# PHARMACEUTICAL PACKAGING

## 15th week

Pharmaceutical formulations must be suitably contained, protected and labelled from the time of manufacture until the patient uses them.

Throughout this period the container must maintain the quality, safety and stability of the medicine and protect the product against physical, climatic, chemical and biological hazards.

## Functions of Packaging;

* Packaging helps for identification of products

* Packaging protects the pharmaceutical product from spoilage, breakage, leakage and microbial contamination

* Packaging facilitates the use of the pharmaceutical products

* Packaging contains information related to the usage and storage of the products

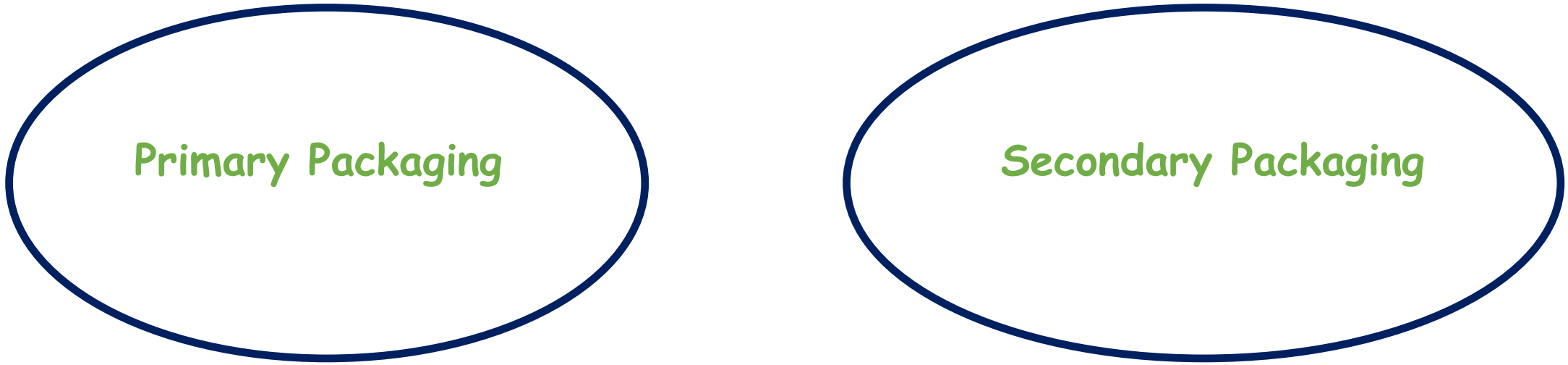
The container must be user friendly to promote good patient compliance.

This situation is particularly important for the elderly person who have to take a large number of medicines and have a greater need for improved compliance.

## The container must protect the product from;

- Physical damage
- Chemical and microbial contamination
- Light, moisture and oxygen as appropriate

# Packaging



# Primary Packaging

Primary packaging materials are in direct contact with the product.

This also applies to the closure which is also part of the primary pack.

* This container must not interact with the drug.

* It should protect the drug from damage and from chemical and microbial contamination.

* It should support the use of drug by the patient.

## Primary containers must not;

- Allow product leakage
- Chemically react with the product
- Release components
- Uptake product components

## Secondary Packaging

Secondary packaging materials are additional materials that improve the appearance of the product and include outer wrappers or labels that do not make direct contact with the product.

They can also supply information about the product and its use.

# Classification of Containers (EP 6)

- Single dose containers
- Multidose containers
- Well closed containers
- Airtight containers
- Sealed containers
- Tamper-proof containers
- Child-proof containers

## Single-dose containers

* They hold the drug that is intended for single use.

### Glass ampoules

## Multidose containers

* They hold a quantity of the drug that will be used as two or more doses.

### Multiple dose vials

## Well-closed containers

* They protect the product from contamination with unwanted foreign materials and from loss of contents during use.

## Airtight containers

* They are impermeable to solids, liquids and gases during normal storage and use.

* If the container is to be opened on more than one occasion it must remain airtight after reclosure.

## Sealed containers

* They are closed by fusion of the container material.

* They could not be closed again in their original form after first opening.

### Glass ampoules

## Tamper-proof container

* They are closed containers fitted with a device that irreversibly indicates if the container has been opened.

## Child-proof containers

* They are designed to prevent children accessing to the potentially hazardous product.

# Bottles

They can be used for packaging of;

* Syrup

* Solution

* Suspension

* Emulsion

* Tablet / Capsule / Powder

## Tubes

- They are generally used for packaging of semisolid dosage forms and cosmetic products.

- They can be produced using metal or plastic.

- Microbial contamination of drug can be prevented.

* The most common metal tubes in current use are made of aluminium with an internal lacquered surface.

* Metal tubes are being superseded by plastic tubes made from a variety of materials; high density polyethylene, low density polyethylene, polypropylene ...

## Ampoules

- They are sealed containers used for the packaging of single dose parenteral solutions.

- They are made from glass.

- They are sealed by fusion of the packaging material (glass) after filling the drug.

# Vials

- They are small bottles used for the packaging of single dose or small volume parenteral preparations.

- Their mouths are covered with a rubber stopper and an aluminum cover (hood) which is used to immobilized the stopper.

# Strip Packs

* They have at least one sealed pocket of material with each pocket containing a single dose of the product.

* The pack is made of two layers of film or laminate material.

* The nature and the level of protection that is required by the contained product will affect the composition of these layers.

# Blister Packs

* They are composed of a base layer with cavities that contain the pharmaceutical product and a lid.

* The lid is sealed to the base layer by heat, pressure or both.

* They are more rigid than strip packs and are not used for powders or semisolids.

* They can be printed with day and week identifiers to produce calendar packs. These identifiers will make a contribution to patient compliance.

## Pressurized Packs

* They expel the product through a valve.

* The pressure for the expulsion of the product is provided by the positive pressure of the propellant that is often a compressed or liquefied gas.

The selection of packaging for a pharmaceutical product depends on these factors;

- The chemical activity, moisture and oxygen sensitivity of the product
- Compatibility between the packaging materials and the product
- The type of patient; elderly, arthritic patient, child...
- The type of dosage form; solid, semisolid, liquid...
- Administration route and method
- The required shelf life

# Packaging Materials

Glass

Plastic

Metal

Rubber

Paper

# GLASS

## Advantages

- It is inert for most of the medicinal products
- It is impermeable to air and moisture
- It allows easy controlling of the content (product)
- It can be coloured to protect the product from harmful wavelengths of light
- It is easy to clean
- It can be sterilized by heat
- It is available in variously shaped containers

# GLASS

## Disadvantages

- It is fragile. Glass fragments can be released into the product during transport or contaminants can penetrate into the product by way of cracks in the container
- Certain types of glass release alkali into the container contents
- It is expensive when compared to the price of plastic
- It is heavy. This situation is resulting in increased transport costs

* Colorless glass is permeable to the visible light (at the wavelength range of 400 – 700 nm)

* Colored glass is obtained by addition of several metal oxides (iron oxide, copper oxide, cobalt oxide, chromium oxide, nickel oxide etc) at small amounts.

# GLASS

The chemical stability of glass for pharmaceutical use is given by the resistance of the glass to the release of soluble minerals into water contacting the glass.

This is known as the hydrolytic resistance.

## Type I Glass;

- ✓ It is known as neutral glass or borosilicate glass.
- ✓ It possesses a high hydrolytic resistance because of its chemical composition.
- ✓ It also has a high thermal resistance.
- ✓ It is unlikely to crack on exposure to rapid temperature changes.
- ✓ It is the most inert type of pharmaceutical glass.

## Type I Glass;

- ✓ It is suitable for packing all pharmaceutical preparations.
- ✓ However, it is expensive and this restricts its applications.
- ✓ It is widely used as glass ampoules and vials to package fluids for injection.
- ✓ It is also used to package solutions that could dissolve basic oxides in the other types of glass. This would increase the pH of the formulation and could negatively affect the drug stability and potency.

## Type II Glass;

- ✓ It is made of soda-lime-silica glass with a high hydrolytic resistance because of the surface treatment of the glass.
- ✓ It is used to package aqueous preparations.
- ✓ It has a lower melting point than type I glass. Thus, it is easier to produce and consequently cheaper.

## Type III Glass;

- ✓ It is made of a soda-lime-silica glass.
- ✓ It has a similar composition to type II glass but contains more leachable oxides.
- ✓ It offers only moderate hydrolytic resistance.
- ✓ It is suitable for packaging non-aqueous parenteral products and powders for injection.
- ✓ It is commonly used to produce dispensary metric medical bottles.

## Type IV Glass (Type NP);

- ✓ It is made of a soda-lime-silica glass.
- ✓ It has a low hydrolytic resistance.
- ✓ It must not be used for packaging parenteral products.
- ✓ It is suitable for packaging solid, liquid and semi-solid formulations.

# METALS

Metals used for packaging are;

- Aluminium
- Tin coated steel
- Stainless steel

# *Aluminium*

**Tube production**

**Lid foil of blister packs**

## Advantages of Metals

- They are impermeable for light, moisture and gases.
- They can be made into sheets and foils.
- They are light in weight.

## Disadvantages of Metals

- They can react with some chemicals.
- Coating of internal or external surfaces of the container may be required in order to protect it from corrosion.
- They are expensive.

# PLASTIC

Plastics have been widely used for several years as containers for the medicinal products.

In more recent times, plastic has been developed for the packaging of parenteral products including infusion fluids and small volume injections.

Two types of plastics are used for packaging of pharmaceutical products.

* Thermosets
* Thermoplastics

## Thermosets

They are used for making screw caps for glass and metal containers.

## Thermoplastics

**Thermoplastic polymers are used for production of a wide variety of pharmaceutical packages.**

| | |
|---|---|
| High density polyethylene | Solid dosage form containers |
| Low density polyethylene | Flexible eye drop bottles |
| Linear low density polyethylene | Heat-sealable containers |
| Polypropylene | Container closures, IV solution bottles |
| Polyvinyl chloride | Laminate for blister packs, IV bags |
| Polystyrene | Containers for oils and creams and solid dosage forms |

## Advantages of Plastics

- They release few particles into the product
- They are flexible and not easily broken
- They are of low density and thus light in weight
- They can be heat sealed
- They are easily moulded into various shapes
- They are cheap

## Disadvantages of Plastics

- They are not as chemically inert as Type I glass
- Some plastics undergo stress cracking and distortion from contact with some chemicals
- Some plastics are very heat sensitive
- They are not as impermeable to gas and vapour as glass
- They may possess an electrostatic charge which will attract particles
- Additives in plastics are easily leached into the product
- Active substances or preservatives may be taken up from product by plastic

The additives used for production of plastics depend on the composition of the polymer and the production method.

- ✓Plasticizers
- ✓Resins
- ✓Stabilizers
- ✓Lubricants
- ✓Antistatic agents
- ✓Mould release agents

# RUBBER

- Natural rubber is not preferred as packaging material.
- Synthetic rubbers (elastomers) are often used as stopper for vials.
- Depending on the properties of the active substance, the parts of the rubber which come into contact with the drug can be covered and by this way incompatibility can be prevented. Teflon is the commonly used material for this purpose.

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