THE EFFECT OF MACHINE SPEED ON THE COMPACTION OF SOME DIRECTLY COMPRESSIBLE TABLET DILUENTS

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Transferring a tablet formulation from an eccentric to a rotary tablet press (or vice versa) sometimes causes a deterioration in tablet quality. It has been suggested that differences in the time over which the compressing force is applied to the particulate mass is responsible for this, and Armstrong et al (1983) have introduced the concept of power input as a compaction parameter in which time is a factor. This enables a quantitative study of the effects of speed of compaction to be made.

Microcrystalline cellulose (Avicel), lactose B.P., modified starch (Starch 1500), spray-dried lactose (Fast-Flo) and calcium phosphate dihydrate (Emcompress) were compressed without prior treatment between flat-faced 12.5mm lubricated punches. The machine was an Apex press, originally hand operated but subsequently equipped with a 0.25 H.P. motor driving through a Kopp variator gearbox, enabling a range of speeds of 20 to 158 tablets per minute to be achieved. The upper punch was fitted with strain gauges and the relative punch positions monitored by an LVDT, the outputs from the transducers being processed in a BBC Acorn microcomputer. Tablet strength was measured on a CT40 strength tester and tensile strength calculated.

All solids showed an increase in tablet strength as machine speed was decreased, but the relative increase varied considerably. Emcompress was least affected by speed changes, whereas Starex showed the largest relative increases in strength. The relative speed dependency of the solids is summarised (Table 1) by interpolating each compression force-tensile strength profile at 10 kN.

Strength-force curves for two size fractions of lactose, and that of unfractionated material, were determined at 2 speeds. For any one sample, the 2 curves were parallel, but the 3 samples had different slopes. This indicates that in the case of lactose at least, the effect of speed depends on the substance and not on its physical form.

A longer exposure to compression brings about greater consolidation from whence the tablet derives its strength. It is tempting to relate speed dependency to the consolidation mechanism of the solid. Fragmentation of Emcompress is rapidly achieved and prolonging exposure to the force has no further effect. Deformation is more of a time dependent process, and tablets made from substances which consolidate primarily by deformation benefit from increased exposure to force.

Table 1 Interpolated values of tensile strength (MPa) at 10 kN

Speed	Avicel	Fast-Flo	Starch 1500	Emcompress	Lactose		
tablets min^{-1}					53-63μm	105-125μm	unfract.
24	6.6	0.98	0.42	0.59	0.69	0.53	0.46
38	6.5	0.95	0.39	0.58	-	-	-
158	5.9	0.82	0.26	0.56	0.60	0.46	0.38

Armstrong, N.A., et al (1983) J. Pharm. Pharmacol. 35: 320-321