MIXING MECHANICS

Peter R. Holman

Preventing segregation during discharge

Like many bulk solids processors, you may have segregation problems when discharging products from a blender. Segregation can occur whether you're using a fixed-shell horizontal blender or a rotating-shell blender, such as a V-shell or double-cone blender, and is mostly likely when the blend has both large and fine particles. The problem generally doesn't occur if the blend isn't free-flowing or contains only particles less than 10 to 15 microns.

The key to eliminating segregation is to make the fine particles coat the large ones. In some cases this happens naturally, but sometimes you have to use special techniques to make it happen. In this column, we're going to explore some ways to encourage your fines to coat your large particles and eliminate segregation during discharge.

The fines in my blend agglomerate and then segregate during discharge. What can I do about this?

Fines tend to agglomerate, especially at 1 micron or less. If you use a fixed-shell horizontal blender, you may need a chopper or high-speed disperser bar to break up the agglomerates. Such a device is generally powered by a direct drive operating at over 1,800 rpm and at high horsepower. If you use a rotating-shell blender, use a high-speed beater bar equipped with pegs. The bar rotates at high speed, breaking up the agglomerates and fluidizing the powder as the shell's rotation causes it to flow by the bar. Breaking up the agglomerates encourages the fines to coat the large particles.

I've tried using a chopper or beater bar and I still can't get my fines to stick to my large particles. What can I do?

Try to dissolve your fines in water or another solvent. Use only a small amount so it can be evaporated off. If it won't all be evaporated, be sure to use a solvent that's compatible with your product.

Once the fines are dissolved, the solution can be sprayed into the blender. If you use a fixed-shell horizontal blender, you'll need multiple spray nozzles to atomize the droplets to coat the moving large particles. You can also use chopper blades to increase the larger particles' fluidization and add heat to help evaporate the solvent. If you use a rotating shell blender, you can spray the solution using a processing bar that's similar to a beater bar except that it's hollow and has canted disks with beater-bar-like "ears." The processing bar's rotation creates centrifugal force that pulls the solution into the bar. The disks spin at about 3,300 rpm and atomize the solution as it leaves the disks, spraying over the larger particles as they move through the blender. The canted disks help the solution cover a larger volume of large particles than if the disks were 90 degrees to the shaft. The ears on each disk act like beater bars to fluidize the powders, exposing greater particle surface area to promote coating of the larger particles.

An alternative to dissolving your fines and spraying the solution onto the larger particles is to add a solvent to your blend to make the larger particles slightly tacky. This will encourage the fines to stick to them. As with the spraying solution, use a small quantity of the solvent or use one that's compatible with your blend. The heat generated by mixing may evaporate the solvent. If not, you may need to use a heat-jacket on the blender to evaporate the solvent or insert a vacuum wand into the blender to remove it.

Some blenders, such as the twin-shaft paddle blender, the conical screw blender, and the drum blender, have integral components or accessories for adding liquids to a powder. The key factor for success is to have an atomized spray and a fast-moving material bed that constantly presents new particle surface area so the spray doesn't cause a wet spot. Remember, the idea is to end up with a free-flowing powder, not mud. **PBE**

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