MINISTRY OF FOOD PROCESSING INDUSTRIES
GOVERNMENT OF INDIA

सत्यमेव जयते

Reading Material

Paneer Production

Under PMFME Scheme


AATMA NIRBHAR BHARAT

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Chapter – 1

Raw Material

1.1 Introduction

Milk, liquid secreted by the mammary glands of female mammals to nourish their young for a period beginning immediately after birth. The milk of domesticated animals is also an important food source for humans, either as a fresh fluid or processed into a number of dairy products such as butter and cheese (https://www.britannica.com). Milk is a nutritious choice as it provides nine essential nutrients our body needs. Milk contains essential nutrients like high-quality protein, calcium, vitamin D and more. These nutrients help our bodies function properly. For example: Protein helps build and repair muscle tissue Calcium and vitamin D helps build and maintain strong bones and teeth Milk also contains B vitamins, which can help your body convert food into energy.

1.2 Dairy Industry in India

India is leading milk producing country in the world, accounting for 19 percent of the global market share and expected to grow at compound annual growth rate (CAGR) of 14.8% between FY 2018 – 2023. As per fiscal year 2019, milk production in India amounted to about 187 million metric tons. As per FY – 2018, around 81% of the Indian dairy and milk processing market comes under unorganized sector, where milk is processed in unhygienic infrastructure, which affects the overall quality of milk and milk-based products. Consumption patterns of liquid milk at the farm level and less infrastructure for processing is the main reason for low value addition of milk. The demand for value added products especially traditional dairy products is increasing day by day and the dairy industry of the country is trying to meet the present demand.

Uttar Pradesh, Rajasthan and Gujarat are the major milk producing states in India. Uttar Pradesh is the largest milk-producing state, as it has the highest buffalo population and the second-highest cattle population in the country. Majority of the rural population in this state is engaged in livestock nurture and dairy farming. Gujarat holds several cooperative dairy unions, milk cooperative societies and private dairy plants, which play vital roles in the production of milk and milk-based products in the state.

1.3 Insight on value-added product

Apart from processed liquid milk, Indian dairy and milk processing industry generates revenue from several value-added products such as butter, curd, paneer, ghee, whey, flavoured milk, ultra-high temperature (UHT) milk, cheese, yogurt, dairy whitener and milk powder. During the FY 2016 – 2020, the market size of dairy ingredients is expected to grow by around 14%.

1.4 Export-import opportunities

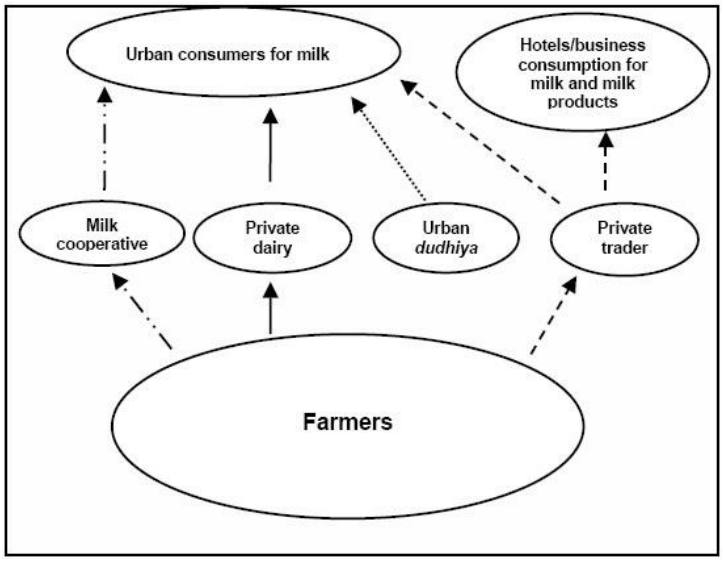
The export of dairy products from India has increased to countries like Bhutan, Afghanistan, Canada, Egypt, and the United Arab Emirates. India has also imported a significant number of dairy products from countries like France, New Zealand, Ireland, France, Ukraine, and Italy.

1.5 Key deterrents to the growth of the market

Despite having a significant livestock base of milch animals, India lacks in terms of good processing facility and availability of cold storages which results in wastage of dairy output. Lack of sufficient storage facilities and inefficient distribution channels are hampering the growth of the Indian dairy and milk processing industry.

Sufficient quantity and good quality of feed and fodder are required for proper animal rearing and milk production. Improper droughts and flood management affect the production of fodder in India. Deficiency of proper feed and fodder for milch animals, due to high usage of agricultural crop residues by producers of fibreboard, paper, and liquid fuels, affect its availability for dairy production and milk processing.

Dairy marketing channels in India



Reference: FAO

1.6 Need for Processing Milk

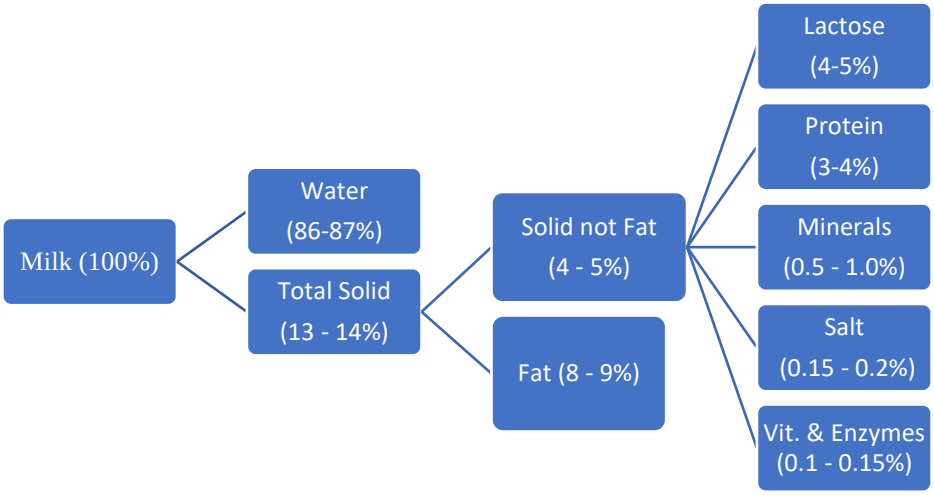
Milk is considered wholesome food mainly because of its high nutritive value. It has to be processed to;

- Increase the shelf life, because it is highly perishable.
- Prepare value added products like dahi, cheese, paneer, butter, ghee, AMF, flavoured milk, cheese, and yogurt, dairy whitener, milk powder etc. and many more dairy based products, for a good health.
- Make business out of it, create job opportunities, consequently building financially strong Nation.

1.7 Composition of Milk

Milk composition varies with species, breed (Holstein, Jersey), feed, and the stage of lactation. As per FSSAI, "Milk is a whole, fresh, clean lacteal secretion obtained by complete milking of one or more healthy milch animals excluding that obtained within 15 days before calving or 5 days after calving. Market milk must possess the pre-determined percentage of milk fat and SNF (Solid Not Fat)."

Milk of different classes and types must conform to the standards laid down by FSSAI. Mixed milk means a combination of the milk from cow and buffalo or any other milch animal. The combination also should at par with FSSAI standards.



1.8 Nutritional Value of Milk

Table: Nutritional values of milk

Nutritional Factor	Description	Energy Value
Protein	Milk protein is casein, a high-quality protein. All essential amino acids are present in Milk.	4.1 kC/g
Minerals	Milk contains phosphorus and calcium.	
Vitamins	Milk contains vitamins A, D, thiamine, and riboflavin.	
Fat	Milk fat is responsible of good flavor and physical properties. The fat content in cow milk is generally from 3.5 to 4.5 %	9.3 kC/g
Lactose	Lactose is the sugar component of milk and it supply energy.	4.1 kC/g

Chapter – 2

Processing and Machinery

2.1 Introduction

Paneer is a very common indigenous dairy product in Indian subcontinent, is similar to an un-ripened variety of soft cheese which is used in the preparation of a variety of culinary dishes and snacks. It is obtained by heat and acid coagulation of milk, entrapping almost all the fat, casein complexed with denatured whey proteins and a portion of salts and lactose. Paneer is marble white in appearance, having firm, cohesive and spongy body with a close-knit texture and a sweetish-acidic-nutty flavour. Preparation of paneer using different types of milk and varied techniques results in wide variation in physico-chemical, microbiological and sensory quality of the product. Paneer blocks of required size are packaged in laminated plastic pouches, preferably

vacuum packaged, heat sealed and stored under refrigeration. Paneer keeps well for about a day at ambient temperature and for about a week under refrigeration (7 °C). The spoilage of paneer is mainly due to bacterial action.

As per Food Safety and Standards Regulations (FSSR), 2011 Paneer is the heat assisted coagulated product resulted from the coagulation of cow or buffalo milk or a combination thereof with the help of lactic acid or citric acid. The paneer must have the moisture content less than 70 %. The fat per cent of paneer shall be greater than 50.0 of the dry matter. Milk powder may also be used in the preparation of paneer. The moisture and fat percent of low-fat paneer shall not be more than 70 and 15 respectively on dry matter basis. According to Bureau of Indian Standards (IS 10484:1983), paneer shall contain a minimum of 50% fat on dry matter basis but the moisture content shall not go beyond 60%.

2.2 Paneer Processing Flow Chart

Milk Reception

↓

Filtration (to remove if any extraneous matter)

↓

Standardization

↓

Standardization (Fat:SNF 1:1.65 using skim milk powder)

Heating (85 to 90 Deg. C for 5 min)

↓

Cooling (70 to 75 Deg. C)

↓

Addition of coagulant (1 % Citric acid solution)

↓

Continuous stirring till whey separates out and hold for 10 min

↓

Draining of whey

↓

Pressing the coagulum after filling in muslin cloth

↓

Removal of blocks and cutting into desired size

↓

Immerse the Paneer blocks in chilled water (4 Deg. C)

↓

Packaging and storage at 4 Deg. C

2.3 Step wise detail of paneer manufacturing

1. Receiving milk: Milk is received in a clean and sterilised Stainless Steel (SS-304) multi-purpose vat. Milk is standardized for Fat and SNF (fat: SNF 1:1.65) in a. Then milk is heated to 85-90^{0}C and hold it for 5 minutes, maintaining the same temperature. This process is also referred to as batch pasteurization. Purpose of batch pasteurization is to reduce the microbial load. Temperature of the pasteurized milk is then brought down to 70^{0}C.

2. Prepare 1% citric acid solution with respect to the milk, which is used as a coagulant. The temperature of coagulant is maintained at 70^{0}C, which is same as the temperature of milk at the time of addition of coagulants.

3. The coagulant is added in optimum quantity and stir them slowly, so that a clear whey separation shall be achieved. The green colour of the whey indicates proper coagulation. Stirring should not be intense otherwise this will lead to the break up the curd mass.

4. Once the pH of whey reached in the range of 5.7 to 6.0, allow the curd mass to be settle for about 5 - 10 minutes. Allow the whey to be drained out through a muslin cloth and the coagulated curd remains in the vat/cloth. It is advised that the whey temperature should not fall below 63^{0}C during the whole process.

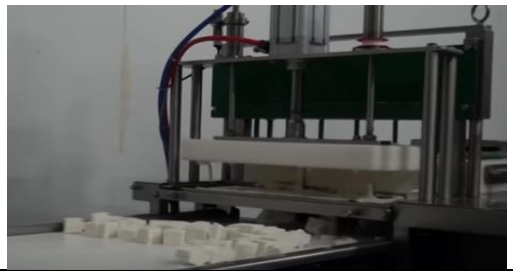
5. The curd mass shall be filled in the SS hoops lined with muslin cloth and pressed for 15- 20 min. Pressing can be achieved through a manual press or pneumatic press.

6. Immersed the pressed paneer blocks in chilled water (4- 6^{0}C) or 5% brine solution (4-6%) for 2 - 3 hours to achieve firmness. Further the paneer blocks were cuts and dried to remove extra free water.

7. At last, the paneer slices were packed in a vacuum-package made of high-density polyethylene (HDPE) and stored at 5 - 8^{0}C for further sales/distribution.

Process Description	Pictorial Representation
Milk Reception and Standardization	
Heating at 90 ^{0}C as per process requirement. The protein present in the milk denature at this temperature.	
Cooling at 70 ^{0}C as per process requirement for the addition of coagulant.	
Temperature: Checking temperature of milk prior to the addition of Acid Coagulant	
Preparation of Acid Coagulation: Citric acid at 1-2 % concentration is the most widely used coagulant for paneer making. The optimum pH of coagulation should be in the range of 5.3-5.35 for buffalo milk and 5.20-5.25 for cow milk paneer. With the decrease in pH, the moisture retention in paneer also decreases. This results in reduced yield and profit.	

Mixing of Acid Coagulation at 70^0C	
Formation of curd	
Side-line the curd for easy whey removal from the outlet	
Whey Removal: Whey may be stored for further use	
Straining with muslin cloth	

Hooping: The coagulated mass was collected from the vat and transferred manually to a hoop, lined with muslin cloth.	
Pneumatic Press: The pressing of paneer mass placed in the hoops (MOC: SS) were subjected to pressing with the help of compressed air. The excess whey drained in this process and resulted compact block of paneer.	
Cooling: After pressing, the paneer blocks are immersed in the pasteurized chilled water maintained at 4-5^{o}C for 2 hours. This process facilitates cooling of paneer blocks. It enhances the moisture content of paneer and improves the body and texture of final paneer blocks.	
Paneer Slicer: As per requirement	
Manual slicing: As per requirement	

Convening and draining of extra moisture Paneer having 51-54% moisture is expected to exhibit yield of 21-23% and 17-18% when made out of standardized buffalo and cow milk respectively.	
Printing 1. MRP 2. Batch number 3. Manufacturing code 4. Date and time of packaging	
Primary Packaging, weighing and vacuum sealing in 200 gms, 500gms	
Secondary Packaging: Shelf life of paneer packaged in laminated pouches is 30 days under refrigeration (6^{o}C). Secondary Packaging for storage and transportation under refrigerated conditions	

2.4 Types of Paneer

Paneer from Buffalo Milk

In this process, buffalo milk with fat content 5.8 to 6.0% was heated to 90**^{o}C** without holding. This milk is further cooled down to 70**^{o}C** and coagulated with 1 to 1.5 % per cent citric acid solution which is also uphold at 70**^{o}C**. Stirring is preferred till the separation of clear whey. Remove all the whey produce in this process and collect the coagulated mass in the hoops lined with muslin cloth. The whey temperature must be maintained above 63**^{o}C** during draining. The

filled hoops were further pressed (manually or pneumatically) for 10-20 minutes. After this the block of curd is removed and immersed in pasteurized chilled water maintained at 5-6**ºC** for around 2 hours.

Dipping of paneer pieces helps to improve the body and texture of paneer along with cooling. Further, the paneer blocks/pieces were placed on the perforated tray to allow loose water to drain. The moisture per cent of final paneer also increases after dipping. Finally, it is packed and stored under refrigeration environment for further sale

Paneer from Cow Milk

Paneer may be prepared from standardized cow milk (using cream extracted from cow milk only) with a fat per cent in the range of 4.5 - 5.0. Calcium chloride is also added to this milk in the range of 0.05 to 0.10%. The milk is heated to 90^{o}C without holding and further cooled down to 85^{o}C. For coagulation, citric acid solution (2%), which was prepared and maintained at temperature of 85^{o}C was mixed with the milk at this temperature only.

All others steps will remain the same as Paneer from buffalo milk.

Recombined Milk Paneer

Recombined milk means a milk which is prepared with skim milk powder, cream/butter and good quality water. This milk is standardized (fat 5.8% and SNF 9.5%) and homogenized for further process. This milk is then heated to 90^{o}C without holding and coagulated with the help of 10% citric acid solution maintained at the same temperature. All others steps will remain the same as Paneer from buffalo milk.

Reconstituted Milk Paneer

In this type, whole milk powder is dissolved in good quality water at 50^{o}C and hold in a tank for 3-4 hours for proper hydration of milk components. Calcium chloride (0.1 to 0.15%) is added to the milk and the mixed milk is heated to 90^{o}C without holding. All others steps will remain the same as Recombined Milk Paneer.

2.5 Composition of Paneer

Product	Moisture (%)	Fat (%)	Protein (%)	Lactose (%)	Ash (%)
Paneer made from Buffalo Milk	52.3	27.0	15.8	2.2	1.9
Paneer made from Cow Milk	52.5	25.0	17.3	2.2	2.0

2.6 Quality Analysis of paneer

Preparation of Sample of Paneer (Ref – IS 12758 - 1989 / I.S.O 1735-1987 Cheese and Processed Cheese products - Determination of fat content by gravimetric method - reference method. Bureau of Indian Standards, New Delhi).

Grate the paneer sample quickly through a suitable grater. Mix the grated sample thoroughly. Transfer the grated sample to an air-tight container to await analysis, which should be carried as soon as possible after grinding. Keep sample in an airtight container until the time of analysis. If delay is unavoidable, take all precautions to ensure proper preservation of the sample, and to prevent condensation of moisture on the inside surface of the container. The storage temperature should be below 10°C.

Determination of Moisture in Paneer (Ref – IS:2785:1979; Reaffirmed 1995). The moisture content of paneer is the loss in mass, expressed as a percentage by mass when the product is heated in an air oven at 102 ± 2°C to constant mass.

2.7 Chemical/Physical criteria

Description	Standard
Smell + taste	Fresh creamy to slightly fresh sour
Colour	White to light yellow
Appearance + texture	Solid dices or blocks
Foreign particles	No foreign particles
Fat	Minimum 50% in the DM
Moisture content	52 – 53 %
Friability	Good
Acidity	20 - 23% LA or 22 - 25,5 ºN
Phosphatase test	Negative

2.8 Microbiological criteria

As per 10th Amendment Regulations, 2016, Food Safety & Standards Authority of India (FSSAI) has specified microbiological requirements for process hygiene and food safety.

Microbiological data for paneer

Microbes	Minimum	Maximum
TPC	150,000/gm	350,000/gm
Coliform (cfu/gm)	10/gm	100/gm
Yeast and mould (cfu/gm	50/g	150/gm
E. coli	Less than 10/gm	
S. aureus	10/gm	100/gm

Chapter – 3

Packaging

3.1 Selection of packing material for paneer packing

1. Vegetable parchment: paneer can keep well 3-4 days at 21-270C, 10 days at refrigerated storage.
2. Vegetable paper parchment treated with Na-propionate increases the keeping quality of paneer.
3. Wax/plastic coated paper: 55-60 gsm / 0.02 mm ---0.009-0.02 mm.
4. Poster paper/Al-foil/LDPE - 150 gauze.
5. MST Cellulose (300)/LDPE – 150 gauze.
6. Poster paper/Al-foil (0.02 mm)/LDPE.
7. Al-foil 0.009 mm, 4-50C 100% RH Poster paper laminate (0.02 mm).
8. Al-foil 0.009 mm is found superior to MST-300/LDPE which has minimum keeping quality.

Vegetable parchment paper and PE bags are generally used. PE gives greater keeping quality (7 days at 50C) than that given by vegetable parchment Paper. The Cryovac system using shrink film is being successfully used. Retortable tins are also used. Long life can be given by Metallized polyester or Nylon – PET / METPET/ PE or Aluminium foil or Nylon or LDPE/LLD.

Paneer is packed in laminated tin container along with the brine. These tins are sterilized and it may be having a slight cooked flavour and maillard browning which will increase with storage period.

3.2 Vacuum packaging:

Paneer is high in fat compare to milk and subjected to decrease in quality. The shelf life of paneer is normally 1 day in an ambient temperature but the same may be enhance significantly with the help of vacuum packaging. A laminated or co-extruded pouch along with vacuum also helps in enhancing the shelf life further. As reported in literature, the shelf life of paneer packed in an oxygen barrier film along with vacuum and heat treatment at 90 °C for one min may reaches up to 90 days under refrigeration.

3.3 Advantages of Vacuum Packing

1. Extended Shelf Life - As reported in literature, the shelf-life of paneer packed in vacuum packaged may improve from 50%-400%. This type of packaging is available with the organized dairy sector throughout the world.
2. Minimized Product Loss – The moisture present in the paneer will retain with the vacuum type of packaging methods as the packaging films is not permeable for water. This will maintain the package weight throughout the storage period.
3. In case of vacuum packaging, no need of chemical preservatives for the extended shelf life.

Chapter – 4

Food Safety Regulations and Standards

4.1 Registration and Licensing of Food Business

All Food Business Operators in the country will be registered or licensed in accordance with the procedures laid down

Registration of Petty Food Business

a. Every petty Food Business Operator shall register themselves with the Registering Authority by submitting
b. An application for registration in Form A under Schedule 2 of these Regulations along with a fee as provided in Schedule 3.
c. The petty food manufacturer shall follow the basic hygiene and safety requirements provided in Part I of Schedule 4 of these Regulations and provide a self-attested declaration of adherence to these requirements with the application in the format provided in Annexure-1 under Schedule 2.
d. The Registering Authority shall consider the application and may either grant registration or reject it with reasons to be recorded in writing or issue notice for inspection, within 7 days of receipt of an application for registration.
e. In the event of an inspection being ordered, the registration shall be granted by the Registering Authority after being satisfied with the safety, hygiene and sanitary conditions of the premises as contained in Part II of Schedule 4 within a period of 30 days.
f. If registration is not granted, or denied, or inspection not ordered within 7 days as provided in above sub regulation (3) or no decision is communicated within 30 days as provided in above sub regulation (4), the petty food manufacturer may start its business, provided that it will be incumbent on the Food Business Operator to comply with any improvement suggested by the Registering Authority even later.
g. Provided that registration shall not be refused without giving the applicant an opportunity of being heard and for reasons to be recorded in writing.
h. The Registering Authority shall issue a registration certificate and a photo identity card, which shall be displayed at a prominent place at all times within the premises or vehicle or cart or any other place where the person carries on sale/manufacture of food in case of Petty Food Business.

i. The Registering Authority or any officer or agency specifically authorized for this purpose shall carry out food safety inspection of the registered establishments at least once in a year. Provided that a producer of milk who is a registered member of a dairy Cooperative Society registered under Cooperative Societies Act and supplies or sells the entire milk to the Society shall be exempted from this provision for registration.

4.2 Hygienic, Sanitary and Good Manufacturing Practices (GMP/GHP)

In addition to Part-II, the dairy establishment in which dairy based food is being handled, processed, manufactured, stored, distributed and ultimately sold by the food business operator, and the persons handling them should conform to the sanitary and hygienic requirement, food safety measures and other standard as specified below.

1. Sanitary requirements

a. Facilities for the hygienic handling and protection of raw materials and of non-packed or non-wrapped dairy products during loading and unloading, transport & storing including Bulk Milk cooling facilities.
b. Special watertight, non-corrodible containers to put raw materials or dairy products intended for human consumption. Where such raw materials or dairy products are removed through conduits, these shall be constructed and installed in such a way so as to avoid any risk of contamination of other raw materials or dairy products;
c. A waste water disposal system which is hygienic and approved;
d. Facilities for cleaning & disinfecting of tanks used for transporting dairy products and raw milk. These containers have to be cleaned after every use.
e. The occupier of a dairy establishment shall take appropriate measures to avoid cross-contamination of dairy products in accordance with the cleaning program as specified in point 9.1 of Part II.
f. Where a dairy establishment produces food stuffs containing dairy products together with other ingredients, which have not undergone heat treatment or any other treatment having equivalent effect, such dairy products and ingredients shall be stored separately to prevent cross-contamination.
g. The production of heat-treated milk or the manufacture of milk-based products, which might pose a risk of contamination to other dairy products, shall be carried out in a clearly separated working area.

h. Equipment, containers and installations which come into contact with dairy products or perishable raw materials used during production shall be cleaned and if necessary disinfected according to a verified and documented cleaning programme.

i. Equipment, containers, instruments and installations which come in contact with microbiologically stable dairy products and the rooms in which they are stored shall be cleaned and disinfected according to a verified and documented. Food Safety management programme drawn up by the owner/occupier of the dairy establishment.

j. Disinfectants and similar substances used shall be used in such a way that they do not have any adverse effects on the machinery, equipment, raw materials and dairy products kept at the dairy establishment. They shall be in clearly identifiable containers bearing labels with instructions for their use and their use shall be followed by thorough rinsing of such instruments and working equipment with potable water, unless supplier's instructions indicate otherwise.

2. Personal hygiene requirements

a. The Food Business Operator shall employ those persons only in such an establishment to work directly with and handle raw materials or dairy products if those persons have proved to the occupier's satisfaction by means of a medical certificate, on recruitment, that there is no medical impediment to their employment in that capacity.

b. Persons working directly with and handling raw materials or dairy products shall maintain the highest standards of personal cleanliness at all times. In particular they shall

- wear suitable, clean working clothes and headgear which completely encloses their hair;
- wash their hands at least each time work is resumed and whenever contamination of their hands has occurred; e.g., after coughing / sneezing, visiting toilet, using telephone, smoking etc.
- (cover wounds to the skin with a suitable waterproof dressing. No person with injury on hand, even with dressing, shall be placed in any product making/handling section.
- avoid certain hand habits - e.g., scratching nose, running finger through hair, rubbing eyes, ears and mouth, scratching beard, scratching parts of bodies etc. that are potentially hazardous when associated with handling dairy products, and might lead to food contamination through the transfer of bacteria from the employee to

product during its preparation. When unavoidable, hands should be effectively washed before resuming work after such actions

3. Sanitary requirements for storage

a. Immediately after procuring, raw milk shall be placed in a clean place, which is suitably equipped so as to prevent any kind of contamination.

b. The cans/ containers made up of mild steel metal and plastic material used for storage and transportation of milk and milk products shall not be allowed.

c. If raw milk is brought to the dairy plant by a producer or farmer then it shall be ensured that he brings it within four hours of milking and it shall be cooled as soon as practicable to a temperature of 4ºC or lower and maintained at that temperature until processed.

d. Where raw milk is collected daily from a producer, it shall be cooled immediately to a temperature of 4ºC to 6ºC or lower and maintained at that temperature until processed;

e. When the pasteurization process is completed, pasteurized milk shall be cooled immediately to a temperature of 4ºC or lower. Subject to Paragraph 7 below, any dairy product not intended to be stored at ambient temperature shall be cooled as quickly as possible to the temperature established by the manufacturer of that product as suitable to ensure its durability and thereafter stored at that temperature.

f. Where dairy products other than raw milk are stored under cooled conditions, their storage temperatures shall be registered and the cooling rate shall be such that the products reach the required temperature as quickly as possible.

g. The maximum temperature at which pasteurized milk may be stored until it leaves the treatment establishment shall not exceed 5ºC.

4. Wrapping and packaging

a. The wrapping and packaging of dairy products shall take place under satisfactory hygienic conditions and in rooms provided for that purpose.

b. The manufacture of dairy products and packaging operations may take place in the same room if the following conditions are satisfied:

- The room shall be sufficiently large and equipped to ensure the hygiene of the operations;
- the wrapping and packaging shall have been brought to the treatment or processing establishment in protective cover in which they were placed immediately after manufacture and which protects the wrapping or packaging from any damage during

transport to the dairy establishment, and they shall have been stored there under hygienic conditions in a room intended for that purpose;

- the rooms for storing the packaging material shall be free from vermin and from dust which could constitute an unacceptable risk of contamination of the product and shall be separated from rooms containing substances which might contaminate the products. Packaging shall not be placed directly on the floor;
- packaging shall be assembled under hygienic conditions before being brought into the room, except in the case of automatic assembly or packaging, provided that there is no risk of contamination of the products;
- packaging shall be done without delay. It shall be handled by separate group of staff having experience in handling and product wrapping and
- immediately after packaging, the dairy products shall be placed in the designated rooms provided for storage under required temperature.

c. Bottling or filling of containers with heat-treated milk and milk product shall be carried out hygienically.

d. Wrapping or packaging may not be re-used for dairy products, except where the containers are of a type which may be re-used after thorough cleaning and disinfecting.

e. Sealing shall be carried out in the establishment in which the last heat-treatment of milk or liquid milk-based products have been carried out, immediately after filling, by means of a sealing device which ensures that the milk is protected from any adverse effects of external origin on its characteristic. The sealing device shall be so designed that once the container has been opened, the evidence of opening remains clear and easy to check.

4.3 Packaging and Labelling

The packaging design and materials shall provide protection for products in order to prevent contamination, damage and accommodate required labelling as laid down under the FSS Act and the Regulations there under. Only food grade packaging materials shall be used as primary packaging material. Packaging materials like aluminium, tin and plastic shall conform to the Indian standards as mentioned under the FSS Regulations from time to time. The food packaging materials shall be inspected before use to avoid using damaged, defective or contaminated packaging, which may lead to contamination of the product.

- The wrapping and packaging of dairy products shall take place under satisfactory hygienic conditions and in rooms provided for that purpose.

- The rooms for storing the packaging material shall be free from vermin and from dust which could constitute an unacceptable risk of contamination of the product and shall be separated from rooms containing substances which might contaminate the products. Packaging shall not be placed directly on the floor.
- Packaging shall be done without delay followed by labelling. If it is not the case, appropriate procedure shall be applied to ensure that no mix-ups or mislabelling could occur. It shall be handled by separate group of staff having experience in handling and product wrapping and immediately after packaging; the dairy products shall be placed in the designated rooms provided for storage under required temperature.
- Packaging material/wrapping materials shall be protected from external environment/contamination during transport and storage. Facilities shall be established for safe and hygienic storage of packing materials at the dairy plant."
- Wrapping or packaging may not be re-used for dairy products, except where the containers are of a type which may be re-used after thorough cleaning and disinfecting.
- "Packaging of milk and milk products shall be carried after processing. The packages should be designed so as to ensure they are tamper proof and are not easily damaged during general handling /operation. Once the packages are opened it should be easily identifiable and cannot be duplicated against a fresh/unopened package".
- The ink used for printing of primary food packaging should be of food grade quality. This should comply with **IS 15495** standards or other international standards for use in food packaging and printing.

4.4 Coding and Labelling of Packaging Material

Fluid milk: The caps of the milk bottles /pouch/tetrapack shall clearly indicate the nature of the milk contained in them. The indication may be either in full or by abbreviation shown below:

i) Buffalo milk may be denoted by the letter 'B'.
ii) Cow milk may be denoted by the letter 'C'
iii) Goat milk may be denoted by the letter 'G'
iv) Standardized milk may be denoted by the letter 'S'
v) Toned milk may be denoted by the letter 'T'
vi) Double toned milk may be denoted by the letter 'DT'
vii) Skimmed milk may be denoted by the letter 'K'
viii) Pasteurised milk may be denoted by the letter 'P; followed by the class of milk. For example, Pasteurised Buffalo milk shall bear the letters 'PB '.

ix) Alternatively, suitable indicative colours of the packs/caps/bags shall be indicative of the nature of milk contained in them, the classification of colours being displayed at places where milk is sold\stored or exhibited for sale, provided that the same had been simultaneously intimated to the concerned Designated Officer, and information disseminated through the local media

4.5 Exemptions from labelling requirements

Where the surface area of the package is not more than 100 square centimetres, the label of such package shall be exempted from the requirements of list of ingredients, Lot Number or Batch Number or Code Number, nutritional information and instructions for use, but this information shall be given on the wholesale packages or multi piece packages, as the case may be.

1. The 'date of manufacture' or 'best before date' or 'expiry date' may not be required to be mentioned on the package having surface area of less than 30 square centimetres but this information shall be given on the wholesale packages or multipiece packages, as the case may be;
2. In case of liquid products marketed in bottles, if such bottle is intended to be reused for refilling, the requirement of list of ingredients shall be exempted, but the nutritional information specified in regulation 2.2.2 (4) these regulations shall be given on the label. Provided that in case of such glass bottles manufactured after March 19, 2009, the list of ingredients and nutritional information shall be given on the bottle.
3. “To make a fluid not below the composition of toned milk or skimmed milk (as the case may be) with the contents of this package, add (here insert the number of parts) of water by volume to one part by volume of this condensed milk or desiccated (dried) milk”.
4. In case of food with shelf-life of not more than seven days, the 'date of manufacture' may not be required to be mentioned on the label of packaged food articles, but the 'use by date' shall be mentioned on the label by the manufacturer or packer.
5. In case of multi piece packages the particulars regarding list of ingredients, nutritional information, Date of manufacture/ packing, best before, expiry date labelling of irradiated food and, vegetarian logo/non vegetarian logo, may not be specified.

4.6 Date of manufacture or packing

The date, month and year in which the commodity is manufactured, packed or pre-packed, shall be given on the label:

Provided that the month and the year of manufacture, packing or pre-packing shall be given if the "Best Before Date" of the products is more than three months:

Provided further that in case any package contains commodity which has a short shelf life of less than three months, the date, month and year in which the commodity is manufactured or prepared or pre-packed shall be mentioned on the label.

Best Before and Use By Date

i) the month and year in capital letters up to which the product is best for consumption, in the following manner, namely:

"BEST BEFORE ..... MONTHS AND YEAR

OR

"BEST BEFORE ..... MONTHS FROM PACKAGING

OR

"BEST BEFORE .....MONTHS FROM MANUFACTURE

(Note: — blank be filled up)

ii) In case of package or bottle containing sterilised or Ultra High Temperature treated milk, soya milk, flavoured milk, any package containing bread, dhokla, bhelpuri, pizza, doughnuts, khoa, paneer, or any un-canned package of fruits, vegetable, meat, fish or any other like commodity, the declaration be made as follows

"BEST BEFORE ……DATE/MONTH/YEAR"

OR

"BEST BEFORE.....DAYS FROM PACKAGING"

OR

"BEST BEFORE ……..DAYS FROM MANUFACTURE"

Note:

(a) blanks be filled up

(b) Month and year may be used in numerals (c) Year may be given in two digits

(iii) On packages of Aspartame, instead of Best Before date, Use by date/recommended last consumption date/expiry date shall be given, which shall not be more than three years from the date of packing;

(iv) In case of infant milk substitute and infant foods instead of Best Before date, Use by date/ recommended last consumption date/expiry date shall be given, Provided further that the declaration of best before date for consumption shall not be applicable

4.7 Documentation and Record Keeping

Every organization has to maintain records of raw material procurement, production processes, and sales. This is to ensure that the business runs effectively and is profitable. Listed below are some reasons why there is a need for documentation:

1. It gives detailed knowledge about running the business.
2. It helps to control product quality.
3. It helps to keep track of the money invested in the business.
4. It helps to identify the separate costs of raw material or product ingredients.
5. It helps to identify the production cost of a particular process.
6. It helps to make sure that all the quality assurance practices were followed during the production.
7. It helps to make sure that the production equipment is running smoothly/effectively.
8. It works as an evidence for legal procedures.
9. It helps to set an appropriate product price.
10. It helps to take corrective measures at the right time.

4.8 How to Keep Records?

Every food processing organization follows a more or less similar way of keeping records. Production records keep a log of the following:

- The quantity and type of raw materials received
- The quantity and type of ingredients used during processing
- The processing conditions in which production took place (e.g. the temperature set or the air pressure applied)
- The product quality produced

Product quality can be maintained only when:

- The same quantity and quality of ingredients and raw materials are mixed in every batch
- A standard formulation is used for every batch
- Standard process parameters are applied for every batch

Every batch of food is given a batch number. This number is recorded in:

- Stock control books (where raw material procurement is noted)
- Processing logbooks (where production process is noted)
- Product sales records (where sales and distribution is noted)

The batch number must correlate with the product code number, which is printed on labels. This helps the processor to trace any fault found in a batch back to the raw material used or the production process.

Sample Paneer Processing Record:

Paneer Processing Record		
Date:		Batch No:
Processing	**Parameters**	**Value**
Milk	Fat %	
	SNF %	
	Ratio of SNF to Fat	
	TS%	
	Acidity % LA (= ºN x 0.9/100)	
	Coliform count per gram	
Processing	Qty of Milk (kg)	
	Heat Treatment ºC (90 ºC)	
	Time taken for heating in minutes	
	Coagulation Temp. ºC (70 ºC)	
	Time taken for cooling in minutes	
	Temp of Citric solution ºC (70 ºC)	
	Concentration of Coagulants (2%)	
	Qty of citric acid used per litre of milk (1.65 gr/L)	
	Quantity Coagulants (82.5 ml/L milk)	
	Dipping time	
	Hooping Temp ºC	
	Load in kg of Pressing	
	Time of Pressing in min.	

	Temp of Chilled Water ºC	
	Soaking Time in min.	
	Temp of Paneer after Soaking ºC (40 ºC)	
	Drying Temp. ºC	
	Drying Time	
	Temp. After Drying in ºC	
	pH of Whey	
Paneer	Moisture %	
	Acidity % LA	
	Fat %	
	Fat on Dry matter %	
	Qty in kg	
	Yield %	
	SPC per gram	
	Coliform per gram	
	Colour	
	Texture	
	Flavour & Taste	
	Friability	
	No of 200g pack made	
	Actual yield in kg	
	Handling losses in %	

Production Supervisor Production Manager

Chapter – 5

Cleaning and CIP

5.1 Tanker Washing

The main objective of this unit is to clean the tankers properly after unloading or before uploading milk or any other dairy ingredients to avoid microbial and bacterial growth.

Stepwise washing operation:

- Circulate Caustic solution for 15min. (1 – 1.5%) at 70 – 75^{0}C.
- Flush out Caustic with water.
- Circulate with hot water for 15min. (80 – 85^{0}C)
- Allow temperature to cool down
- Get QA clearance

5.2 Crate Washing:

Normally a semi-automatic crate washer is used for cleaning the crates. The washer cleans the crates in stages

Solid waste removal – Manually

1. Pre-rinse
2. Hot water and caustic solution
3. Final rinsing

5.3 CIP of raw milk tank, multipurpose tank etc.

- Flush Silo with necessary water
- Clean (by brushing) the door of the manhole and sampling point with soap oil and water.
- Circulate Caustic solution for 20min. (1 – 1.5%) at 70 – 75^{0}C.
- Flush out Caustic with water.
- Circulate with acid for 20min. (0.6 – 1.0%) at 60 – 65^0
- Circulate with hot water for 20min. (80 – 85^{0}C)
- Allow temperature to cool down

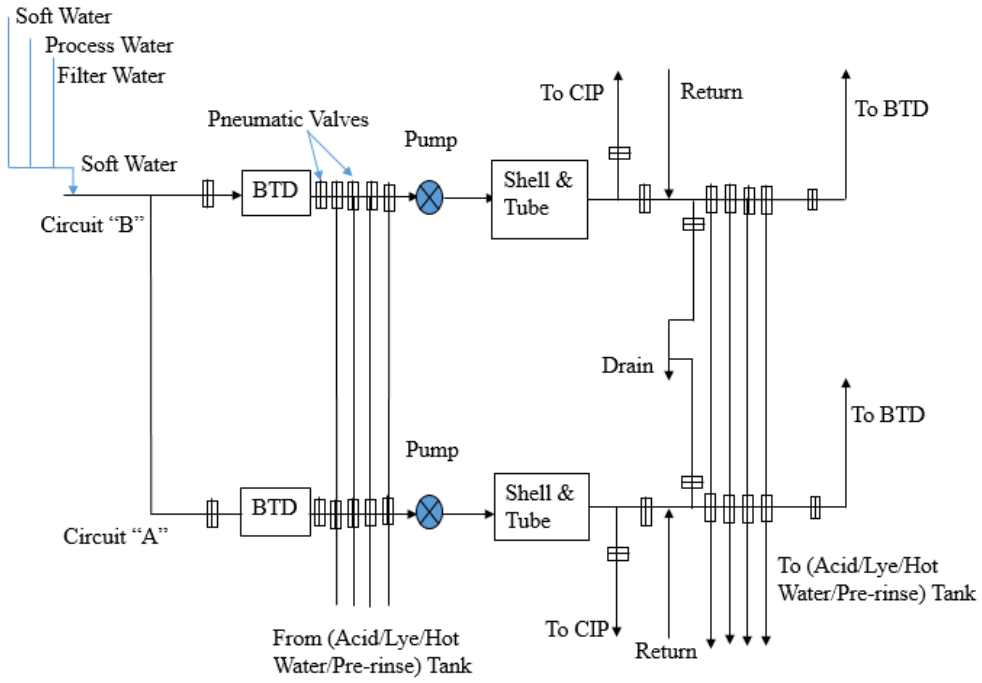


Fig: A two station CIP Circuit (model)

5.4 Effluent Treatment Plant (ETP)

ETP is a 24 hrs. continuous process. It takes hazardous outlet from all the process as inlet, treat it in three stages (Primary, Secondary and Tertiary stage) to reach the environmental standard. The outlets of the plant namely solid waste and treated water are respectively disposed in field and used for irrigation purpose in plant to develop green belt.

Effluent Sources:

1. CIP: Caustic and Nitric Acid
2. Backwash: Water
3. Tanker wash: Caustic and Nitric Acid
4. Boiler: Water
5. Caret wash: Caustic

Stepwise description of ETP functioning:

1) Screen chamber: Raw effluent from the plant is received by screen chamber and suspended particles are removed here.

2) Collection and equalization tank: After the screening the effluent enters the collection and equalization tank, where it is neutralized with hydrochloric acid and the effluent is made homogeneous.
3) Holding tank: It only meant for storage when excess amount of effluent is discharged from plant during CIP
4) Dissolved Air Floatation (DAF): The neutralized effluent from collection and equalization tank is received here and aluminum sulphate (a non-ferric alum) is added. The suspended and emulsified solids are separated here.
5) Buffer tank: It is an over flaw storage tank
6) Up blow Anaerobic Suspended Sludge Blanket (UASSB) Reactor (I&II): 12% to15% of the total volume of this tank is filled with biomass. It receives the effluent from DAF from the bottom of the tank. There are two type of bacteria present here.
    a. Acetogenesis: - It converts the large chain molecule to small chain molecule and produces amino acid.
    b. Methenogenesis: - It converts to methane gas, and hence organic load decreases
7) Hopper bottom tank: It is just a tank to control the escaped microbes from UASSBR and again recirculate it.
8) Aeration tank: In this tank aerobic microbes are developed
9) Lamella clarifier: It is used for solid settling purpose i.e., the solid liquid separation takes place here
10) Secondary clarifier: Here the aerobic culture is settled and again circulated to aeration tank to maintain the amount.
11) Treated water tank: Here the treated water from secondary clarifier or lamella clarifier is collected.

5.5 Plant Performance and Monitoring:

- Carryout regular monitoring program involving maintenance of record and analysis of effluent sample.
- ETP assistants have to collect samples at different stages of treatment system in presence of ETP in-charge for analysis.
- ETP in-charge has to do the analysis and record the result also report the result to EHS-engineer and EHS-officer. EHS-engineer and EHS-officer both will assess the performance of the plant based on laboratory analysis report and instruct the ETP in-charge and assistants about the action to be taken in case of any deviation from normal.

- The treated effluent has to be analyzed on daily basis and the results are recorded

5.6 Environmental Management System (EMS): Implementation and operation:

2. **Level-1:** EMS manual; describes the core elements of the EMS and their interactions. It outlines the structure of the document used in the EMS in line with-ISO 14001-2004 manual also describe the procedures elaborately how various requirements of ISO 14001-2004 are implemented.
3. **Level-2:** Documents; the filled formats which conveys the data that affects the environment. Ex – Operational control process, environmental management programs, emergency procedures, monitoring and management plans, training plan etc.
4. **Lavel-3:** Formats; used for recording and conveying data effecting the environment