Table 10.2 Example of powder grades as specified in pharmacopoeias

Description of grade of powder	Coarsest sieve diameter (μm)	Sieve diameter through which no more than 40% of powder must pass (μm)
Coarse	1700	355
Moderately coarse	710	250
Moderately fine	355	180
Fine	180	–
Very fine	125	–

Some pharmacopoeias define another size fraction, known as ultrafine powder, in which the maximum diameter of at least 90% of the particles must be no greater than 5 μm and none of the particles should have diameters greater than 50 μm.

Size separation by sedimentation

Separation ranges

These are shown in Figure 10.18.

Principles of operation

The principles of particle sizing using sedimentation methods are described in Chapter 9. Size separation by sedimentation utilizes the differences in settling velocities of particles with different diameters, and these can be related according to Stokes' equations (see Eqns 9.9, 9.10 and 9.11).

One of the simplest forms of sedimentation classification uses a chamber containing a suspension of solid particles in a liquid, which is usually water. After predetermined times, particles less than a given diameter can be recovered from a fixed distance below the surface of the liquid. Size fractions can be collected continuously using a pump mechanism.

Alternatively, a single separation can be carried out simply by removing the upper layer of suspension fluid after the desired time. Disadvantages of these simple methods are that they are batch processes and discrete particle fractions cannot be collected.

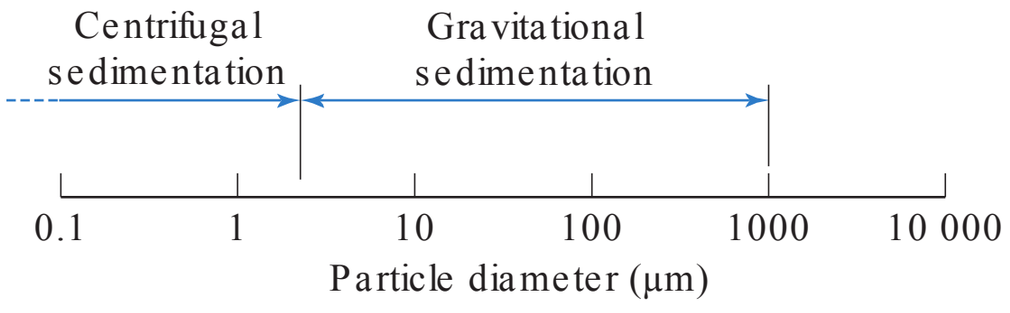

Fig. 10.18 • Separation range for sedimentation techniques.

Size separation by elutriation

Separation ranges

These are shown in Figure 10.19.

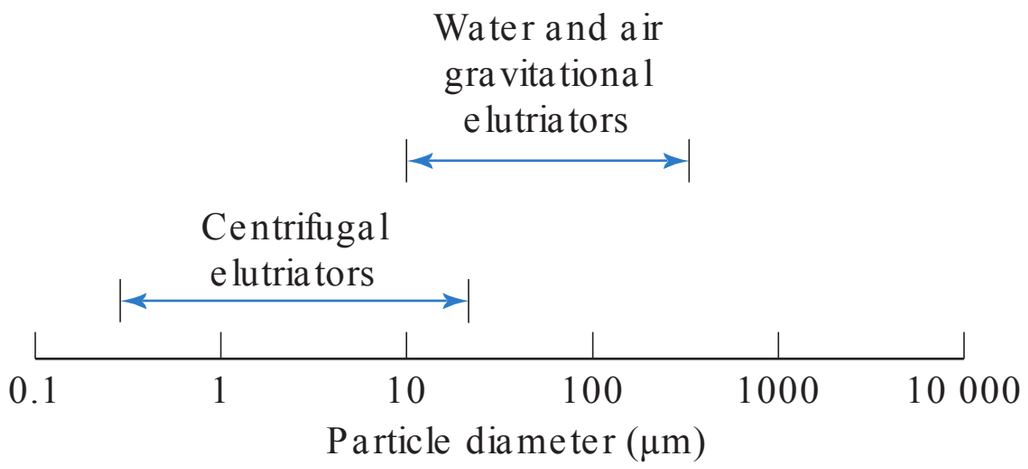

Fig. 10.19 • Separation range for elutriation methods.

Principles of operation

In sedimentation methods the fluid is stationary and the separation of particles of various sizes depends solely on particle velocity. Therefore, the division of particles into size fractions depends on the *time* of sedimentation.

Elutriation is a technique in which the fluid flows in an opposite direction to the sedimentation movement, so that in gravitational elutriators particles move vertically downwards while the fluid travels vertically upwards. If the upward velocity of the fluid is less than the settling velocity of the particle, sedimentation still occurs and the particles move slowly downwards against the flow of fluid. Conversely, if the upward fluid velocity is greater than the settling velocity of the particle, the particle moves upwards with the fluid flow. Therefore, in the case of elutriation, particles can be divided into