80P

ACOUSTIC EMISSION DURING TABLET COMPRESSION

M.J. Waring*, M.H. Rubinstein, J.W. Forrester* & P. Cole+, School of Pharmacy, Liverpool Polytechnic, Liverpool L3 3AF, *E.R. Squibb & Sons Ltd., Moreton, Merseyside L46 1QW & + Dunegan UK Ltd., Cambridge CB4 5QE.

The measurement of Acoustic Emission (A.E.) is a popular technique in the disciplines of ceramics and metallurgy for the non-destructive testing of materials under stress. The technique has also been demonstrated by Rue et al (1979) for the detection of capping and by Rue and Barkworth (1980) for the monitoring of stress relaxation in sodium chloride tablets. In this study acoustic emission was used to monitor common tableting materials during the compression cycle. The experiments were conducted using a universal testing machine (Model 1121, Instron Ltd.) and a Portable Activity Monitor (P.A.M.)(Dunegan U.K. Ltd.). An acoustic wave guide was spring loaded against the side of a conventional tablet die; the acoustic signal being enhanced by the use of an acoustic coupling agent. A D140B transducer (Dunegan U.K. Ltd) was fitted to the wave guide and had a bandwidth of 40-320 KHZ. A number of measurement modes were used on the P.A.M., total counts, total events, count rate, event rate, average signal level and a direct monitor of the A.E. signal.

Four materials were examined; sodium chloride (Analar B.D.H. Ltd.), paracetamol (Analar B.D.H. Ltd.), lactose B.P. and Zeparox, a free flowing form of lactose (Whey Products Ltd.). Three distinct stages in the average signal level were evident for all materials during the compression cycle, when using a pre-lubricated die. Stage 1: Corresponds to low compression forces when rearrangement of particles is occurring. During this stage average signal level amplitudes were always relatively high for all the materials studied. Stage 2: Corresponds to the application of higher compression forces. During this phase the average signal level was always very low. Stage 3: A post compression acoustic peak was observed with all the materials investigated.

The total acoustic count values were different for all materials during compression and ejection. Total counts reduced as the particle size of sodium chloride and Zeparox reduced (Fig. 1). When measuring acoustic count rate it was also possible to characterise each material during the compression cycle. Lactose B.P. and Zeparox exhibited relatively few emissions at loads greater than 0.8KN, whereas sodium chloride continued to emit at high count rates and average signal level amplitudes up to 2KN, suggesting that brittle fracture may be occurring at low compression forces and that plastic deformation, characterised by lower amplitudes and counts, is the predominant mechanism above this level. The ratio of compression to ejection counts (Fig.2) indicates that although particle to die wall contact is contributing to the total emissions, the higher level of emissions during compression is the result of particle to particle interaction.

FIGURE 1
EFFECT OF PARTICLE SIZE ON TOTAL COUNTS

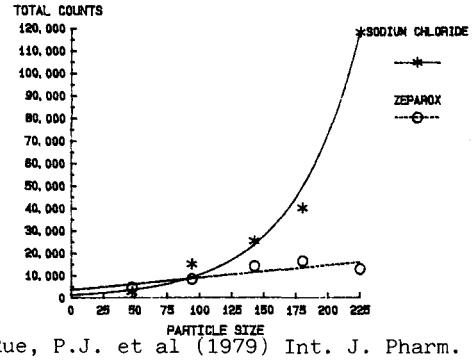
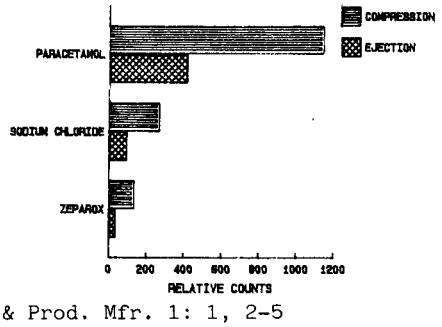


FIGURE 2
COMPARISON OF COMPRESSION COUNTS
WITH EJECTION COUNTS



Rue, P.J. et al (1979) Int. J. Pharm. Tech. & Prod. Mfr. 1: 1, 2-5
Rue, P.J., Barkworth, P.M.R. (1980) Ibid. 1:2,2-3