises to about 120 C the larger bubbles are gradually replace by smaller one with cracking sound. At this stage ghee is ready.

Cool the ghee and pack in appropriate container.

## LECTURE NO.6

### **\* ISI/BIS, PFA and AGMARK\***

#### Regulatory environment in dairy processing sector :

Compulsory legislation :-

- 1) Prevention of food adulteration act 1954 (PFA)
- 2) Milk and milk product order 1992
- 3) Standards of weights measures (packaged commodity rules)1977
- 4) Export quality control & inspection act 1963
- 5) Packaging commodity rules 1977
- 6) Pollution control act

voluntary standards :-

- 1) BIS-( Bureau of Indian Standards)
- 2) DMI- (Directorate Of marketing & Inspection )

Other government regulations :

- 1) Industrial license
- 2) Foreign investment
- 3) Foreign technology agreement
- 4) Import of capital goods
- 5) Import of second hand capital goods
- 6) Divident balancing

For the regulation of standards of traditional dairy products following agencies are involved :-

- 1.Prevention of Food Adulteration (PFA)
- 2.Bureau of Indian Standards (BIS)
- 3.Agriculture Marketing (AGMARK)
4. Food safety law (FSL)

#### 1. Prevention of Food Adulteration Act (PFA)

To safeguard the interest of the consumers and also the producers and distributors of food articles in India. The prevention of Food Adulteration Act was passed in 1954 by parliament .

PFA rules were framed which came into force 1 June,1955.Different food articles have been defined accurately and the limits of the various analytical parameters specified.

The PFA Act is implemented by a countrywide network of food inspector who collect at random samples suspected having adulterated.

#### **The main provision of PFA Act and rules**

1. It is operative throughout the India.
2. The adulterated has been defined in wide perspective (broad view) in terms of purity, nutrition, toxicants , contaminants ,bacterial toxins preservatives or anything which may be injurious to health.
3. Provision of sampling method,(crime or fault) and punishments.
4. Establishments of own food analytical laboratories for inspection and to formulate standards.

Procedure has been given for submission of samples and getting certificate

1. Provision are made to appoint public analyst and food inspectors having the prescribed qualification and duties of them are fixed.
2. Local health authorities are also empowered to take samples of food.
3. Prohibition of import of certain articles of food without license.
4. Prohibition of manufacture, sales, are certain articles of food.

#### 2. Bureau of Indian Standards (BIS)

BIS is the largest body for formulating standards for various food items .It came into existence through an Act of Parliament dated 26 November 1986.It is the statutory body under Ministry of Civil Supply ,consumers affairs and public distribution.

The bureau is a body corporate consisting of 25 members representing both central and state governments.

### **Organizational Network**

BIS Headquarters at New Delhi a network has 5 regional offices at Kolkata, Chennai, Mumbai, Chandigarh, and Delhi central and branch offices at Ahmedabad,Banglore,Bhuvaneshwar,Bhopal,Coimbatore,Faridabad,Guwahati,Hyderabad,Jaipur , Nagpur, Kanpur, Lakhnou, Rajkot, Pune, Patna and Vishakhapatnam serve as a effective links between state governments industries, technical industriesand consumer organization etc.of the region.

#### **Activities/Functions of BIS**

The activities of BIS can be broadly grouped under the following heads.

- 1.Standards formulation.
- 2.Certifications.
- 3.Laboratory services.
- 4.Sales of Indian standards/other publications
- 5.International activities.
- 6.Consumer related activities
- 7.Training services.
- 8.Information services.
- 9Financial,resources-Mobilisation and utilization etc.

### **3.Agriculture Marketing (AGMARK)**

AGMARK is an abbreviation of 'Agriculture Marketing' which provides quality standards for grading, packaging and marketing of agricultural and Animal husbandary products through the Agriculture produce (grading and marketing) Act 1937, as ammended in 1986.

The directorate of Marketing and Rural Development in the Ministry of Agriculture is vested with the responsibility to enforce and implemented the Act.

The label of AGMARK is available in various colors showing the different standards of produce this is provided by Central Agricultural Marketing advisory (Faridabad). It is volunteer skill if any seller want to sell his produce under quality specification of AGMARK the advisory provides him this label.

The label of AGMARK is fixed on the packed product in such a way that the contains of the product can not be removed without AGMARK label . The produce of AGMARK labels are pretested and quality assured.

#### 4.Food safety law :-

The union of ministry for food processing industry is ready for draft of an integrated food laws by integrating all act that will replace laws that regulate a sector at present. The centers has constitutes a group of minister to formulate a law for food processing industry under the chairmanship of union agricultural minister. All efforts have been made that integrated food laws should be form in time born manner with a single food law & single regulatory agencies approach .

#### Objective of act:-

- 1) Laying down science based standards for food
- 2) To regulate manufacture, storage, distribution and import of food products.
- 3) To insure availability of safe and wholesome food for human consumption
- 4) Regulatory control for the formulation of standards .

## **LECTURE NO.7**

### **INTERNATIONAL REQUIREMENT FOR EXPORT OF MILK AND MILK PRODUCT**

#### **Introduction:**

With the expanding significance of global food trade, the need for a more universal food code will be paramount in the near future. The food and agriculture organization (FAO) and the world Health organization (WHO) have set up Codex Alimentarius commission (CAC) and subsidiary bodies that present a unique opportunity for all countries to join the international community in formulating food standard and working towards their global implementation . Development of dairy portion of the CAC in process and will be of significance in governing the hygienic processing practices and recommendation relating to compliance with dairy product standards that can be adopted globally.

In order to meet international sanitation Standards and Regulation, establishment of food Hygiene during the entire chain from production to processing is essential for Indian dairy industry. India being a tropical country with wide climate variations poor organizations and infrastructure facilities , this is a big challenge. Preparations are already underway at various levels to strengthen the national food control system in order to keep pace with the global movement on "Food Safety".

#### **Essential commodities act**

A number of quality control orders have been issued under Essential Commodities Act such as milk & milk product Order (MMPO), meat product order (MPO) and vegetable oils control order (VOCO). These orders are mandatory and are primarily meant for regulating the hygienic conditions. The government of India's latest amendment of MMPO (March 2002) from the department of animal husbandry and dairying (ministry of agriculture), in its fifth schedule now include sanitary/hygiene measures for quality and safety of food which shall be applicable even for the business handling <10,000 l of milk per day. These so many orders that need to be included in single order, which may later be named the food products order (FPO)

#### **Harmonization of export Inspection and certification System.**

In the area of export inspection and certification systems, a decision has already been taken to take into account international guideline (ISO-17020) "the general criteria for the operation of various type of bodies performing inspection as well as codex standard. Establishment of export inspection council (EIC) as the official certifying body of government of India has already been

designated as competent authority by the European commission for marine products and basmati rice and is awaiting recognition for egg products and milk products

### 1.3 Establishment of CAC:-

CAC is an international commission, a body of over 165 countries constituted by FAO and WHO, whose objective is to protect the health of consumers and to ensure fair practices in food trade. The Codex Alimentarius is a collection of international standards for the safety and the quality of food as well as codes of good manufacturing practices and other guidelines to protect the health of consumers and remove unfair practices in international trade and settling disputes in WTO

In addition to commodity standards, the Codex Alimentarius include the general standards, which has across –the –board application to all food and are not product specific.

There are general standards or recommendation for :

- Food labeling and Food additives
- Contaminants
- Method of analysis and sampling
- Food hygiene
- Nutrition and food for special dietary uses.
- Food import and export inspection and certifications systems.
- Residues of veterinary drugs in food
- Pesticide residues in food

### Codex contact point in India:-

The codex contact point in India is The director general of health services.(DGHS)in the ministry of health and family welfare, the department of food processing industries is closely associated with the activities of codex Alimentarius

The hindrances in harmonization :

On several aspects, our present dairy standards do not fully comply with the codex guidelines. For instance, the maximum residual limit (MRL) of lead in butter was 0.05 ppm as endorsed by the codex committee on food additives and contaminants (CCFAC)in the 24<sup>th</sup> session of CAC at Geneva in July 2001. Indian delegation objection to this MRL and the request to revert in to 0.5ppm was considered.

Agreement on SPS measure In  
regard to food, the term sanitary and phytosanitary measure means any gauge applied to protect human and animal life or health within the territory of the member countries from risk arising from food additives, contaminants, toxins or disease causing organisms in foods beverages, or feed stuffs. Animal life and health the SPS agreements recognize the standards adopted and recommended by the international office of epizootics (OIE) and for plant life and health, those recommendations of the international plant protection convention (IPPC). The organization Codex, OIE and IPPC are known as three sister. Only those measures that are necessary to send mesurment must be based on scientific principles.

Guideline on the judgment of equivalence of sanitary measures



Under the agreement ,all measures are to be based on risk assessment (RA) of the risk to human health using internationally accepted risk assessment techniques .CAC has develop these procedure further use by Codex member countries Principal for risk analysis in the frame work of Codex.include a provision that requires that risk assessment should be based on data from different parts of the world including developing countries ,based on realistic exposure scenarios ,including susceptible and high risk population group and taking into account acute ,chronic and cumulative adverse health effects

## LECTURE NO.8

### Preservation of milk and milk product by bio, herbal, chemical and physical preservatives

Defination :- preservation is any treatment of milk and milk product which prevent spoilage and extend the keeping ability of raw material to period longer than it's natural keeping quality.

#### PRESERVATION METHODS

- Chemical Method
- Physical Method
- Biological Method
- Herbal Method

1. **Chemical Method:-** In this method preservation is made by small addition of artificial, chemical such chemical not only indigestable in greater quantites but are harmless to humen health when applied in concentration just sufficiant to produce the preservatis effect.Even concentration of this chemical lethal to microbes or inhibit their growth.

Several antimicrobial substances have been used for centuries. Salt, sugar, wood smoke and vinegar have a long history of traditional use as flavouring and antimicrobial compounds. Apart from this, there are many chemicals, intended to prevent or retarad microbial spoilage. This includes the various organic acid, parabens, sulfites and nitrites.

#### Selection of chemical preservatives

The antimicrobial and chemical properties of the compound such as a solubilities and disassociation constant.

The safety of compound at intended used level.

The properties and composition of food product such as, Ph,fat, protien and water activities.

The cost of added antimicrobial chemicals.FOR eg. Parabens, propionic acid.

Chemicals	Effective ph range	Antimicrobial activity	Comments
Benzoic acid	2.5 – 4.0	Yeasts and mold food poisoning	Phenolic taste, lipids decrease

		bacterias sporeforming.	effectivness
Propionic acid	< 5.0	Spore forming bacteria especially rope forming bacteria, molds.	Molds and rope inhibitors in bread not interfere with yeast
Sorbic acid	Effectives upto 6.5	Yeast and molds seltively against bacteria,gram positive	Lipids decreases effectiveness taste and odour.
Parabens	Wide ph range effective at ph 7.0 and above 8.5	Yeast and mold gran positive bacteria.	As alkyl chain increases inhibitory action increases
Sulphar dioxide and sulphites	< 4.5	Yeast ,mold bacteria	In undissociated sulphourus acid is most active form.

Other important chemicals used in preseration of milk

#### A.Formalin

Formalin is solution of 40% formaldehyde in water and found very affective in small concentration. Normaly it is used in preservation of milk samples at the rate of 0.1ml in 25ml milk formalin. It also serves as disinfectant and preservaive for houshold product.

#### B.Lactoperoxidase system for preservation of milk

Collection and transportation of raw milk present several insurmountable techno-economic problems of dairy industry in developing country. While efficient cooling of milk may be recommended as ideal for preservation of milk. The proposition is not always practical

The enzyme lactoperoxidase is present in milk in various species in adiquate quantity to permit activation of LP system,bovine milk buffalo milk(0.16 to 0.21 units/ml) ewe milk (0.14 to 2.38 units/ml) and goat milk (0.05 to 3.55 units/ml) however this system is not working for prolong period.

2. **Herbal method**: There has been increasing concerns of the consumer about foods free or with lower level of chemical preservatives those could be toxic for human concomitantly,consumer have also demanded for food with longer shelf life and absense of risk of causing food born disease this prespective has put pressure on the food industry for progressive removal of chemical preservatives and adoption of natural alternatives to obtain its goal concerning microbial safety.

Recently,there has been increasing interest in discovering new natural antimicrobials.plant product with natural antimicrobial properties notably have obtain emphasis for possible application in food production in order to prevent bacterial and fungal growth.

Antimicrobial activies of species depends on several factors which includes:

→ Kind of spice

- Compostion and concentration of spice
- Microbial species and its occurance level
- Substrate compostion
- Processing condition and storage

Spices have been defined as plant substances from indigenous or exotic origin,aromatic or with strong taste,use to enhance taste of food.spices include leaves flower bulbs,fruits,stem,rhizomes,and other plant parts. allthhough spices have been well known for there medicinal , preservatives and antioxidants properties,they have been currently used with primary purpose of enhancing flavour of food rather then extending shelf life.

Table1: antimicrobial effectiveness of spices and herbs

Spices and Herbs	Inhibitory effects
Cinnamon,Cloves,Mustard	Strong
Allspice,bayleaf,caraway,coriander,cumin,oregano,rosemary,sage, thyme	medium
Black pepper,red pepper,ginger	weak

Table 2: inhibitory effect of species and herbs

Spices and herbs	Microorganism
garlic	Salmonella typhimurium, Escherichia coli; staphylococcus aureus Bacillus cereus
onion	aspergillus flavis Aspergillus paraciticus
cloves	Mycotoxigenic aspergillus
Cinnamon	Aspergillus paraciticus
Allspice	Mycotoxigenic aspergillus
mustard	Mycotoxigenic aspergillus
rosemary	Bacillus cereus

#### Application of Herbs in dairy product

1. Cardamom: The seeds of cardamom have pleasant aroma and characteristics warm but slight pungent taste. Cardamom powder added @ 0.1 to 0.2% enhanced the shelf life of sandesh, phedha etc.
2. Saffron: these are the dried stigmas of the crocus flowers of *crocus sativa*. Addition of 0.015% saffron (w/w of chhana) at the end of cooking stage improve the shelf life of sandesh upto 9 and 68 days at 30°C And 7°C as against 3 and 51 days for untreated sandesh samples.
3. Nutmeg: it is used as condiment and medicine. It is stimulant, carminative, astringent and aphrodisiac. Alcoholic extraction of nutmeg shows antimicrobial activity against micrococcus var. qureus.

3. **Bio-preservation method**: bio-preservation method refers to the extending storage life and enhanced safety of food using their natural or control micro flora and/or their antimicrobial products. The diver group of lactic acid bacteria and bacteria belonging to genera *Lactobacillus*, *Lactococcus*, *Leuonstoc*, *Pediococcus*, *Streptococcus*, synthesize a variety of inhibitory compound

such as acid, hydrogen peroxide, ethanol, acetaldehyde, diacetyl, carbon dioxide, bacteriocin or bacteriocidal proteins, etc. That inhibit the growth of undesirable microorganism particularly interic bacteria the bactoriocins which are small single or complex protein or proteinaceous substance which a wide inhibitory spectrum are interesting because of there potential to control the growth of spoilage and patogenic flora.

Microorgnism	Bacteriocin Type	Antibacterial Spectrum
Bifidobacterium	Bifidin	E.coli other pathogen
Lactococcus lactis spp. Lactis	Nisin	Micrococcus, Listeria staphylococcus, Bacillus Clostridium
Lactococcus Lactis spp. Cremoris	Diplococcin	Wide range of gram positive
Lactobacillus brevis	Lactobacilln	L.brevis & other related strains of lab
Lactobacillus planterium	Lactolin	L.brevis, L.acidophilus
Lactobacillus acidophilus	Lactocidin,Acidophilin	Narrow spectrum antibiotic L.leichmann
Lactobacillus helveticus	Helveticin	Lactobacillus spp. of closely related strains
Leuconostoc mese nteroids	Mesenterocin 5	Enterococcus, Micrococcus
Propionibacterium jenseni	Jensenin G	Limited inhibitory effect Propionibacterium and related strains

Nisin: It is the bio-preservative in food system. The bacteria producing nisin are *Lactobacillus lactis* subsp. *Lactis*, *Leuconocins* of *Leuconostoc mesenteroids* and pediocins of *Pediococcus acidilactici*. Nisin is recogised for 50 years for its antibacterial activity. It has found to effectively control spoilage and pathogenic gram positive bacteria spore formers in liquid milk, ice cream, cottage cheese and different meat product.

Table 2: Effect of Nisin in Food System

Product	Nisin concentration	Observation
Milk	100-1000 RU/gm	Extended the shelf life of pasteurized milk from 6-7 days to 10 days at 6 degree c
Milk	100 mg/ml	Shelf life extention 2-12 days at 25 degree c
Sterilized Milk	100 RU/gm	Shelf life extension from 3-5 days to 60 days at 37 degree c
Sterilized Milk	500-1000 RU/ml	Copmlete inhibition of clostridium perfringenes
Cottage cheese	2500 IU/ml	Inhibition of <i>Listeria monocytogenes</i>
Cheese	500 IU/gm	Inhibitated the growth of non-starter LAB for one

		month
Yoghurt	25 IU/gm	Enhanced shelf life of 10 days at 7 degree c
Dahi	1000 IU/gm	Effective in controlling lipolysis in dahi during storage at 25 degree c
Kheer	200 IU/gm	Lowering of thermal processing time and enhancing shelf life for six month

4. **Physical methods**: The physical method of preservation of milk is as following.

Sr no	Method	Description	Objective	Remark
1	Pasteurization of milk	Heating milk at 72 degree C. For 15 sec cooled immediately at 5 degree C in appropriate container	To kill pathogens	Most suitable and practice method.
2	Pasteurization milk product	Heating raw materials including milk at 72 degree C for sufficient period	To kill pathogen	Routine practice
3	Vacuum pasteurization	Pasteurization under reduced pressure by direct steam	-Do-	Control of steam temp and pressure
4	Stassanization	Milk is heated at 72 degree C for 7 sec cooled immediately in a heat exchanger	-Do-	Mostly used in France
5	Ultra high temp pasteurization	Milk is heated at 137.7 C for 2sec	Sterilizing the product	Suitable for aseptic processing of milk
6	Cold or refrigerator storage	Gentlest method of food preservation, reduces the rate of deterioration. Actually this is a post processing treatment	Unfavorable for growth of microbes	It is used for variety of products were store them >5 degree C
7	Freeze drying	Used to dehydrate liquid food. In which product is frozen, then water is removed by sublimation	To make unavailable for the growth of microbes. To decrease water activity	It is only method to preserve delicate flavour, colours, size, and texture
8	Retort processing	Filling into heat resistant package	To sterilize the product	Mostly used in ready to use

		then sealing them with air tight,pressure resistant cap and starilization to product heating is indirect either by steam or hot water under controlled condition	without any damage to the various component present in milk eg flavoured milk in bottles	food product
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## LECTURE NO.9

### Utilization of Dairy By Product whey and high acid value milk :-

Definition :A dairy by product may be define as a product of commercial value produced the during the manufacture of a main product.

#### Principle of Utilization

The product for the utilization of the various thus dairy by product, bothforeign and Indian ,together, with names ,of commonly made food product.

### By-product and their principles of utilization and names of food products made

By product	Principle of utilization	Food products made
Skim milk	Pasteurization Sterilization Fermentation  Fermentation and concentration Concentration  Drying Coagulation	Flavoured milks Sterilised flavoured milk Cultured butter milk Acidophilus milk Bulgarian butter milk Concentrated sour skim milk Plain condensed skim milk sweetened condensed skim milk Dried skim milk Cottage cheese Bakers cheese
Butter milk	Fermentation and concentration Drying Coagulation	Condensed butter milk Dried butter milk Soft cheese
Whey	Fermentation  Concentration	Whey beverage Yeast whey Plain condensed whey Sweetened condensed

	Drying Coagulation	whey Lactose Whey paste whey protein concentrate dried whey ricotta cheese
Lassi	Icing and seasoning	Beverage
Ghee-residue	Processing	Toffee or paste or indigenous sweetmeat

### **Method Of Utilization**

1. Flavoured Milks.
2. Sterilized flavoured milks.
3. Cultured buttermilks.
4. Acidophilus milks.
5. Bulgarian butter milks.
6. Concentrated sour skims
7. milks .

### **Types of Whey:-**

- 1)Whey beverage :The whey obtained as a by product of chees industries has been employed in production of fermented beverage , both alcoholic and non alcoholic The production technique of one such beverage of the acidic type .
- 2)Yeast Whey: This is newly developed product. Protein deficiency makes the production of yeast from whey particularly attractive ,as much needed food supplement rich in proteins and vitamins can be made from a substrate which is often used inefficiently or wasted .
- 3)Plain condensed whey :This is made of pasteurizing the separate whey and hot liquid in vacuum pan.
- 4)Sweetened Condensed Whey: separated, Pasteurized, sweet chees whey
- 5)Whey protein concentrate :- These include soluble and coagulated whey proteins earlier soluble whey proteins were recovered from separated sweet cheese whey by partially neutralizing it,condensing it to 62 % total solids .
- 6)Whey paste :- this is manufactured in Russia by pre concentrating a mixture of whey and skim milk in vacuum evaporator and adding sufficient suger syrup ,butter and crem so as to obtain 15 % sugar ,15% fat ,65 % total solid in the finished product .

## LECTURE NO.10

### **Packaging of milk & milk products with modern techniques**

Definition:

Packaging can be defined as a tool that protects and contains our goods with the aim of minimising the environmental impact of our consumption.

#### **The function/role of packaging :**

Millions of pounds are spent on packaging of food and other items each year. Sixty percent of all packaging is for food products. At the beginning of the 20th century most food was sold loose. It was weighed and advertising was virtually unknown. Today packaging is a massive and often it is the way the packaging looks that persuades the shopper to buy the product inside it.

1) To protect a product from damage or contamination by micro-organisms, air, moisture and toxins. (physical, barrier protection): the product must be protected against being dropped, crushed, and the vibration as it happens during transport. Delicate products such as fruit need to be protected by a rigid package such as a laminated container. The product must also be protected against the climate including high temperature, humidity, light and gases in the air. It must also be protected against micro-organisms, chemicals, soil and insects.

2) To keep the product together, to contain it (i.e. so that it does not spill):

Some shapes cannot be easily packaged, for example, gulabjamun, paneer, rasgulla, however, there are methods of getting around this problem. Some products such as basundi, rabri, need to be contained in packages that hold them together and are sealed to prevent spillage and loss.

3) Protection during transport and ease of transport :

A package should be designed to make it easy to transport, move and

lift. A regular shaped package (such as a cube) can be stacked without too much space between each package being wasted. Unusually shaped packages can lead to space being wasted and this can be costly if thousands of the same package are being transported.

5) Stacking and storage: in supermarkets and shops it must be possible to stock packages so that space is not wasted on the shelves. Lost space on shelves is looked upon as a lost opportunity to sell to a customer. Also, the package must be designed in such a way that all the important



information can be seen by a potential buyer, especially the product name. The next time you visit the supermarket look carefully at the shape of the packages. They are usually the same rectangular/cuboid shape. Often packages are stacked on top and alongside each other to reduce wasted space. The shape and form of the package determines how efficiently they can be stacked or stored.

6) Provide convenience: packages can have features which add convenience in distribution, handling, stacking, display, sale, opening, re-closing, use, and re-use.

7) Keep the product safe for consumption

8) Contributing to the product image through structural and graphic design

9) Increasing the shelf-life and ensuring longer availability.

10) Environmental protection i.e. eco-friendly.

Properties/requirements of packaging material:

1. material does not react with product.
2. It should be non-toxic and non-tainting.
3. should have good resistance to rough handling.
4. should protect or delay spoilage
5. should be easy to open, dispense (distribute), reseal and store.
6. should be durable and eco-friendly.
7. reusable
8. should give convenience to consumer.
9. should provide graphics to product which become a fashion.
10. should protect the food from physical/mechanical shock.
11. reliability of closures.
12. biodegradability and recycling potential low cost.
13. easily available at
14. should have printing characteristics.
15. should protect the food from water vapour, gases and volatiles.
16. should appealing product presentation is gaining prominence.

Forms Of Packaging Material

1. Metal can
2. Earthen pot
3. Glass bottle

4. Paper carton
5. Corrugated board
6. Plastic:( HDPE)-High density poly Ethylene ,LDPE, PVC
7. Multilayer sheets

1) Metal Can: These can be classified in to round, square, oval.

- ✓ Light weight
- ✓ Ease for fabrication
- ✓ Long shelf life

### **USES: Packing of ghee, milk**

Glass bottles: glass bottles and containers are available in many different shapes such as large size “free size or one shote” styles. Light weight bottles

### **Advantages:**

- ✓ Quality image
- ✓ Low cost production tooling
- ✓ UV protection a
- ✓ ND good pressure resistance

USES: For packaging of ghee, milk powder

Board containers: The paper board is commonly used for packaging the milk product.

Plastics: Plastics containers are commonly used as primary food product . plastics are flexible form

Advantages:

- ✓ low price of family sized packs
- ✓ have versatility lower manufacturing costs and lightness weight

Earthen pots: Mostly Dahi is marketed by having small producer in earthen pot

Flexible Pouches- A Pouch is a container made up of flexible packaging material, such as

Plastic film, alluminium foil, paper etc.

- ✓ Most recent development in drinks packaging.
- ✓ Usually made from multi-layer composite –aluminium foil is essential barrier layer.
- ✓ Process compactness when empty & disposability.
- ✓ Potential for excellent graphic decoration, often build on a metalized surface
- ✓ Easy to carry
- ✓ Incorporate tamper evidence feature & closure system
- ✓ Make consumption on the move even easier
- ✓ Very low weight-to-content ratio. saves resource.

TABLE-an overview of packing materials used in dairy industries

Product	Packaging material
Liquid milk	Glass bottles (obsolete) LDPE film in combination with LLDPE or octane/butane-based films. Paper laminate for tetra packs.
Milk powder	Tin plate container, nitrogen packed and lacquered from outside. Flexibility laminate such as metallized PST/BOPP/aluminium foil/poly laminates. Refill pack: lined cartons laminated with BOPP/PET, varnished on the outside. Paper laminated film also used. Bag-in-box: powder filled in laminated and packed in cartons.
Butter	duplex board with vegetable parchment paper tinplate container, aluminium foil
Cheese/cheese spread	Tin plate containers lacquered from inside Packed in AL foil and then in duplex board carton Injection moulded PPI HOPE container.
Ghee	Tinplate container (lacquered inside) Glass bottles .BOPE film pouches
Ice cream	Termoformed/injection moulded plastic containers Duplex board carton which are poly laminated laminated of BOPE film PET
Peda/burfi	Paper board carton with paper lining paper, paper bags dhak leaves

## PACKAGING TECHNIQUES/ SYSTEM

The basic systems used for packaging ;

1. Modified atmosphere packaging (MAP)
2. Vacuum packaging
3. Aseptic packaging
4. Retort packaging
5. Active packaging

### 1) MODIFIED ATMOSPHERE PACKAGING (MAP):

Def:- MP may be defined as the enclosure of food product in gas barrier material, in which gaseous environment has been changed.

Advantages of MAP:-

- Fresh appearance
- Reduced economic losses
- Increased market area
- Easier to open

Disadvantages of MAP:-

- Visible added cost
- Temperature control necessary
- Special equipment and training required

## **2.Vaccuum Packaging;**

This process is useful to extend the shelf life of perishable product without addition of preservative.

The purpose of packaging is to stop microbiological & non-microbial deterioration of the products & thereby increases its shelf life.

- It removes air from the packaging with no gas replacement resulting in skin tight film package .
- In normal packaging, the presence of oxygen in the air causes oxidation of fat.
- The eliminating air, through vacuum package, the product spoilage is checked and shelf life is increased.

## **3.Aseptic packaging:-**

- It is a relatively new packaging concept aimed at developing new product group. Namely pre-sterilised and aseptically packaged milk and milk product. During aseptic packaging process, as per sterilized product is filled under sterile condition into sterile packages in sterile environment and then germproof sealed.

Packaging material for aseptic packaging

- Glass
- Cans
- Paper board cartons

## **4.Retort packaging**

Retorting may be defined as a process for preserving food achieved by the application of a thermal sterilization procedure to product packed in hermetically sealed containers. Tin plate and glass were the two most preferred packaging material because of their strength, impermeability to gases/vapour and spoilage organism. Later development in packaging led to the introduction of retort pouches as flexible packaging material for retort processed food with certain added advantage over conventional cans/glasses.

## **5. Active packaging-a new dimension in packaging technology**

It is technology provided in protective atmosphere, packaging material itself may play an active role in enhancing the shelf life of product by nullifying the rate of deterioration reaction in this technique growth of spoilage and pathogenic microorganism is stopped. Other term which is coined for this packaging called smart functional packaging.

Active packaging technique involves interaction between the food, packaging material and internal gases atmosphere. Active packaging senses environmental changes and responds by changing its property.

Active packaging is group of technology in which package is active involved with food product or interact with internal atmosphere to extreme shelf life while maintaining the quality.

## **OBJECTIVE OF ACTIVE PACKAGING**

- Shelf life extension
- Simpler processing
- Easier handling
- Preservation
- Reduced additive foods.
- 

## **DEFINATION**

**MARKET MILK** – It refers to fluid whole milk that is sold to individuals usually for direct consumption .

**OPERATION FLOOD** – It was planned strategy for dairy developement in India . It is multiplication for Anand model for dairy development .

**PACKAGING** – Packaging mean placing a commodity in a protective wrapper or container for transport and storage .

**LACTOMETER** – It is instrument which can be used for rapid determination specific gravity .

**SAMPLING** – It is process of taking small quantity of representative sample from aggregation to carryout various physical or chemical examination .

**TOTAL SOLID** – It is entire residue left .

**VACCUM PASTEURIZATION** – Pasteurization of milk at reduced pressure by direct steam .

**STASSANIZATION** – Milk is heated in between two water heated pipes at about 74 c for 7 seconds .

**U.H.T PASTEURIZATION** – It is ultra high temp pasteurization milk is heated to 135-150 C for fraction of second .

**HOMOGENIZATION** – It refers to process of forcing the milk through a homogenizer with object of sub-deviding the fat globules .

**STANDARDIZATION** – It refers to adjustment of fat and solids not fat of milk to desired so as to confirm legal standards as prescribed .

**STERLIZATION** – It is process of complete destruction of micro-organism from milk .

**CREAM-** It is portion of milk which is rich in milk fat .

**SKIMMING EFFICIENCY** – It refers to the percentage of total fat from milk recovered in the cream .Higher fat % in the milk greater fat loss in skim milk , the lower will be skimming efficiency and vice versa .

**BUTTER OIL** – It is fat concentrate obtained mainly from cream or butter by removal of all moisture .

**STARTER CULTURE** – It is selected group of organism which brings desirable changes in milk and milk products .

**PANEER**- It is product obtain from cow or buffalo milk by coagulation with citric acid .

**KULFI** – It is indigenous frozen products , composed of milk malai and sugar .

**COTTAGE CHEESE** – It is soft , unripened cheese usually prepared from skim milk having mild acidic flavour in the form of flakes of curd which have meaty consistency .

**YOGHURT**- It is fermented milk product obtained by scuring of bacteria like lactobacillus bulgaricus and streptococcus thermophilus produce desirable changes in milk and milk product .

**PLASTIC CREAM** – It is type of cream which contain fat % 65-80 % used for preparation of ice cream .

**MARGARINE**- It is an article of food prepared by blending various fats and oils resembles like that of butter .

**BABY FOOD** – It is adjustment of fats , proteins , carbohydrates of milk with addition of vitamins and minerals .

**TABLE BUTTER** – IT is product obtained from churing of cream .

**DETERGENTS** – It is substance which function is to remove milk deposits and other foreign matter from surface .

**SANITIZER**- A chemical substance which prevents growth of micro-organism.

**MILK STONE** – Milk deposits dries and become hard called as milk stone .

**VITAMINIZED MILK** – It is milk to which one or more vitamins are added .

**IRRADIATED MILK** – It is milk in which vit-D content has been increased by exposures to U.V rays .

**METABOLIZED** – Feeding irradiated yeast to milch animals vit-D content of milk increased .

**FILLED MILK** – Fat of milk is derived from a vegetable source .

**FORTIFIED** – Adding definite amount of standardized vit-D concentrate .

**IMITATION MILK** – A product resembling milk but of non dairy origin.

**VEGETABLE TONED MILK** – The milk protein of skim powder is substituted by vegetable protein isolated from the groundnut .

**SOY MILK** – It is made from soya bean by patented process.

**HUMANIZED MILK** – Whole cow or buffalo milk is so modified in its chemical composition that it resembles human milk.

**SWEETENED CONDENSED MILK** – It is product obtained from cow or buffalo milk by partial removal of water and after addition of conc . sugar .

**SUGAR RATIO** – It is concentration of sugar in water content of sweetend condensed milk .

**FORCED CRYSTALIZATION** – It is process of agitating the product at a desired temp for period of 30-40 min by adding seed material to get smooth texture to final product .

**EVAPORATED MILK** – It can be defined as conc milk product prepared by using cow milk having consistency like that of thin cream and preserved by sterilization process

**DRIED MILK** – It is product obtained from whole milk or skim milk by removal of water to such an extent that milk solids produced contain less than 5% moisture with help of heat or other suitable means .

**INSTANT MILK POWDER** – It is powder when mixed into water gets dissolved in period of 15 sec with vigorous agitation and must produce stable reconstituted milk .

**WETTABILITY OF MILK POWDER** – It is tendency of powder to dissolve in water rapidly and easily without much vigorous agitation .

### **\* TRUE AND FALSE \***

1. Maximum over-run obtain in butter is 50%

-> False.

2. Creamery butter is more uniform in quality than dairy butter

-> True.

3. Soft- ice-cream is drawn from freezer without hardening

-> True.

4. Stabilizers improve whipping quality of ice-creams

-> False.

5. Parmesan is very soft cheese

-> False.

6. The object of curing of cheese is to develop a character flavor, body and texture

-> True.

7. The sucrose ratio in condensed milk is 62.5%

-> True.

8. The heat stability of milk is dependent on casein whey protein ratio.

-> False.

9. Dahi is used as base for production of rasgulla.

-> False.

10. Direct cream is better method of ghee production than deshi or prestratification  
-> True.
11. Margarine is used as an imitation of butter and not as substitute.  
-> False.
12. Cottage cheese is preferred by low income group people  
-> True.
13. Evaporated milk can be used as "Baby Food"  
-> False.
14. Spray drying process is preferred in manufacture of whole milk powder  
-> True.
15. Standardization of cream in manufacture of butter is done to fulfill legal requirement.  
-> True.
16. Paraffining the cheese is essential  
-> True.
17. Plastic cream is preferred for manufacture of butter  
-> False.
18. Starter culture is used in preparation of cheddar cheese  
-> True.
19. Fruits used in ice cream preparation impart colour  
-> True.
20. Roquefort cheese is blue in colour  
-> True.

### **M.C.Qs**

1. Milk freshly drawn from udder of cow has Amphoteric in nature
2. Colostrum is first secretion obtained after Parturition
3. The first drawn milk during milking is called as foremilk which is low in fat
4. Administration of drug / hormone may affect temporary changing fat.
5. Milk fat present in emulsion form.
6. Standardized milk contains minimum 4.5% fat
7. Toned milk contains minimum 3% fat
8. Double toned milk contains minimum 1.5% fat
9. Casein forms 78-80% total protein



10. Milk protein also present in colloidal form
11. Milk sugar or lactose is true form of solution
12. Carotene act a anti oxidant and of vit –d
13. Yellow colour of milk due to carotene
14. Specific gravity of skim milk is 1.035-1.037
15. Addition of water or cream lower the specific gravity of milk
16. Addition of skim milk increase the specific gravity of milk
17. Freezing point of cow milk is -0.547°<sub>C</sub>
18. Freezing point of buffalo IS -0.549°<sub>C</sub>
19. viscosity of water is 1.005cp
20. viscosity of milk is 1.5 to 1.7cp
21. Sweet taste of milk is due to lactose
22. Salty taste of milk is due to minerals
23. Sulfur dry compound significantly contribute to cook flavour of heated milk
24. Refractive index of cow milk is 0.2065 to 0.2075%
25. Refractive index for buffalo milk is 0.2076 to 0.2086%
26. The common milk m.o grow best in between 20to 40°<sub>C</sub>
27. Plate cooler are generally used for continues cooling of milk in dairy industry
28. Filtration removed the surprised foreign particles by straining process
29. Riboflavin being a vitamin is greenish yellow pigment gives characterstic colour to whey
30. Enzymes are biological catalysis
31. Amylase is starch spitting enzyme
32. . Lipase is fat spiting enzyme leading to rancid flavor
33. Protease is protein spitting enzyme
34. Titrable acidity of cow milk ranges from 0.13 to 0.14
35. Titrable acidity of buffalo milk ranges from 0.14 to 0.15
36. The pH of normal fresh milk varies from 6.7 to 6.8
  
37. Pasteurization of milk was first attributed to Dr.Soxhlet of Germany in 1986
38. Mycobacterium tuberculosis is index organism of pasteurization.
39. . Vacreation is pasteurization of milk at reduced pressure by direct steam.
40. U.H.T Pasturization is the milk heated to 135-150°<sub>C</sub>.
41. Pasteurization is process of heating every particle of milk at 63° for 30 min or 72° for 15 sec
42. Homogenization refers to the process of forcing the milk through a homogenizer with the objective of sub-dividing the fat globules.
43. Neutralization of cream is partial reduction in it,s acidity.
44. Market milk refers to fluid whole milk i.e sold to individuals usually for direct consumption milk co-operative of Anand.
45. Amul was the promoter of operation flood.
46. .operation flood was formulated during February 1970.

47. .Dr.verghese kurien may be regarded as Father of Indian dairy co-operative.

48. Dr.D.NKHUODY the mother of Indian Dairy Development.

