PHYSICAL PHARMACY CAPSULE 14.1

Particles Versus 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. Most nonprotein or small molecule organic drugs have formula weights ranging from 150 to 500.

EXAMPLE

Let's look at how many molecules may be present in a 1-ng particle of ibuprofen with a formula weight of 206:

$$\frac{(1\text{ ng})(1\text{ g})\left(6.02\times10^{23}\text{ molecules}\right)}{(\text{particle})\left(1\times10^{9}\right)\ (206\ \text{g})\,(\text{Mole})} = 2.923\times10^{12}\text{ molecules}$$

This illustrates that a 1-ng invisible particle will contain 2,923,000,000,000 molecules.

of uniform doses. For a properly prepared dispersion, this should be accomplished by moderate agitation of the container.

The focus of this chapter is on dispersions of drugs administered orally or topically. The same basic pharmaceutical characteristics apply to dispersion systems administered by other routes. Included among these are ophthalmic and otic suspensions and sterile suspensions for injection, covered in Chapters 17 and 15, respectively.

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. Some suspensions are available in ready-to-use form, that is, already distributed through a liquid vehicle with or without stabilizers and other additives (Fig. 14.1). Other preparations are available as dry powders intended for suspension in liquid vehicles. Generally, this type of product is a powder mixture containing the drug and suitable suspending and dispersing agents to be diluted and agitated with a specified quantity of vehicle, most often purified water. Figure 14.2 demonstrates preparation of this type of product. Drugs that are unstable if maintained for extended periods in the presence of an aqueous vehicle (e.g., many antibiotic drugs) are most frequently supplied as dry powder mixtures for reconstitution at the time of dispensing. This type of preparation is designated in the USP by a title of the form "for Oral Suspension." Prepared suspensions not requiring reconstitution at the time of dispensing are simply designated as "Oral Suspension."

Reasons for Suspensions

There are several reasons for preparing suspensions. For example, certain drugs are chemically unstable in solution but stable when suspended. In this instance, the suspension ensures chemical stability while permitting liquid therapy. For many patients, the liquid form is preferred to the solid form of the same drug because of the ease of swallowing liquids and the flexibility