Powder

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Powder:

Most active and inactive pharmaceutical ingredients occur in the solid state as amorphous powders or as crystals of various morphologic structures. The term "powder" has more than one meaning in pharmacy.

- It may be used to describe the physical form of a material, that is, a dry substance composed of finely divided particles.

OR

It may be used to describe a type of pharmaceutical preparation, that is, a medicated powder intended for internal (i.e., oral powder) or external (i.e., topical powder) use.

A powder is defined as a dosage form composed of a solid or mixture of solids reduced to a finely divided state and intended for internal or external use.

Granules, used as a dosage form, consist of powder particles aggregating to form a larger particle, usually 2-4 mm in diameter.

- This is much larger than granules prepared as an intermediate for tablet manufacture.

Powders have qualities that make them an attractive dosage form for certain situations:

➢ Unlike a standardized capsule or tablet, powders enable a primary care provider to alter the quantity of medication for each dose easily.

➢ Powders can also aid in clinical studies of drug preparations because the dose can be readily adjusted.

➢ Doses can be individually weighed and placed in powder papers, envelopes, or small vials/bottles

➢ Infants and young children who cannot swallow tablets or capsules will accept powders that can be mixed with formula or sprinkled in applesauce or other appropriate food.

➢ If a drug is too bulky to be prepared as a capsule or tablet, it may be suitable for a powder dosage form.

➢ Powders provide a rapid onset of action because they are readily dispersed, have a large surface area, and usually require only dissolution, not disintegration, before absorption.

The use of powders:

Although medicated powders per se in therapeutics are limited, using powdered substances in preparing other dosage forms is extensive. For example, Powdered drugs may be blended with powdered fillers and other pharmaceutical ingredients to fabricate:

➢ Solid dosage forms as tablets and capsules;

They may be dissolved or suspended in solvents or liquid vehicles to make various liquid dosage forms;

➢ They may be incorporated into semisolid bases to prepare medicated ointments and creams.

Physicochemical Considerations

- Particle Characteristics
- Before their use in the preparation of pharmaceutical products, solid materials are first characterized to determine their chemical and physical features, including

➢ Morphology,

➢ Purity,

➢ Solubility,

➢ Flowability,

➢ Stability,

➢ Particle size,

➢ Uniformity, and

➢ Compatibility with any other formulation components

Particle Size

- The adjustment and control of a drug and other materials powder's particle size; enable both the efficient production of a finished dosage form and the optimum therapeutic efficacy.
- The particles of pharmaceutical powders and granules may range from extremely coarse, about 10 mm (1 cm) in diameter, to extremely fine, approaching colloidal dimensions of 1 μm or less.

- In order to characterize the particle size of a given powder, the *United States Pharmacopeia* (USP) uses these descriptive terms:
- **Very coarse,**
- **Coarse,**
- **Moderately coarse,**
- **Fine, and**
- **Very fine**
- which are related to the proportion of powder that is capable of passing through the openings of standard sieves of varying fineness in a specified period while being shaken, generally in a mechanical sieve shaker.
- Sieves can be referred to either by their aperture size or mesh size (or sieve number).
- The mesh size is the number of wires per linear inch. The sieve number denotes the number of holes present in the sieve within one-inch length of the sieve mesh.

- Very coarse (No. 8): All particles pass through a No. 8 sieve, and not more than 20% pass through a No. 60 sieve.
- Coarse (No. 20): All particles pass through a No. 20 sieve, and not more than 40% pass through a No. 60 sieve.
- Moderately coarse (No. 40): All particles pass through a No. 40 sieve, and not more than 40% pass through a No. 80 sieve.
- Fine (No. 60): All particles pass through a No. 60 sieve, and not more than 40% pass through a No. 100 sieve.
- Very fine (No. 80): All particles pass through a No. 80 sieve. There is no limit to greater fineness.

TABLE **6.1.** Opening of Standard Sieves

Sieve Number	Sieve Opening
2.0	9.50 mm
3.5	5.60 mm
4.0	4.75 mm
8.0	2.36 mm
10.0	2.00 mm
20.0	850.00 μm
30.0	600.00 μm
40.0	425.00 μm
50.0	300.00 μm
60.0	250.00 μm
70.0	212.00 μm
80.0	180.00 μm
100.0	150.00 μm
120.0	125.00 μm
200.0	75.00 μm
230.0	63.00 μm
270.0	53.00 μm
325.0	45.00 μm
400.0	38.00 μm

Particle size can influence a variety of factors:

1. Dissolution rate of particles intended to dissolve; **drug micronization can increase the drug dissolution rate and its bioavailability.**

2. Suspendability of particles intended to remain undissolved but uniformly dispersed in a liquid vehicle (e.g., fine dispersions have particles ~0.5 to 10 μm)

3. Uniform distribution of a drug substance in a powder mixture or solid dosage form **to ensure dose-to-dose content uniformity**

4. Penetrability of particles intended to be inhaled for deposition deep in the respiratory tract (e.g., 1 to 5 μm)

5. Lack of grittiness of solid particles in dermal ointments, creams, and ophthalmic preparations (e.g., fine powders may be 50 to 100 μm in size)

Micromeritics

- Micromeritics is the science of small particles; a particle is any unit of matter having defined physical dimensions. Micromeritics is the study of several characteristics, including:

a. particle size

b. size distribution,

c. shape,

d. angle of repose,

e. porosity,

f. true volume,

g. bulk volume,

h. apparent density,

i. bulkiness

- **Angle of Repose**

The angle of repose is a relatively simple technique for estimating the flow properties of a powder. It can easily be determined by allowing a powder to flow through a funnel and fall freely onto a surface. The height and diameter of the resulting cone are measured, and the angle of repose is calculated from this equation:

$$\tan \theta = h/r$$

- Where **h** is the height of the powder cone and **r** is the radius of the powder cone.