CHAPTER NO. 5
MANAGEMENT OF BY PRODUCTS OF MAHANAND

5.1 Introduction

Milk products like Butter, Curd, Ghee, Cheese, Ice Cream, Lassi, Panner and sterilized Milk etc have become an essential part of our food and are consumed in good quantity every day. In spite of the huge demand that exists for such milk based items conventional methods are employed for producing these items. These milk products are being made with easy both in rural and urban areas using conventional and modern techniques. Since the raw material for such products are available easily and locally. Such units can be started at every town and village to provide self-employment to the youth in the district. Minimal technical knowledge is however required for operating the machinery and other equipment.

Dairy development in India has been acknowledged the world over as one of modern India's most successful development programme. India is the second largest milk producing country with anticipated production of about 78 million tons during 1999-2000. The production of milk products stood at 3.07 lakh tonnes in 1999-2000. Production of milk powder including infant milk food has risen to 2.25 lakh tons in 1999-2000, whereas that of malted food is at 65,000 tons. Off late, market for milk products showing a steady increase.

Mahanand production of dairy products is modern process and apply advanced technology. Raw milk is to be boiled in utensils, after boiling the milk the temperature of the milk has to be reduced. Cream is appeared on top of the milk. It should be separated and apply chilling method. Butter will be removed to prepare ghee. The ghee is ready for packing. The semi boiled milk to be formed as curd after adding small quantity of curd. From hot milk sweets can be prepared with adding some amount of sugar. Mahanand dairy produce a such type of milk product Butter, Curd, Chass,Ghee, Cheese, Ice Cream, Lassi, Panner and Rasgule etc.. their use production method is modern type and machinery , technology mostly used tera pack Technology in dairy.
5.2 Contents in Milk

Milk is composed of water (85.5 to 89.5%) and total solids (10.5 to 14.5%). Total solids can be classified into two major types, Fat (liquid) and solids-not-fat (SNF). SNF contains lactose, nitrogenous substances (Protein and non-protein), lactose, mineral matter, and other constitutes such as vitamins, enzymes dissolved gases, pigments and bacteria.

Chart No. 5.1
Chart of Contents in Milk

5.3 Properties of Milk

Milk in two types of properties Physical Properties and Chemical properties this properties test important for clarify the pure milk. This milk properties knowledge is must for the farmers, Society milk tester, Dairy chemist etc
5.3.1 Physical Properties

1. Colour

Colour is white mainly due to the presence of casein. If milk in presence of the pigment carotene, than intensity of golden yellow colour may increase.

2. Taste and Odour

Milk is slightly sweet in taste. It has a mild aromatic flavor due to lactose and milk fat. Abnormal taste or flavor may be produced if the animal is fed with certain kind of fodder, onions, grails etc of if there is any infection of the udder.

3. Specific Gravity

Milk is heavier than water. The specific gravity of cow milk varies from 1.018 to 1.036 and that of buffalo milk varies from 1.018 to 1.038. Specific gravity varies with the temperature. It is lower a high temperature and higher in low temperature. The specific gravity is measured at 15.6°C using a lactometer.

4. Density

Density means thickness or degree of consistence of milk varies with temperature since milk expands when heated and contracts when cooled. Density of milk is measured with the hydrometer at 20°C.

5. Viscosity

The viscosity of milk is always higher than viscosity of water due to the presence of solid constituents. The viscosity of milk depends on the temperature and the amount and state of dispersion of the solid constituents. The casein micelle and the fat globules largely contribute to the viscosity of milk. The viscosity of milk at normal temperature varies from 1.5 to 2 cp (centipoises). The viscosity of the whole milk at 25°C is about 2.0 cp.

6. Surface Tension

Surface tension of the milk, which is the force acting on the surface of the milk, is about 50 dynes per centimeter at 20°C. (dyne is a unit of force equal to that needed to produce acceleration of 1cm per second in mass of 1gm or 1 dyne= 10-5 N, where N (Newton) is a unit of force equal to that creating an acceleration of 1m per second when applied to a mass of 1 kg). The surface
tension of milk depends on fats, proteins, phospholipids and fresh fatty acids present in it. The surface tension increases by the process of homogenization and sterilization by heat.

7. **Refractive Index**

The refractive index of milk at 20°C varies from 1.3440 to 1.3485. The refractive index depends on the total solids and the other constituents present in the milk. In fact, the relation between solids present in the milk and refractive index is linear. It is, therefore, possible to use refractive index as a means of determining the total solids in milk or even the quantity of water that might have been added in milk.

8. **Boiling Point**

The boiling point of milk is about 100.17°C. The boiling point may reach up to 100.2 depending on the dissolved constituents.

9. **Freezing Point**

The freezing point of milk is different in cow milk varies from -0.512°C to -0.572°C, and buffalo milk varies from -0.521°C – 0.575°C. The freezing point of milk is lower than water because of the presence of water soluble constituents. Amongst all the constituents, lactose and chloride are mainly responsible for depressing the freezing point. Determination of freezing point is important because it helps by determining the water content of the milk.

10. **Heat Stability**

Heat stability can be defined as the length of time required to induce coagulation at a given temperature or the temperature required to induce coagulation in a given time.

5.3.2 **Chemical Properties**

1. **Buffering Action of Milk**

Fresh milk acts as a complex buffer due to the presence of CO₂, phosphates, citrates, proteins and other constituents. This property of milk is important as far as curdling of milk is concerned as well as for heat stability.
2. Natural Acidity of Milk

Fresh milk has very little acid in it because of the presence of CO$_2$ citrate, casein and some other constituents. The pH of fresh milk has a range of 6.5 of 6.7. The terrible acidity of fresh milk is between 0.14 and 0.20 percent calculated as lactic acid. The natural acidity of milk is important so far as heat stability is concerned.

5.4 Methods of Milk Processing of Mahanand

For maintaining quality of milk, necessary steps must be taken to stop bacterial growth from the milk is taken out in the farm and till it reaches the dairy. In this dairy, further processing is done various purposes. Two stage of milk 1. Cooling 2. Milk Treatment
5.4.1 Cooling

Artificial cooling is done on the farm and during transport from the farm by the dairy. Milk is therefore, chilled to 4°C soon after milking. The cooling of the milk is done by the following methods:

1. By keeping milk in can and then keeping it in another vessel containing the cooling medium. The cooling medium may be cold water, chilled brine or chilled water. In this method, milk must be continually stirred to obtain uniform cooling.
2. By keeping milk in a special type of can provided with an inner cylinder filled with ice. This method is widely used in many parts of our country especially during summer.
3. By Mahanand by keeping milk in storage tank and by circulating a cooling medium. The cooling medium may be melted ice from an ice tank or chilled brine water from a brine water tank. Cooling also may be done directly with the help of directly expanding refrigerant. In all the cases, a mechanical refrigeration system is necessary to chill the cooling medium.
4. By using a special type of cooler in which cooling medium flows through tubes and the milk flows in a thin film over the exterior of these tubes. The cooling medium may be chilled water, brine or directly expanding refrigerant.
5. By using a plate-heat exchanger and maintaining temperature of milk to within 4° to 6°C. The plate-heat exchanger is made up of a number of stainless-stall plates fitted closely (0.69 cm apart) and the liquid can flow as a colder or warmer medium through the plates in such a way that one plate represents the heat exchanging divining wall between the two streams.

5.4.2 Milk Processing Stages-

Milk processing is included method Clarification, Homogenization, Standardization, Pasteurization, Aseptic filling, and Sterilization. The various stages of operation for processing milk are as follows:

1) Clarification: It is the first stage of milk treatment in the dairy. It is the process by which sediments present in the milk are removed in a centrifugal clarifier. During clarification, some cells and bacteria may also be removed.
2) Homogenization: It is a process by which fat globules are subdivided into smaller globules so that the creaming property of the milk is lost. It is done by heating milk to
about 60°C so as to inactivate the lipase and then pumped through a small orifice at a very high pressure. By homogenization, the viscosity of milk is increased.

3) **Standardization of milk:** In some cases, as in 'toned milk', a standard composition of milk must be maintained. It may be required to standardize the fat content of quite a large proportion of the cream. To obtain the required standardization, the whole milk and the skim milk are mixed in a particular proportion for the improvement of milk SNF and Fat percentage.

4) **Pasteurization:** Pasteurization of milk is carried out at temperatures below 100°C to destroy disease-causing organisms present in the milk. In order to destroy all the pathogenic microorganisms it is necessary to heat the milk to a certain temperature to a certain length of time before it is cooled down, by using following pasteurizing methods:

This process in milk 62-65°C for 30 minutes or 71-72°C for 15 to 40 second or 85 to 90°C for 1 to 4 Second.

**Chart No 5.2 Flow Chart of Milk Processing**

5) **Aseptic Filling (Aseptic Packaging):** In order to maintain the quality of milk for longer periods (Months), the aseptic filling (Aseptic Packaging) method is used. This can be done by using cans or polyethylene paper board. In this process, the cans are passed through superheated steam or hot gas at about 205°C to sterilize cans. The cans are then filled with the pasteurized milk and the sterilized can covers are used to seal the cans. Now-a-days, a new method of aseptic cartooning has been developed using polyethylene paper board.

6) **Sterilization:** Pasteurization definitely reduces the number of microorganisms drastically but pasteurized milk is not sterile. In tropical and sub-tropical countries, pasteurized milk cannot maintain keeping
quality in room temperature for a long time. Therefore, pasteurized milk is required to be kept below 10°C under refrigeration. On the other hand, sterilized milk can be kept for a long (Source-Mahanand Dairy Field Visit) time in ordinary temperature. Sterilization is done by heat-treatment processes such as very-high-temperature (VHT) system or ultrahigh-temperature (UHT) system. Mahanad recently used the UHT system usually refers to pasteurization technique with temperatures of at least 130°C in a continuous flow, with holding times of approximately 1 sec or more. It is carried out by direct-heating methods such as steam-injection technique or steam-infusion technique.

5.5 By Products of Mahanand

Milk products include market milk, that is, the fluid milk, and various other milk products such as Setrelized milk, Cheese, Cured (Yogurt or Dahi) Butter, Ice-cream, Condensed Milk, Chas, Shrikhand, Amarkhand, Cheese, infant food, as well as several indigenous products such as Khoa and Chhana, which form the basis of several sweet preparations Lassi, Shrikahd, Amarkhand, etc.

5.5.1 Market Milk

Milk is considered as an ideal food for kids, aged peoples and ailing people. It is rich in carbohydrate primarily lactose, protein mainly casein and fat. Further minerals like calcium, phosphorous, sodium, potassium and magnesium are present in appreciable quantities. Milk also provides considerable quantity of thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, biotin, folic acid, vitamin B12 etc. apart from different Vitamins. The following nutrition facts in Mahanand various milk brand Annapurna, Toned, Double Toned, Standard and High Fat etc. Mahanands total number of milk brand too much sale is Annapurna Brand, because it brand in average nutritional facts and its economically good for marginal people.
Table No.5.1
Mahanand Milk brand wise Nutritional percentage (Amount of Per 100ml)

<table>
<thead>
<tr>
<th>Nutritional facts</th>
<th>Annapurna Milk</th>
<th>Toned Milk</th>
<th>Double Toned Milk</th>
<th>Standard Milk</th>
<th>High Fat Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>63 kcal</td>
<td>58 kcal</td>
<td>46 kcal</td>
<td>72 kcal</td>
<td>90 kcal</td>
</tr>
<tr>
<td>Energy from fat</td>
<td>32 kcal</td>
<td>27 kcal</td>
<td>13.5 Kcal</td>
<td>40 kcal</td>
<td>54 kcal</td>
</tr>
<tr>
<td>Total fat</td>
<td>3.5%</td>
<td>3.0%</td>
<td>1.5%</td>
<td>4.5%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Total carbohydrate</td>
<td>4.8%</td>
<td>4.8%</td>
<td>4.8%</td>
<td>4.8%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Protein</td>
<td>3.1%</td>
<td>3.1%</td>
<td>3.4%</td>
<td>3.1%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Calcium</td>
<td>110mg</td>
<td>110mg</td>
<td>120 mg</td>
<td>130 mg</td>
<td>210 mg</td>
</tr>
</tbody>
</table>

(Source- Record of Mahanand)

Photo No.5.3
Milk Brands of Mahanand

The raw and chilled milk is received from chilling center in a dump tank. The milk is then chilled up to 4 deg C in a PHE type chiller and stored to chilled milk storage tank, from where it is pumped to pasteurizer. Through pasteurizer it goes to cream separator, where cream is separated through milk and skimmed milk is obtained. Milk/skim milk is standardized with cream, butter oil, SMP to make Full cream milk, standardized milk, toned milk, double toned milk and skim milk. The milk is packed in 250 g, ½ kg and 1 kg plastic pouches and 1 kg. The separated cream is processed to manufacture butter, butter oil and ghee. Cream from cream storage tank goes to Butter churn, then ghee boiler, Ghee settling Tank, Ghee pre-stratification tank and Ghee clarifier to manufacture Ghee. Ghee is packed either in tin or poly pouches.
Table No 5.2
Percentage Fat and SNF in Milk of Mahanand

<table>
<thead>
<tr>
<th>Type of Milk</th>
<th>Fat (%)</th>
<th>SNF (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Cream Milk</td>
<td>6.0</td>
<td>8.5</td>
</tr>
<tr>
<td>Standardized Milk</td>
<td>4.5</td>
<td>8.5</td>
</tr>
<tr>
<td>Toned Milk</td>
<td>3.0</td>
<td>8.5</td>
</tr>
<tr>
<td>Double Toned Milk</td>
<td>1.5</td>
<td>9.0</td>
</tr>
<tr>
<td>Skim milk</td>
<td>Not more than 0.5</td>
<td>8.7</td>
</tr>
</tbody>
</table>

(Source- Field visit to Mahanand dairy)

Mahanand's all type of milk in fat and SNF percentage against the Food Safety Act. It is the liquid milk product made from milk and cream. It is consumed directly by consumers. Market milk is sold in the market after it has been processed.

5.5.2 Cheese

Cheese is a fermented food derived from the milk of various mammals. Since humans began to domesticate milk-producing animals around 10,000 B.C., they have known about the propensity of milk to separate into curds and whey. As milk sours, it breaks down into curds, lumps of phosphor protein, and whey, a watery, grey fluid that contains lactose, minerals, vitamins, and traces of fat. It is the curds that are used to make cheese, and practically every culture on Earth has developed its own methods.

Cheese is the cured substance formed by the coagulation of the milk of certain mammals by rennet or similar enzymes in the presence of lactic acid produced by added or adventitious microorganisms from which part of the moisture has been removed by cutting, warming and/or pressing, and which has been shaped in moulds and then ripened by holding for some time at suitable temperatures and humanities.

5.5.3 Cured (Yogurt or Dahi)

Fermented milk products are very popular in India and is consumed by large population. Indian Curd (Dahi) is of these products. For making this the Filtered, standardized, homogenized and pasteurized milk is cooled to 22-25 deg C and then culture is inoculated to milk. The inoculated milk is then packed in cups and kept for
incubation 16-18 hours to incubation chamber/room. Dahi is a type of sour milk but thick in consistency. Dahi was originally made from goat’s milk. But now-a days it is made from cow’s milk.

Table No.5.3
Nutrition percentage in Mahanands Dahi and Chass

<table>
<thead>
<tr>
<th>Nutritional facts</th>
<th>Chass per 100 ml</th>
<th>Dahi per 100 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>20 kcal</td>
<td>73 kcal</td>
</tr>
<tr>
<td>Fat</td>
<td>1.0%</td>
<td>4.5g</td>
</tr>
<tr>
<td>Proteins</td>
<td>1.1%</td>
<td>3.2 g</td>
</tr>
<tr>
<td>carbohydrate</td>
<td>1.7%</td>
<td>5.0g</td>
</tr>
</tbody>
</table>

(Source- Field visit to Mahanand dairy)

The method of preparing Dahi is as follows:

1) The whole milk or skim or partly skim milk is boiled down. To one half its initial volume. However, a more or less similar effect can be achieved by adding 4 to 5 percent dry-milk solids to whole milk or by using condensed milk. In this case, the heat treatment can be as high 200°F about 93.5°C) for as long as 90 minutes.

Dahi is one of the most popular fermented dairy products for its wide variety of flavours and fruits that are added to it. Different forms of Dahi are available in the market like stirred, set, frozen and liquid Dahi. The flavour of Dahi irrespective of the type is the same since the main flavor compound is acetaldehyde. The fat content in yoghurt may vary from 0.5 to 5% and the total solids from 9 to 20%. The minimum SNF of milk should be 8.2 percent. The amount of stabilizer varies with the type of stabilizer. The stability and the consistency of the yogurt are improved by the homogenization of milk.
The heat treatment not only lowers the level of resident microbial flora but also makes the milk more suitable for growth of the Dahi culture.

2) The milk after boiling or heat treatment 90 °C for 20 Minutes, allowed to cool down 40 °C then inoculation with 2 to 3% culture containing and fermentation of Lactose to lactic acid at 45 °C. finally packaging at 4.5 °C than distribute in market.

3) After cooling, the milk is inoculated with 2 to 3 percent starter that is that material containing microorganisms to induce a desired fermentation. Two species of bacterial are responsible for the production of yogurt. There are streptococcus thermophilus and Lactobacillus bulgaricus.

4) The inoculated milk or culture is then incubated at 113°F (45°C). Rather large vinculum produces the desired effect i.e. about 0.9 percent acidity in about 3 hours.

5.5.4 Butter

Butter is a fatty substance obtained from milky churning. Butter, therefore, is essentially the fat, of the milk which can be directly consumed along with bread, biscuits etc. The essential procedures for making creamery butter (salted) in dairies and creameries using modern technology are as follows.
1. **Preheating Separation and Storage:** The whole milk is preheated and then separated. The cream is then cooled and kept in a storage tank.

2. **Standardization:** It is done so that the fat content of the cream should be at least 35-40%.

   **Chart No. 5.3**

   **Flow Diagram of Butter Manufacturing**

3. **Pasteurization:** Cream is pasteurized to 63°C for 60 minutes or in 85°C-95°C for about 10 minutes. Pasteurization in high temperature is done to destroy microorganisms and enzyme or better keeping quality of butter.

4. **Cooling and Ripening:** Cream is now cooled to 20-22°C and a good starter (acid producing bacterial culture) is added. However, the acidity is not allowed to exceed 0.5 percent. Ripening takes about 12 to 15 hours.

5. **Churning and Washing:** Cream is now churned, that that is it is vigorously agitated to break down the fat globules and thus causing the fat to coagulate into butter grains and butter milk. It is done at 10°C for obtaining better of firm consistency. The churning continues for 30 to 40 minutes.

   At this stage, butter milk is drawn off and the butter is washed two to three times with fresh clean water.

6. **Salting and Working:** Salt is added as per requirement and the butter is worked to a continues fat phase containing a finely dispersed water phase. It is done so that the
salt is uniformly incorporated. And the butter (Source- Field visit to Mahanand dairy)
does not contain any excess moisture

7. Packaging and Storage: Butter is now packed in a packaging unit and stored in a
cold storage at about –23°C.

5.5.5 Condensed Milk

Condensed milk is the product obtained either by concentration of full-cream milk
by removing part of its water or from skimmed milk by concentration. In both
the cases, the condensed milk is produced with or without the addition of sugar. Thus,
the condensed milk may be of Two types: (i) unsweetened condensed milk and (ii)
sweetened condensed milk.

The essential procedures for making these condensed milk are given below:

1. **Standardization of milk:** Raw milk is standardized to maintain the composition of
fat and dry solids. If the condensed milk is obtained from full-cream milk, the total
solids and fats in the finished product should be about 31% and 9% respectively.

2. **Stabilization of protein:** This is done by heat treatment. Stabilization of protein is
done to avoid risk of coagulation in the subsequent sterilization process. Heat
treatment also helps in destroying the microorganisms.

3. **Concentration of milk:** This is done by evaporation. For concentration, heat
treated milk is taken to an evaporator in which vaporization of water takes place. It is
done at 50 to 60°C. The milk is concentrated till its density readies a value of about
1.07.

4. **Homogenization:** The concentrated milk is homogenized under a pressure of
12500 to 25000 kpa (pa = pascal - a unit of pressure equal to the force of 1 N acting
over an area of 1 m²).

5. **Cooling:** The homogenized milk is now cooled to 5°C if it is to be stored or to
14°C if it is packed directly. At this stage, vitamins and phosphates may be added.

6. **Packaging:** Cooled condensed milk is then filled in the cans and then sealed.

7. **Sterilization:** It is done auto at 110° - 120°C for 10 to 20 minutes.

8. **Cooling and storage:** The packed condensed milk is now again cooled and stored
at 0° to 10°C or maintaining quality of the milk for a long period.

Sweetened condensed milk is manufactured in almost similar way as that of
unsweetened condensed milk except that sugar is added and there is no sterilization
after packaging. Sugar may be added by two methods: (a) addition of dry sugar before heat treatment and (b) Addition of sugar syrup in evaporator. In sweetened condensed milk, concentration is done till the density reaches about 1.30kg/l for sweetened whole milk, and about 1.36kg/l for sweetened skim milk. The finished product should have about 44% sugar, 8% fat and 29% water.

### 5.5.6 Ice Cream

ICE cream is a frozen product of milk. ICE cream can be defined as frozen dairy product made by blending and processing of cream and other milk products along with sugar flavor with or without stabilizer and colour. So far as the manufacturing process is concerned there are two main aspects such as ingredients and mixing process. These two aspects can be described briefly as follows.

**Ingredients**

- **Fat**: Fat is added in the form of whole milk, sweet cream and unsalted butter. Fat is added to increase richness of flavour and to impart a smooth texture.
- **Solids Not fats**: Proteins, Lactose and mineral salts and other solids not fats are added in the form of milk, cream, skim milk and whole milk powder, and condensed milk. These substances give high nutritional value and also improve the texture.
- **Sugar**: Sugar is added to give sweetness generally 10-18% sugar is added.
- **Stabilizers**: There are substances which bind a large number of water molecules when dispersed in a liquid phase, Gelatin, sodium alginate, casein albumin and globulin are commonly used as stabilizers. The amount of stabilizers should be 0.2 to 0.4% volume of the mix.
- **Emulsifiers**: There are substances which help emulsification by reducing surface tension of liquid products. Yolk of egg is a good emulsifier. There are also other emulsifiers such as sorbitol esters, glycerin esters, emulsifiers should be about 0.3 to 0.5% of the volume of the mix.
- **Flavoring Substances**: A number of flavoring substances are used such as vanilla chocolate etc.
- **Colouring matter**: Colouring matter is added as a powder or paste. The amount of colouring matter should be 10 to 20 ml per 100 liters of mix. Sodium benzoate is added as a sterilant.
8. Fruits: Different kinds of fruits may be added to give ice cream their characteristic flavour. Mixing process.

Mixing Process

This is the process of mixing all the ingredients in definite proportions and then subject the mix to various treatments. The different stages of the entire mixing process can be described as follows.

1. Measuring and Mixing of Ingredients: All the ingredients are accurately measured or weighed and are mixed in a definite order which is determined by the temperature and solubility. All the liquid ingredients are added in a vessel or container provided with a stirrer. The mix is thus continuously agitated with the stirrer. The mix is also slowly heated to help the mixing process. The dry ingredients are added to the mix and agitation of the mix is continued and at the same time, the temperature is slowly raised up to about 50°C.

2. Homogenization and Pasteurization: The mix is homogenized and then pasteurized to kill microorganisms.

3. Cooling: The pasteurized mix is cooled and chilled to about 5°C.

4. Ripening: It is the process by which fat is crystallized and the protein and stabilizers are allowed to bind water. This is done by holding the mix in the ripening tank for three to six hours at 2-3°C and agitating the mix continuously. At this state, colouring matter and flavoring agents may be added. Ripening contributes to the consistency of the cream.

5. Freezing: The mix is now taken (pumped) to the freezer. The freezer consists of a cylinder which is refrigerated. A controlled amount of air is released into the mix so that the water content in the mix can form a large number of small ice crystals.

6. Packaging: The mix is now packaging in different ways in large cartoons or packs, cones, cups etc.

7. Hardening: This is done in order to complete the process of crystallization. For this, the ice cream i.e. the Packaging mix is subjected to a temperature of 5°C or below.

8. Storing: The ice cream is usually stored at a temperature of 25°C or 30°C.
5.5.7 Ghee

**Photo No.5.5**

*Ghee Product of Mahanand*

It is essentially clarified butter fat of milk. Ghee can be defined as the clarified fat derived solely from milk or from Butter or from cream to which no colouring matter is added. Bulk of ghee is prepared from buffalo milk. Ghee can be prepared by desi method or creamery method. In desi method, Dahi is prepared by seeding lukewarm milk with old Dahi or butter milk. The Dahi is then churned in a vessel to obtained butter, which is heated and ghee is produced. Ghee Packed in Plastic bottle and polythene bag.

5.5.8 Khoa

It is a partially dehydrate (desiccated) whole milk, produced by continuous heating of milk in an open pan. It contains 70 to 75 percent of total solids. During heating or boiling the milk is constantly stirred. Khoa is used as the base in the preparation of various sweets product like Gulab Jamun, Rasgule, Peda etc.

**Chart No 5.4**

*Flow Chart of Khoa Processing*

(Chart No. 5.4 is not included in the text)

Khoa is a partially dehydrated whole milk product prepared by desiccation of milk to 65-70 percent total solids in an open pan. Milk contains nearly 83-87 percent water; in order to increase the concentration of milk, water is evaporated from the milk by boiling. Khoa is used as a base material for the preparation of variety of sweets like Burfi, Peda Rassgule, Gulab Jamun etc.
5.5.9 Chhana / Rasogolla

It is a solid product produced from acid coagulation of milk. It is prepared from partially or wholly skimmed milk by the addition of acid in the form of citrus fruit juice or citric acid solution or sour whey while the milk is boiling. Whey is drained off through a muslin cloth or any fine cloth. This product is similar to soft cheese prepared in western countries. In chana, the fat content should not be less than 15% channa is mainly used for the preparation two famous India sweets Rasogolla and Sandesh.

5.5.10 Lassi

Photo 5.6 : Lassi Product of Mahanand

It is a mixture of cured, water, sugar and may be some essence. Cured is prepared by standard method and the soft curd is broken with agitator and required amount of water and sugar. The mixture is then passed through a single stage homogenizer. In Lassi, fat content may be 3 to 3.5% and total solids 16 to 18%. Lassi is the traditional Indian beverage that is made by blending curd with water, salt with spices or sugar with flavor.

We provide complete range of equipments to manufacture fermented milk products. The equipments used to make these products are Storage tank, Pasteurizer, Homogenizer, Double jacketed multipurpose vat, Incubation chamber etc. Mahanands Lassi in total nutritional facts in calories 102 kcal, Fat 4.0g, Proteins 2.9g and Carbohydrate 14.0g.
5.5.11 *Shrikhand /Amrkhand*

*Photo.5.7*

**Shrikhand /Amrkhand product of Mahanand**

It is a fermented and coagulated product of milk. It is prepared from dahi, whey is drained off from dahi and semisolid material is produced after mixing sugar and essence. Shrikhand contains 5 to 15% fat, 40-45% moisture and 45 to 55% sugar.

Prepared from lactic fermented curd, Shrikhand is the semi-soft, sweetish-sour whole milk product. A solid mass is obtained by partially straining dahi through a cloth. This process removes the whey from Dahi.

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**Table No 5.4**

Mahanands *Shrikhand and Amrkhand Nutrition percentage* per 100ml

<table>
<thead>
<tr>
<th>Nutritional facts</th>
<th>Badam pista Shrikhand &amp; Elaich Shrikhand</th>
<th>Amrakhand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>275 kcal</td>
<td>275 kcal</td>
</tr>
<tr>
<td>Fat</td>
<td>8.5 g</td>
<td>6.5g</td>
</tr>
<tr>
<td>Proteins</td>
<td>6.0 g</td>
<td>6.0g</td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>44.0g</td>
<td>48.0g</td>
</tr>
<tr>
<td>Calcium</td>
<td>80.0g</td>
<td>80.0g</td>
</tr>
<tr>
<td>Added Sugar</td>
<td>41.5g</td>
<td>41.0 g</td>
</tr>
</tbody>
</table>

(Source- Field visit to Mahanand dairy)
5.5.12 Paneer

Chart No. 5.5
Flow Chart of Paneer Process

Paneer is a pressed preparation that is obtained by acid coagulation of milk at about 85°C, which is followed by removal of whey. As per the PFA rules (1976), the paneer should not contain more than 70 percent moisture and the milk fat content should not be less than 50 percent of the dry matter.

Nutrition percentage in Mahanands Panner

<table>
<thead>
<tr>
<th>Nutritional facts</th>
<th>Paneer per 100ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>102 kcal</td>
</tr>
<tr>
<td>Fat</td>
<td>4.0 g</td>
</tr>
<tr>
<td>Proteins</td>
<td>2.5 g</td>
</tr>
<tr>
<td>carbohydrate</td>
<td>14 g</td>
</tr>
</tbody>
</table>

(Source- Mahanand Field Visit)

Photo. 5.8

Paneer product of Mahanand
5.5.13 Flavored Milk / Josh Milk

Mahanand Flavoured milk is sale by the brand name Josh milk. The method of production of flavored milk involves standardizing the milk to the desired fat and SNF percent (generally 2% fat and 9.5% SNF). It is then heated, homogenized and clarified. The desired amount of cocoa powder at the rate of 1.5%, sugar at 7 to 9% and stabilizer (at the prescribed level) are added to the warm milk for the preparation of chocolate milk.

In the case of fruit flavoured milk, instead of cocoa powder, 0.04% of fruit flavors and colours are added to milk. Milk is pasteurized, cooled, bottled and kept under refrigeration. Popular flavors for flavoured milk are strawberry, orange, lemon, pineapple, banana, vanilla, etc. Mahanand Josh milk in Nutritional facts is Energy 87 kcal, Fat 3.0g, Proteins 3.0g and total carbohydrate 12.0g.

5.6 Management System For Quality and Food Safety

Mahanand dairy is Constantly striving to provide good quality of safe milk and milk products to delight our esteemed customers/ consumers’ using the best quality raw material and process in hygienic conditions with due care for preservation of environment and latest available technology with compliances of relevant of food safety and environmental laws. Mahanand is committed to continuous improvement through review and up gradation of our quality food safety and environmental management system based on ISO9001, HACCP, and ISO14001.

The trade reforms initiated by the World Trade Organization (WTO) have transformed the business environment across the globe, with an upsurge of new activities in the industries and governments in many countries. Suitable strategies to conform to international quality norms are being implemented to make a dent in competitive markets of unprecedented magnitude, which have emerged post-WTO. Industries have recognized the importance of quality for entry into the competitive global markets.

This realization has its repercussions on the Indian dairy industry an important segment of food industry in India. Manufacturing a good dairy or food product is not enough. The product must also be free from harmful additives, microbes and remain so during its intended shelf life. Therefore, methods to be employed for quality
assurance by the food industry will have great deal of accuracy and sophistication depending on the type of the production process and nature of resources available.

Excellence in food quality and safety has taken a tangible form with the advent of ISO 9000 Quality Management System and Hazard Analysis Critical Control Points (HACCP) standards. ISO 9000 encompasses all the activities of a company to ensure that it meets its quality objectives, while HACCP is directed towards ensuring food safety. The ISO 9000 standards were brought by the International Organization for Standardization (ISO) and the HACCP standards by the Codex Alimentarius Commission (CAC). These standards have assumed importance worldwide both as an essential requirement to tap the market potential and as a marketable feature of the company. Since the global market has become more demanding in terms of quality, safety and timely delivery, installation of the ISO 9000 Quality Management System and HACCP by the food industry is essential for getting a competitive international edge.

The HACCP system identifies, evaluates and controls hazards to food safety. Its introduction has signaled a shift in emphasis from inspection and testing of resource-intensive end-product to preventive control of hazards at all stages of food production. HACCP is a tool to assess hazards and establish control systems that focus on production line preventive measures rather than relying mainly on end-product testing. HACCP standards have found favour with the food industries and the government regulatory agencies as a cost-effective means of minimizing the occurrence of identifiable food-borne biological, chemical and physical hazards and maximizing product safety.

Mahanand technology initiative include development of new products, processing technology, measures to enhance milk production and quality through subsides to install chilling units. Automatic in processing and packaging areas is Hazard Analysis and Critical Control Point (HACCP).

**In this Section**
1. International Agreements on Food Trade: Technical Barriers to Trade Measures
2. Good Manufacturing Practices
3. Codex Alimentarius Commission
4. ISO 9000 Quality Management System
5. Total Quality Management
6. Food Safety Management System

A combined effect of above system would be a safe and wholesome food to consumer. Therefore, the best way is to use ISO 9000 route to manage HACCP.

5.6.1 International Agreements on Food Trade

The establishment of WTO is aimed at strengthening the world economy. Its emphasis is on increasing trade investments and accelerating employment and income growth throughout the world. It emerged from the Uruguay Round of trade talks and is the successor of the General Agreement on Tariffs and Trade (GATT). It governs the world trade transactions including intellectual property rights through intergovernmental agreements.

One of the main objectives of WTO is to mitigate obstacles to international trade. In the context of international food trade, the agreements on the Technical Barriers to Trade (TBT) and the Sanitary and Phytosanitary (SPS) measures have been brought under the WTO. These agreements envisage application of international standards and certification systems, and bring transparency in the national regulatory requirements to facilitate international food trade. SPS is particularly applicable to food industry, and adoption of HACCP standard under this agreement makes it mandatory for the food industry to follow HACCP standards for international trade. A brief outline on the TBT and SPS agreements is given below:

Good Agriculture and Animal Husbandry Practices (GAAHP) ensure safe and sound processing.

Interrelationship between TBT & SS Agreements of raw materials that does not impart to the food product undesirable contaminants such as pesticide residues, metallic impurities and spoilage microorganisms. The GAAHP approach to quality management includes safe use of authorized pesticides under actual conditions for effective and reliable pest control. It encompasses a range of pesticide application levels up to the highest authorised one, applied in a manner that leaves a residue in the smallest amount possible. In the manufacture of food products, problems often arise due to the inherent variations in the quality and composition of raw materials being used. These differences may be due to agro-climatic conditions, cultivation and
rearing techniques, and non-uniformity within the inputs concerned. This poses additional burden on the system to ensure consistent safe processing of raw materials.

5.6.2 Good Manufacturing Practices (GMP)

Consumer satisfaction and economical production of wholesome food products are key to the survival and growth of a food plant. Traversing the road to these goals becomes easy if the focus is on factors of critical importance like plant conditions, manufacturing practices, house-keeping, sanitary standards, personal hygiene and work habits of employees and visitors. Taking care of these factors forms the core of good manufacturing practices (GMP). These are related to methods and control procedures employed in a food plant for the manufacture, processing, packaging and storage of food product with a view to guaranteeing their quality and safety to the consumer. Observance of GMPs will help the plant add to consumers health and happiness through its wholesome products. Besides, it will also be able to minimize production losses and increase profits. The united state food and drug administration has published elaborate guidelines for GMP.

Guidelines For Good Manufacturing Practices (GMP)

1. Employees working in a food plant are required to wash their hands with a sanitizing soap prior to beginning or returning to handling of food.
2. Loose hair poses serious sanitation problems in the plant. Therefore, all persons working or visiting the production area must wear authorized head covering to avoid contact of loose hair with food products.
3. Sanitary precautions are required to be taken by employees when sneezing or coughing. An employee with infectious skin eruption, communicable disease or other infected conditions must have plant management clearance before allowed to handle food.
4. Employees in production areas should wear clean uniforms. The uniforms should be changed daily or sooner if soiled for any reason. Shirts are required to be buttoned and tucked into trousers.
5. Workers in the production area will not wear rings, and neck/ear jewellery. This practice will preclude mix-up of the foreign materials in food. Watches,
pens, pencils and loose materials should be removed prior to entry to production areas.

6. Smoking, spitting or chewing of tobacco should be prohibited in the production as well as storage areas.

7. Consumption of beverage or food is allowed exclusively in the designated area.

8. Nail polish and/or perfume is not allowed in production or storage areas.

9. Containers and equipment made of glass, including glass thermometers, should not be permitted in the production area.

10. Good housekeeping in the production area is necessary for work efficiency and workers' safety.

5.6.3 Codex Alimentarius Commission (CAC)

The FAO and the WHO jointly established the Codex Alimentarius Commission (CAC) in 1962 to implement the joint FAO/WHO Food Standards Programme. The aim of the Commission is to protect the health of consumers by ensuring observance of fair practices in the food trade. It promotes coordination of work on formulation of food standards undertaken by international governmental and non-governmental organizations. Adoption of HACCP standards, formulated by CAC, under the Sanitary and Phytosanitary (SPS) measures has made the HACCP system an instrument of food safety. It has become incumbent on signatory countries of the SPS agreement to implement these standards.

5.6.4 ISO 9000 Quality Management Systems

With the changed focus on quality issued worldwide, the ISO 9000 standards serve as a basis for ensuring consistent quality of goods and services as well as improving productivity. Their aim is to harmonize quality management practices on international scale and establish quality as a factor in global trade. These standards necessitate organizations to reorient themselves to follow the process-centred approach to quality management system and place the system on a continual improvement mode. The International Standardization Organization (ISO), a federation of national standards bodies, set up in 1979, a technical committee on quality management systems to evolve international quality standards. After
widespread consultations and deliberations, an international consensus was reached on ISO 9000 series of standards, which were brought out in 1987. Subsequently, standards on supporting systems were brought out to make ISO 9000 models more efficiently operational.

In short time, the ISO 9000 has become an internationally recognized benchmark for measuring

**Model for Excellence**

The core of quality management systems is ISO 9001:2000 under which organizations could be certified. It is built on four pillars:

1. Management responsibility
2. Resource management
3. Product and service realization; and
4. Measurement, analysis and improvement.

**1) Management responsibility**

In an organization, the quality management system is a management-driven activity. It demands commitment from the top management to make its intent known for fulfillment of quality to meet customer requirements. To realize this objective, the organization has to enunciate a quality policy with clear goals. The main driving force is the need to meet the customer and legal requirements. The organization has to establish its management systems defining responsibility and authority of key personnel, documenting processes and exercising control over them and reviewing performance of the QMS operation.

**2) Resource Management**

The system requires coordination of resources of different types for satisfactory operation. The main resources are trained, competent and qualified personnel; right information for control of processes and for ensuring conformity of products and services with customer requirements. The organization provides right type of infrastructure to achieve this conformity. Infrastructure includes workplace facilities, equipment, hardware and software, suitable maintenance and support services. The personnel should work in a congenial environment to achieve conformity of products and services. Factors having a bearing on work environment
include health and safety conditions, work methods, work ethics and ambient conditions.

3) Product and service realization

Organizations have to ensure that processes are operated under controlled conditions to produce outputs as per customer requirements. The controlled conditions entail appropriate methods and practices. Methods for controlling processes are necessary to bring the product and service in conformity with the customer requirements. Methods are also required for verification and validation of process measurement; monitoring of processes and follow-up action to ensure that processes continue to operate for achieving planned results and outputs; and securing information, data and quality records for effective operation and monitoring of processes.

4) Measurement, analysis and improvement

Organizations should measure, monitor, analyze and improve process to ensure that the quality management system, processes and products conform to requirements. All this is essential to measures and monitor the system performance in relation to customer satisfaction. Furthermore, it is important to monitor process performance characteristics of products and services by conducting internal audits. It is also necessary to control non-conformity by identifying recording and reviewing the nature and extent of non-conformity encountered. Analyses of data for effecting continual improvement form the basis of corrective and preventive action.

5.6.5 Total Quality Management (TQM)

It is defined as that aspect of the overall management that determines and implements the quality policy and as such is the responsibility of top management. Thus, TQM is an organizational concern and not a domain of any specialist or specific function. TQM is not just a question of achieving standards but one of survival and being strong all the time. Further more, the managerial responsibility is not just limited to focusing on one particular aspect of the business but it has to be fully aware and in control of all the activities, no matter how small these are. Elements of a TQM system are listed and Guiding principles for successful TQM are listed below.
### Elements of TQM system

<table>
<thead>
<tr>
<th>Management Commitment</th>
<th>It should be clear, and the management must disseminate the quality policy at all levels.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Work Participation</td>
<td>All employees must be deeply involved in improvement of quality systems.</td>
</tr>
<tr>
<td>Quality Toll and Techniques</td>
<td>All modern tools and techniques are adopted</td>
</tr>
<tr>
<td>Continuous Education and Training</td>
<td>Documented procedures to be adopted to identify training needs, especially for skilled tasks.</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>Methods to generate and evaluate customer satisfaction must be devised</td>
</tr>
</tbody>
</table>

### Guiding Principles for Successful TQM

<table>
<thead>
<tr>
<th>Customer Orientation</th>
<th>An obsession for customer needs through regular feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vision</td>
<td>Further vision of the organization</td>
</tr>
<tr>
<td>Quality Culture</td>
<td>Dedication to continuously strive for improvement and professional excellence</td>
</tr>
<tr>
<td>Leadership</td>
<td>Coach the team and support the efforts</td>
</tr>
<tr>
<td>Quality Strategy</td>
<td>Leads to strategic goals and plant translates for organization strategy into thrust areas</td>
</tr>
<tr>
<td>Values</td>
<td></td>
</tr>
<tr>
<td>Employees</td>
<td>Empowerment and Participation</td>
</tr>
<tr>
<td>Team work Approach</td>
<td>For efficiency and maximizing productivity</td>
</tr>
<tr>
<td>Training</td>
<td>Education for Learning</td>
</tr>
<tr>
<td>Process-Centre</td>
<td>Each function to be assessed for its purpose</td>
</tr>
<tr>
<td>Communication</td>
<td>Essential for active involvement of whole organization and people in company’s vision and values</td>
</tr>
<tr>
<td>Continuous Improvement</td>
<td>Follow dynamic concept of improvement, raise benchmark</td>
</tr>
<tr>
<td>Measurement and audit</td>
<td>Meticulously planned and periodic monitoring systems to ensure excellence</td>
</tr>
</tbody>
</table>
In a dairy enterprise, the organizational processes normally composed of five serially connected components, namely

1. Outside units, Viz, suppliers of milk and ingredients, vendors.
2. Inputs for example labour-capital material and information.
3. Transformation/value-auditing process.
4. Outputs viz. finished products/services and.
5. Customers

Performance of such a complex process may be evaluated in terms of the following criteria

1. Effectiveness
2. Resource Utilization
3. Quality
4. Productivity
5. Quality of work life
6. Profitability

The total quality management is necessary of establishing a culture of continuous improvement by identifying waste and eliminating it, aiming for a zero-defect objective. The internal objective of redefining the business operation changes the work culture of the organization. Where competitiveness is based on quality criteria, characterized by an optimization of internal and external operations in pursuit of excellence.

5.6.6 HACCP for Food Safety Systems

Food affects human health and safety if it is contaminated. Ensuring food safety is a complex process because food products face hazards from sub-standard raw material, process contamination and improper handling and packaging before they reach the customer. Controlling these hazards at different stages must be an essential function of any food manufacturing system.

Advantages of HACCP

- HACCP control conditions rather than sampling finished products.
  Conventional quality sampling not all encompassing.
- HACCP enables lower cost self-inspection versus cumbersome full-time
government policing.
- HACCP makes food safety as top of the agenda for all employees.

Internationally, the HACCP system is recognized as an ideal tool to give
assurance of food safety. This system is built to ensure food safety from the origin of
the raw material through different processing stages of the food product till it reaches
the hands of consumers. By focusing on critical areas of processing the HACCP
system reduced the risk of production and sale of unsafe products. The system can be
applied throughout the food chain from primary producer to the consumer-to enhance
food safety. Besides, it helps in better use of resources and timely responding to
problems.

**Hazard Analysis Critical Control Point (HACCP) At Glance**

Hazard analysis is useful in safe design of a food product. Defining critical
control points helps to eliminate or control hazardous microorganisms or their toxins
at any point during the entire production sequence. The HACCP principles (according
to the United States Department of Agriculture Guidelines) are enumerated below:

1. Assess risk associated with growing, harvesting raw materials and ingredients,
   processing, manufacturing, distribution, marketing, preparation and
   consumption of milk and milk product.
2. Determine critical control points (CCPs) required to control hazards,
3. Establish critical limits that must be met at each CCP.
4. Establish procedure to monitor CCPs.
5. Establish corrective actions to be taken when a deviation occurs.
6. Establish record-keeping systems which document the system.
7. Verify that the system is working.

Hazard analysis involves ranking a food according to six hazard characteristics
and assigning risk category based on the ranking. Ranking of hazard characteristics of
a food is related to:

1. Presence of microbiologically sensitive components.
2. Processing step to eliminate harmful organisms or their toxins.
3. Post-processing contamination with harmful organisms or toxins.
4. Abusive handling and distribution.
5. Potential of harmful effects due to consumer handling.
6. Post-packaging heat process at the factory or when cooked at home.

Hazard analysis involves detailed diagram of the process flows and identification of critical control points in the production sequence. Types of raw materials and ingredients used in products manufacture are also an integral part of the analysis. Development of a HACCP system includes the following:

1. Food products specifications, including chemical, physical and microbiological standards.
2. Product safety analysis, including potential microbiological problems.
3. Purchasing requirements from approved suppliers conforming to ingredient specifications.
4. Adherence to Good Manufacturing Practices.
5. Physical Systems Hazard Control Programs, such as Flow Charts, Critical Control Points, Controls, Monitoring
6. Controls, etc. Product recall system.
7. Contract packers and their standards.
8. Audit programmes by quality assurance.
10. Responding and recording regulatory inspections of the plant by government authorities.