

# Introduction to aerosol packaging

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# AEROSOL:

- A system that depends on the power of a compressed gas or liquefied gas to expel the contents from the container.

## PHARMACEUTICAL AEROSOL:

- Pharmaceutical Aerosol is defined as aerosol product containing active ingredients dissolved, suspended or emulsified in a propellant or a mixture of solvent and propellant and intended for oral or topical administration or for administration into the eye, nose, ear, rectum and vagina.

- Absence of air prevents oxidation of the product.

## **Advantages:**

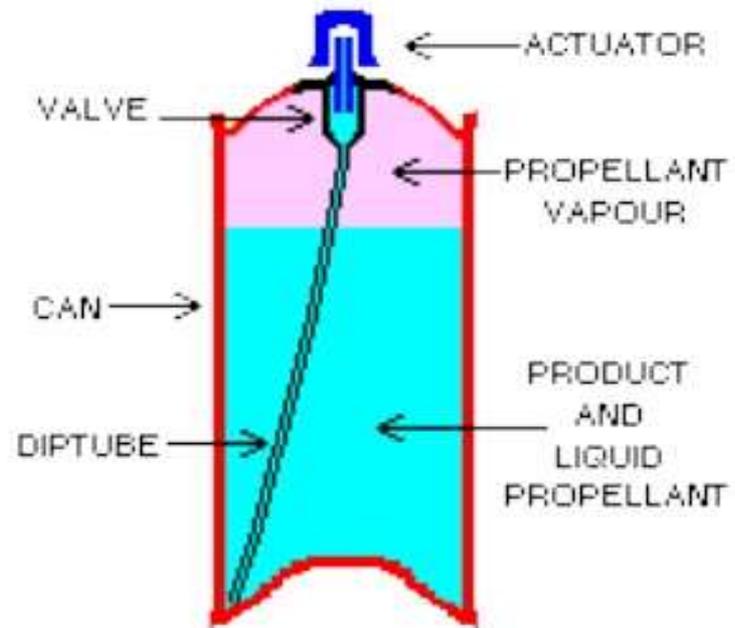
- The hydrolysis of medicaments can be prevented.
- Drugs can be given by oral inhalation.
- The sterility products can be maintained.
- The application of medicament can be easier.
- A fine mist is easily formed for inhalation purpose.
- Manual contacts with medicaments can be avoided.
- Drug given by oral inhalation do not pass through G.I.T. hence its chances of decomposition are less.

## **Disadvantages:**

- Aerosols are costly preparations.
- Some of the propellants are very toxic.
- The cooling effect of highly volatile propellants may cause discomfort on injured skin.
- Lot of difficulties are faced in aerosol formulation when the drug is not soluble in propellant.

# COMPONENTS OF AEROSOLS

- Propellant
- Container
- Valve and actuator
- Product concentrate



# PROPELLANTS:

A propellant is a chemical with a vapor pressure greater than atmospheric pressure at 40°C (105°F).

Function:

- 1) It is responsible for developing the vapor pressure
- 2) within the container Expel the product when the valve is opened and in the atomization or foam production of the product.

<b>1. Compressed Gas Propellants</b>	<b>Inert gases</b>	<b>Carbon Dioxide Nitrous Oxide Nitrogen</b>
<b>2. Liquefied gas propellants</b>	<b>Hydrocarbons(HC)</b>	<b>Liquefied Petroleum Gases(Propane, Isobutane, n-Butane) Isopentane, n-Pentane.</b>
	<b>Chloroflourocarbon (CFC)</b>	<b>Trichloro-mono-flouro methane (11), Di-chloro-diflouro-methane (12) , Di-chloro-tetra-flouro-methane (114)</b>
	<b>Fluorinated hydrocarbons(FHC)</b>	<b>1,1 Diflouroethane (152a)</b>
	<b>Ethers</b>	<b>Dimethyl ether</b>

# CONTAINERS:

## CONTAINERS

They must be able to withstand pressures as high as 140 to 180 psig (pounds per sq. inch gauge) at 130 ° F.

### AEROSOL CONTAINERS

#### A. Metals

1. Tinplated steel
2. Aluminum
3. Stainless steel

#### B. Glass

1. Uncoated glass
2. Plastic coated glass

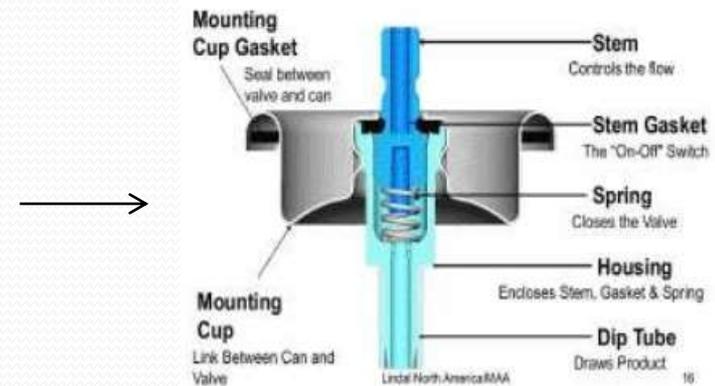


# VALVES:

- Easy to open and close .
- Capable of delivering the content in the desired form such as spray, foam, solid stream etc.
- It can deliver a given amount of medicament .

## TYPES OF VALVES :

1. Continuous spray valve
2. Metering valves



# 1. Continuous spray valve:

## a. Ferrule/ mounting cup

- Use to Attach the valve in proper position in container.
- Coated with epoxy resin.



## b. Valve body / housing

- Made of nylon/ derlin
- Connect dip tube, stem & actuator
- Determines rate of delivery



## c. Stem

- It is made of nylon /derlin /s.steel
- One or more orifice (0.013 to 0.030 inch) 33

## d. Gasket

- It is made of Buna –N, Neoprene rubber



## e. Spring

- Use to Hold the gasket in its place
- Made of stainless steel

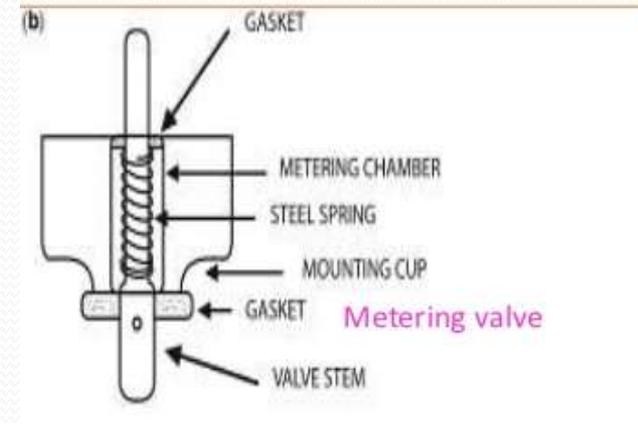


## f. Dip tube

- Made of poly propylene material / poly ethylene
- Inner diameter 0.120 –0.125 inch for less viscous
- Viscous product - 0.195 inch.
- It convey the liquid from the bottom of the container to the valve at the top.

## 2. Metering valves:

- Used for dispensing of potent medication.
- Operates on the principle of a chamber whose size determines the amount of medication dispensed.
- Approximately 50 to 150 mg  $\pm$ 10 % of liquid material scan be dispensed at one time with the use of such valve.



# ACTUATORS:

These are specially designed buttons which helps in delivering the drug in desired form i.e., spray, wet stream , foam or solid stream .

## TYPES OF ACTUATORS :

- Spray actuators
- Foam actuators
- Solid steam actuators
- Special actuators



# SPRAY ACTUATORS:

- It can be used for topical preparation, such as antiseptics , local anesthetics and spray on bandages etc.

- It allows the stream of product concentrate and propellant to pass through various openings and dispense as spray.



## FOAM ACTUATORS :

- It consist of large orifice which ranges from 0.070—0.125inch .



## SOLID STREAM ACTUATORS :

- These actuators are required for dispensing semi solid products such as ointments .

## SPECIAL ACTUATORS :

- These are used for a specific purpose.
- It delivers the medicament to the appropriate site of action such as throat, nose, dental and eyes etc.

# Packaging of aerosol:

It can be filled in two types :

## 1. Cold-fill process:

- This process is used to fill metered aerosol products using a fluoro-carbon propellant.
- The propellant becomes liquid at atmospheric pressure.
- The active ingredients or concentrate and propellants are cooled to a low temperature of about  $-30^{\circ}$  to  $-40^{\circ}\text{F}$ .
- The concentrate is generally cooled to below  $0^{\circ}$  in order to reduce loss of propellant during the filling operation.
- The chilled concentrate is poured into the chilled container and propellant is added.
- Sufficient time is given for the propellant to partially vaporize.
- In order to expel the air present in the container. The valve is fitted on the container which is placed into a water bath so that the contents are heated to  $130^{\circ}\text{F}$  ( $54^{\circ}\text{C}$ ) in order to check any leakage and strength of container.
- A dry ice-acetone bath is used to obtain the desired low temp. for laboratory scale preparation whereas refrigeration equipment is used for the large scale production of aerosols

## 2. Pressure-fill process:

- This process is used for filling aerosols containing hydrocarbon propellant.
- The product concentrate is placed into the container and the valve is sealed.
- The propellant is forced through the valve under pressure.
- After this the container is immersed in water bath at 130°F (or 54°C) in order to check any leakage and strength of the container.
- It is essential that the air present in the container must be expelled before filling the contents into the aerosol container.

# Applications of aerosol

## packaging:

- They are used for spray bandages and for application of drugs meant for topical use.
- They are used for spray administration of drugs into various body cavities.
- They are use for administration of drug such as local anesthetics, local antiseptic, local analgesics and anti-inflammatory drugs.
- They are used to spray cosmetic preparation such as perfumes.
- They are used to spray disinfectants, deodorizers and air sanitizers.