A Quadro Engineering White Paper

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Why Pay More For Product Smoothing, When There's Another Solution

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Industry Issue

Many industries work with products that are a blend of solids and liquids that can easily form lumps during processing. The source of lumps can often be in the nature of the product to begin with, or they can form as agglomerates when mixing powders into liquids. Regardless of the source, lumps and agglomerates are often undesirable in a final product and need to be smoothed out before packaging.

There are a couple of ways to approach product smoothing, but the Food & Beverage, Personal Care, and Household Product industries often struggle with a cost effective method to address the issue. The cost competitive nature of the products manufactured by these industries can end up driving capital equipment purchase decisions based on the extent of initial investment, rather than the best processing solution for the application. What then is a company to do if a product demands improved smoothing/deagglomeration performance, but falls short of justifying the expense associated with the next level in processing equipment?

Previous Options

Once lumps exist in a product they are typically difficult to smooth out and require filtering or some sort of high shear mixing process. Whether you're dealing with agglomerated powder lumps or chunky bits of soft fruits and vegetables, a high shear rotor-stator mixer can be a good solution to avoid product loss and the need for filtration.

High shear rotor-stator mixers can be broken down into two main categories as either in-tank or in-line solutions. In-tank solutions suffer from ineffective mixing and tank turnover, which results in an unequal distribution of shear energy. Without control over the distribution of shear energy it becomes very difficult to achieve consistent end-product and scalability in a process. A better approach is to use in-line rotor-stator mixers which transfer an equal amount of shear energy to all product passing through the machine, resulting in consistent end-product and predictable scalability. When in-line mixers are set up in an external recirculation loop for batch processing it becomes more difficult to control the distribution of shear energy, but it can be managed with good macro mixing, a positive displacement pump and a consistent number of batch turnovers.

In-line rotor-stator mixers can be further categorized when evaluated by their level of performance and capabilities. On the more economical end of the spectrum, devices termed "shear pumps" offer a combination of self-pumping and moderate shear mixing, while on the higher end, multi-stage rotor-stator mixers offer enhanced high shear performance but lack self-pumping capability. A large gap exists in the performance levels offered by either end of the spectrum and with it comes a significant difference in the cost of capital investment. So again, what is a company to do if their product smoothing requirement exceeds the limitations of a common shear pump but doesn't justify the large jump in performance offered by the next level of in-line process equipment?

Quadro Solution

Quadro Engineering has recently developed a new line of shear pumps to address the product smoothing issue in these industries. The Quadro® ShearFX extends enhanced high shear performance into self-pumping applications at a price comparable to conventional shear pumps. The evolution in this shear pump technology offers more process flexibility with a controllable balance between shear energy and pumping efficiency. Basically, with the option to quickly change between three styles of tooling (i.e. centrifugal pumping, standard shear, or enhanced shear) the equipment can be tailored to process at high pumping capacity or higher shear energy.

Standard ShearFX Tooling

Enhanced ShearFX Tooling

In a head-to-head experiment on a lumpy guar gum (1.3 wt%) slurry, the deagglomeration performance of a conventional shear pump (i.e. angular blade rotor and slotted screen tooling) was compared to the ShearFX technology. Multiple sieves with screen mesh sizes ranging from 3mm to 650µm were used to filter discharged product from each machine on a pass or fail basis. The conventional shear pump failed to delump agglomerates below 3mm, whereas the enhanced ShearFX tooling was able to remove all visible traces of lumps retained in the sieve above 650µm. In an extension to this study, it was also found that the deagglomeration performance of the ShearFX matched the capability of higher end rotor-stator mixers with a single stage of multi-zone tooling.

The ShearFX technology with the use of its enhanced shear tooling bridges the gap in performance that existed in the previous in-line process spectrum, making it possible to have high-end smoothing/deagglomeration performance without the high-end price tag.