Pharmaceutical technology

Suspensions

Part V

Types of suspension

Examples of suspension

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- **Suspension containing of oil in inhalation**

1. Used for suspension containing volatile oils
2. To ensure uniform distribution of oil, diffusible solid (magnesium carbonate) is used to adsorb some of the oil
3. The powder should not interfere with free vaporization of the oil when the inhalations are added to water at about 65°C for use.
4. If quantity is not mentioned 1 g of light magnesium carbonate for each 2 mL of oil or 2 g of volatile solid gives satisfactory result
5. For example menthol and eucalyptus oil inhalation

- **Suspension containing solid product of chemical reaction**

1. Insoluble active constituents are formed by chemical reaction
2. The reaction substances should be dissolved separately in half volume of vehicle and two parts are mixed
3. Finer precipitate formed is diffusible and no suspending agent is necessary

Example of oral suspensions

1. Antacid suspension e.g., Aluminum, Magnesium and simethicone oral suspension.

- Antacids are intended to counteract the effects of gastric hyperacidity and, as such, are employed by persons, such as peptic ulcer patients, who must reduce the level of acidity in the stomach. They are also widely employed and sold over the counter (OTC) to patients with acid indigestion and heartburn.
- Most antacid preparations are composed of water-insoluble materials that act within the gastrointestinal tract to counteract the acid and/or soothe the irritated or inflamed linings of the gastrointestinal tract.

- A few water-soluble agents are employed, including sodium bicarbonate, but for the most part, water-insoluble salts of aluminum, calcium, and magnesium are employed; these include aluminum hydroxide, aluminum phosphate, calcium carbonate, calcium phosphate, magnesium carbonate, magnesium oxide, and magnesium hydroxide.

2. The antibacterial oral suspensions: include preparations of antibiotic substances (e.g., erythromycin derivatives and tetracycline and its derivatives), sulfonamides (e.g., sulfamethoxazole and sulfisoxazole acetyl), other anti-infective agents (e.g., methenamine mandelate and nitrofurantoin), or combinations of these (e.g., sulfamethoxazole–trimethoprim).

- Many antibiotic materials are unstable when maintained in solution for an appreciable length of time, and therefore, from a stability standpoint, insoluble forms of the drug substances in aqueous suspension or as dry powder for reconstitution are attractive to manufacturers.

- The dispersing phase of antibiotic suspensions is aqueous and usually colored, sweetened, and flavored to render the liquid more appealing and palatable.
- The palmitate form of chloramphenicol was selected for the suspension dosage form not only because of its water insolubility but also because it is flavorless, which eliminates the necessity to mask the otherwise bitter taste of the chloramphenicol base.

3. Dry Powders for oral suspension

A number of official and commercial preparations consist of dry powder mixtures or granules that are intended to be suspended in distilled water or some other vehicle prior to oral administration.

- As indicated previously, these official preparations have “for Oral Suspension” in their official title to distinguish them from prepared suspensions.
- Most drugs prepared as a dry mix for oral suspension are antibiotics.

- The dry products are prepared commercially to contain the antibiotic drug, colorants (FD&C dyes), flavorants, sweeteners (e.g., sucrose or sodium saccharin), stabilizing agents (e.g., citric acid, sodium citrate), suspending agents (e.g., guar gum, xanthan gum, methylcellulose), and preserving agents (e.g., methylparaben, sodium benzoate) that may be needed to enhance the stability of the dry powder or granule mixture or the liquid suspension.

- When called on to reconstitute and dispense one of these products, the pharmacist loosens the powder at the bottom of the container by lightly tapping it against a hard surface and then adds the label-designated amount of purified water, usually in portions, and shakes the slurry until all of the dry powder has been suspended .
- It is important to add precisely the prescribed amount of purified water to the dry mixture if the proper drug concentration per dosage unit is to be achieved

- Also, the use of purified water rather than tap water is needed to avoid the possibility of adding impurities that could adversely affect the stability of the resulting preparation.
- Generally, manufacturers provide the dry powder or granule mixture in a slightly oversized container to permit adequate shaking of the contents after the entire amount of purified water has been added.

4. Anthelmintics: e.g., Albenzadol oral suspension
5. Antifungals: e.g., Nystatin oral suspension

Package and storage of oral suspensions

- All suspensions should be packaged in wide mouth containers having adequate airspace above the liquid to permit adequate shaking and ease of pouring.
- Most suspensions should be stored in tight containers protected from freezing, excessive heat, and light.
- It is important that suspensions be shaken before each use to ensure a uniform distribution of solid in the vehicle and thereby uniform and proper dosage.
- Many of the oral suspensions that are intended primarily for infants are packaged with a calibrated dropper to assist in the delivery of the prescribed dose.

Examples of other suspensions

1. Otic suspensions: for example combination of polymyxin B sulfate, neomycin sulfate and hydrocortisone otic suspension.
2. Ophthalmic suspensions: Hydrocortisone eye drop suspension
3. Rectal suspensions: for example Barium sulfate for suspension may be employed orally or rectally for the diagnostic visualization.

- Commercially, barium sulfate for diagnostic use is available as a bulk powder containing the required suspending agents for effective reconstitution to an oral suspension or enema prior to administration.
- Enema units, which contain prepared suspension in a ready-to-use and disposable bag, are also available.

5. Parenteral suspensions: Most parenteral suspensions are designed for intramuscular or subcutaneous administration to control the rate of absorption.

- For example, Triamcinolone Acetonide Injectable suspension and insulin zinc suspension are intended for intramuscular (or intra-articular) and subcutaneous administration respectively.

6. Externally applied suspensions.

- For example calamine lotion; lotion when applied to skin solvent evaporates leaving a light deposit of medicament on the surface.

Applications of suspensions

1. Suspension is usually applicable for drug which is insoluble or poorly soluble.
2. Suspension is used to prevent degradation of drug or to improve stability of drug.
3. Suspension is used to mask the taste of bitter of unpleasant drug. For example chloramphenicol palmitate suspension.
4. Suspension can be formulated for topical application.

5. Suspension can be formulated for parenteral application in order to control rate of drug absorption.

- For example procaine penicillin G.

6. Suspension is used for formulation of vaccines (immunizing agent). For example cholera vaccine.
7. Suspension can be used as adsorbent of toxins in GIT, for example in soluble powers (kaoline and aromatic chalk) can be administered as suspension.

- Kaolin is used for mild-to-moderate diarrhea, severe diarrhea (dysentery), and cholera.
- Aromatic chalk powder (chalk powder): a powder ranging in colour from white to light-brown, containing chalk and cinammon, nutmeg, cloves, cardamon and sugar.
- Chalk acts as an antacid and astringent on the intestinal canal; a little becomes absorbed and produces the remote effects of lime. It is used chiefly in diarrhea, alone or combined with other astringents and aromatics.