ChE 794 - PROFESSIONAL PRESENTATIONS FOR PH.D. STUDENTS
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Effect of Dry Particle Coating on Properties of Cohesive Powders under Low Consolidation

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Abstract

Dry coating is an innovative technique in which nano particles are mechanically coated onto the surface of larger (from a micron to few microns) host particles to impart useful properties to the final product, which are engineered particles. Dry coated engineered particles can have improved flow and handling properties, and hence are very useful for a number of industrial applications. In this paper, we present preparation, characterization and applications of such engineered particles to pharmaceutical applications.

Cornstarch particles, with a mean size of around 15 microns are coated with 20nm hydrophobic fumed silica nanoparticles by dry particle coating method to reduce the cohesiveness of the original powder. Acetaminophen and tolmetin sodium particles were also used as host particles. The weight percentage of additive is varied between 0.025% and 5%, which influences the cohesion of the coated powder. We examine the influence of the cohesion on packing density and other important properties.

Flowability of fine powders is strongly dependent on memory effects such as the effect of previous consolidation stresses on the packing density of the powder. In this work we present measurements of the particle packing density of fine cohesive powders as a function of the consolidation stress previously applied on the sample. Experiments are carried out using a novel device for measuring the tapped density as well as the Sevilla Powder Tester apparatus, which is based on the use of gas flow either to fluidize to erase memory of the powder or to compress the bed in order to subject it to a controllable consolidation stress. The particle volume fraction is derived from the height of the bed, which is measured by a high-accuracy sensor placed on top of the vessel. It is observed that powders with lower amounts of coated additive have larger cohesion and form larger agglomerate structures and hence show lower packing densities. As amount of coated additive increases, cohesion is reduced and smaller agglomerates are formed which pack better in both fluidized and non-fluidized states. The effect of low consolidation stresses on the packing density is also examined.

Lack of flowability is a continual problem in manufacturing processes of pharmaceuticals, for example. By altering the flow characteristics of the powder, these manufacturing processes can be improved and using one or both of these powder testing methods would help in further formulations by quantifying the improvement. Specific applications potentially include mixing and tableting and other manufacturing processes.