WEIGHT VARIABILITY PREDICTION IN ANTIBIOTIC POWDER VIAL FILLING

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Vials have been filled with antibiotic powder in a computer-controlled vacuum-held volumetric filling machine. Each port on a rotating wheel is filled from a hopper by the application of a vacuum, and the resultant powder plug ejected into a vial by pressurised air. The intermittent motion of the filling wheel is controlled by a computer-driven stepping motor so that the angular velocity of the wheel and the dwell time for powder filling are independently controllable. These two parameters cannot be separately adjusted on conventional industrial filling machines. In addition to rotational speed and dwell time control, the machine used was fitted with port lining bushes that allowed a powder plug to be removed entire, and to be sectioned, so that variation of bulk density through its depth could be measured.

Several batches of fine grade cefuroxine sodium (median size 10-20 μm, compressibility* 40-50%) differing slightly in filling behaviour were filled into glass vials over a range of conditions, using different powder plug lengths, filling speeds, dwell times and hopper-agitation speed and applied suction levels. Fill weight increases with plug length, but in a non-linear fashion, (Fig 1) the non-linearity depending upon other conditions, notably the dwell time and the hopper-agitator speed. Fill-weight variability, assessed as coefficient of weight variation (CV) generally decreases with increasing dwell time, increasing agitator speed (Fig 2), applied suction, and plug length. The utility of the results and their correlation is that a required fill-weight and an acceptable CV can be chosen. The increased CV consequent upon an increased production rate can be reduced by increasing the hopper-agitation rate and the applied suction. Large fill-weights or modest fills of awkward powders are achieved by multiple-shot filling into each vial. Filling rates for double shot filling are usually substantially lower than for single shot. However, careful selection of filling conditions can result in a reduced coefficient of fill weight variation with small losses of production capacity. The method enables the optimisation of such filling conditions to be carried out.

Fig.1 Fill Weight versus Port Depth.

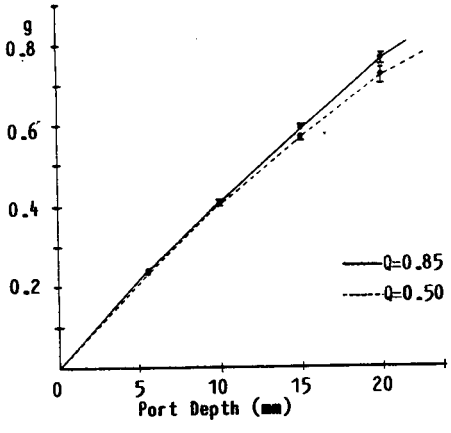
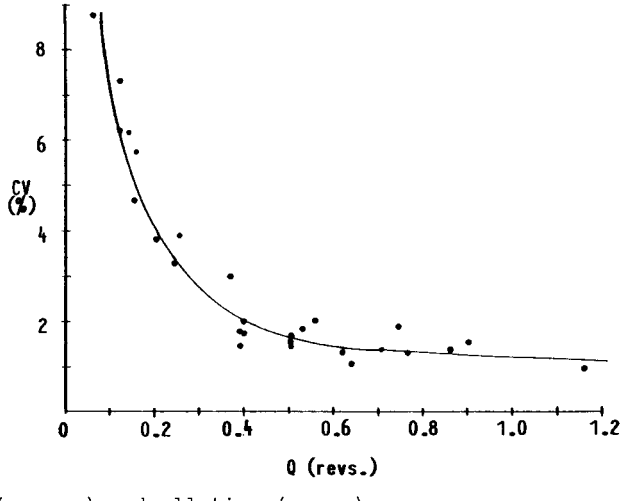


Fig.2 Effect of Dwell Time and Paddle Speed on CV.



Q ◻ paddle speed (r.p.s.) x dwell time (secs.)

*Compressibility = percentage reduction in volume on tapping a powder bed.