

**Paper No.: 12**

**Paper Title: FOOD PACKAGING TECHNOLOGY**

**Module – 18: Packaging of Dairy Products - 1**

### **1 INTRODUCTION:**

The appropriate packaging of milk is of utmost importance not only to preserve its nutritive value and saving of wastage, but also to improve the marketability to achieve better returns. The challenge to the packaging industry is to deliver the nutritious milk to the consumer in most economical, hygienic, safe and environmentally friendly package.

Because of the shelf-life requirements of UHT milks, multiple laminates, for example a triple layer of high density polyethylene are used. An intermediate light barrier may be incorporated, according to the manufacturer's preference. Oxygen penetration during storage is not usually a problem. Whatever the source of bottles, aseptic techniques are used in filling and sealing to prevent contamination, and milk can be expected to have a shelf-life of 6 months at ambient temperatures.

Cream contains a high percentage of fat, so it is very susceptible to spoilage. So packaging material used should be selected in such a way that it possesses good grease resistance, and barrier properties against oxygen and moisture. Cultured milk products have various textures and viscosities, i.e. when liquid they are considered as beverages (Butter milk) and when semisolid they are spoonable products (Yoghurt). The material used for packaging must be compatible with the special physical chemical and bacteriological properties of fermented milk.

Traditionally, Indian dairy products have been manufactured by individual sweet makers-“halwais” and small entrepreneurs. Very little attention is paid to sanitary handling and packaging of these products. Indigenous products have been packed in leaves, paper cartons or paper-board boxes. These materials do not provide sufficient protection to the product from atmospheric contamination and manual handling. Consequently, the sweets soon lose their typical body and texture, absorb foreign odours, lose their aroma characteristics and show mold growth. Moreover, the products are stored in open metal trays.

## **2 PACKAGING OF FLUID MILK**

There are two main types of packaging systems for fluid milk one is traditional bottling system in which container is to be returned and other is one way delivery in which container is disposable and does not travel back to the dairy. In the non-returnable distribution system there are several alternative systems where different packaging materials, shapes, sizes, forms and machines are employed for packs.

For selection of a suitable package material, the knowledge of important characteristics of milk/ milk products is essential.

### **2.1 Characteristics of Pasteurized Milk:**

- 1) Milk has a tendency to absorb the flavours from its environment
- 2) Risk of Contamination is more in liquid milk
- 3) Adulteration can be done easily when not packed properly
- 4) It is difficult to handle milk in bulk quantities
- 5) Milk is prone for oxidation when exposed to sun light

### **2.2. Criteria for selection of milk packaging material for fluid milk:**

Milk, an extremely perishable and sensitive product, need exact packaging material in order to preserve its initial quality for some span of time. The necessary characteristics of packages for pasteurized milk are:

- 1) It should be free from off-flavours
- 2) It should not impart any taste or flavour to the product.
- 3) It should act as barrier to bacterial contamination,
- 4) It should be resistant to UV light ( max transmission: 8% at 500 nm & 2% at 400nm)
- 5) It should have no physiological effects on the products
- 6) It should possess good mechanical properties (sealing, tensile, structural strength etc.)
- 7) It should be tamper proof.
- 8) It should possess good oxygen barrier properties
- 9) It should be economical
- 10) It should fit in to processing- in-Line.

### **2.3 Materials Used:**

1. Glass
2. Plastics: (1) LDPE is widely used (2) LLDPE: 25% thinner film used and LDPE and LLDPE in 5:1 to 4:1 ratio.
3. Others: Coated paper board, wax coated paper board ESL ( Extended Shelf life Pouch )

#### **2.3.1 Glass Bottles:**

Packaging of milk in glass bottles is the oldest system. Clear glass bottles of 500ml capacity conforming to IS: 1392 – 1967 are used. The glass bottles offer certain advantages like transparency, rigidity, hygienic and non-toxic nature and compatibility. This system involves collection and transportation of empty bottles to processing plant, washing and sterilization of dairy bottles. This packaging system requires large storage space requirement for both empty as well as filled bottles. These factors increase the fixed and the variable costs. Heavy weight, fragility and return ability of bottles has inconvenience both to the distributor as to the well as consumer which made this packaging system undesirable and is not in use at present.

#### **2.3.2 Returnable Plastic Bottles:**

Plastic bottles reduce the weight and the chances of breakage are rare but most other characteristics of packaging milk in glass bottles remain same.

#### **2.3.3 Non-Returnable Plastic Bottles:**

This system reduces transport charges through light weight and one way of delivery of bottles in a convenient way in comparison to any other system. Ex: HDPE with PP lid.

#### **2.3.4 Plastic Films:**

Plastic pouches are generally made of low-density polyethylene (LDPE) film. Co-extruded LDPE-LLDPE film is also used because of its advantage of eliminating pin-hole problems. The films are of 45-75 $\mu$  thick. The pouches are formed and filled on form-fill-seal (FFS) machines in capacities of 200, 500ml and 1000 ml. The film should confirm to IS: 11805 – 1999. The plastic pouches are clean, hygienic and safe for this application and since these are not reused, the cleaning operation is eliminated and energy loss is avoided. Moreover, these pouches are easily recyclable for other purpose.

#### **2.3.5 Aseptic Packaging of Milk:**

Aseptic or long-life milk was originally introduced in Sweden in the early 1960's originally called the "Tetra-pack" system. It utilizes a laminate pre sterilizer and a filling environment heater. Aluminium foil is an integral part of the flexible laminate in order to provide a barrier against light and gas. In UHT processing, Milk is preheated to 73– 85<sup>0</sup>C then rapidly raised to 135 °C for fraction of second and then suddenly cooled by flashing into a vacuum chamber. It must be packed under completely sterile conditions. No refrigeration is necessary for at least 3-6 months. If kept under refrigeration a self-life of up to 1 year is possible.

In the distribution system, the pouches are placed in reusable multi-trip plastic crates. The crates are made of HDPE or PP and packs are stackable. The plastic crates shall conform to specifications laid down in IS: 11584 – 1986.

#### **2.3.5.1 Paper Board Cartons:**

This kind of packaging materials are commonly used in aseptic filling systems for milk, cream, fruit juices, soups etc. The filling systems could be either of the following two types: those in which the carton is formed within the filler from a continuous reel of material; and those in which the cartons are supplied as preformed blanks, folded flat, which are assembled into cartons in the filler. The packaging material is mainly composed of printed- Paper coated with aluminium foil and several plastic layers (Polyethylene - paper board – polyethylene - aluminium foil - polyethylene). The inner material side of the finished package is coated with a special layer facilitating the sealing process. Each layer has a specific function:

- The outer polyethylene layer protects the ink and enables the sealing process of the package flaps.
- The paperboard serves as a carrier of the decor and printing gives the package required mechanical strength.
- The laminated polyethylene binds the aluminium to the paper.
- The aluminium foil acts as a gas and light barrier.
- The inner polyethylene layer provides liquid barrier and sealing

The same type of packaging material can be used for packaging of flavoured milk also depending on treatment and shelf-life.

### **3. PACKAGING OF CREAM**

Cream is the concentrated form of milk fat. Cream contains a high % of milk fat and is very susceptible to spoilage. Moisture loss from cream can occur if not properly packed. It is prone to oxidative and lipolytic rancidity. It can absorb flavours

#### **3.1 Characteristics of Packaging Material required:**

1. Prevent light passage
2. Prevent water loss
3. Prevent oxygen transmission
4. Shall offer resistance for microbial contamination

In early 20<sup>th</sup> century waxed paperboard cartons were used as containers for cream. Now a days creams is packed in similar packages used for milk i.e. Newer cream packaging concepts include thermoformed packs made from linear polyethylene, polystyrene or polypropylene. These may be closed with a peelable lid or snap-on cover. Tin plate containers have also been used for larger sizes. Whipped cream and synthetic formulations are sold in aerosol cans and polyethylene tubes.

Imitation cream made from soybeans and vegetable oils is often marketed in wax coated paper board cartons. Ultra pasteurization has been applied to heavy and light creams. The product then goes for packing. A strong seal is necessary for product protection. PE extruded or wax coated paperboard tubs are used to pack single portion cream. Sterilized/UHT cream is packed in similar lines to that of UHT milk.

### **4 PACKAGING OF FERMENTED DAIRY PRODUCTS**

The material used for packaging of fermented dairy products must be compatible with the special physical chemical and bacteriological properties of fermented milk. The packaging materials used are glass, polyethylene, complex card, LD / LLDP, HDPE cups, Co extrusion plastic complexes, polystyrene- EVOH (polyvinyl alcohol and ethylene co polymer, Polystyrene –PETG (polyethylene glycol terephthalate).

**4.1 Yoghurt:** Yoghurt has become very popular in many nations. In the United States yoghurt is packed in coated paper board containers. The product is automatically filled in polystyrene tubs and covered with 0.005mm aluminium foil. The inherent brittleness of polystyrene may become a problem. The terpene containing aroma of fruit yoghurt has an

effect on polystyrene. Fruit acids may also cause pitting of unanodized aluminium lids. A polystyrene tub is an excellent package for yoghurt. It is economical, practical and widely used. Yoghurt is also being sold in expanded polystyrene foam tubs in trays. Each tray holds 20 tubs of yoghurt. Trays are stackable and serve not only as display holders and light weight shippers but also hold during fermentation of yoghurt. This saves extra handling and repacking cost.

**4.2 Fermented milks (Buttermilk, sour cream, lassi):** LDPE sachets, polystyrene cups, polypropylene cups are used. Wax coated paper cups are used. Recently buttermilk, lassi and sour cream are packed in aseptic tetra packs. HIPS for stored products must never be employed as free fatty acids may lead to cracking of the material. Lassi which is a sweetened butter milk product is packed in polystyrene cups with coated aluminium foil lids. The packaging materials such as earthen wares give firmness to product. Others are glass jars, PS / PP cups, PVC lined HDPE. Tetrapak / Brick are recommended for Lassi.

**4.3 Dahi:** The traditional pack so far was the earthenware pot with a loose cover of glassine or greaseproof paper. The earthenware pots are very heavy, easily breakable and because of oozing of water from its body, the product inside develops shrinkage cracks. Recently, injection moulded polystyrene and Polypropylene/ HIPS cups have been introduced with aluminium foil based peelable lids. These cups are available in capacities of 200 grams and 400 grams and provide a shelf-life of about 10 days under refrigeration. The plastic cups are light in weight, easy to handle and are hygienic. Some private dairies are also packing dahi in LDPE pouches of 200ml capacity.

**4.4 Shrikhand:** Shrikhand is packed in polystyrene/PP Cups. HIPS are more common for 100 gm to 1 kg size which are sealed/capped/lined with Al-PE foil. Small manufacturers use lined (Glassine) paper board boxes. HDPE containers with lid of LDPE made by injection moulding are also in use. PP or PE bags, Glassine paper lined containers are also used.

## **5 PACKAGING OF ICE CREAM**

The chief requirements of packages for ice cream are protection against contamination, attractiveness, ease of opening and reclosure and ease of disposal, protection against moisture loss and temperature fluctuations is desirable. Bulk ice cream is packed and hardened at a low temperature. Shaped bars are hardened prior to packaging.

### **5.1 Package forms for Ice cream:**

Most bulk ice cream is packaged in a liner less bleached sulphate board carton, coated with wax or polyethylene wax blends for protection from moisture and oxygen. Once the carton is opened it is difficult to reclose and the paper board tends to warp. Although economic considerations favour the simple rectangular paper board carton, improved packaging often leads to higher sales and a marginal price differential may be offset by higher throughput. Other forms used for packaging of ice cream are Aluminium foil cartons, cylindrical containers, Plastic containers etc.

## **6 PACKAGING OF TRADITIONAL DAIRY PRODUCTS**

**6.1 Khoa:** Under existing trade practice, producers and traders do not employ any packaging for khoa. By employing proper packaging the shelf life of khoa can be enhanced. Hot packaging of khoa in pre-sterilized cans can improve the shelf life up to 14 days at room temperature and 75 days under refrigerated temperatures. Three times increase in shelf life was claimed by packing khoa in rigid polypropylene containers with lid and khoa packed in pre-sterilized laminate pouches (paper, Polyethylene and aluminium foil). Vacuum packaging and packing in Cryovac Shrink wrap pouches will prevent growth of aerobic microorganisms. However, these two packaging methods do not offer protection against bacteria growing inside khoa. Bulk packaging of khoa is done in PP buckets.

**6.2 Peda:** Peda is generally packed in paper board containers lined with parchment paper or grease proof paper. However, plastic trays, tubs can be used to pack peda to enhance its marketability. Paper board lined with PE or PP liner or glassine can be used. Peda packed in multilayer transparent laminate pouches under modified atmospheric packing of Nitrogen and CO<sub>2</sub> has a shelf life of 15 days at room temperature and 30 days at 20 °C. Peda samples packed with oxygen scavenger exhibited a shelf life of 2 month at 37 °C and 6 months at 20 °C.

**6.3 Paneer:** Vegetable parchment paper and PE bags are generally used. PE gives greater keeping quality (7 days at 5°C) than that given by vegetable parchment Paper. The Cryovac system using shrink film is being successfully used. Retortable tins are also used. Long life can be given by Metallized polyester or Nylon – PET / METPET/ PE or Aluminium foil or Nylon or LDPE/LLD.

Paneer is packed in tins along with the brine. These tins are sterilized and it may be having a slight cooked flavour and maillard browning which will increase with storage period. Paneer is also vacuum packed in laminated pouches to have an extended shelf life. Paneer is also packed in EVA/EVA/PVDC/EVA film under vacuum which may have a shelf life of 3 months under refrigeration

**6.4 Rasogolla:** Tin cans with resistant lacquer + SO<sub>2</sub> (100 ppm maximum) are generally used which gives highest shelf life to the product. Earthen pots which may be lined with leaves are also used in some areas of the country. HIPS or PP cups are also used along with heat sealable caps. Retailers use HIPS / polypropylene cups with press on lids.

## **7. Conclusion**

The shelf life of a milk and milk products depend upon the product and the packaging system used, the specifications of packaging material and the storage conditions in which it is held. There are many new concepts of packaging are coming which can improve the shelf life of dairy products, especially in India the traditional dairy products were normally available in the specific region only, but now due to invention of better packaging materials the traditional dairy products are available in various parts of country.