POWDER BULK SOLIDS

How to Find the Right Mixer for Your Application

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Industrial mixing equipment is a major investment for any production facility, so the temptation is great to choose a processor with the fastest throughput, typically achieved by continuous mixing. However, the tradeoffs between continuous and batch mixing need to be carefully understood before making the choice. In fact, for most applications, it's possible to implement continuous process batch control, which combines the best of batch and continuous mixing.

This article reviews the different types of mixing, advantages and disadvantages of each, and gives specific considerations that every processor should consider when making the choice between continuous, batch, or continuous process batch control mixing.

Understanding Each Type of Mixing

First, it's important to understand the differences between each type of mixing.

Continuous mixing is a process by which materials are constantly flowing through controlled feeds into the mixer, being mixed for a short period of time (seconds or minutes), and then flowing through discharge. Continuous mixing provides high throughput and low energy use comparatively to batch mixing. Continuous mixers are mainly used for dry materials. Certain types of slurries and viscous materials can also be processed in continuous mixers if the mixer is customized to control flow.

Batch mixing, similarly, takes in materials from feeders or hoppers and mixes them for a longer period of time. At the end of the mixing process, the mix exits the machine, and then the machine is ready for either cleaning or for the next batch. Batch mixing gives high precision and control of the exact makeup of the mixture. Full control of what goes in gives full control of what comes out.

Continuous process batch control mixing is a batch process that improves the speed of batch mixers. In continuous process batch control, the hoppers are filled while the mix is in the mixer, and then as soon as the mixer is emptied, the next batch is immediately fed into the mixer. This process combines the precision of batch with some of the speed of continuous mixing. Manufacturers who want high-throughput and high accuracy should be considering this option. Continuous process ensures the equipment is at maximum capacity, while providing precision control through batch loading.

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Usually, it's quite straightforward to choose the right mixing process, once you understand the different consideration, described below. If there are any doubts, it's best to speak to a few different vendors with long-term experience in the industry. Because mixing equipment last decades, reputable vendors want to provide accurate information that creates a long-term relationship

between the vendor and the producer. For that reason, always seek advice from companies that have been in business at least as long as the lifetime of mixing equipment.

Main Considerations for Choosing Continuous Versus Batch

Throughput and Costs

Obviously, throughput and costs are major considerations when choosing batch or continuous processing. Continuous processes provide very high throughput, which has several implications. First, continuous mixers process large quantities of materials in a short time, and they require much less energy and floor space than batch mixers.

When determining the type of mixer to use, consider the following in regard to throughput and costs:

* Processing time: The time that it takes for material to flow from the feed inlet to the discharge outlet is known as rate per moment (RPM). The RPM for continuous mixers ranges from 30 seconds to 4 minutes. If longer mix times are required, continuous mixing won't suffice. Continuous mixers need to keep the materials moving quickly or else they produce an uneven product blend.

* Energy costs: Continuous mixers utilize much less energy per throughput/hour than batch mixers.

* Labor costs: Like energy costs, with continuous mixing, the labor costs and human intervention are significantly lower than with batch mixers.

* Footprint: Continuous mixers are much smaller in terms of the space they require on the production floor.

The immediate assumption is that faster is better, but that's not always true. The necessary throughput depends on where the bottleneck is for each application or production line, as discussed below in the section on upstream and downstream.

Precision, Complexity, and Control

When it comes to precision and control of mixes, continuous mixing tends to fall short. When the process pushes through a tremendous amount of material quickly, it's difficult to control the precise quantities of each element in the mix. One good rule of thumb is that if someone will be consuming or tasting the mix (including animal feed), you need higher precision than a continuous mixer can provide. For that reason, continuous mixing is used for industries such as chemical, petrochemical, and recycling, while other industries, like food, tend to lean toward batch processing or continuous processes batch control.

Precision, complexity and control factors include:

* Number of different ingredients to blend. Generally, continuous mixing tops out at two or three different items in the mix. If the formula requires three or more types of ingredients, batch mixing is the way to go. Mixing for a longer period is simply necessary as more ingredients are added to the mix.

* Precision and control required. As mentioned above, if anyone is going to be tasting the mix, precision is required. Spices, nutritional supplements, and pharmaceuticals are examples of where the taste, composition, and smell simply must be precise. With continuous feeds, it's not always possible to ensure consistent flow because of the mechanical nature of the feeders and silos. While weight-based and volumetric feeds can make a huge difference in the accuracy of feeders, it's often not worth risking the material loss, so batch mixing is optimal.

Examples of common uses of batch mixing include drywall powders, cake mixes, spice mixes, coffee, and pet foods. Where low precision is required, for example, with two ingredients, where a variance of 5% is acceptable, continuous mixing is appropriate. An example of where continuous mixing can be used is in colored mulch. Mixing pigment with wood mulch doesn't have to be consistent, because, in any case, the absorption of the pigment is nicer when it's varied, and the pigment tends to absorb based on the hardness of the wood. Longer mixing times wouldn't have much effect on the consistency of those types of materials. Bird seed and grass seed are other instances where the precision isn't as important.

Upstream and Downstream: Mixing as Part of a Process

Mixing is just one part of the process for any material. Another factor in decision-making is understanding what happens before and after the mixing. In fact, any vendor should be asking about the input and output of the mixer as one of their first questions when considering the right mixer for any application.

* Inlets: Consider where the materials will be coming from, and whether the different sources for the feeders can consistently provide the right mix. In some processes, there may be differences in how the ingredients are acquired, so continuous mixing may be impractical in these cases. If, for any reason, the inflow may be inconsistent, batch mixing will always be able to provide quality output.

* Outlets: When the mix is being packaged, the size of the packaging is a consideration. When materials are packaged in small portions, the consistency of the material is of major importance. The spice mix isn’t right when there are clumps of one ingredient in one bag of spices and a different clump in the next bag. When mixes are going into larger drums, less precision can potentially be tolerable. Similarly, if the material is being processed downstream, depending on the type of processing, it may be more important to have fast flow (continuous) or more important to have precision mixes (batch).

In short, make note of how the inflow and outflow of material will affect the entire processing line before choosing the industrial mixing technology that fits.

Thermal Processing

Batch processing allows heating or cooling of mixes from 0-600°F. Continuous mixing can occur at specific temperatures, with a very small variance (typically 5°) in temperature. Furthermore, for most applications, heating of just a minute or two isn't enough to ensure the thermal processing needed. When it's important to mix at a specific temperature, batch mixers are more appropriate.

Coating

Despite the limitations of continuous processing for coating of materials, often continuous processing is adequate for coating of materials with few constraints. Batch mixing will give a more consistent and thorough mix and be able to handle any fluctuations in the inputs.

Sanitary Production

Periodic cleaning is important in some industries, either due to the types of materials, like dairy products, or due to regulatory requirements. Working with fresh foods or pharmaceuticals can require pristine cleaning either on a regular basis or when using a mixer for different kinds of mixes. For industries where cleaning the machinery is important, batch processors are generally the most appropriate option.

Agitators and Customizations

Batch mixing has great flexibility when it comes to the types of agitators available, meaning that batch mixers can handle mixes with different viscosities and attributes. Paddle, ribbon, and hybrid agitators can be installed in batch mixers. For continuous mixers, only paddle mixers can be installed.

Testing

Every application is different, so in addition to considering these different approaches, it's also useful to work together with the vendor and run a test before making a final decision. Most vendors will have facilities that allow customers to run actual tests for the applications, so it's possible to see the real results rather than make assumptions. Of course, it's important to consider that it's difficult to gauge the long-term issues, particularly with continuous mixing, because of the variability of the hoppers and feeders. Testing the mixer isn't an indicator of how the feeders and hoppers will perform

over time, so test results from batch tests will be more precise than long-term results from continuous mixing.

Conclusion

Continuous and batch processing both have their uses in manufacturing. It’s important not to confuse continuous processing with continuous process batch control mixing, which uses a batch processor for a continuous process. While continuous processing is more economical and provides faster throughput, it’s useful only for limited applications involving dry materials and where precision control of the formula is not essential. Yet, manufacturers achieve very high throughput with large-capacity batch mixers, and by using efficient loading methods through hoppers and feeders that can be loaded in a continuous manner. Every mix is different, so researching the full range of options can make huge differences in quality and cost over time.

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