It should be noted that the type of mixture can change during processing. For example, if the viscosity increases sufficiently, a mixture may change from a negative to a neutral mixture. Similarly, if the particle size, degree of wetting or liquid surface tension changes, the mixture type may also change.

The mixing process

To discuss the principles of the mixing process, a situation will be considered where there are equal quantities of two powdered components of the same size, shape and density that are required to be mixed, the only difference between them being their colour. This situation will not, of course, occur practically but it will serve to simplify the discussion of the mixing process and allow some important considerations to be illustrated with the help of statistical analysis.

If the components are represented by coloured cubes, then a two-dimensional representation of the initial unmixed or completely segregated state can be shown as in Figure 11.1a.

From the definition of mixing, the ideal situation or *perfect mix* in this case would be produced when each particle lies adjacent to a particle of the other component (i.e. each particle lies as closely as possible in contact with a particle of the other component). This is shown in Figure 11.1b where it can be seen that the components are as evenly distributed as possible. If this mix was viewed in three dimensions then behind and in front of each coloured particle would be a white particle and vice versa. Powder mixing, however, is a 'chance' process and while the situation shown in Figure 11.1b could arise, the odds against it are so great that for practical purposes it can be considered impossible. For example, if there are only 200 particles present, the chance of a perfect mix occurring is approximately 1 in 10^{60} and is similar to the chance of the situation in Figure 11.1a occurring after prolonged mixing. In practice, the best type of mix likely to be obtained will have the components under consideration distributed as indicated in Figure 11.1c. This is referred to as a *random mix* which can be defined as a mix where the *probability* of selecting a particular type of particle is the *same* at all positions in the mix and is equal to the *proportion* of such particles in the total mix.

If any two adjacent particles are selected from the random mix shown:

- the chance of picking two coloured particles = 1 in 4 (25%)
- the chance of picking two white particles = 1 in 4 (25%)
- and the chance of picking one of each = 2 in 4 (50%).

If any two adjacent particles are selected from the perfect mix shown in Figure 11.1b, there will always be one coloured and one white particle.

Thus if the samples taken from a random mix contain only two particles, then in 25% of cases the

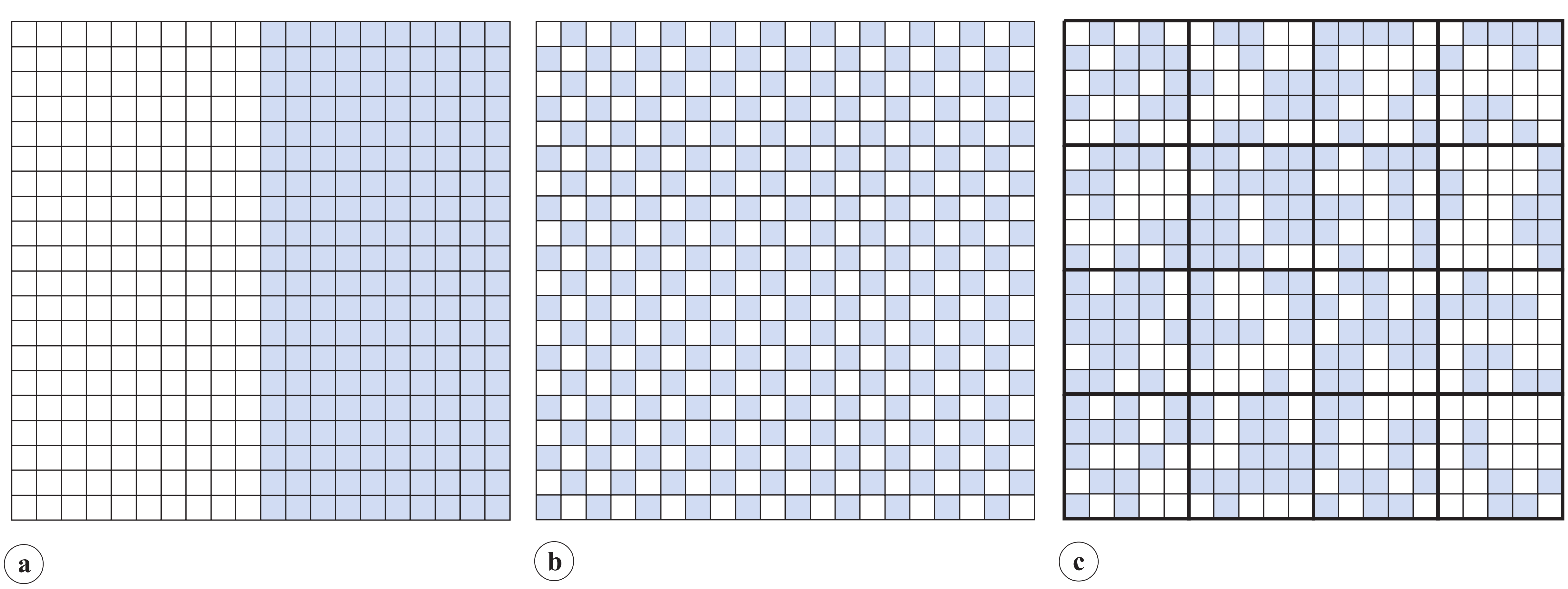

Fig. 11.1 • Different states of powder mixing. **(a)** Complete segregation. **(b)** An ideal or 'perfect' mix. **(c)** A random mix.