SUSPENSIONS

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Definition

➢ A Pharmaceutical suspension is a coarse dispersion in which internal phase (**therapeutically active ingredient**) is dispersed uniformly throughout the external phase.

- The **internal phase** consisting of insoluble solid particles having a range of size (**0.5 to 5 microns**).

- The external phase (**suspending medium**) is generally aqueous in some instance, but may be an organic or oily liquid for non oral use.

The reasons for the formulation of a Pharmaceutical suspension:

- When the drug is insoluble.
- To mask the bitter taste of the drug.
- To increase drug stability.
- To achieve controlled/sustained drug release.

SOME PHARMACEUTICAL SUSPENSIONS

- 1. Antacid oral suspensions
- 2. Antibacterial oral suspension
- 3. Dry powders for oral suspension (antibiotic)
- 4. Analgesic oral suspension
- 5. Anthelmentic oral suspension
- 6. Anticonvulsant oral suspension
- 7. Antifungal oral suspension

Classification

Based On General Classes

- Oral suspension
  eg: Paracetamol suspension,
  antacid suspensions.

- Externally applied suspension
  eg :Calamine lotion.

- Parenteral suspension
  eg: Procaine penicillin G
  Insulin Zinc Suspension

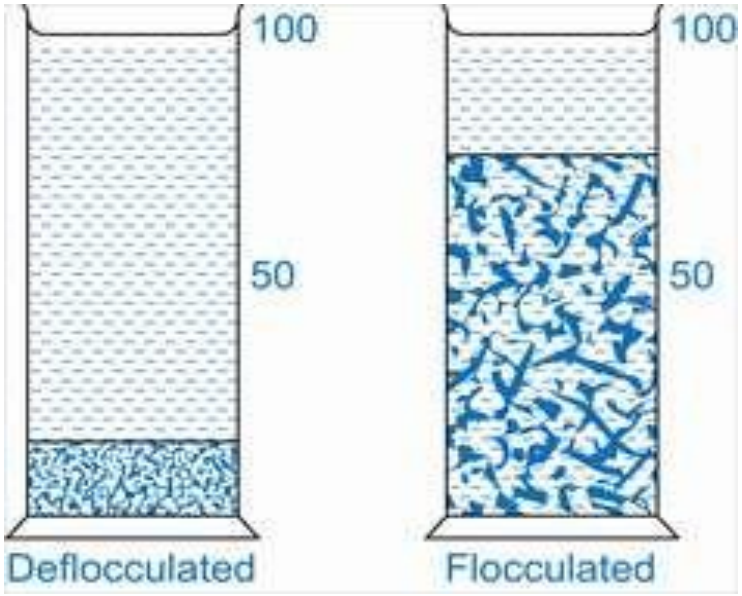
Based on Proportion of Solid Particles

- Dilute suspension (2 to10%w/v solid)
  Eg: cortisone acetate suspension

- Concentrated suspension (50%w/v solid)
  Eg: zinc oxide suspension

Based on Electrokinetic Nature of Solid Particles

- Flocculated suspension
- Deflocculated suspension



Based on Size of Solid Particles

- **Colloidal suspensions (< 1 micron)**
- **Coarse suspensions (> 1 micron)**
- **Nano suspensions (< 50nm)**

Advantages

- Drug in suspension exhibits higher rate of bioavailability than solid dosage forms.

Solution > Suspension > Capsule > Compressed Tablet > Coated tablet

- Suspension can improve chemical stability of certain drug.
- Controlled drug release
- Suspension can mask the unpleasant/ bitter taste of drug.
- Ease of administration.

Disadvantages

- Physical stability , sedimentation and compaction can causes problems.
- It is bulky, sufficient care must be taken during **handling and transport.**
- It is difficult to formulate.
- **Uniform and accurate dose can not be achieved** unless suspension are **packed in unit dosage form.**

Features Desired In Pharmaceutical Suspensions

- The suspended particles should not settle rapidly and sediment produced, must **be easily re-suspended** by the use of moderate amount of **shaking**.
- It should be easy to pour yet **not watery** and **no grittiness.**
- It should have **pleasing odor**, **colur and palatability**.
- Good **syringeability**.
- It should be **physically,chemically and microbiologically stable**.
- Parenteral /Ophthalmic suspension should be sterilizable.

INGREDIENTS FOR

FORMULATION OF SUSPENSIONS

Suspending agents	CMC, gums , sodium alginate.
Wetting agents	Polysorbate 80 , acacia , tracaganth
Buffers and pH adjusting agents	Phosphate , and carbonate buffers
Osmotic agents	Dextrose , mannitol , sorbitol etc.
Coloring agents	Amaranth , Titanium dioxide,
Preservatives	Disodium EDTA, Butyl paraben , propylene glycol

Manufacturing of Suspension:

Suspension can be made by using two methods, namely:

1. Dispersion methods

2. Precipitation method, this method is divided again into three kinds :

- precipitation with organic solvents
- precipitation with a pH change of media
- precipitation with double decomposition

Precipitated method

1. Organic solvent precipitation :

E.g Prednisolone is precipitated from a methanolic solution to produce a suspension in water.

2. Precipitation effected by changing the pH of the medium:

E.g Estradiol is readily soluble in potassium or sodium hydroxidesolutions. If a concentrated solution of estradiol is thus prepared and added to a weakly acidic solution of hydrochloric, citric or acetic acids, the estradiol is precipitaed.

3. Double decomposition method :

E.g: White ointment by dissolving zinc sulphate soln. in sulphurated potash.

Packaging of Suspensions

Introduction

- Pharmaceutical suspensions for oral use are generally packed in **wide mouth container** having adequate space above the **liquid to ensure proper mixing.**

- Parenteral suspensions are packed in either glass ampoules or vials.

Evaluation of Suspensions

- Sedimentation method
- Rheological method
- Electro kinetic method
- Micromeritic method

Sedimentation method :

Two parameters are studied for determination of sedimentation.

1. Sedimentation volume,

2. Degree of flocculation.

Sedimentation volume

- Sedimentation volume is calculated according to the equation:

Where,
F = sedimentation volume,
V_u = ultimate height of sediment, and
V_o = initial height of total suspension

$$F = V_u / V_o$$

➢ Rheological method

➢ It provide information about Settling behaviour .

➢ The arrangement of the vehicle and the particle structural features.

➢ Brookfield viscometer is used to study the viscosity of the suspension .
➢ It is mounted on heli path stand and using T-bar spindle.

- The dial reading is plotted against the number of turns of the spindle.

- The better suspension show a lesser rate of increase of dial reading with spindle turns, i.e. the curve is horizontal for long period.

Electro kinetic method

- Measurement of Zeta-potential using Micro electrophoresis apparatus & ZetaPlus (Brookhaven Instruments Corporation, USA

- It shows the stability of a disperse system.

Micromeritic method :

- The stability of suspension depends on the **particle size of the dispersed phase.**

- Change in the particle size with reference to time will provide useful information regarding the stability of a suspension.

- A change in particle size distribution and crystal habit studied by

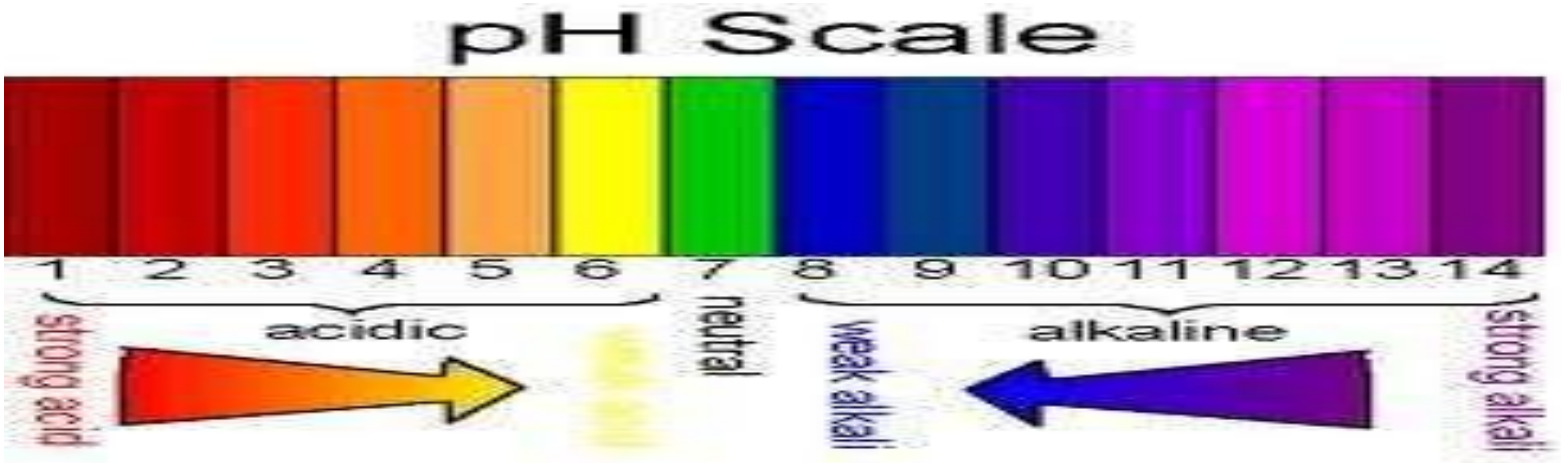
  - ✓ microscopy
  - ✓ coulter counter method

FREEZE- THAW TEST

- Freeze-Thaw test conducted by placing the sample in a freezer for 18 hours followed by thawing at room temperature for 4 to 6 hours.
- Repeat the Freeze-Thaw cycle **for up to 10 times.**
- This test is conducted to determine the tendency to crystallize or cloud)

pH MEASUREMENT

➢ The measurement and maintenance pH is also very important step in the Quality control testing .



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