PHB

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Course Name	**: D. Pharm**
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Topic Name	**: Suspension**

Ch – 12.5

Suspension

Suspensions may be meant for oral administration, external application or parenteral use. They generally consist of a finely divided solid (individual particles ranging in size from 0.5 to 5.0μ) suspended in a liquid or semi-solid vehicle which constitutes the continuous phase.

Example of Pharmaceutical Suspension:

- Analgesic oral suspension
- Antifungal oral suspension
- Dry powders for oral suspension (antibiotic)
- Anthelmentic oral suspension
- Anticonvulsant oral suspension
- Antacid oral suspensions
- Antibacterial oral suspension

Classification of Pharmaceutical Suspensions

A. *Classification based on solid particles proportion*

1. Dilute Suspension: This suspension contains solid weights that range between 2% to 10% per volume. An example is the cortisone acetate suspension.

2. Concentrated Suspension: The solid weight per volume in these solutions is 50%. An example is the Zinc oxide suspension.

B. *Classification based on the size of dispersed particles*

1. Molecular Dispersion: The size of particles in this suspension is not greater than 1μm.

2. Colloidal Dispersion: Its particle size is between 0.1μm-0.2μm

3. Coarse Dispersion: The particle size in this suspension is always greater than 0.2μm.

C. *Classification based on the route of administration*

1. Oral Suspension: These suspensions are administered orally for instance paracetamol suspension.

2. Parenteral Suspension: The intravenous or intramuscular routes are used to administer such drugs mostly through injections. Its example is sodium benzylpenicillin.

3. Ophthalmic Suspension: This is a suspension that is used to treat aching eyes. Its particles should be very fine, not irritating, sterile and isotonic.

4. Tropical Suspension: These are suspensions that are used for external purposes. They are applied to the external part of a patient's body that is aching.

D. *Based on electro kinetic nature of Solid Particles*

1. Flocculated suspension

2. Deflocculated suspension

Advantages of Pharmaceutical Suspension

1. It eases the delivery of low soluble therapeutic agents.
2. It facilitates the dispersion of bitter drugs
3. It increases the bioavailability of drug dosage
4. Provides controlled drug delivery
5. It provides proper storage of drugs

Disadvantages of Pharmaceutical Suspensions

1. They are fundamentally unstable
2. It is not possible on aesthetic pharmaceuticals.
3. Difficult to administer the correct dosage.
4. It may be inconvenient to be carried by patients.
5. It is subjected to difficulties during administering.

Formulation Additive

In addition to vehicle, stabilizer, sweetening and flavouring agents, which are common in liquid dosage forms, the following additives are required to prepare suspensions which include:

1. Suspending and Thickening agents
2. Wetting Agents
3. Dispersing agent
4. Flocculating Agent

1. Suspending and Thickening agents: They are added with the objective to increase apparent viscosity of the continuous, phase thus preventing rapid sedimentation of the dispersed particles.

a) Natural Polysaccharides: Gum acacia, Tragacanth, sod. Alginate, Xanthan Gum

b) Semi-Synthetic Polysaccharides: Sodium Carboxymethyl cellulose, Methyl cellulose, Hydroxypropyl methyl cellulose, microcrystalline cellulose

c) Clays: Aluminium Magnesium Silicate, Bentonite, Hectorite

d) Synthetic Agents: Carbomer, Colloidal Silicon dioxide

2. Wetting Agents: Wetting agents are additives which are usually added to decrease this hydrophobicity. These agents generally get adsorbed at the solid-liquid interface and promote wetting of the solid particles by the liquid of the dispersion medium.

a) **Surfactants: E.g.:** polysorbates, sorbitan, esters, sodium lauryl sulfate, sodium dioctyl sulfosuccinate
b) **Hydrophilic Polymers: E.g.:** acacia, bentonite, colloidal silicon dioxide and cellulose derivatives
c) **Hydrophilic Liquids: E.g.:** alcohol, glycerol, propylene glycol

3. Dispersing agent: These additives are generally added as an aid to uniform distribution and dispersion of solid particles of the dispersed phase. Wetting agents such as surfactants are often employed as dispersing agents.

4. Flocculating Agent: These are substances added to cause controlled aggregation of the particles of the dispersed phase in a suspension. Examples of such agents include surfactants, electrolytes and hydrophilic polymers.

Methods for formulation of suspension

1. Precipitation method
   a. Organic Solvent precipitation
   b. Precipitation by pH
   c. Double decomposition

2. Dispersion method

3. Use of controlled flocculation

4. Use of structured vehicle

Stability of Suspension

To check the stability of suspension, some parameter should be identify.

A-Physical stability

- Appearance, color, odor and taste
- pH
- Specific gravity
- Sedimentation rate
- Sedimentation volume
- Zeta potential measurement
- Compatibility with container
- Compatibility with cap liner

- Microscopic examination
- Determination crystal size
- Determination uniform drug distribution

B-Chemical stability:

- Degradation of active ingredient
- Viscosity change
- antimicrobial activity:
    - Incompatibility with preservative
    - Degradation of preservative
    - Adsorption of preservative onto drug particle