INTRODUCTION

Oxford dictionary in its intricate texture of lexicon says, “Milk” is an opaque white fluid in fat and protein, secreted by female mammals for the nourishment of their young”. Dairy products are part of our daily life and to some extent we are dependent on them. Several products including curd, sweet, milk powder, milk, flavored milk, ghee and associated products are regularly produced for consumers.

Milk contains a protein Casein which is rich, and offering of nutritious, tasty and healthy food products under well-known brand. Several important factors are always evaluated for any dairy product before reaching to the consumer which consists of health associated factors, taste, reliability of the product, vitality, convenience of the producer in maintaining the pure quality etc.

In this context, buffalo milk is considered as full of nutrient values which contains milk proteins, lipids adequate vitamins etc. Other source of good milk is cow, goat and sheep [1].

It was found that sheep milk contains higher specific gravity, titratable acidity, and lower freezing point than average cow milk along with more viscosity and refractive index [2-4]. The aim and target of the present report is to bring before you, the different testing schedule of different parameters to be measured in the dairy industry to ensure the better safety of the end product. This consists of clear information about the standard values and the information about those parameters that are to be analyzed chemically in the laboratory.

We, as researchers have surveyed one diary named “Tirumala Diary” with its headquarters in the Guntur District of Andhra Pradesh, geographically located in the Southern India.

Milk, in general comes from cattle herd that receive the best care along with healthy and nutritious diet in the form of quality feed to ensure that they produce wholesome, high-quality milk. That said, there are a few factors listed below, that lay the platform for success for any commercial milk industry. They are,
1. Milk Procurement Network,
2. Superior sales and marketing prowess,
3. Strategic technological and infrastructural advantage and

This diary has the greatest advantage of a few points. There are listed below.

1. Procurement of Quality Buffalo and Cow milk through a strong network of chilling centers spread across states of Andhra Pradesh, Tamil Nadu and Karnataka of India,
2. Strong roots in local markets and first-hand knowledge of the local culture.
3. Business intelligence and technical expertise that is applied to serve our consumers and
4. Strong management focus.

In general, milk is known as the opaque liquid produced by the mammary glands of any mammal. Importance of milk as the best food is well known to all and it has been recognized as the major nutrition source for the new born and infants [5-10].

The early lactation milk is known as colostrum, and carries the mother's antibodies to the baby. Scientific investigations proved that milk not only serves as the primary nutrition source for the infants, it is also having disease protective properties for the babies and new born. From species to species the component percentage in raw milk varies, but, more or less, it has been reported earlier that it contains significant proportion of saturated fat, calcium, proteins along with important vitamins such as Vitamin C [11-14]. The pH range is another factor which is maintained in the milk between 6.4 and 6.8, inferring it slight acidic in nature.

It is an excellent culture medium of many microbial species. Freshly drawn milk varies in chemical composition due to many a reason. In India, milk usually refers to that from cow or buffalo milk according to the Prevention of Food Adulteration Act (P.F.A).

The animal milk production in India has more than doubled in the last 2 decades. A major part of this comes from Buffalo (56%), followed by Cow (45%) and Goat (3%) which are present in the 12 million dairy sector. The dairy industry exists for the purpose to provide milk and milk products at a reasonable cost to consumer appetite and fulfill his (or) nutritional needs [15-17].

Commercial importance and value of milk is majorly due to the content of milk fats and Solids – not – Fat (SNF). The Solids – not – Fat (SNF) are also referred to as serum solids which largely consist of Proteins, Lactose and Minerals.

The above two parameters usually play a huge role in the basis of payment to the milk producers in India. Total solid is known as the representation of the SNF plus content of any milk sample. It may range from 12 to 16%, depending on its source. The TS value for cow milk is 12% (3.5% fat and 8.5% SNF) and that of the buffalo milk, TS value ranges from 15-16% (6-7% fat and 9% SNF) (Tables 1-3).

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Cow Milk (%)</th>
<th>Buffalo Milk (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>86.5</td>
<td>83.18</td>
</tr>
<tr>
<td>Fat</td>
<td>4.39</td>
<td>6.71</td>
</tr>
<tr>
<td>Protein</td>
<td>3.30</td>
<td>4.52</td>
</tr>
<tr>
<td>Lactose</td>
<td>4.44</td>
<td>4.45</td>
</tr>
<tr>
<td>Total Solids</td>
<td>13.50</td>
<td>16.82</td>
</tr>
<tr>
<td>Solids not Fat</td>
<td>9.11</td>
<td>10.11</td>
</tr>
<tr>
<td>Ash</td>
<td>0.73</td>
<td>0.80</td>
</tr>
<tr>
<td>Calcium</td>
<td>0.12</td>
<td>0.18</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Sodium</td>
<td>0.05</td>
<td>0.04</td>
</tr>
<tr>
<td>Potassium</td>
<td>0.15</td>
<td>0.11</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>0.10</td>
<td>0.10</td>
</tr>
<tr>
<td>Citrate</td>
<td>0.18</td>
<td>0.18</td>
</tr>
<tr>
<td>Chloride</td>
<td>0.10</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table 1. Chemical Composition of Milk.

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Protein and protein fractions</th>
<th>Concentration in milk g/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total protein</td>
<td>36</td>
</tr>
<tr>
<td>2</td>
<td>Casein</td>
<td>29.5</td>
</tr>
<tr>
<td>3</td>
<td>alpha s1-Casein</td>
<td>11.9</td>
</tr>
<tr>
<td>4</td>
<td>alpha s2-Casein</td>
<td>3.1</td>
</tr>
<tr>
<td>5</td>
<td>beta Casein</td>
<td>9.8</td>
</tr>
<tr>
<td>6</td>
<td>kappa Casein</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Table 2. Nutrients in Milk.
| gamma Casein | 1.2 |
| beta Lactoglobulin | 3.2 |
| alpha Lactalbumin serum | 1.2 |
| Serum Albumin | 0.4 |
| Immunoglobulins | 0.8 |
| Proteose-Peptones | 1.0 |

<table>
<thead>
<tr>
<th>Moisture (g)</th>
<th>Buffalo</th>
<th>Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>4.3</td>
<td>3.2</td>
</tr>
<tr>
<td>Minerals (g)</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Carbohydrates (g)</td>
<td>5.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Energy (kilocalories)</td>
<td>117.0</td>
<td>67.0</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>210.00</td>
<td>120.0</td>
</tr>
<tr>
<td>Phosphorous (mg)</td>
<td>130.0</td>
<td>90.0</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Carotene (ug)</td>
<td>160.0</td>
<td>174.0</td>
</tr>
<tr>
<td>Thiamine (mg)</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>0.1</td>
<td>0.19</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Vitamin B12 (ug)</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total Free</td>
<td>3.3</td>
<td>5.6</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>19.0</td>
<td>73.0</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>90.0</td>
<td>140.0</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>7.97</td>
<td>3.78</td>
</tr>
<tr>
<td>Total fatty acids (g)</td>
<td>7.18</td>
<td>3.57</td>
</tr>
<tr>
<td>Linoleic acid (g)</td>
<td>0.08</td>
<td>0.09</td>
</tr>
<tr>
<td>Linolenic acid (g)</td>
<td>0.09</td>
<td>0.06</td>
</tr>
<tr>
<td>Total phospholipids (g)</td>
<td>0.03</td>
<td>0.035</td>
</tr>
<tr>
<td>Cholesterol (g)</td>
<td>0.014</td>
<td>0.012</td>
</tr>
</tbody>
</table>

**CONSTITUENTS OF MILK**

**Water:** This serves as the medium for solution or suspension of other constituents. Water is usually separated by the process of evaporation from the milk solids.

**Fat:** The milk fat is a mixture of glycerides of several fatty acids and compounds of glycerol and fatty acids. This is found in the form of globules suspended in the milk serum. The particle size depends upon the stage of lactation and on the type of the animal breed. Fat can be separated by the gravitational and the centrifugal forces.

**Proteins:** The milk proteins constitute Casein, Lactalbumin and Lacto globulin. Casein is important milk and is generally present in huge amounts. It exists in the form of calcium caseinate – phosphate complex. Lactalbumin and Lacto globulin are the whey proteins and get coagulated on heating. Albumin is a free phosphorous compound and is not coagulated either by acid or tenet. Albumin generally contains 3 times more sulphur compound than the casein.

**Lactose:** This is the only carbohydrate content of the milk and is responsible for the sweet taste of milk. This is present in the entire solution of the milk. The milk gets coagulated when the acidity reaches a certain point.

**Mineral matter or Ash:** 0.6 – 0.8% of the total milk is the mineral matter constituent and this is usually determined after ashing. The ash is distinctly basic and a part of it occurs in the true solution while a part in the colloidal solution.

**Vitamins:** Milk generally contains the vitamins like A, B1, B2, C, D, and E.

**Enzymes:** Catalytic substances secreted by living cells are enzymes. Some take their origination from the animal cells and some from the bacteria. The enzymes give and useful indication about the bacteriological condition of the milk and about the physiological condition of the animal (Table 4).
Table 4. Principle enzymes and their use in the milk.

<table>
<thead>
<tr>
<th>S.no</th>
<th>Enzyme</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Amylase</td>
<td>Digests starch.</td>
</tr>
<tr>
<td>2</td>
<td>Catalase</td>
<td>A reducing enzyme.</td>
</tr>
<tr>
<td>3</td>
<td>Galactase</td>
<td>A protein digesting enzyme present in normal milk and useful in ripening of cheese.</td>
</tr>
<tr>
<td>4</td>
<td>Lipase</td>
<td>A fat splitting enzyme found in normal milk and is associated with rancidity of butter.</td>
</tr>
<tr>
<td>5</td>
<td>Peroxidase</td>
<td>An oxidizing enzyme which is destroyed by LHT and HTST methods of pasteurization.</td>
</tr>
<tr>
<td>6</td>
<td>Reductase</td>
<td>It is a reducing enzyme of bacteriological origin. It reduces methylene blue.</td>
</tr>
</tbody>
</table>

**PROPERTIES OF MILK**

**Chemical Properties**

Freshly drawn milk normally shows an amphoteric reaction in which the red litmus paper is turned into blue and the blue litmus is turned into red. This property is due to the presence of different amino acids in milk proteins. Amino acids consist of NH$_2^+$ ions as well as COOH groups, indicating the alkaline and the acidic reactions.

**Acidity:** When normal fresh milk is titrated with an alkali solution using phenolphthalein as an indicator, it appears acidic. This acidic nature is due to the presence of phosphates, proteins, citrates and dissolved carbon dioxide. Normally, acidity in milk may be ranging from 0.13%-0.21%. The increasing acidity depends in the production of lactic acid as a result of microbial activity.

**PH of Milk:** Normal fresh milk has a PH of 6.5-6.7 indicating that milk is slightly acidic. If the PH value of milk is less than 6.6, then it is considered to be added with colostrums or bacterial deterioration might have taken place.

**Buffering Action:** Normal fresh milk acts as a complex buffer because it contains several substances, which contribute to this property of milk. Certain constituents normally carbon dioxide, proteins, phosphates, citrates and a number of minor constituents of milk are responsible for buffering capacity of milk. This property of milk is considered as an important factor from the curdling and also from heat stability aspect.

**Oxidation – Reduction Potential:** Oxidation is defined as the loss of hydrogen or the uptake of oxygen and Reduction is defined as the loss of oxygen or the uptake of hydrogen. This phenomenon involves the loss or gain of electrons. The voltage measured under these conditions reflects the oxidizing or reducing capacity of the solution which normally falls within the range of +0.2-+0.3 volts. Certain factors such as heat treatment, bacterial activity and contamination with trace metal particularly with copper effects the PH of milk. Methylene blue reduction test of milk is based on the principle of lowering of the potential through use of available oxygen by the micro organisms.

**Physical Properties**

**Taste and Aroma:** Milk generally tastes slightly sweet and has a mid aroma and aromatic flavor. The sweet taste comes from the milk sugar and the butter fat. This very sweet taste and aroma are affected when milk is produced under unhygienic conditions.

**Color:** The pigments in the milk impart the color. Cow’s milk is always in yellow color due to the presence of carotene. Buffalo’s milk is in white due to the absence of carotene. White to opaque color is seen in reflected light which is caused by the colloidal substances present in it.

**Specific Gravity:** Specific gravity is the weight of given volume of milk compared with the weight of the same volume of water at the same temperature. Lactometer is used for measuring the specific gravity and the specific gravity of milk is greater than that of water. The specific gravity of milk ranges between 1.028-1.034.

**Freezing point:** The freezing point is a temperature at which a material is in equilibrium as both solid and a liquid at a given pressure. In this temperature, the liquid may freeze or crystallize and the solid phase may melt or liquefy. The latent heat of fusion is involved at this solid or liquid at equilibrium. The freezing point of milk is generally in the range of 0.535 to 0.55 degrees. The addition of 1% water to milk will raise the freezing point by 0.006 degrees of centigrade.

**Viscosity:** The viscosity of a substance refers to its resistance of flow. It is a measure of the friction between the molecules as they slide past one another. The viscosity of a heterogenous substance such as milk at given temperature depends upon its composition and the physical state of its colloidal dispersed substance (fat). The net viscosity vs temperature relation is that, the viscosity decreases with a certain raise in the temperature. The viscosity of milk is always higher than that of the water.

**Surface tension:** This very property of surface tension is due to the force of attraction between the molecules. These forces of attraction have coverage to the center of molecules from all the directions. The surface tension of milk is at 54.5 dynes/ cm and decreases as the temperature is raised. The presence of fat lowers the surface tension. Whole milk has a lower surface tension when compared with that of skimmed milk and that of cream is even lower than the rest of all.
TYPES OF MILK

Milk is of the following types. They are:

Sterilized Milk

This is defined as milk, which has been heated to a temperature of 100 °C or above for such lengths of time that it remains fit for consumption for at least 7 days at room temperatures. Usually the milk is heated to 108-111 °C for 25 to 30 min. Commercially sterilized milk is rarely sterile in the strict bacteriological sense. This is because the requirements for the complete sterility conflict with the consumer’s preference for normal color and flavor in the sterilized product.

Homogenized Milk

It is a milk, which has been treated in such a manner as to insure break up of fat globules to such an extent that after 48 h of quiescent storage no visible cream separation occurs on the milk; and the fat percentage of the milk in the top 100 ml of milk in a quart bottle or proportionate volumes in containers of other sizes, does not differ by more than 10 per cent of itself from the fat percentage of the remaining milk as determined after thorough mixing.

In the properly homogenized milk, the fat globules present in the milk are split in to less than 2 microns in size.

Soft Curd Milk

It is milk that forms a soft curd when coagulated with rennet or pepsin under standardized procedure. Soft curd milk has a curd tension of less than 25 g.

Mineralized Milk

It is milk to which some minerals have been added.

Vitaminized or Irradiated Milk

Vitaminized milk is milk to which one or more vitamins are added. Irradiated milk is milk in which the vitamin D content has been increased by exposure to ultra violet rays. Addition of vitamins (and minerals) to milk is called fortification and such milk is called fortified milk. The vitamins and minerals may be added singly or in combination as multi-vitamin and mineral milk preparations.

Frozen Concentrated Milk

It refers to milk, which has been partially concentrated and then solidified by freezing.

Fermented Milk

It refers to such milk, which has been made by employing selected microorganisms to develop the characteristic flavor and/or body and texture.

Bulgarian Buttermilk

It refers to such milk produced by fermentation with Lactobacillus bulgaricus. The temperature of incubation will be usually higher in the range of 40–43 °C with a higher acidity in the finished product.

Kumiss

This is a lactic acid – alcohol fermented milk originated in Russia. The culture used for fermentation may be Lactobacillus acidophilus or Lactobacillus bulgaricus. The finished product contains a higher alcohol content of up to 2.5 per cent.

Kefir

It is a self carbonated milk beverage containing 1 per cent lactic acid and 1 per cent alcohol. The fermentation is usually done by kefir grains, which contains Streptococcus lactis, Betabacterium caucasium, keir bacilli and lactose fermenting yeasts.

Standardized Milk

It is milk whose fat and / or solids not fat content have been adjusted to certain pre determined level. The standardization can be done by partially skimming the fat in the milk with a cream separator or by admixture with fresh or reconstituted skim milk in proper proportions. In India, as per PFA Rules, the standardized milk for liquid consumption should contain a minimum of 4.5 per cent fat and 8.5 per cent solids not fat.

Recombined Milk

It refers to the product obtained when butter oil (otherwise known as dry / anhydrous milk fat), skim milk powder and water are combined in the correct proportions to yield fluid milk. In India, as per PFA Rules, the recombined milk should contain a minimum of 3.0 per cent fat and 8.5 per cent solids not fat.
Reconstituted/Rehydrated Milk

This refers to milk prepared by dispersing whole milk powder (also called dried whole milk) in water approximately in the proportion of 1 part powder to 7-8 parts water. Spray dried milk powder is usually used since it is more soluble and produces less sediment.

Toned Milk

Also called single toned milk, refers to milk obtained by the addition of water and skim milk powder to whole milk. In practice, whole milk from buffalo is mixed with reconstituted spray dried skim milk for the production of toned milk. In India, as per PFA Rules, the toned milk should contain a minimum of 3.0 per cent fat and 8.5 per cent solids not fat.

Double Toned Milk

Refers to milk obtained by the addition of water and skim milk powder to whole milk. Usually buffalo whole milk is mixed with reconstituted spray dried skim milk. In India, as per PFA Rules, the double toned milk should contain a minimum of 1.5 per cent fat and 9.0 per cent solids not fat.

Skimmed Milk

Fat content is reduced to 0.5-2% by centrifugation. By removing the fat from the milk, not only the taste or flavor is reduced but the fat soluble vitamins A and D are reduced. Skimmed milk is used for low calorie diets and for children who need high protein.

Evaporated milk

This is the milk from which about 50-60% of the water has been evaporated. Raw milk is clarified and concentrated in a vacuum pan at a temperature of 74-77°C.

Dry milk

This can be made with whole milk or skimmed milk. Milk powder can be dehydrated to about 97% by spray drying and vacuum drying.

UHT processed milk

Milk is heated at temperature higher than those used for pasteurization, 138°C – 150°C at 2-6 seconds. Then under sterile conditions, it is packaged into presterilized containers, which are aseptically sealed so that spoilage organisms cannot enter. Hydrogen peroxide is generally used to sterilize the milk packaging materials. UHT milk can be stored unrefrigerated for atleast 3 months.

Filled milk

This is a homogenized product prepared from refined vegetable oil and non-fat milk solids and water. Its fat content should not be less than 3 percent and S.N.F 8.5 percent.

CHEMICAL ANALYSIS OF MILK

Milk is analyzed with the help of different chemicals to identify the quality of raw milk. In general, the following tests are done.

- Organoleptic test
- Acidity test
- Alcohol test
- Heat stability test
- Fat content
- SNF (Solid – not – Fat) Content
- Hardness of water

Organoleptic Test

**Color:** Normal milk: yellow color (cow), white color (buffalo)

Abnormal milk: Due to the growth of bacteria, certain characteristic colors like blue, red, yellow and black are observed.

**Flavor:** Milk samples which give foul or an abnormal smell like acid, sour, rancid, putrid metallic, oxidized, weedy and stable flavor etc. should be rejected.
Taste: sweet in taste due to presence of lactose (milk sugar) and bitter due to contamination of milk.

Acidity Test

**Aim:** To test the lactic acid percentage by titrometric method.

**Principle:** Natural acidity of milk is due to the constituents like casein, albumin, citrate, phosphate, and carbon dioxide. The activity can be measured by titrating milk against standard alkali using indicator like phenolphthalein.

**Requirements:**
1. Milk Sample.
2. Pipettes.

**Reagents:** Phenolphthalein indicator.

**Procedure:** Milk sample is mixed thoroughly and about 9ml is pipetted into a beaker. To this, 1ml of phenolphthalein indicator is added, mixed well and titrated against 0.1N NaOH till pink color appears and remains for 10 to 15 seconds.

**Calculation:** 
\[ \text{% lactic acid} = \frac{9 \times \text{Normality of NaOH} \times \text{volume of NaOH used}}{\text{volume of milk}} \]

**Interpretation:** The normal range of acidity of milk varies from 0.12 to 0.155% lactic acid. Any value in excess of 0.155% can be safely recorded as developed lactic acid.

Heat Stability Test

**Aim:** To determine the strength of milk with 0.1N NaoH.

**Principle:** Optimum heat stability is dependent on a certain ratio or balance of calcium + magnesium ion to phosphate + citrate ions. Any disturbance in salt balance is due to the excess or deficiency of either group accelerates heat coagulation. Mineral imbalance may be due to higher acidity developed due to bacterial action or chemical means.

**Requirements:** Milk sample, test tubes, pipettes, water bath.

**Reagents:** 0.1N NaoH.

**Procedure:** Take a clean and dry test tube and pour 0.6ml of 0.1N HCL into the test tube. Add 10ml of milk into the test tubes. Mix the contents well and keep them in boiling water bath for 5 to 10 minutes. Remove and observe for clots or flakes formation.

**Interpretation:** Poor heat stable milk coagulates on heating. Grading of milk can be done as follows (Table 5).

<table>
<thead>
<tr>
<th>Heat stability</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative 0.5 ml above</td>
<td>Good</td>
</tr>
<tr>
<td>Negative 0.4 ml</td>
<td>Poor</td>
</tr>
<tr>
<td>Negative 0.3 ml below</td>
<td>Very poor</td>
</tr>
</tbody>
</table>

Table 5. Grading of milk with heat stability.

Determination of Fat by Gerber Method

**Aim:** To estimate the percentage of fat by Gerber method.

**Principle:** When a definite quantity of sulphuric acid and amyl alcohol are added to a definite volume of milk, the proteins are dissolved and the fat globules are set free which remains in liquid state due to the heat produced by the acid. On centrifugation, fat being lighter is separated on top of the solution.

**Apparatus:** Butyrometer, 10ml customizable, 10.75 ml pipette for milk, 1ml automatic measure for alcohol, Stopper for butyrometers, Centrifuge – electrical or hand operated.

**Reagents:** H2SO4 (density 1.807 to 1.812 at 27 °C) and Amyl alcohol (density 0.803 to 0.805 g/ml at 27 °C)

**Procedure:** Transfer 10ml of H2SO4 in to the butyrometer by means of 10 ml automatic tilt measure. Heat the milk sample to 27 °C and shake well for even distribution of fat in the sample. Transfer 10.75 ml of milk sample in to the butyrometer by means of 10.75 ml pipette. Pipette out milk slowly taking care that the milk from separate layer over acid to avoid charring. Measure 1 ml of amyl alcohol in to butyrometer by means of 1 ml pipette or automatic measure. Close the neck of the butyrometer firmly. Shake the butyrometer carefully without inverting it until the contents are thoroughly mix and curd particles are completely dissolved. Then invert the butyrometer few times by mixing the contents uniformly. Place the butyrometer in centrifuge sockets in opposite
direction and balance. Centrifuge at maximum speed for 4 minutes and stop the centrifuge gradually. Adjust fat column in the scale, hold the butyrometer fat % to the nearest part of the small scale division.

Precautions:

1) If fat column is white or curd, the following may be the reasons.
   a) Acid was not mixed completely
   b) Acid delivered through tilt was not sufficient as less volume might have been added.
2) If the fat column appears as charred.
   a) Dilution may not have done properly and a strong acid might have been added.
   b) Milk might be added to acid in the butyrometer.
   c) The contents in butyrometer might not have been mixed immediately.

Determination of Snf- (Solid-Not-Fat) Content

Aim: To estimate the amount of solid – not – fat content or total solids.

Principle: The principle involved in measuring the specific gravity by a lactometer is that a floating object sinks until it has displaced fluid equal to its own weight. The greater the volume of the fluid, the lower the lactometer reading.


Procedure: Adjust the temperature of the milk sample at 21oc. Pour the sufficient of milk into the lactometer jar to allow the lactometer float freely. Allow it to come to a constant level. Record the lactometer reading and lactometer temperature of milk.

Observation: a) Lactometer reading
   b) Temperature of the milk.
   c) C.L.R (corrected lactometer reading) = observed reading to correction factor.

Correction factor: For every degree raise of temperature in milk above 21oc, 0.2 lactometer reading is to be added to the observed lactometer reading like wise for every oC below 21 C, 0.2 lactometer reading is to be detected from observed lactometer reading.

Calculation: SNF content = CLR /4+ 0.21F +0.36.

Hardness of Water

Aim: To test the hardness of water.

Apparatus: Conical flask, Burette

Reagents: Ammonia buffer solution, EDTA Solution, Crichnam black.

Procedure: Take 100ml of sample in a sterilized conical flask. Add 0.1mlof ammonia buffer solution and 0.1g of crichnam black and mix well. Titrate against EDTA solution till the color of changes from pinkish to blue.

Formula: Hardness = Reading x 0.10

Bacteriological Analysis

This involves analyzing the bacteriological testing to detect the pathogenic and non-pathogenic bacteria. The tests involved in this analysis are,

1.) Methylene Blue Reduction Test (MBRT)
2.) Phosphatase Test

Methylene Blue Reduction Test

Aim: To determine the bacterial load present in 10ml of milk sample.

Principle: Barthel and Orel- Jenson first employed this test in 1990. Wilson and his colleagues modified the original test. It is the official test for both untreated and the pasteurized milk. It is taken as an indication of the bacterial load i.e., the more the bacteria present, the faster the reduction. The methylene blue reduction time thus gives an indication of bacterial numbers and activity in milk.

The MBRT is generally used for,
Judging the hygienic quality of milk.

Grading the raw milk supplies.

For assessment of the post pasteurization of milk

For detecting post pasteurization of milk.

Requirements:

- Milk samples
- Sterile screw cap test tubes
- Water bath at 37°C
- Clock or timer

Reagents Required: Standard methylene blue solution.

A standard solution of methylene blue is made by dissolving one tablet of approved methylene blue thiocynate or chloride (BHD or MERCK) in cold sterile water in a flask by gentle heating in a water bath or by allowing the mixture to stand for several hours to facilitate complete solution and then adding 600 ml of sterile distilled water. The stock solution must be stored in a sterile glass stoppered, amber colored bottle in a place colored bottle in a dark place. Fresh solution must be prepared once in every 2 months.

Procedure: The milk sample was mixed thoroughly. Two sterile screw cap tubes were taken and 10ml of milk was pipetted into each test tube. Later, 1 ml of methylene blue was added to each of the test tube using a sterile pipette. The tubes were then cooled with stoppers and the contents were mixed by gently inverting them 2 or 3 times. The tubes were placed in a water bath at 37°C and the time was recorded. The incubated milk test tubes were observed at regular intervals of 30 minutes for 3-6 hrs for reduction of methylene blue i.e., the change in color of the samples was recorded and the result was tabulated.

Interpretation: The following standards are taken as a guide of raw milk or pasteurized milk on the MBRT test (Table 6).

<table>
<thead>
<tr>
<th>MBRT in Hours</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 and above</td>
<td>Very good</td>
</tr>
<tr>
<td>3 to 4</td>
<td>Good</td>
</tr>
<tr>
<td>1 to 2</td>
<td>Fair</td>
</tr>
<tr>
<td>½ hour and below</td>
<td>Poor</td>
</tr>
</tbody>
</table>

Phosphatase Test

Aim: To estimate the phosphate enzymes present in the pasteurized milk.

Principle: Raw milk contains phosphates enzyme. It is destroyed at the temperature necessary for efficient pasteurization. But when milk containing phosphates is incubated with p-nitro phenyl disodium orthophosphate, the liberated para nitro phenol gives an yellow color under the alkaline phosphates condition of the test. The color is the measure of the phosphates content of the milk sample. Therefore, if phosphate is present, it follows that the milk has been contaminated after the heating process by raw milk.

Apparatus: Standard discs, Fused glass cells, Water bath, Pipettes, Test tubes with a stopper to fit.

Reagents: p-nitro phenyl – disodium orthophosphatase

Procedure: Transfer 5ml of p-nitro-phenyl-disodium orthophosphatase into a phosphate in a test tube at 37°C. Add 1ml of the milk into the test tube for 30 minutes to 2 hours at 37°C (Table 7).

Table 7. Interpretation of results.

<table>
<thead>
<tr>
<th>Interpretation Results</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc reading after 30 min incubation</td>
<td>Properly pasteurized</td>
</tr>
<tr>
<td>Disc reading after 2hrs of incubation</td>
<td>Properly pasteurized</td>
</tr>
<tr>
<td>0 or trace</td>
<td>Properly pasteurized</td>
</tr>
<tr>
<td>6</td>
<td>Doubtful</td>
</tr>
<tr>
<td>10 or over</td>
<td>Under pasteurized</td>
</tr>
<tr>
<td>Over 10 to 18</td>
<td>Slightly under pasteurized</td>
</tr>
<tr>
<td>Over 18 to 42</td>
<td>Under pasteurized</td>
</tr>
<tr>
<td>Over 42</td>
<td>Grossly under pasteurized</td>
</tr>
</tbody>
</table>
SUMMARY AND CONCLUSION

The Tirumala Diary, Vellacheruvu, Prakasam District is an ISO 9001:2000 certified company for the scope of processing, manufacturing and marketing of milk and milk products. The company has many branches throughout the state of Andhra Pradesh.

A detailed study of various tests that are analyzed in chemically and bacteriologically in the laboratory was learnt and the in-depth knowledge was obtained. The different testing schedules that are practiced in the laboratory were also learnt.

The in-plant training period in the Tirumala Diary has given me a huge opportunity to get a clear understanding about various aspects in the dairy industry. It has also helped me to learn the different quality control techniques and to get knowledge of overall processing stages and techniques involved in the diary plant.

The overall in-plant training was of immense help as it not only taught me the subject, but also led to my overall personality development as it provided me a great opportunity to interact with people of different kinds and eventually work with them.

Asif Mahmood and Sumaira Usman during their research in 2010 said, in order to obtain high-standard milk and dairy products satisfactory on a physico-chemical and microbiologic level, the following aspects must be considered. They emphasized that, the increase of the specific hygienic-sanitary knowledge level must be conducted on an organized basis for personnel working in raw matter and processing sectors, as they are the ones, who provide normal conditions for food security.

The aforementioned researchers have immensely pressed on the limitation of economic losses and said, an education of personnel in the food sector must be accomplished regarding the importance of milk and dairy products quality parameters, and the accomplishment of a stimulating framework for selective competition based on objective grounds for consumer advantage.

They also said that the extension and modernizing of the official production control must be considered in order to increase milk production for bubaline breeding and development, especially for the private sector; to increase the number of active population; the number of milk somatic cells is associated with a severe decrease of physiologic and processing milk traits, at times hazardous for consumer health.

In any milk industry, the determination of somatic cell number is an important parameter that must be taken into consideration for the control of management programmes for raw matter milk quality and as a control parameter for measure efficacy within the mamite control programme for dairy buffaloes. The evolution of somatic cells appears in accordance with buffalo milk production. Another highly important aspect that draws our attention refers to the microbial charge, which is influenced by breeders’ degree of education, by hygiene conditions that have to be respected in milking and milk storage until capitalization. The above lines are one of the very few important lines that have been indicated by the researchers.

Lastly, I humbly thank Mrs Prasanna Lakshmi Maddineni, my senior at the university where I have completed my two year Program towards achieving the degree Master of Science for helping me out during the entire program and the entire management of Tirumala Dairy, for giving me an once in a life time opportunity to learn laboratorial techniques and gain experience at an industrial level in their esteemed organization.

REFERENCES


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