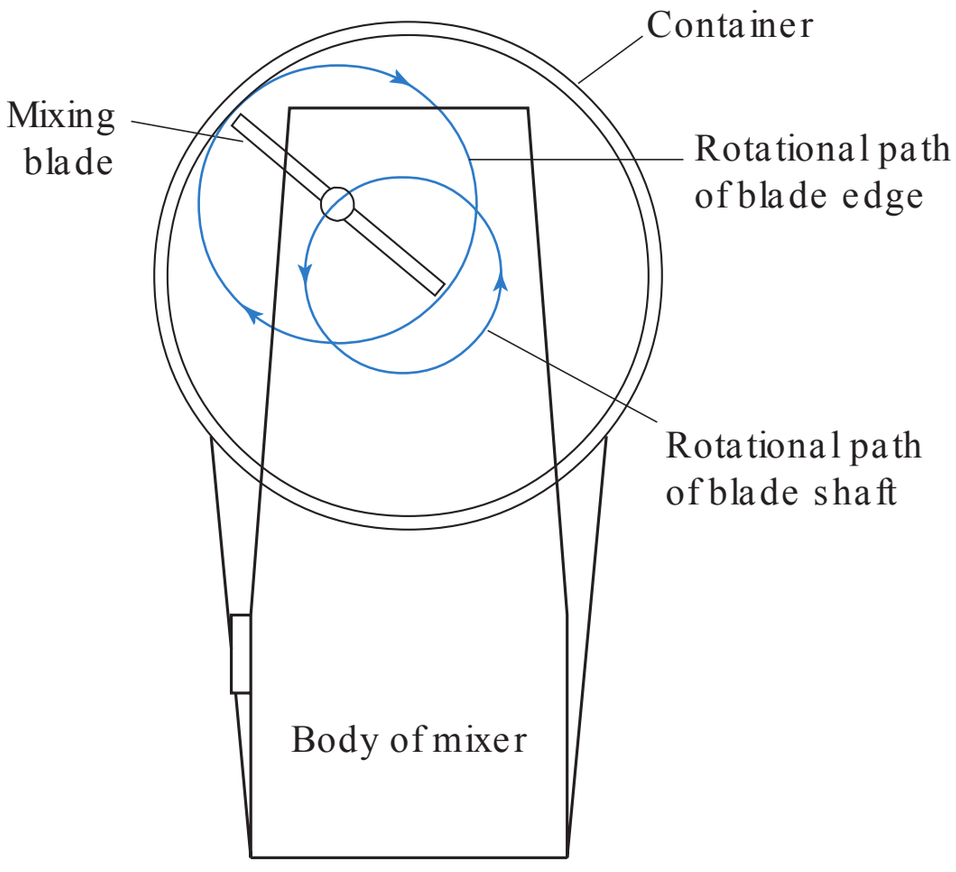

Fig. 11.11 • Top view of a planetary mixer, showing path of paddle.

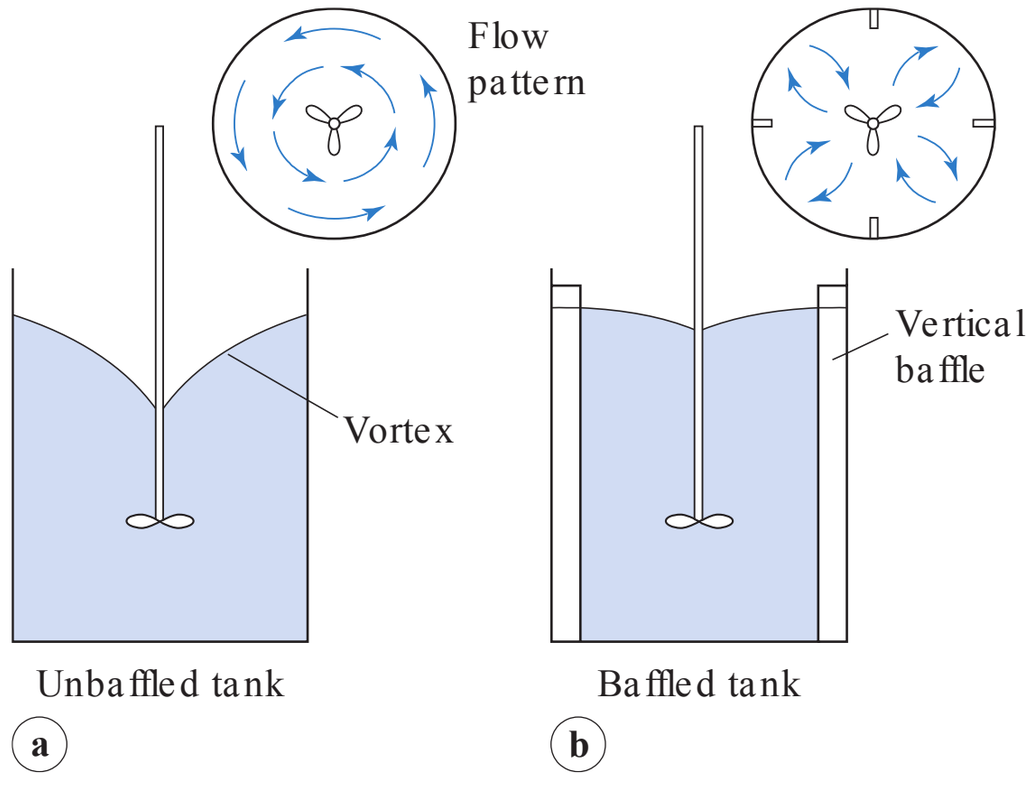

Fig. 11.12 • Propeller mixer with **(a)** unbaffled tank and **(b)** baffled tank.

lubricants care is needed to avoid overlubrication which may, for example, lead to soft tablets and delayed disintegration and dissolution.

Problems associated with a deficiency of some of the components of a formulation, which have been encountered at a production scale but not in development work, have been traced to adsorption of a minor constituent (e.g. a drug or colourant) onto the mixer wall or mixing blade.

Drug particle characteristics may also change when the drug is manufactured on a large scale. This in turn may affect the movement of the particles in the mixer and the interaction with other components and hence the tendency to mix and segregate.

The optimum mixing time and conditions should therefore be established and validated at a production scale so that the appropriate degree of mixing is obtained without segregation, overlubrication or damage to component particles. Minimum and maximum mixing times which give a satisfactory product should be determined, if appropriate, so that the 'robustness' of the mixing process is established.

Mixing of miscible liquids and suspensions

Mobile liquids with a low viscosity are easily mixed with each other. Similarly, solid particles are readily suspended in mobile liquids though the particles are likely to settle rapidly when mixing is discontinued. Viscous liquids are more difficult to stir and mix but they reduce the sedimentation rate of suspended particles (discussed further in Chapter 26).

Mixers for miscible liquids and suspensions

Propeller mixers

A common arrangement for medium-scale fluid mixing is a propeller-type stirrer which is often used clamped to the edge of a vessel. A propeller has angled blades, which cause the circulation of the fluid in both an axial and radial direction. An off-centre mounting discourages the formation of a vortex, which may form when the stirrer is mounted centrally. A vortex forms when the centrifugal force imparted to the liquid by the propeller blades causes it to back up round the sides of the vessel and form a depression around the shaft. As the speed of rotation is increased, air may be sucked into the fluid due to the formation of a vortex; this can cause frothing and possible oxidation (Fig. 11.12a). Another method of suppressing a vortex is to fit vertical baffles into the vessel. These divert the rotating fluid from its circular path into the centre of the vessel where the vortex would otherwise form (Fig. 11.12b).

The ratio of the diameter of a propeller stirrer to the diameter of the vessel is commonly 1:10 to 1:20 and it typically operates at speeds of 1–20