Parenteral Products

By: Howida Kamal, Ph.D
Containers and Container components

- Glass
- Rubber
- Plastic
Containers and Container components

Glass

Rubber

Plastic
Containers and Container components

**Glass**
- **Type I**: Borosilicate glass (Neutral)
  - Made mainly of silica (70-80%) and boric oxide (7-13%) with smaller amounts of the alkalis (sodium and potassium oxides) and aluminium oxide.

- **Type II**: Soda glass with a surface treatment (sulphated glass)
  - Treated with moist sulphur dioxide at high temperature

- **Type III**: Regular soda lime
  - 75% silica ($\text{SiO}_2$) and 25% of sodium oxide ($\text{Na}_2\text{O}$), calcium oxide ($\text{CaO}$) and magnesium oxide ($\text{MgO}$)

**Rubber**

**Plastic**
Containers and Container components

**Glass**

- Type I: Borosilicate glass (Neutral)
  - Chemically resistant (Low leachability)
  - High resistance to hydrolysis
  - Withstands thermal sterilization
  - Solution of pH of up to 8.
  - Expensive

- Type II: Soda glass with a surface treatment (sulphated glass)
  - A neutral surface film with high hydrolytic resistance
  - Lower resistance to temperature than for Type I glass.

- Type III: Regular soda lime
  - Little resistance to hydrolysis
  - Little resistance to temperature
  - Less expensive

**Rubber**

**Plastic**
Containers and Container components

Glass
- Type I: borosilicate glass (Neutral)
  - For most injections (especially where chemical reactions may occur)
  - Water for injection
- Type II: Soda glass with a surface treatment (sulphated glass)
  - Products of pH<7
  - Infusion fluids
  - Blood
  - Plasma
- Type III: Regular soda lime
  - Oily injections
  - Dry substances
  - Thiopentone Na (stabilized with alkali)

Rubber

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Containers and Container components

Glass

- Relatively inert (excellent product/pack compatibility)
- Good product presentation (clarity, sparkle, design)
- Good product identification and inspection.
- Can be handled at high speed on production lines.
- Easy to sterilize

Rubber

- Heavy weight
- Fragility
- Need for vented administration sets with LVP bottles

Plastic

Advantages

Disadvantages
Containers and Container components

Glass

- Easier store and transport
- Light weight
- Less susceptible to breakage.
- They collapse when empty
  (no air interchange is required with LVP flexible plastic bags)

Rubber

Plastic

Advantages

- Lack of clarity
- Easily punctured
- Leaching of plastic additives.
- Adsorption of parenteral components
- Permeability (Vapor transmission)
- Difficult sterilization
Containers and Container components

Glass

Rubber

Plastic

Unsaturated elastomers

Polybutadiene rubber

Styrene butadiene rubber

Nitrile butadiene rubber

Ethylene propylene rubber (EP)

Saturated elastomers

Silicone rubber

Ethylene propylene diene rubber
Leaching, adsorption and drug/rubber incompatibilities
Containers and Container components

Single-dose container

- Are opened or penetrated with aseptic care and its content used at one time

Multiple-dose container

- More than one dose can be withdrawn at different times
- Not more than 10 doses
- The period between the withdrawal of the first & last dose must be limited
- Should contain a preservative
- For IM, SC and IC routes
- Require full aseptic precautions
- A risk of introducing contamination
Containers and Container components

Single-dose container
- LVP
  - Glass bottles
  - Semi-rigid containers
  - Flexible plastic bags
- Ampule
- Mix-O
- Vial
- Vial
- Vial

Multiple-dose container
- SVP
- Cartridge
- Pre-filled Syringe
Containers and Container components

Ampule

• The most commonly used single dose containers

• Range from sizes of 0.5 to 50 mL.

• Made from neutral or soda glass.

• May be used either for solution or for powder.

• Amber glass ampules are available for light sensitive products.
Containers and Container components

Ampule

After filling, ampules are sealed by fusion

They are **completely air tight**

- essential for packaging under atmosphere of N\textsubscript{2}
- no danger of entry of micro-organisms

Opened by breaking the neck at prescored position

They could liberate glass particles on opening

A filter needle could be used
Containers and Container components

Ampule

Ampules are no longer glass container of choice for new SVPs in the United States
Containers and Container components

Vials

• They are rubber capped glass container which allow the removal of a dose via a needle.

Advantages

• They allow removal of variable volumes (SVP & LVP).
• Suitable for solution or powder
• Facilitate dissolving the powder immediately prior to administration.

Disadvantages

• The rubber closure may lead to particulate contamination and adsorption of preservative.
A slight excess volume of product should be added to allow the nominal injection volume to be drawn into a syringe.

<table>
<thead>
<tr>
<th>Labeled size (mL)</th>
<th>Excess volume for mobile liquids</th>
<th>Excess volume for viscous liquids</th>
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<tr>
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<td>0.1</td>
<td>0.12</td>
</tr>
<tr>
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<td>0.1</td>
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<tr>
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<tr>
<td>5</td>
<td>0.3</td>
<td>0.5</td>
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<tr>
<td>10</td>
<td>0.5</td>
<td>0.7</td>
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<tr>
<td>30</td>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>50 or more</td>
<td>2%</td>
<td>3%</td>
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</tbody>
</table>
Containers and Container components

Cartridge

• Are cylindrical glass tubes sealed by rubber at each end.

• Hold slightly more than 1 ml.

• They are inserted into a syringe barrel or a pen.

• Used for one occasion only.
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Pre-filled Syringes

• Less preparation
• Ease of administration (home use and emergency situations)
• Easy storage and disposal
• Elimination of overfill (ampule & vial)
• Fewer materials
• Lower injection costs
• Reduction of medication errors (better dose accuracy)
• Increased assurance of sterility
• Removal of preservatives
Containers and Container components

Glass Bottles

• Used for large volume fluids.

• They are sealed with plastic or rubber disks and aluminum screw cap.

• They facilitate the addition of SVP for IV admixture.

• They are transparent and allow easy estimation of unused volume.

• They are easily read

• They are easily sterilized

• They are inert

• They are heavy and breakable

• They need vented administration sets
Containers and Container components

Medical Devices

Disposable syringes
Polyethylene
Polypropylene
Polycarbonate

Catheters
Teflon
Polypropylene

IV infusion set
Nylon
Lucite
Polyvinyl chloride
Polypropylene