



Semi-Bulk Systems, Inc.

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Mixing & Shear Comparison Between The Vacucam® Ejector Mixer (EJM) And Typical High Shear/High Energy Mixers



The Subject: Mixing & Shear Comparison Between The Vacuam® Ejector Mixer (EJM) And Typical High Shear/High Energy Mixers

The Difference

The major difference between the, frequently called, high shear, high energy type of mixer compared to the EJM is the method that is used to introduce the powder into the liquid. The resulting mixing dynamic is quite different and provides a much more efficient contact between the high surface area of the liquid and the high surface area of the powder which is pre-conditioned. The EJM provides a vacuum zone with an extremely high surface area of liquid which produces the most efficient contact between the powder and the liquid. The geometry of the mixing zone provides maximum wetting, hydration and mixing of powder and liquid.

The geometry and contact efficiency eliminates the forming of lumps or fish eye. The EJM produces the efficiency of mixing with “single pass” processes [for all gums, thickeners, starches, and functionalizing ingredients]. The single pass process delivers the most efficient mixes of functionalizing ingredients totally **without the use of shear**.

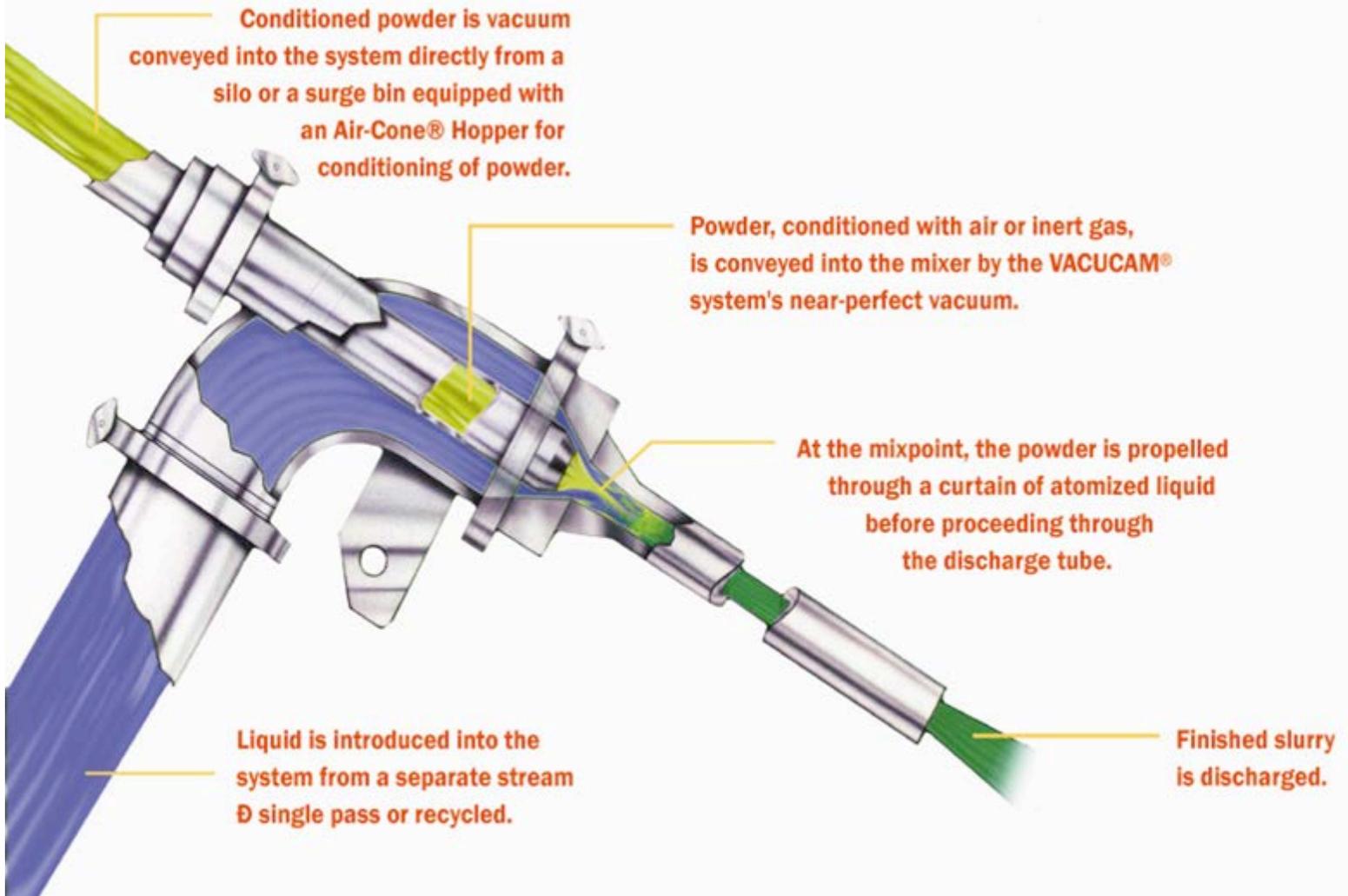
- *With single pass processes, since the finished mix delivers a finished and high quality slurry product, there is no requirement for high shear mixing, use of high energy pumps and costly maintenance for close tolerance mechanical equipment. There could be 80-90%+ energy savings from both electrical and heat energy savings.*

For the typical high shear, high energy, high maintenance mixing processes, the powder is conveyed below the liquid surface in an attempt to deliver the powder into the mixing zone of the mechanical mixer; However, this is rarely successful since the liquid will wet out the powder to produce powder lumps and fisheye. So the process creates its own challenge for providing a quality mix and will then require a high shear, high energy, and high mechanical wear to resolve the problem which was created in the inherently inefficient process.

- *If the powder simply requires an eventual dispersion, hydration, and mixing to achieve a quality mix, the process will eventually produce a satisfactory result at the sacrifice of time, capacity, energy, high maintenance and production cost efficiencies.*
- *However, if the powder is a typical functionalizing ingredient [i.e., gum, pectin, starch, polymers, etc.], the high shear process will consume high energy costs to destroy the lumps at a substantial longer process time. Since some ingredient will be caught in the strainer or discharged to sewer, the product yield for the process will be greatly reduced. Also, with high shear mixing, the mechanical energy will destroy the molecular structure of the functionalizing ingredient and will require additional amounts of costly ingredients to be added to the recipe to produce the desired finished product quality. This combination of reducing the process yield will consume 10-30% more functional ingredient addition and could result in a process loss greater than \$1MM/ year in typical high capacity processes.*

If the process requires a high solids level or does require some degree of shear to reduce agglomerate size of the inherent powders, then the EJM will be configured to operate in a recycle process mode – either Batch Recycle or Continuous Steady State.

- *Typical high shear, high energy, mechanical processes will achieve dispersion and shear, by moving the “metal” through the “liquid”. The process mix is achieved at a cost.*
- *When slurry or liquid dispersions are circulated through the orifice of the Mixer, efficient dispersion and shear is achieved by moving the “liquid” through the “metal”. Based on the design of the mixer orifice, pumping the liquid through the shear orifice generates a shear rate of approximately 20,000 seconds⁻¹ [inverse seconds]; which is approximately twice the shear rate of a high shear mixer.*



Vacucam® Ejector Mixer

Conditioned powder is conveyed into the mixer by a near-perfect vacuum, which is created when pressurized fluid is discharged as a high-velocity, hollow jet into which the powder is drawn.

The Vacucam® system achieves high-speed, instantaneous and complete wetting by bringing together conditioned powder and highly atomized liquid from two separate streams, incorporating particles of liquid with particles of powder. The reactive surface areas of both the powder and the liquid are maximized before intimate contact is actually made. The result is consistently uniform, superior wetting without the agglomeration or “clumping” usually associated with conventional mixing methods.