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TECHNICAL
MANUAL
Milk is a highly perishable commodity, it can get spoiled very easily. Thus strict hygiene measures must be maintained throughout the processing of milk.

A. FLOW DIAGRAM FOR MILK PROCESSING
A. STORAGE NORMS

Milk should always be maintained at low temperatures to avoid growth of bacteria or other microorganisms.

Always follow "First in, First out" (FIFO) system for milk processing.

B. PROCESS NORMS

1. Homogenization

Homogenization is the process that gives milk its smooth texture and fine white color. The fat in milk normally separates from the water and collects at the top. Homogenization breaks the fat into smaller sizes so it no longer separates.

2. Clarification and Standardization

Clarification is the process of filtration for the removal of dirt and foreign matter from milk and hence, improves the quality, appearance and marketability of milk. Standardization involves adjusting the content of fat and solid non-fat (SNF) in the milk.

3. Pasteurization

Pasteurization is the process of subjecting milk to treatment at very high temperatures, in order to kill bacteria and other harmful microorganisms. Milk is pasteurized by first heating it to 72°C for about 15 seconds, and then cooling it to 4°C. Other time and temperature combinations may also be used.

4. Fortification

Fortification is the process of adding vitamins and minerals in the food. Milk can be fortified with Vitamin A and vitamin D. Vitamin A is a nutrient that the human body requires for good vision and Vitamin D promotes calcium absorption and improves the immune system. These vitamins get easily dissolved with milk and increase the nutrition of milk manifolds. Fortification of milk can be done in two ways:

i) Batch mixing- It is the process of mixing premix in pre-defined quantity of Milk i.e. 10,000 Kg-15,000 Kg tanks. Calculate the vitamin required according to the batch quantity and then add and agitate it properly to get the fortification level of Vitamin A: 900-1500 IU or 270-450 µg RE and Vitamin D: 200-300 IU or 5.0-7.5 µg per litre of milk. The blending proportion is one litre premix in 50,000 litres of milk (However, it may vary with different premix suppliers).

Prepare a pre-blend first by mixing the pre-mix with small amount of milk. Before adding this pre-blend to bulk milk, mix it well with a stainless steel stirrer and then add it to bulk tank before pasteurization of milk.
ii) Continuous mixing- It the process in which premix is added continuously into milk with the help of dozers. This method is more controlled as it is regulated by valves.

- You should take pre-mix only from suppliers approved by FSSAI.
- You should store the pre-mix in a cool, dry place and away from sunlight, insects and rodents.
- Develop a standard operating procedure (SOP) for fortification and train the workers to follow the same.
- Heat the premix in a water bath at 45 degree C for 15 minutes before making the preblend.
- You must add the vitamin concentrate after standardization and before pasteurization to allow complete mixing.
- Maintain a constant flow rate of the pre-mix concentrate during continuous mixing.
- You must use a check-valve(s) to separate milk lines from vitamin concentrates in continuous mixing process.
- For batch addition, use only accurate, calibrated measuring devices, such as food grade plastic graduated cylinders, or pipettes.
- Rinse the measuring devices used during batch mixing with milk being fortified to remove any residual pre-mix concentrate.

Vitamin Fortification of Milk: Continuous mixing
FREQUENTLY ASKED QUESTIONS
Q: **What is Milk Fortification?**
A. Milk fortification is the process of adding vitamin A and D to milk.

Q: **Why fortify Milk?**
A. Recent National Nutrition Monitoring Bureau (NNMB) survey and a report of the expert group of ICMR in 2012 has stated that India has very high burden of Vitamin A and D deficiencies among both young children and adults particularly in urban areas where people are physically less active and have a very limited exposure to sunlight.

Since milk is consumed by all population groups, fortification of milk with certain micronutrients is a good strategy to address micronutrient malnutrition.

When fat is removed from full-fat milk while processing it to produce toned and double toned milk, it also leads to depletion or loss of fat-soluble vitamins, especially the vitamins A and D. Fortification of milk thus helps to top up these lost vitamins.

Milk fortification benefits the low income population groups, who prefer the low fat milk due to the lower cost and many others who prefer consuming low-fat milk.

Q: **What is the feasibility of milk fortification in India?**
A. Technology for milk fortification is simple and equipment are readily available. The concept, technology and quality control procedures are well established for sustained production of fortified milk within India. Hence, appropriately and adequately fortified milk can be made available through the milk dairies and through the regular open market commercial channels.

Q: **What are the micronutrients which can be used as fortificants to fortify milk?**
A. Usually, vitamin A and D are added into milk for fortification.
Q: Is the micronutrient premix used for fortification, of vegetarian source?
A. Yes, premix is manufactured from vegetarian sources. Vitamin A in the form of Retinyl Acetate/Retinyl Palmitate/Retinyl Propionate and Vitamin D2 (Ergocalciferol) that are added to milk for fortification are of vegetarian origin.

Q: How safe is fortified milk for consumers?
A. Consumption of any type of food is self-limiting. Considering that milk is fortified at 25-30% of the recommended dietary allowances (RDA), and that its consumption is self-limiting; a person cannot consume fortified milk in such high quantities that would exceed the upper safety levels of vitamin and mineral intakes. Hence milk fortification is entirely safe.

By applying strict monitoring and supervision measures, companies can ensure that fortification levels do not exceed the safe limits.

Q: Do added vitamins get removed, if the fat layer is removed from milk after boiling?
A. As water soluble forms of vitamin A and D are preferred for fortifying liquid milk in India, there is uniform blending of premix with milk without the need for a homogenizer. Also, when fat layer is removed after boiling, these vitamins will remain in the liquid milk.

Q: How does fortification affect the shelf life of milk?
A. Fortification has no impact on the shelf-life of any kind of milk. The vitamins have a shelf life of their own although they do become less active over time.

Q: Does fortification change appearance, taste, texture and flavor of milk?
A. No. When deciding on the appropriate premix for milk fortification, only those vitamins are considered, which will not change the appearance, taste, texture and flavor of the milk. The concept is based on the fact that the consumer buying behavior should not be affected by the fortification process.
Q: Is milk fortification costly?
A. Fortification of milk is relatively inexpensive and affordable and costs less than 2 paise per litre. Micronutrient premixes for milk are made within India and are readily available at competitive prices.

Q: What is the process for storing premix used for fortification of milk?
A. Premix should be stored at 20-25 degree centigrade temperature, in a cool, dry place, preferably in an air conditioned room.

Q: Can the premix used for milk fortification be consumed directly?
A. No, never. Premix has micronutrients in the range of million grams or million international units, which is toxic for the body if consumed directly.

Q: Will there be any loss of micronutrients after heating the fortified milk?
A. There is 10-15% loss of the micronutrients during boiling of milk.

Q: What claims is a company allowed to make to market their fortified milk?
A. Milk processing and packaging dairies can state that their product (milk) is fortified with vitamins. But they need to indicate levels of added micronutrients in this nutritional information panel as required by the Packaging and Labelling Reuqirements mentioned in Food Safety and Standards (Fortification of Foods) Regulations, 2017 as operationalized on 22nd November 2017, F. No. 11/03/Reg/Fortification/2014 (pt.I).
GOOD MANUFACTURING AND HYGIENE PRACTICES
1. LOCATION AND SURROUNDINGS

- You must keep the surroundings of the milk plant especially, areas around the silos, clean and dry at all times to avoid any environmental contamination.
- For a milk processing plant, you should choose a location that is away from industrial pollution like strong odour, fumes etc.
- You must check that the surroundings are clean with no stagnant water or garbage dumps in the area.
- Control any excessive vegetation in the premises to avoid attracting insects and pests.
- Cut the grass and shrubs short.

2. INFRASTRUCTURE AND LAYOUT

- You should check that there is sufficient free space around the machines to allow easy cleaning of floor and equipment in the processing and packaging areas.
- Check that the floors, walls and ceilings are made of non-absorbing and non-toxic materials like Tiles, non-porous stones, Kota stones etc. that are easy to clean.
- It is preferable to provide the floors with slope of at least 8 degrees for easy drainage of water into the drains to avoid water logging.
- You must screen the windows, doors, openings for ventilation with wire mesh, strip curtains, air curtains, grills as suitable, to prevent the entry of dust, cockroaches, rats, lizards, birds and stray animals like dogs.
- Cover the lights and other overhead fixtures with shatter-proof coverings like fibre, grills etc. to prevent broken glass pieces from falling into the milk during processing and packaging.
- Ensure that there is continuous supply of safe potable water for food processing, cleaning of equipment and hand washing purposes.

3. EQUIPMENT

- Equipment and containers that are used for milk handling, storage, preparation, processing, packaging and serving should be made of corrosion free materials like stainless steel, aluminium, etc. which do not impart any toxicity to the milk.
- You must never leave the milk open at any stage of processing. Always store milk in clean vessels covered with a well-fitting lid.
- You must have a cleaning-in-place (CIP) facility in a milk plant especially in the

pasteurization unit.

• Use valves to prevent back flow of milk in the pipelines and check these valves periodically.
• Maintain the records for cleaning and maintenance of equipments.

4. DRAINAGE AND WASTE DISPOSAL

• You should provide the floors with a slope of at least 8 degrees to avoid water logging in the manufacturing area.
• Do not let the waste generate accumulate in the food processing or packaging areas. You must immediately collect the wastes in covered containers and store them away from the food handling areas.
• Dispose of the collected waste at regular intervals so that it does not generate bad odor in the area or lead to development of microbial growth.
• Ensure that the plastic/metal/ glass wastes are disposed of in an environment friendly manner.
• Collect the dry and wet wastes separately and segregate the biodegradable, non-biodegradable and recyclable wastes.
• See that there are sufficient covered dustbins in all the areas, and that no waste is left lying in the open.
• Clean, disinfect and dry all the dustbins before next use.
• Ensure that all the drain openings are screened with metal grills or mesh to avoid waste accumulation.

5. CLEANING AND MAINTENANCE

• Due to multiple pipelines, valves and high risk of food contamination in milk plant, cleaning and maintenance have to be strictly followed as per the standard procedures including time and temperature controls for cleaning and washing of machines.
• You must follow a regular cleaning schedule in the milk plant which clearly describes:
  ➢ the instructions for cleaning
  ➢ the time schedule for cleaning and
  ➢ the person responsible for cleaning
• Store the cleaning chemicals and equipment in a separate area.
• Keep the floors and equipment clean and dry at all times.
- Wipe the doors and windows regularly. Also clean the wire mesh, grills and insectocutters regularly to clean any accumulated dirt.
- You must have a CIP (Cleaning In Place) system for cleaning the milk processing equipment as bacteria may develop inside the pipelines and valves if not cleaned properly, especially in the pasteurizing unit.
- You must follow these steps to clean the milk processing equipment to avoid growth of bacteria due to milk residues.
- You must maintain the temperature instructed to keep the equipment germ-free.
- Do not leave the chemicals used for cleaning for longer than suggested time to avoid corrosion of equipment.
- Maintain a record of all cleaning and maintenance activities.

### PEST CONTROL SYSTEM

Though the milk processing area is highly protected from the environment, it is still suggested that you take some precautions to keep the insects and pests away from the premises.

- Do a daily pest sighting.
- Use the 4D system for pest management.
- Screen the windows, doors, openings for ventilation with wire mesh, strip curtains, air curtains, grills as suitable to prevent the entry of dust, cockroaches, rats, lizards, birds and stray animals like dogs.
- Use glue pads, rodent traps, insectocutters to limit the entry of and to eliminate any pests or rodents present in the premises.
- Use licensed agency for the pesticide and insecticide sprays in the food plant periodically to kill the pests. You should spray the chemical in the manufacturing area only after the production operation has finished. Keep a record of these
pesticide applications.
- Maintain a record of all pest control activities in the premises.

7. **PERSONAL HYGIENE**
- Do not allow workers suffering from infectious disease or illness inside the milk handling areas.
- You should conduct health check-up for the workers by a registered doctor at-least once in a year and maintain a record of these check-ups.
- You must see that all the food handlers wear clean uniform, hand gloves, face masks, hair nets and shoe covers in the milk processing area.
- You must see that all the food handlers wear clean uniform, hand gloves, face masks, hair nets and shoe covers in the milk processing area.
- You must wash hands with soap and dry them every time after using toilets, sneezing, coughing, scratching your body parts and after touching your mobile phones, money etc.
- Do not eat, drink or spit inside the processing area.
- Always cut your nails and keep them clean.
- Avoid wearing any jewellery like rings, bangles, watches or pins while working in the plant. If you can’t remove these because of any personal or religious reasons then use hand gloves to cover them.

8. **TRAINING OF FOOD HANDLERS**
Train the workers and staff on how to use the machines, and how to handle the milk and its products to ensure food safety at all stages of processing.
- You must train the workers for GMPs and GHPs to be followed in the milk processing plant.
- Train the workers for various time and temperature controls to be maintained during milk processing.
- You must train the workers to clean the valves, pipelines, curved ends of the pipelines and milk containers properly with steam or vacuum for standard time and temperature.
- You should do a skill assessment for workers periodically by way of quiz, discussions, reviews etc.
PACKAGING & LABELLING REQUIREMENTS
1. **NUTRIPANEL:**

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<th>Nutritional Information</th>
<th>(Approximate Composition per 100 g)</th>
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<tr>
<td>Calcium</td>
<td>mg</td>
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<tr>
<td>Added Vitamin A</td>
<td>X mcg/ug* RE**</td>
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<tr>
<td>Added Vitamin D</td>
<td>Y mcg/ug*</td>
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* mcg/ug stands for micrograms
** RE stands for Retinol Equivalent

2. **+F LOGO**

+F logo should be in blue colour as per the logo dimensions and colour codes mentioned in Appendix 1

Fortified with Vitamin A and Vitamin D

Fortified with “Name of Fortificant(s)” should be in Black Colour

3. **Ingredients:** Milk Solids, Water, Vitamin A, Vitamin D or D2

OR

**Ingredients:** Toned/Double Toned/Standardized Milk, Vitamin A, Vitamin D or D2

In addition to usual ingredients, add Vitamin A and Vitamin D or D2 in the ingredient list.
+F LOGO DIMENSIONS
Below is an indicative size of the logo. It can be used in any size keeping the ratio intact.

All dimensions in millimeters

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<th>D</th>
<th>a</th>
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COLOR CODES
PANTONE 3005 C
C-100, M-46, Y-2, K-0
R-0, G 116, B-200
Web- 0074C8

COLOR CODES
PANTONE BLACK
C-0, M-0, Y-0, K-100
R-35, G-31, B-32
Web- #231F20