The influence of pulsation on the dissolution rate measurements in column type apparatus

A variety of apparatus and methods have been described for the measurement of dissolution rates *in vitro*. Control procedures require good reproducibility of all physical factors influencing the data obtained. To limit the number of external physical factors different authors (Rippie & Johnson, 1969; Baun & Walker, 1969; Marshall & Brook, 1969; Langenbucher, 1969) have introduced the column type, or flow trough, method. Most of the authors use oscillating or peristaltic methods, i.e. displacement pumps. Experiments we have made have indicated that displacement pumps influence the results.

From one batch of commercial aspirin tablets (500 mg acetylsalicylic acid per tablet) dissolution rates have been measured in a constant circulation column type apparatus. The principle components of the apparatus are shown in Fig. 1A, and consisted of a double-wall dissolution cell (internal cross-sectional area 10 cm^2), a double-wall mixing vessel and one of the pumps under test. The dissolution cell was partly filled with glass spheres, on top of which the dosage form was placed. The flow rate of the circulating test liquid was kept constant on 2 cm^3/s. All experiments were at 37° in 0·1N hydrochloric acid. The samples were pipetted, using a glasswool filter, diluted appropriately with 0·1N hydrochloric acid, and analysed spectrophotometrically at 278 nm for acetylsalicylic acid, checking for the presence of salicylic acid at 303 nm. The data obtained are given in Fig. 1B. All data are the average of 3 runs.

Dissolution curves 1 and 2 have been derived using peristaltic pumps with two rollers and silicone rubber tubing, the pumps being of different manufacture. A peristaltic pump with six rollers was used for dissolution run 3. For dissolution run 4

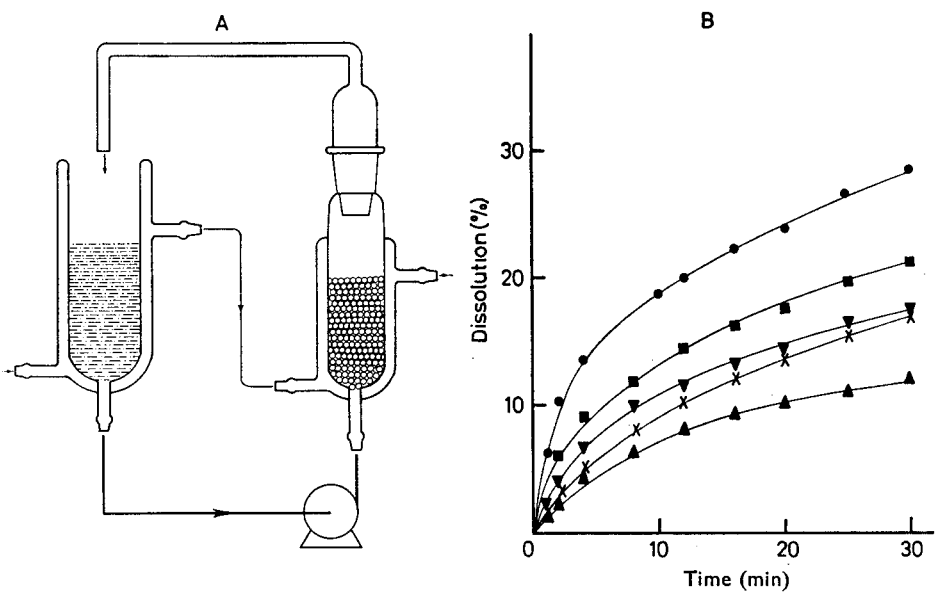

FIG. 1.A. Constant circulation dissolution apparatus. For description see text.

B. Rate of dissolution of one batch of aspirin tablets, containing 500 mg acetylsalicylic acid per tablet. Flow rate of circulation liquid (0·1N HCl) 2·0 cm^3/s. Different pumps: (1) peristaltic pump, two rollers, manufacture a ●; (2) peristaltic pump, two rollers, manufacture b ×; (3) peristaltic pumps, six rollers ▼; (4) plunger pump ■; (5) centrifugal pump ▲.

a plunger pump was used, while dissolution curve 5 was derived applying a centrifugal pump. The results show clearly the influence of the pump used on the dissolution rate, keeping all other variables constant. The serious finding is that peristaltic pumps of the same type but different manufacture give different results. This was attributed to liquid pulsation which caused different hydrodynamic conditions around the dosage form.

Centrifugal pumps, i.e. momentum pumps, show no pulsation. The hydrodynamics of a liquid stream from a momentum pump is therefore determined by the linear liquid velocity only. Consequently centrifugal pumps may be more suitable for reproducing hydrodynamic conditions around a dosage form.

Measurements on acetylsalicylic acid crystals show analogous dependances.

Summarizing, for dissolution tests in flow through methods, it is recommended that momentum pumps are used instead of displacement pumps to allow comparison of results found at different times in different laboratories.

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