

## DIE WALL REACTION AND FRICTION DURING COMPACTION OF SOME DIRECT COMPRESSION BASE

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Avicel is a direct compression base which reduces ejection force in tablets containing it (Sixsmith 1975). Travers (1978) has suggested that this is due to radial stress relief by elastic recovery and not to a reduction in die wall friction.

To investigate this point, Avicel and other direct compression bases were compressed hydraulically in a 2.54 cm d. die set with chromed walls and punch faces. The die wall reaction  $F_R$  was obtained at various axial forces  $F_A$  by means of a Kistler load washer extending round the die base. This reaction was plotted as it developed v. punch displacement using a transducer and XY plotter. The force transmitted to the bottom punch is then  $F_A - F_R = F_S$ . Values of the apparent friction coefficient  $\mu_a$  between the compact and die wall were calculated from

$$\log_e F_A/F_S = 4\mu_a L/D$$

where L is the compact length and D is the diameter. However  $\mu_a$  has been reported to depend on many factors, notably the ratio of radial to axial stress  $\eta$  (Train, Carrington and Hersey 1962). Some results for lubricated and unlubricated compacts are given below.

	$F_A$ (kN)	$\mu_a$	$\mu_T$	$\mu_a^*$	Ejection Force (kN)	
					Lubric.	Unlubric.
Avicel	30	0.18	0.19	0.021	1.2	< 0.1
Paracetamol DC	40	0.20	0.20	0.026	3.9	0.22
Emdex	30	0.18	0.22	0.10	2.9	0.6
Sta-Rx 1500	30	0.23	0.21	0.025	1.7	< 0.1
Emcompress	25	0.33	0.24	0.032	3.7	< 0.1

Wt. of compacts 8g in each case - All values mean of five determinations except \*(three determinations) - Lubricated compacts contain 1% w/w mag. stearate.

The coefficient of 'no load' static friction  $\mu_T$  was obtained by measuring the force required to move the free compacts over a chromed surface using a tension gauge.

We conclude from these results that

1. Avicel is not 'self-lubricating' despite its low ejection force.
2. Mag. Stearate reduces  $\mu_a$  by about 90% except for Emdex where the effect is less. This is probably attributable to the low shear strength of this base (Travers 1978).
3. For all bases except Emcompress  $\mu_a \approx \mu_T$  suggesting that any increase in  $\mu_T$  due to loading is compensated by the fractional value of  $\eta$ . For Emcompress  $\mu_a$  is greater than the coefficient of 'no load' friction and the unlubricated compacts are difficult to eject.

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