

PACKAGING OF CONCENTRATED AND DRIED MILKS INCLUDING BABY FOOD

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Introduction

- The shelf life of a dehydrated product is influenced to a large extent by the packaging, which must conform to certain special criteria.

These are:

- Protection of the dehydrated product against moisture, light, air, dust micro flora, foreign odour, rodents etc.
- Strength and stability to maintain original container properties through storage, handling and marketing.
- Size, shape, appearance to promote marketability of the product.
- Composition of the container must be approved for use in contact with foods.
- Lower cost.



Selection of Packaging Materials

- Dehydrated dairy products are generally hygroscopic in nature and even slightest increase of the moisture content will decrease the shelf life considerably.
- Hence, the packaging material should be impervious towards water vapour and such property is to be considered important for packing such products.
- When retention of low moisture content is the limiting factor of the shelf life of the product, the tests required to be made for determining the shelf life are: Determination of
 - The normal moisture content of the product
 - The moisture content of the product at which the product becomes unacceptable to the consumer
 - The R.H. and temperature of the surrounding atmosphere at which the equilibrium moisture content is maintained in the product.

Properties of Dried Milk Products Relevant to Packaging

- **Hygroscopicity** is the principal requirement which is important in small packs size where ratio of pack surface area to product is high. In tropical countries because of the high humidity prevailing, this is the important factor.
- **Cohesivity** or the Cohesion of product is the serious stickiness problem particularly in high speed packaging lines. In case of powder, observations made on cohesivity are
 1. Cohesion increases with decreasing particle size.
 2. It is independent of fat content in the range of 20-40% Fat.
 3. A small amount of surface fat is sufficient to give cohesion to WMP.
 4. Increasing the moisture from 2 to 4%, cohesion first decreases and beyond 4% cohesion increases very fast.

- **O₂ Sensitivity:** Preheating releases the -SH groups which protect against oxidization. However still there are chances of oxidation. Therefore for Fat containing products prevent the gas diffusion by employing either Vacuum or N₂ flushing.
- **Light sensitivity:** Powder exposed to light for long period bleaches the surface and thereafter it accelerate Fat oxidization.
- **Heat sensitivity:** Affect Flavour and Solubility. Ideal storage conditions are 180-190°C temperature and dry atmosphere.
- **Bulk Density** is very important because Packaging size is affected. The Free flowing properties improves with increased Bulk Density.

- **Odour pick up:** Product containing Fat is prone to pick up odour. High Fat powders pick up odour from packaging materials, surrounding atmosphere, stores, water and houses. The off flavour problem is encountered from kraft paper, PE film, CFB, fiber board cases and even from rubber sealing compositions.
- **Static electricity:** The problem is difficult to resolve. The plastic packaging materials are also important where antistatic agents are added e.g. Glycol alkyl esters (prevent electrical charge accumulated on the film surface).
- **Bacterial aspects:** Powders of normal moisture and RH do not give rise to bacterial problem.

Requirements of Package for Dried Milks

- **Adequate mechanical strength** to withstand damage during packaging, handling, transportation and storage is necessary.
- **Resistance to climatic hazards:** Resistant to damage by exposure to high / low temperature and humid atmosphere.
- **Convenient closure:** Sealing is of supreme importance. Simple, effective re-closure is also desirable.
- Bulk packages **should be light in weight**, easy to handle and stack during transport and storage.
- **Very low Water vapour and gas permeability:** Dried milk absorbs moisture very easily. **Powder with > 5 %** moisture gets **deteriorated** during storage. The **stale and gluey flavours result from Maillard reaction**. It results in losses of solubility, colour change; lumping and free flowing properties are affected. For **long storage, vacuum and N2 flushing** is essential.

- **Impermeability to light:** To avoid surface bleaching and fat oxidation.
- Inertness, durable, safe, utilizing minimum space, identification of product and directions for use, easy availability at reasonable cost are the other requirements.

Packaging materials available

1. Glass: Bottles, barrels, jars, etc.
2. Metal: Cans, barrels, drums, bins, etc.
3. Wood: Drums, bins, cask, barrels, etc.
4. Paper and paper derivatives
5. Metal foils
6. Thermoplastics and their derivatives
7. Composite films
 - Co-polymer film
 - Coated film
 - Co-extruded plastic film
 - Laminates

Flexibles for powder

- **Cartons lined with Al-foil-PE:**

Bag-in-box: Coated Al-PE bag or plastic coated paper inside cartons.

Modified Atmosphere Packaging -80% N₂ and 20% CO₂ where O₂ content is reduced to 3.0%.

- **Long storage:** Lacquer/print/print pre-lacquer, Al-foil (10 gsm)/Adhesive coated paper (40 gsm)/PE (30 gsm).
- **Shorter Keeping quality:** Al-foil may be omitted. Paper thickness increased to ~ 70 gsm and coated with PVDC (30 gsm).
- **Bulk Packaging:** Sacks made of craft paper laminates, parchment, polyethylene, Al, Cellophane, bitumen, wax or paraffin. Even cast films now are used recently. Most common types:
 1. WMP: Laminates of paper, PE, Foil, Metallized, BOPP/PE or PET.
 2. SMP: HDPE or LDPE or Laminates of HD, LD, LLD, Nylon, Saran (coating), EVA. PE coating or wrinkling- Bag-in-box paper board/lined with paper, Al or Metallized/PE

- Powder packaging materials:

1. Number of Kraft paper layers for strength required is 3-6 for 25 kg wt.

2. Outer Kraft paper bag strength 70 gsm, Second Kraft paper bag with paper alone. PE lined (95 gsm).

WMP: 4-6 ply kraft paper, 3 mm PE

SMP: 2-4 ply kraft paper 2 mm PE

Separate PE liner/inner bag – 0.04 mm for 25 kg & 0.05 mm for 50 kg.

PE varies in thickness from 0.02 to 0.08 mm as inside layer.

Retail packages

- Thick laminated paper (45 gsm) – Al-foil (9 μ) – PE (25 μ) having Bursting strength 179 KPa (1.83 kg.f/ cm²) and very low WVTR & GTR.
- PET (12.5 μ)/Al-foil (9 μ) / PE (64 μ), Bursting strength 290 KPa (2.95 kg.f/ cm²).

Metallized film is also used.

Lined cardboard

Metal/Plastic laminate – Retain O₂ content of 0.5 % even after 13 numbers.

- PE is used to much lesser extent as a separate bag within or as a liner for (a) Card board cartons, (b) Calico bags, (c) Jute bags with paper, (d) Liner between jute and PE.

- Alternative material to PE

Multi walled paper sack may incorporate one layer of waxed paper which is more satisfactory than paper alone but is inadequate for long storage.

Multi wall sack may include a layer of bituminized paper, often the outer layer with 4-5 inner kraft layers. This is a good packaging material used even for export but is slightly inferior to PE.

- Perfect closure is required

Metal is completely impervious but closure is a weak point.

Sack is sealed by sewing threads which makes holes and therefore it is covered by H₂O proof tape.

Gas packaging by mixture of N₂ + H₂ + Palladium as a catalyst and if kept impervious can have up to 10 years of storage life.

Whole Milk Powder and Baby Food

- Generally packed in Lacquered tins under N₂ gas packaging. Whole milk powder is packed in 15 kg tins.
- For retail milk powder s packed in laminate bags made of PET /A1 / PE.

Skim Milk Powder

- Skim milk in bulk quantities of 25 kg is packed in kraft paper bags with inside polyethylene bag.
- Skim milk powder for retail is packed in HDPE bottles and HDPE bags.

Malted Milk Food

- The malted food beverage industry is popularly known as the health beverage sector.
- Malted milk foods are highly sensitive to moisture and are prone to oxidative changes in the presence of light, heat and oxygen.
- Aroma retention of the product and prevention of moisture and oxygen ingress are important and therefore are very critical in protecting the product, and in selection of the right packaging material.
- Malted milk foods are packed in quantities of 200 grams to 1 kilogram in a variety of packages.



- Conventional packages are glass jars, tinfoil containers, which are now slowly being replaced by plastic containers and flexible laminated pouches.
- Tinfoil containers though provide good protection from gases and moisture, are likely to rust at body welding or at top and bottom seams. Tinfoil containers are also expensive.
- The plastic containers used are blow moulded HDPE or stretch blow moulded PET containers / jars, for brown and white malted milk food products for capacities ranging from 200 grams to 2.5 kilograms. The plastic containers are light weight, sturdy, unbreakable and hygienic, and have a good shelf appeal.
- Flexible pouches, made up with or without paperboard cartons. Advantage is of low cost compared to plastic bottles, less storage space, fast filling.

Precautions Before Packaging

- Protection against moisture pick up: The low moisture products must be packaged as soon as possible after removal from the dehydrator. Each product has its individual need with regard to moisture uptake.
- **In-package desiccation**
- The desiccant compound is placed in the container inside a small envelop made out of a moisture permeable material which does not allow the contamination of the product with desiccant
- Calcium oxide or silica gel are usually used for this purpose.
- When in package desiccant is used, the dried product can be stored at higher moisture content without caking than in the absence of a desiccant.
- However, this is not used for milk powders.

Anticaking agents

- Anticaking agents are mixed with the low moisture product usually during the milling operation.
- Calcium Stearate is the most commonly used Anticaking agent in dehydrated products.
- This is also not used in case of milk powders.

Packaging of condensed milk and evaporated milk

- In the **early days** sweetened condensed milk in bulk is packed in **barrels made of gumwood**.
- **Later white oak, paraffin lined barrels** were used 50 to 300 kg.
- For **industrial purposes steel drum containers with removable lids** are used which are suited for re-use.
- For **retail marketing**, sweetened condensed milk is packed in **lacquered hermitically sealed tin can** (400 gm).
- Most tins used are open top tins, the top end of which is clinched on to the can after filling.
- The tins are filled in **automatic filling machines** with less space remains in the head space.
- The temperature of filling room is maintained around 16°C.
- The tins and lids should be sterilized by super heated steam/ hot air or U.V radiation before use.
- Evaporated milk is packed in cans before sterilization.

THANK YOU