

PACKAGING POWDERS – A DOUBLE CHALLENGE

Processors of powders are faced with two interesting problems that can be solved with physical test instruments. The first is the potential jamming of the powder in vertical discharge from a hopper which feeds a metering augur or conveyor. The second is the package or container that receives the powder in a filling process, which is then sealed and transported for distribution to customers. Will the powder stay loose and free flowing or will it consolidate? Powdered beverage mixes for consumer use and processed cocoa are two good examples. The former is fed into flexible pouches or packets while the latter is fed into bags or sacks; all may have variable size.

Flow behavior of powders in gravity feed hoppers is not well understood scientifically by many in industry. One technique for coping with powder jams is to physically beat the hopper with enough frequency and force, usually a hammer or mallet, in order to dislodge the packed powder inside. The powder has become packed because it naturally tends to consolidate or settle due to its own self weight in the bin.

The established scientific method for predicting potential powder hang-ups (both stoppages and blockages) is to use a shear cell (see Figure 1) to test the powder beforehand. The shear cell contains the powder which is compressed and then sheared by the test instrument. (See Figure 2) This test method establishes how much friction there is between the powder particles in order to resist movement relative to each other. The resulting data gives a picture of powder strength at increasing consolidation stress (see Figure 3), which correlates with the fill levels for the powder within the bin.



Figure 1: Shear Cell, Inner Catch Tray and Outer Catch Tray



Figure 2: Brookfield Powder Flow Tester

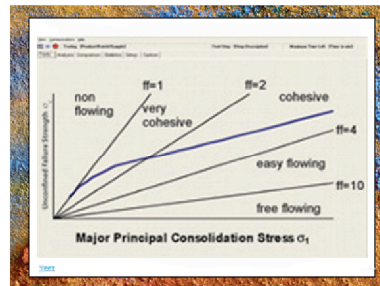


Figure 3: Flow Function Shows Powder Strength vs. Fill Level in the Bin

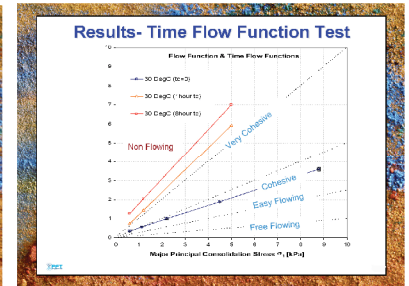


Figure 4: Time Consolidation Shifts the Flow Function Upward

Powder consolidation can continue, once packaged, for a variety of reasons. If the packages are flexible and stacked on top of one another, consolidation of the powder continues, just as it would in the bin before processing. The science of powder mechanics explains that powder particles will continue to reorient themselves to find the “least stressful” position, which means that air pockets and voids will eventually be filled during the consolidation process. An example of such a powder is shown in Figure 4 where the flow function shifted upward in a relatively short time period. The powder could potentially become as solid as a brick if it can develop sufficient internal strength, thereby preventing the powder particles from sliding against each other.

So the packaging issue is a potentially tricky one for several reasons. The first objective is to make sure the powder remains in a loose and unconsolidated state before packaging. The second is to avoid significant stacking of the packaged containers on top of each other in order to minimize continuing consolidation.

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