Granules

One disadvantage of powders is that, because of particle size differences, the ingredients may segregate (see Chapter 11), either in the hoppers of packaging machines or on storage in the final bulk container. If this happens, the product will be non-uniform and the patient will not receive the same dose of the ingredients on each occasion. This can be minimized by efficient granulation of the mixed powders.

Granules are preparations consisting of solid, dry aggregates of powder particles sufficiently resistant to withstand handling. They are intended for oral administration. Some are swallowed as such, some are chewed and some are dissolved or dispersed in water or another suitable liquid before being administered.

Granules contain one or more active substances with or without excipients and, if necessary, suitable colouring and flavouring substances. They are mainly used for low-toxicity, high-dose drugs. Methylcellulose Granules, for example, are used as a bulk-forming laxative and have a dose of 1–4 g daily. Many proprietary preparations contain similar bulk-forming laxatives.

Granules are presented as single-dose or multidose preparations. Each dose of a multidose preparation is administered by means of a device suitable for measuring the quantity prescribed. For single-dose granules, each dose is enclosed in an individual container, for example a sachet or a vial. If the preparation contains volatile ingredients or the contents have to be protected, they should be stored in an airtight container. For example, Methylcellulose Granules should be kept in a wide-mouthed, airtight container.

There are several categories of granules:

- effervescent granules
- coated granules
- gastro-resistant granules
- modified-release granules.

Effervescent granules. Effervescent granules are uncoated granules generally containing acid substances and carbonates or hydrogen carbonates which react rapidly in the presence of water to release carbon dioxide. They are intended to be dissolved or dispersed in water before administration. The effervescence and subsequent disintegration of the granules should be complete within 5 minutes at which time the granule ingredients should be either dissolved or dispersed in the water. Effervescent granules should be stored in an airtight container.

Coated granules. Coated granules consist of granules coated with one or more layers of mixtures of various excipients. The substances used as coatings (generally polymers) are usually applied as a solution or suspension in conditions in which evaporation of the vehicle occurs leaving a film of coating (see Chapter 32). A suitable test should be carried out to demonstrate the appropriate release of the active substance(s), for example one of the tests described in Chapter 35.

Modified-release granules. Modified-release granules are coated or uncoated granules that contain special excipients or which are prepared by special procedures, or both, designed to modify the rate, the place or the time at which the active substance or substances are released.

Modified-release granules may have prolonged-release or delayed-release properties. A suitable test must be carried out to demonstrate the appropriate kinetics and extent of the release of the active substance(s).

Gastro-resistant granules. Gastro-resistant granules (also referred to as enteric-coated granules) are delayed-release granules that are intended to resist the gastric fluid and to release the active substance(s) in the intestine fluid. This is generally achieved by covering the granules with a gastro-resistant polymer (see Chapters 31 and 32). Again a suitable test should be carried out to demonstrate the appropriate release of the active substance(s).

Powders for other routes of administration

Powders for inhalation

The use of dry-powder systems for pulmonary drug delivery is now extensive. This dosage form has developed into one of the most effective methods of delivering active ingredients to the lung for the treatment of asthma and chronic obstructive pulmonary disease. Its popularity is reflected in the number of commercial preparations available in a number of sophisticated and increasingly precise delivery devices. Pulmonary delivery is discussed fully in Chapter 37.

Nasal powders

Nasal powders are medicated powders intended for inhalation into the nasal cavity by means of a