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Maximising Mixing

Technical Article: Utilising Hanningfield's integrated systems to deliver mixing process improvements

Utilising Hanningfield's integrated systems to deliver mixing process improvements

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When you think about what blending and mixing operations entail, one realises there is a lot of moving parts and considerations. Many mixing processes are burdened with bottlenecks, pain, and pinch points. Rather than looking at individual unit processes that comprise the mixing process, taking an integrated process system approach results in maximum speed, safety, and efficiency while improving finished product quality.

Raw Materials

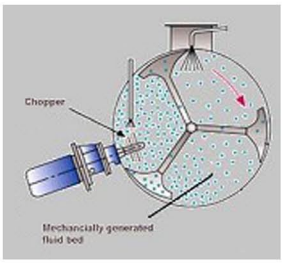
This often entails bulk solids, intermediates, liquid additions as well as minor ingredients. The bulk solids may need pre-conditioning. Pre-conditioning may involve de-lumping of the solid ingredients as well as sifting, size reduction and in some cases tramp and contaminant removal. In a perfect world, all the solid ingredients will be of the same particle size distribution. This is in addition to having a consistent bulk density and bulk solids that are free of agglomerations. This promotes maximum mixing efficiency reflected in shortest cycle time as well as mix quality and integrity.

Material Handling

Depending on the batch size, material handling might be the biggest challenge facing the designers and operators of a mixing process. After the raw ingredients are pre-conditioned, if required, they must be loaded into the mixer in a contained manner. The considerations involved with material handing are ergonomics, efficiency, safety, dust containment, speed, and vessel venting. Existing process infrastructure, particularly space constrains above and below the mixer or blender, may govern the optimal manner how a mixer is filled and discharged. Material handling also encompasses weighing, unloading, dispensing and in the case of liquids, the injection piece. Ideally, gravity process streams from filling to discharge are the most efficient. In many cases, even in grass root plants, the head space required for complete gravity integration does not exist or is too expensive to be considered. In this case, pneumatically loading or a combination of pneumatic and gravity loading might present a solution.

Finishing and Packing

Some mixed or blended products can be weighed and packed directly from the mixer discharge port. However, agglomerations can form in dispersive mixing operations especially when fats, oils and other liquids are added during the mix cycle. Dyes pigments and colorants with extremely small particles sizes may be introduced to surface coat a carrier material such as in cosmetics and some food mixes. Despite internal shear devices built into the mixer (e.g. choppers and intensifiers) un-dispersed pigments and fat laded agglomerations may still exist. This requires an external milling step to fully homogenize the mix. This is commonly known as "finishing".



Strategies to reduce agglomeration of particles and improve dispersion use two fluid air-liquid nozzles to spray coat fluidized particles. Injection of liquids directly into the chopper or intensifier also aids in dispersive mixing. Agglomerations can still form, however. This is due to the randomized presentation of the process material to the shearing device. Longer mix cycles and longer exposure of the agglomerated particles to the high shear device may also promote unmixing while still not fully achieving full dispersion. Moreover, long mix cycles hamper productivity and have an impact on the materials being mixed.

Integration of Unit Processes

Combining unit processes in gravity, pneumatic and hybrid mixing processes is the smart way to improve efficiency and improve product quality.

Direct Fill

In the right “direct fill” process flow diagram, bulk material is vacuum conveyed from an intermediate bulk container (IBC) through an in-line configured Hanningfield Kwik-Sift. The Kwik-Sift is used to de-lump and sift agglomerated particles back to the principal particle size without creating attrition of the principal particles. The creates a uniform bulk density and promotes the exchange of dissimilar materials in the mixer. At the same time, minor impurities are isolated. Here, pre-conditioning is integrated in the pneumatic transfer system.

The Hanningfield Kwik-Sift reduces soft agglomerates; typically, those that can be crushed with finger pressure. The Uni-Mill provides more aggressive action for harder agglomerations. A variety of quick change screens are available to comply with FSA requirements and HCCCP plans as well as the desired finished product characteristics. The Kwik-Sift and Uni-Mill generate low noise, low dust and are extremely efficient. Simplicity in design and construction allow for easy cleaning and fast product change over.

Material is loaded at ground level and is directly conveyed into the mix vessel that acts as a drop-out pot. Very little carry over is then conveyed to a Uni-Vac convey system typically operating in a continuous mode. The Uni-Filter separates the small amounts of fine carry over from the convey air. The consideration here is that the mix vessel must be designed to operate at the maximum dead head pressure of the vacuum blower or air mover. This is to avoid “oil canning” or collapse of the mixing vessel while under vacuum.

Indirect Fill

In the case that there is no or insufficient vessel vacuum rating, indirect filling may be a solution. One proviso is that there is sufficient head space above the mixer or blender for fitment of the Uni-Filter receiver. In this scheme, there is no carry over product loss . The conveyor typically operates in a fill and dump cycle mode. With the addition of a double flap valve assembly or a rotary air lock, continuous mode operation is possible. This mode achieves the fastest fill cycle time.

The Uni-Filter can be mounted on a swing arm for easily alternating positioning between process mode and cleaning/maintenance mode. The Uni-Filter is designed to be quickly cleaned, maintained, and deployed.

Gravity Systems Bin and Drum Blending

For smaller batch sizes, bin blending traditionally adopted by the pharmaceutical and nutrition industries has also found favour in the food, ceramic, and metal powder industries. Besides the principal advantage of being a contained process, bin blending allows for bin storage of raw and finished products and lends itself well to gravity based parallel processing. Mechanical transport via lift trucks may be desirable to transport products from one area of the plant to another.

Both the Uni-Mill and Kwik-Sift integrate with IBCs as well as drums providing dust containment and maintaining sanitary conditions. Blending, finishing, and pre-conditioning can be accomplished in one station.

Finishing

As explained, the final homogenization or sizing of mixed materials can easily be accomplished with the incorporation of a Hanningfield Kwik-Sift or Uni-Mill integrated with the mixer discharge port. One Kwik-Sift or Uni-Mill mounted on a portable rolling cart assembly can be positioned under multiple mixers and or dryers. Alternatively, the Kwik-Sift and Uni-Mill can be permanently integrated to the frame of the mixer or surrounding structural steel and decking. Swing arms, post mounts, linkage systems can be provided to facilitate integration. This is in addition to flexible transfer sleeves, BFM adapters and wrap around clamps etc.

The proper application of the Kwik-Sift and Uni-Mill can reduce lumps, aid to disperse colourants and pigments. Fat globules formed during the mix process can be fully dispersed thus improving quality and avoiding batch re-calls and customer rejections.

Before **Finished**

Summary

Improved Safety

Better handling of bulk solids and reduced manual filling of mixing vessels, thus avoiding injuries and downtime.

Lower Manufacturing Costs

Reduction in manufacturing costs due to increased speed of mix times, fill times and integrating pre-conditioning and finishing steps.

Integrated Process

Integrated process is better controlled and lends itself to data recording/process analysis with modern factory automation.

Product Quality

Reduction and possible elimination of recalled and customer rejects, alongside improved product function and quality by eliminating agglomerations.

Space Saving

Reduction of plant floor space utilisation.

Contact Us

Discuss your application with an expert.
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