The effect of granule shape on bulk density, shear properties and tablet weight variation

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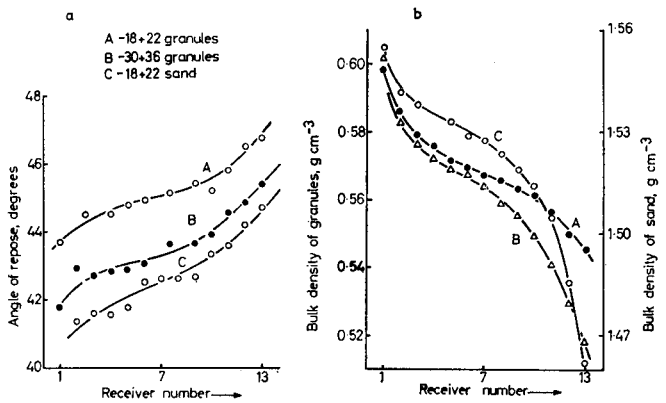
Two size fractions of a commercial lactose granulation (Thomas Kerfoot & Co. Ltd.) have been shape sorted on a vibratory table as described by Ridgway & Rupp (1969). They were 18–22 mesh (710–850 μm) and 30–36 mesh (425–500 μm) and when sorted, yielded 13 fractions varying from about 7·5 to 15·0 in Heywood shape factor. The poured bulk density and crater angle of repose were determined for three shape fractions in each size range. Figs 1a and b show the variation of these two parameters with particle shape: some earlier results for sand are included for comparison.



A new type of annular shear cell was developed which enabled the granules to be sheared under constant volume conditions. This means that the normal force exerted by the granules as they attempt to dilate under shear can be measured, as distinct from the more normal method of allowing the dilation to occur against a known constant applied load. The upper cup was held in an air bearing, and the lower cup was supported by a square array of steel strips carrying strain gauges, so that the vertical force exerted either by external loading or by the granules, could be measured.

Batches of about 150 tablets were made, from three shape fractions from each size range of granules, using an automatically-controlled instrumented Betapress rotary tabletting machine (Manesty Machines Ltd.) (Ridgway, Deer & others, 1971). All tablets were made at a machine speed of 700 tablets per minute, at which rate it proved possible to collect the tablets serially in a long glass tube of suitable diameter. The applied pressure for each tablet was determined from a chart record; the tablets were weighed individually, and their thicknesses measured. It is believed that this is the first time that a one-to-one correlation of such measurements has been made.

It was thus possible to analyse the variance in weight due to (a) the variation in punch lengths, eccentricity of the pressure rolls etc. in one revolution of the machine, (b) repeated compactions of the same pair of punches at one station in the machine and (c) the effect of granule size and shape. The intention was to put into a practical context the results obtained with shape-sorted sand particles on a hand-operated die simulator (Ridgway & Scotton, 1970).

REFERENCES

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