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عنوان المحاضرة باللغة الانجليزية	**Dispersed System**
عنوان المحاضرة باللغة العربية	النظام المشتت
رقم المحاضرة	3
المصادر والمراجع	Pharmaceutical Dosage forms and Drug Delivery Systems By Haward A. Ansel; latest edition.
	Sprowel's American Pharmacy.

محتوى المحاضرة

Introduction

Dispersed Systems

Dispersed phase (solid , liquid, or gas undissolved) + Dispersion medium (Dispersing phase)

Introduction

Particle Size (dispersed phase varied widely)

- Molecular dispersion (dissolution) (NaCl in water)
- Colloidal dispersions 1 nm – 0.5 µm (Magmas and gels)
- Fine dispersions 0.5 – 10 µm
- Coarse dispersions 10 – 50 µm (Susp. and Emu.)

Tendency to separate from the dispersion medium
Settle
Rise

Particles VS Molecules

Particles of drug substances can actually range from an aggregation of two or more molecules to millions of molecules.

The term particle should not be confused with molecule. The molecule is the smallest unit of any chemical compound that possesses all the native properties of that compound.

Particles consist of numerous molecules, generally in a solid state (but can be liquid or gaseous). Dissolution is the solid to liquid transformation that converts solid drug particles to individual, dissolved liquid molecules. Even the smallest invisible drug particle contains billions of molecules.

Introduction

01 Particle Size

Complete and uniform redistribution of the dispersed phase is essential to the accurate administration of uniform doses.

In the case of an aerosol, the dispersed phase may be small air bubbles throughout a solution or an emulsion.

Suspensions

01 Suspensions

Suspensions may be defined as preparations containing finely divided drug particles (the suspensoid) distributed somewhat uniformly throughout a vehicle in which the drug exhibits a minimum degree of solubility.

Suspensions

01 Suspensions

- Ready-to-use form
  This type of preparation is designated in the USP by a title of the form "Oral Suspension"
- Dry powders intended for suspension in liquid vehicles (Reconstituted unstable powder)
  This type of preparation is designated in the USP by a title of the form "for Oral Suspension"

Reasons for Suspensions

01 Certain drugs are chemically unstable in solution but stable when suspended (Suspension provide liquid dosage form for unstable drug).

The liquid form is preferred to the solid form of the same drug because of the ease of swallowing liquids and the flexibility in administration of a range of doses.

Overcome the disagreeable taste of certain drugs prepared in solution form, when the drug is administered as undissolved particles of an oral suspension (Erythromycin estolate poor-solubility).

Features Desired in a Pharmaceutical Suspension

01

In addition to therapeutic efficacy, chemical stability of the components of the formulation, permanency of the preparation, and esthetic appeal of the preparation— desirable qualities in all pharmaceutical preparations. few other features apply more specifically to the pharmaceutical suspension:

A properly prepared pharmaceutical suspension should settle slowly and should be readily redispersed upon gentle shaking of the container.

The particle size of the suspensoid should remain fairly constant throughout long periods of undisturbed standing.

The suspension should pour readily and evenly from its container.

Sedimentation Rate of the Particles of Suspension

The various factors involved in the rate of settling of the particles of a suspension are embodied in the equation of Stokes law

- Diameter
- Density
- Viscosity (pours and redispersed)

Adjustments mainly on dispersed phase are concerned mainly with particle size, uniformity of particle size, and separation of the particles so that they are not form a solid cake upon standing.

Sedimentation Rate of the Particles of Suspension

Stokes' equation was derived for an ideal situation in which uniform, perfectly spherical particles in a very dilute suspension settle without producing turbulence, without colliding with other particles of the suspensoid, and without chemical or physical attraction or affinity for the dispersion medium.

Obviously, the Stokes equation does not apply precisely to the usual pharmaceutical suspension in which the suspensoid is irregularly shaped and of various particle diameters, in which the fall of the particles does result in both turbulence and collision, and also in which the particles may have some affinity for the suspension medium.

However, the basic concepts of the equation do give a valid indication of the factors that are important to suspension of the particles and a clue to the possible adjustments that can be made to a formulation to decrease the rate of sedimentation.

Physical Features of the Dispersed Phase of a Suspension

Probably the most important single consideration in a discussion of suspensions is the size of the particles. In most good pharmaceutical suspensions, the particle diameter is 1 to 50 μm. Generally, particle size reduction is accomplished by dry milling prior to incorporation of the dispersed phase into the dispersion medium.

One of the most rapid, convenient, and inexpensive methods of producing fine drug powders of about 10 to 50 µm size is micro-pulverizatian. Micropulverizers are high-speed attrition or impact mills that are efficient in reducing powders to the size acceptable for most oral and topical suspensions.

For still finer particles, under 10 µm, fluid energy grinding, sometimes referred to as jet milling or micronizing, is quite effective. By this process, the shearing action of high-velocity compressed airstreams on the particles in a confined space produces the desired ultrafine or micronized particles. The particles are accelerated to high velocities and collide with one another, resulting in fragmentation. This method may be employed when the particles are intended for parenteral or ophthalmic suspensions.

Sedimentation Rate of the Particles of Suspension

- One the most important factor to be adjusted is particle size reduction, (too much reducing should be avoided?).
- Caking

As shown by the Stokes equation, the reduction in the particle size of a suspensoid is beneficial to the stability of the suspension because the rate of sedimentation of the solid particles is reduced as the particles are decreased in size. The reduction in particle size produces slow, more uniform rates of settling. However, one should avoid reducing the particle size too much because fine particles have a tendency to form a compact cake upon settling to the bottom of the container.

Prevention of cake formation

To avoid formation of a cake, it is necessary to prevent agglomeration of the particles into larger crystals or into masses. One common method of preventing rigid cohesion of small particles of a suspension is intentional formation of a less rigid or loose aggregation of the particles held together by comparatively weak particle-to-particle bonds. Such an aggregation of particles is termed a floc or a floccule, with flocculated particles forming a type of lattice that resists complete settling (although floes settle more rapidly

than do fine, individual particles) and thus are less prone to compaction than unflocculated particles.

The floes settle to form a higher sediment volume than unflocculated particles, the loose structure of which permits the aggregates to break up easily and distribute readily with a small amount of agitation.

Sedimentation Rate of the Particles of Suspension

- How floccule prepare?
- There are several methods of preparing flocculated suspensions, the choice depending on the type of drug and the type of product desired.
- Oral – Magmas (bentonite)
- Parenteral – pH alterations
- Electrolytes can also act as flocculating agents, apparently by reducing the electrical barrier between the particles of the suspensoid and forming a bridge so as to link them together.
- Sediment Volume ?

Dispersion Medium

Oftentimes, as with highly flocculated suspensions, the particles of a suspension settle too rapidly to be consistent with what might be termed a pharmaceutically elegant preparation. The rapid settling hinders accurate measurement of dosage and, from an aesthetic point of view, produces too unsightly a supernatant layer. In many commercial suspensions, suspending agents are added to the dispersion medium to lend it structure.

Dispersion Medium

Carboxymethylcellulose (CMC), methylcellulose, microcrystalline cellulose, polyvinylpyrrolidone, xanthan gum, and bentonite are a few of the agents employed to thicken the dispersion medium and help suspend the suspensoid.