Unit - 02

Powders

→ A pharmaceutical powder is a mixture of finely divided drug or chemicals in dry form.

→ These are solid dosage form of medicament which are meant for internal & external use.

→ They are available in crystalline or amorphous form.

→ The particle size of powder plays an important role in physical, chemical and biological properties of the dosage forms.

→ There is a relationship between particle size of powder and dissolution, absorption & therapeutic efficacy of drugs.

Advantages of Powders

→ Powders are one of the oldest dosage form and are used both internally and externally.

→ Powders are more stable than liquid dosage form.

→ The chances of incompatibility are less as compared to liquid dosage form.

→ The onset of action of powdered drug is rapid as compared to other solid dosage form. Due to smaller particle size of powder, it get dissolved easily in body fluids.

& The rapid dissolution increases the blood conch in the shorter time and hence the drug action is produced in a shortest period.

Powders

Unit - 02

→ A pharmaceutical powder is a mixture of finely divided drug or chemicals in dry form.

→ These are solid dosage form of medicament which are meant for internal & external use.

→ They are available in crystalline or amorphous form.

→ The particle size of powder plays an important role in physical, chemical and biological properties of the dosage forms.

→ There is a relationship between particle size of powder and dissolution, absorption & therapeutic efficacy of drugs.

Advantages of Powders

→ Powders are one of the oldest dosage form and are used both internally and externally.

→ Powders are more stable than liquid dosage form.

→ The chances of incompatibility are less as compared to liquid dosage form.

→ The onset of action of powdered drug is rapid as compared to other solid dosage form. Due to smaller particle size of powder, it get dissolved easily in body fluids.

↳ The rapid dissolution increases the blood conch in the shorter time and hence the drug action is produced in a shortest period.

→ Large quantity of powdered drugs can be easily administered to the patient orally by dissolving or mixing the powder in a suitable liquid.

→ Small children and elderly patients cannot swallow solid dosage forms, such as tablets & capsules. They can easily take the powdered drug as such or dispersed in water or any other liquid.

→ Powders are more economical as compared to other solid dosage form, because these are prepared extemporeneously without involving any special machinery and techniques.

→ Powders are more easy to carry than the liquid dosage forms.

Disadvantages

→ Drugs having bitter, nauseous, and unpleasant taste cannot be dispensed in powdered form.

→ Deliquescent and hygroscopic drugs cannot be dispensed in powder form.

→ Drugs which get affected by atmospheric conditions are not suitable for dispensing in powder forms.

→ Quantity less than 100 mg or so, cannot be weighed conveniently on dispensing balance.

→ The dispensing of powder is a time censurning.

Mixing of Powders

The powders may be mixed by any one of the following methods :-

1. Spatulation 2. Trituration
3. Geometric dilution 4. Sifting
5. Tumbling.

1. Spatulation

→ In this method, mixing of powders is done by the movement of a spatula throughout the powders on a sheet of a paper or on a porcelain tile.

→ This method is very useful in mixing small amount of powder.

→ Not suitable for large quantities of powders or powders containing one or more potent substances because homogenous blending may not occur.

2. Trituration

→ It is used both to reduce particle size and mix powders.

→ If particle size reduction is desired along with mixing of powders, a porcelain mortar with a rough inner surface is preferred to a glass mortar with a smooth working surface.

→ A glass mortar may be preferred for chemicals that may strain a porceline surface and for simple mixture of substances without special need for comminution.

→ A glass mortar cleans more readily after use.

3. Geometric dilution

→ The method is used when potent substances are to mixed with a large amount of diluent.

→ The potent drug is placed upon an approximately equal volume of the dilute in a mortar and the substances are slightly mixed by trituration.

→ A second portion of diluent equal in volume to the powder mixture in the mortar is added and trituration is repeated.

→ The process is continued, adding diluent equal in volume to the mixture in the mortar at each step, until all the diluent is incorporated.

For example, if 100 mg of potent drug is required to be mixed with 900 mg of lactose, then according to geometric dilution, the following procedure should be followed —

100 mg of a potent drug + 100 mg of lactose = 200 mg of mix.
200 mg of the mix. + 200 mg of lactose = 400 mg of mix.
400 " " " " + 400 mg of lactose = 800 mg of mix
800 " " " " + remaining portion = 1000 mg of mix.
of lactose.

4. Sifting

→ The powders are mixed by passing through sifters.
→ This process results in a light fluffy product and is generally not acceptable for incorporation of potent drugs into a diluent base.

5. Tumbling

→ Tumbling is the process of mixing powders in a large container rotated by an electric motor.
→ These blenders are widely employed in industry as large volume powder mixtures.

Classification of Powders

(i) Bulk powder for internal use.

(ii) Bulk powder for external use.

(iii) Simple and compound powder for internal use.

(iv) Powders enclosed in cachets and capsules.

(v) Compressed powders (tablets)

(i) Bulk Powder For Internal Use

→ Powders are dispensed in bulk, when accuracy of dosage is not important.

→ Bulk powder contains several doses of powder.

→ They are supplied in wide-mouthed containers that permits easy removal of a spoonful of powder.

→ The non potent substances which are supplied in bulk are antacids and laxatives etc.

(ii) Bulk powder for external use

→ Bulk powder meant for external use are non potent substances.

→ These powders are supplied in cardboard, glass or plastic containers, which are often designed for the specific method of application.

eg:, Dusting powders, Insufflations, Snuffs, Dentrifrices.

@ Dusting powders

→ These are meant for external application to the skin and are generally applied in a very fine state of sub division to avoid local irritation.

→ Dusting powders should be passed through sieve no. 80 to enhance their effectiveness.

Types — Medical & Surgical dusting powders.

- Medical dusting powders are used mainly for superficial skin conditions,
- Medical dusting powders must be free from pathogenic microorganisms.
- Surgical powder are used in body cavities and also on major wounds as a result of burns and umbilical cords of infants.
- Surgical dusting powders must be sterilised before their use.

→ Dusting powders are generally prepared by mixing two or more ingredients one of which must be either starch, talc or kaolin as one of the ingredients of the formulation.

→ Talc & Kaolin are more commonly used because they are chemically inert.

→ The dusting powders are dispensed in sifter-top containers or aerosol containers.

→ The pressure aerosol containers are costlier than the sifter top containers but they help in the easy application of the preparation.

→ Also be applied with powder puff or sterilised gauze pad.

→ Dusting powders are generally considered to be non-toxic but the inhalation of its fine powdered ingredients by infants may lead to pulmonary inflammation.

→ The dusting powders are mainly used for their antiseptic, astrigent, absorbent, antiperspirant and antipruritic action.

(b) Insufflations

→ These are medicated dusting powders meant for introduction into the body cavities such as nose, throat, ears and vagina with the help of an apparatus known as "insufflator".

→ It sprays the powder into a stream of finely divided particles all over the site of application.

→ Insufflations are used to produce a local effect, as in the treatment of ear, nose with antibiotics or to produce a systemic effect from a drug that is destroyed in the gut.

→ Nowadays, the insufflations are available in the form of pressure aerosols.

© Snuffs

→ These are finely divided solid dosage forms of medicament which are inhaled into nostrils for its antiseptic, bronchodilator & decongestion action.

→ Snuffs are dispensed in flat metal boxes with hinged lid.

(d) Dentifrices

→ These are applied with the help of a tooth brush for cleaning the surface of the teeth.

→ They contain a suitable detergent, or soap, some abrasive substance and a suitable flabour.

→ The abrasive agents such as calcium sulphate, magnesium carbonate, sodium carbonate and sodium chloride.

⇒ A strong abrasive substance should however not to be used as it may damage the tooth structure.

3. Simple and compound Powders for Internal use

→ A simple powders contain only one ingredient either in crystalline or amorphous form.

→ When the powder is in crystalline form, it is reduced to fine powder, weighed the powder and divided into number of doses and wrapped as individual doses.

→ Compound powders contain two or more than two substances.

→ Which are mixed together and then divided into desired number of individual doses which are dispensed into each powder paper.

4. Powders Enclosed in Cachets

→ Cachets are the solid unit dosage form of drugs.

→ These are moulded from rice paper, which is made by pouring a mixture of rice flour and water between two hot, polished, revolving cylinders.

→ The water evaporates and a sheet of wafer is formed.

→ Cachets are used to enclose nauseous or disagreeable powders and are available in different sizes to hold drugs from 0.2 to 1.5 g of powder.

→ Cachets are also known as wafer capsule.

→ They are quite hard to swallow as such but they are softened by dipping in water for a few seconds and then placed on the tongue and swallowed with a draught of water.

Advantages

→ They can be made easily because no complicated machinery is required.

→ They disintegrate quickly in the stomach.

→ The drug can be easily dispensed in cachets.

→ Large doses of drug can be swallowed by using cachets.

→ Because once they get soften by immersion in water, even large sized cachets can be swallowed readily without any difficulty.

4. Powders Enclosed in Cachets

→ Cachets are the solid unit dosage form of drugs.

→ These are moulded from rice paper, which is made by pouring a mixture of rice flour and water between two hot, polished, revolving cylinders.

→ The water evaporates and a sheet of wafer is formed.

→ Cachets are used to enclose nauseous or disagreeable powders and are available in different sizes to hold drugs from 0.2 to 1.5 g of powder.

→ Cachets are also known as wafer capsule.

→ They are quite hard to swallow as such but they are softened by dipping in water for a few seconds and then placed on the tongue and swallowed with a draught of water.

Advantages

→ They can be made easily because no complicated machinery is required.

→ They disintegrate quickly in the stomach.

→ The drug can be easily dispensed in cachets.

→ Large doses of drug can be swallowed by using cachets.

→ Because once they get soften by immersion in water, even large sized cachets can be swallowed readily without any difficulty.

Disadvantages

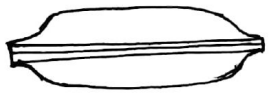
→ They must be softened before swallowing.

→ They are easily damaged.

→ They cannot protect the enclosed drug from light and moisture.

→ The shell of cachets are fragile, so the drug contents cannot be compressed in cachets.

Types



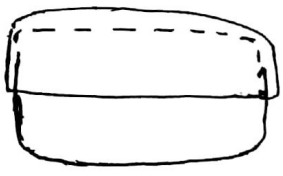
(a) Wet seal cachets

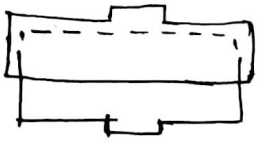
→ A wet seal cachet is made up of two similar convex halves having flat edges.

→ The weighed quantity of powdered drug is placed in one half, the edges of the other half are moistened with water and placed exactly over the first half containing the drug.

→ The flat edges of both the halves are pressed together in order to seal it perfectly.

(b) Dry seal cachets





→ Dry seal cachets consists of two halves, the upper half & the lower half.

→ The diameter of the upper half is slightly larger than the lower half.

→ The powdered drug is filled in lower half and upper half is fitted over it.

→ The filled cachets are then sealed in a machine by pressing the two halves, removed and packed in boxes.

5. Tablet Triturates (Moulded Tablets)

→ These are powders moulded into tablets.

→ Moulded tablets are flat, circular disc and usually contains a potent substance which is mixed with lactose, dextrose or some other suitable diluent.

→ Nowadays automatic tablet triturate machines are available which can prepare 2500 tablet triturates per minute.

Hygroscopic and deliquescent powders

→ The powders which absorb moisture from the atmosphere are called hygroscopic powders.

→ But certain powders absorb moisture to such a great extent that they go into solution and are called deliquescent powders.

→ Such substances are usually supplied in granular form in order to expose less surface area to the atmosphere.

→ These powders shouldnot be finely powdered.

→ For example, NH_4Cl, NaBr, NaI, Fe

Efflorescent powders

→ Some crystalline substances liberate water of crystallisation wholly or partly on exposure to humid atmosphere or during trituration and thus become wet or liquefy.

→ Example of such substances include caffeine, citric acid, ferrous sulphate etc.

→ This difficulty may be overcome by using either corresponding anhydrous salt or an inert substance may be mixed with efflorescent substance before incorporating with other ingredients.

Eutectic mixtures

→ When two or more substances are mixed together they liquefy due to the formation of a compound which has lower melting point than the individual substances.

→ eg., thymol, camphor, phenol, aspirin.

Granular powders

→ Specially prepared solid dosage form of medicament, meant for internal use.

→ They contain a medicament mixed with citric acid, tartaric acid and sodium bicarbonate.

→ Sometimes saccharin or sucrose may be added as a sweetening agent.

→ Before administration, the desired quantity is dissolved in water, the acid and bicarbonate react together producing effervescence.

→ The carbonated water produced from the release of carbon dioxide serves to mask the bitter and saline test of drugs.

→ Moreover, carbon dioxide stimulates the flow of gastric juice and helps in the absorption of medicament.

Liquid dosage forms

Advantages

→ Immediately available for absorption. Therefore, therapeutic response is faster.

→ Easy to color, flavor, & sweeten.

→ Easier to swallow than solids and are therefore particularly acceptable for pediatric and geriatric patient.

→ Most suitable for infants, children and elder patients.

→ Attractive in appearance.

Disadvantages

→ Shorter life than other dosage form.

→ Harder to measure accurately.

→ Need special storage conditions.

→ Easily affected by microorganisms.

→ Bulky to carry.

→ Easy to loss by breakage of container.

Excipients used in formulation of liquid dosage form

① Vehicles → Solvent
→ Co-solvent

Solvents: Solvents are vehicles. Used as base. In which drug and other excipients are dissolved or dispersed.

eg- Water, hydro-alcoholic liquid, polyhydric alcohol acetic acid and buffers.

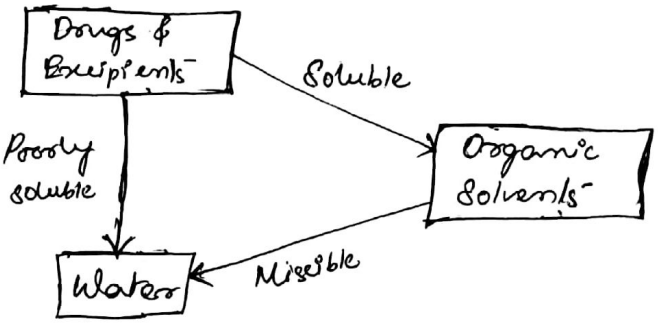
Cosolvents

→ Water miscible organic solvents.

→ That are used to increase solubility of poorly water soluble substances.

* An ideal co-solvent should have dielectric constant value between 25 - 80.

* The most commonly used co-solvent is ethanol. Other co-solvents are sorbitol, glycerol, propylene glycol.



—*—

→ Sweetening agents
→ Viscosity controller agents
→ Antioxidants
→ Buffers
→ Preservatives

① Sweetening Agents

→ They are used to mask the bitter and unacceptable taste of dosage form.

→ Most commonly used sweetening Agents:

a) Sucrose ; Commonly known as 'Tablet sugar' or 'cane sugar'.

→ It is formed by the combination of glucose and fructose.

→ Molecular formula $C_{12}H_{22}O_{11}$.

b) Saccharin

→ It is approx 500 times more sweeter than sucrose.

→ It is used to sweeten products such as drinks, candies, cookies & medicines.

→ Molecular formula : $C_7H_5NO_3S$.

② Viscosity controller agents

→ Viscosity can be controlled by increasing the sugar conc^n or by adding viscosity controlling agents such as polyvinyl pyrrolidone or cellular derivatives such as methyl cellulose and sodium carboxyl methyl cellulose.

→ These compounds form solutions in water that are stable over a wide pH range.

③ Buffers

→ The solutions that are able to resist the changes in pH values are termed as buffer solutions.

Acidic buffers – Acetic acid & sodium acetate.

Basic buffers – Ammonium chloride &
Ammonium Hydroxide

Role of buffer in pharmacy

→ To adjust the pH of product for maximum stability.

→ To maintain the pH within the optimum physiological pH range.

(4) Antioxidants

→ An antioxidant is a molecule / substance that inhibits the oxidation of other molecules.

→ Oxidation is the process of loss of electron.

→ B.H.A (Butylated hydroxy anisole)
B.H.T (Butylated hydroxy toluene)

They both are serve as hydrogen atoms donor and prevent oxidation of oil & fat.

(5) Preservatives

→ Preservatives are added in the formulation to reduce or prevent microbial growth.

Characteristics of ideal preservative

→ It must be effective against a broad spectrum of microorganisms.

→ Must be physically, chemically and microbiologically stable.

→ Must be non-toxic. eg – Sodium benzoate, EDTA sorbic acid.

Solubility enhancement techniques

① pH adjustment

→ pH adjustment for improving the solubility can be achieved in 2 ways :-

a) Salt formation

b) Addition of buffers to the formulation.

② Cosolvency

→ It is the technique of increasing the solubility of poorly soluble drugs in liquid by addition of a solvent miscible, to the liquid in which drug is also highly soluble.

→ Cosolvents such as ethanol, glycerol, propylene glycol, decreases the interfacial tension and increase the solubility.

→ Example :- Formulation of diazepam injection using propylene glycol as co-solvent.

③ Complexation

→ It may be possible to increase the solubility of a poorly soluble drug by allowing it to interact with a soluble material to form a soluble intermolecular complex.

→ Eg. - Nicotinamide & β-cyclodextrin.

Solubility enhancement techniques

① pH adjustment

→ pH adjustment for improving the solubility can be achieved in 2 ways :-

a) Salt formation

b) Addition of buffers to the formulation.

② Cosolvency

→ It is the technique of increasing the solubility of poorly soluble drugs in liquid by addition of a solvent miscible, to the liquid in which drug is also highly soluble.

→ Cosolvents such as ethanol, glycerol, propylene glycol, decreases the interfacial tension and increase the solubility.

→ Example :- Formulation of diazepam injection using propylene glycol as co-solvent.

③ Complexation

→ It may be possible to increase the solubility of a poorly soluble drug by allowing it to interact with a soluble material to form a soluble intermolecular complex.

→ Eg. - Nicotinamide & β-cyclodextrin.

(4) Micronization

→ Surface area and particle size are inversely related to each other. Smaller the drug particles larger the surface area and greater is the solubility.

→ A decrease in particle size achieved through micronization will result in higher solubility of the drug.