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Chapter 2

Packaging Materials

PACKAGING MATERIALS

→ It is the art of science of packing of different dosage form to provide storage, safe Transportation, Stability of the product.

Factors of Packing

- Route of Administrations
- Sensitivity of Product
- Physical state of product

Components Required for Packaging

➢ **Container :** It encloses the drug, thereby remains in direct contact with the drug. Such a container which is always in direct contact with the drug is an immediate container.

Types of Container

- Well Closed Container
- Tight closed Container
- Heametically Sealed Container
- Child Resistant Container
- Light resistant Container
- Single dose Container
- Multi dose Container

➢ **Closure :** It seals the container to eliminate oxygen, carbon dioxide, moisture, and microorganisms. A closure prevents the loss of volatile substances, and also the loss of medicament during transport and handling. It is a component of container system, and has no direct contact with the drug.

➢ **Carton:** It is made up of cardboard, moulded wood pulp, or expanded polystyrene, and provides secondary protection. It is an outer covering and protects against mechanical and other environmental hazards.

➢ **Box:** It is made up of thick cardboard, wood, or any other suitable material, and carries multiples of a product. It provides primary protection against external hazards while transportation and handling.

Objectives of Packaging

❑ **Physical Protection:** The package provides protection to the product against mechanical shock, vibration, electrostatic discharge, compression, temperature, etc.

❑ **Barrier Protection :** A barrier is required to protect the product from oxygen, water vapour, dust, etc:

- **Information Transmission:** Packages and labels provide information about the usage, transport, recycling, or disposing of the package or product.

Pharmaceuticals, food, medical and chemical products need special information stated by the governments.

- **Marketing :** Marketers use the packaging and labels of a particular product for convincing the buyers to purchase.
- **Security:** The security, risks of shipment are minimised by packaging

Ideal Properties of a Packaging Material

- It should be strong enough to endure handling while emptying, filling, closing, sterilising, labelling, transporting, storing, and using by the consumers.
- It should not cause product loss due to any leakage or permeation.
- Its material should be non-reactive to the product components and the closure.
- It should not absorb the product components
- **Example :** cardboard boxes absorb the water and oily substances present in ointment and creams.
- It should not impart any colour, taste, and odour to the product.
- Its size should be according to the product volume.
- Its closure should be easily removable and replaceable.
- Amber coloured glass containers provide protection to light-sensitive products.
- The container surface should be clear to facilitate easy labelling.
- It should ease product identification.

GLASS AS PACKAGING MATERIAL

- A Glass is economical, chemically inert, impermeable, strong, rigid, has FDA clearance, and possesses superior protectivve qualities thus, is used for packaging pharmaceuticals.
- Glass containers are available in various sizes and shapés.
- Glass does not get depreciated with time.
- If a proper closure system is provided, glass serves as an efficient barrier against every element however, only amber-coloured glass can provide protection against light
- The fragile nature and weight of glass are its major limitations when used for packaging.

Selection Criteria

- Limit of alkalinity and hydrolytic resistance of the glass container.
- Thermal expansion properties of the glass container(freeze-drying).
- Sensitivity of the glass container to barium or calcium ions.

Types of Glasses

- Borosilicate Glasses
- SodaLime Glasses
- Sulphur Treated Glasses

- Silica Treated Glasses
- Neutral Glasses
- Light Resistance Glasses / Coloured Glasses

Advantage

- It does not deteriorate with age.
- It is heat resistant, thus can undergo heat sterilisation.
- It can be easily cleaned.
- It is impermeable.
- It is economical.
- It enables identification of products.

Disadvantage

- It is of fragile and brittle nature.
- It is heavy in weight and occupies more volume.
- Once broken, it cannot be joined back.

PLASTIC AS PACKAGING MATERIAL

Plastic containers are used because of their light weight, non-breakable nature, lowtoxicity, and low reactivity with the products (provided they contain fewer amounts of additives).

Selection Criteria

- Stability
- Compatibility with the contents
- Strength of container and the degree of protection required.
- Moisture-proofness
- Resistance to corrosion by Acids or Alkalis
- Protection against salt
- Resistance to microorganisms
- Resistance to insects

Types

- **Polyethylene:**
- **Nylon (Polyamide):**
- **Polycarbonate :**

Advantages

- It has low thermal and electrical resistance.
- It is resistant to weak mineral acids.
- It remains unaffected by inorganic salts.
- It is resistant to slight pH changes.
- It is not very heavy

Disadvantages

- It has low mechanical strength.

- Its expansion rate is high.
- It is not completely impermeable to moisture, gases etc.

METAL AS A PACKAGING MATERIAL

A Metal packaging plays an important role in the process of food preservation that can be described by using the term "canning". Canned food has become an essential part of human diet in the developed countries.

Metals used for packaging

- Aluminium
- Steel
- Tin

Types

- Cans
- Drums and Pails
- Aerosols
- Tubes:
- Closures

Advantages

- They are durable.
- Advantages They do not allow light, moisture and gases to pass through.
- They can be made into rigid resilient containers by impact extrusion.
- They are lighter in weight than the glass container

Disadvantages

- They are costly.
- They may Cause adulteration of pharmaceutical products by shedding metal particles into them.

RUBBER AS A PACKAGING MATERIAL

Rubber is either used as such or as lining materials for plant construction.

Rubbers are categorised into:

- **Natural Rubber:** This naturally occurring polymer is obtained from rubber trees in the form of latex.

It is a common example of an elastomer, which is a substance that can be easily stretched and on releasing quickly move to its original form

Natural Rubber are two types

Soft Rubber

Hard Rubber

- **Synthetic Rubber:** This nubber is resistant to oxidation, solvents, oils, and other chemicals. Due to these superior properties, synthetic rubber is more important than Natural

Examples of some synthetic rubber

Neoprene (Polychloroprene),
Nitrile Rubber,
Butyl Rubber,
Polyisoprene ,etc

Advantage

- Soft rubber provides resistance against dilute mineral acids, dilute alkalis, and salts.

Disadvantage

- Soft rubber can be attacked by oxidising media, oils, and organic solvents.

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