TABLET WEIGHT AND DENSITY VARIATION IN A ROTARY PRESS

P. Ridgway Watt and P.J. Rue, Beecham Pharmaceuticals Research Division, Brockham Park, Betchworth, Surrey, RH3 7AJ.

One of the characteristics of a good formulation for tablet manufacture is that it should produce tablets of uniform weight.

If a single die cavity is filled with the material concerned, there should be a repeatable relationship between the total volume of particles and the total volume of voids between them; and the voids themselves should occupy a minimum volume.

Variations in die filling have been studied by Ridgway and others (1970), and it is usually accepted that the ideal granulation would consist of spherical particles of uniform size, which would flow rapidly and evenly into the die with a predictable packing efficiency.

Ridgway's conclusions have been largely confirmed by such later studies as those of Tan et al (1979), who used a rotary press rather than a single die cavity.

In recent years, it has become possible to produce uniform spherical particles by the technique of spray-drying, and it has been of interest to us to evaluate a spray-dried product in our own instrumented Betapress (Ridgway Watt & Rue 1979).

Using the 16-station Betapress with only one die in position, we prepared a series of compressed tablets from spray-dried paracetamol and were interested to find a regular cyclic variation in the compression force. Subsequent weighing showed that the tablets produced by the single die showed a weight variation of nearly 3%, over a nine-tablet cycle.

The cause for this variation was traced to the filling mechanism. In the Betapress, the lower punch is drawn down by a cam while the die is filled. The punch is then raised by the weight adjusting cam so that the filling level can be set, and excess fill is removed by the rotating fingers of the feeder paddle. From time to time, one of these fingers passes immediately over the die just as the punch is lifting: the result is that the powder charge is unable to escape freely, and is lightly compressed. Since the paddle is geared to the main turret drive at a fixed ratio, there is a repeating pattern of tablet weight variation, which may be affected by the flow properties of the powder.

Experiments with a transparent model of the Betapress turret and die have shown that freely flowing powders move within the die as the turret rotates; centrifugal forces may eject part of the fill before the compression stage, and the tablet itself, when compressed, may exhibit appreciable density variations across its width.

During the subsequent relaxation, these variations in density may appear as distortions in the tablet surface. We have used holographic interferometry as a means of visualizing movement of the tablet surface after compression, and have shown that irregularities in die packing can be seen as corresponding irregularities in surface relaxation. Both the magnitude and distribution of these irregularities are strongly dependent on the flow properties of the material used.

It may be that the traditional concept of the ideal granulation needs re-appraisal.

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