THE EFFECT OF GRANULE STRUCTURE ON THE MECHANICAL PROPERTIES OF TABLETS

P. Rue, H. Seager, I. Burt, J. Ryder, S. Murray and N. Beal, Beecham Pharmaceuticals, Great Burgh, Epsom, Surrey KT18 5XQ.

Seager et al (1978) proposed a solvent extraction method for determining the structure of granules produced by spray drying, roller compaction and conventional wet massing. They showed that the method of granulation had a marked effect on the distribution of the chosen binder (Protein S) and on some physical and in vitro biopharmaceutical properties of the tablets compressed from each of the granule types. This communication shows how the binder distribution affects the mechanical properties of the tablets.

Paracetamol granules and tablets were prepared as described by Seager et al (1978). The properties of the tablets measured were: tensile strength, friability, toughness and tablet deformation during diametral compression (Rees & Rue 1978).

For each granulation method, the binder concentration had little effect on the tensile strength-compaction force profiles of the tablets until incipient capping was revealed during strength testing. At this pressure, the behaviour of granules varied. For wet massed tablets, increasing the binder concentration from 1% to 7% continued to increase the capping pressure. Whereas for spray dried tablets the capping pressure was the same at both the 5% and 7% binder. However, for each binder concentration, at any given compaction pressure within the range studied the spray dried tablets were much stronger than wet massed. Satisfactory tablets could not be produced from the roller compacted granules.

Toughness measurements gave little additional information about the tablets, but the deformation of tablets during diametral compression showed that spray dried granules produced tablets which had a greater failure deformation than that of wet massed tablets suggesting that spray dried tablets were more plastic. During compression, spray dried granules deformed more plastically than the wet massed granules, due to the high surface concentration of binder. This greater plastic deformation led to greater binder-binder contact resulting in increased bonding and the production of tablets of greater strength.

The data indicate that after a certain minimum thickness, the depth of the binder shell around the spray dried granules has little effect on the granule plasticity or their ability to withstand elastic recovery during decompression and ejection. Conversely, with wet massed granules, increasing the binder concentration to the 7% level continues to reduce the effects of elastic recovery presumably by increasing the thickness of the binder film matrix and thus reducing the deformation of the paracetamol itself.

The results show that the binder distribution within a granule considerably alters the compression properties of a drug and is as important as the binder concentration itself. Most effective use of the binder is made when it is distributed as a shell around the granule surface. The binder inside granules has less effect on the bonding during compression but may reduce capping when used at higher levels.

Seager, H., Burt, I., et al 1978 J. Pharm Pharmac. 30 23P
Rees, J.E., and Rue, P.J., 1978 Drug Dev. and Ind. Pharm. 4 131