300d A Micro-Mechanistic Investigation of the Effects of Binder Surface Tension in Pharmaceutical Granulation

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The selection of an appropriate polymeric binder to be used to agglomerate drug with excipients is a critical issue for the development of high shear wet granulation processes for pharmaceutical tablet systems. The aim of the study reported here is to describe the effect of interfacial energies of the solids and liquid binder on the wetting behaviour. A new paradigm is being tested, namely, if the captured volume (volume captured by the solid after contact with the binder solution) is maximised on the drug particles, then this should maximise the number of binder contacts between the drug particles and other particles in the granule, ensuring the most even distribution of drug within the granules. This will also improve other granule properties.

Fine glass ballotini was used as model powder and different polymeric solutions were used as binder. The binder systems investigated had approximately the same viscosity (measured in a shear viscometer) but differed in their surface tension. Solutions with different amounts of two distinct polymers, hydroxypropyl methylcellulose (HPMC) and polyvinylpyrrolidone (PVP) were prepared. Two different wetting agents, Sodium Lauryl Sulphate and Sodium Docusate, were used in different proportions in order to vary the binder surface tension, while the viscosity remained constant.

A novel micro-force balance (MFB) was used to study the microscale interactions between the model particles and the different polymeric binder solutions. The ability of droplets of binder solution to spread over the ballottini, the value of the contact angle and the formation of liquid bridges have been investigated with this innovative technique which allows image analysis of the binder-particle interactions. The results are compared to predictions of granulation performance based on spreading coefficients determined from the surface energies of the dry binder and solids. It is postulated that both dry and wet spreading coefficients are required to fully predict granulation performance, both in regards to process and to the granule properties.