

Advice for sampling powder blends

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In this article, an experienced mixing consultant explains how understanding *why* you need to take samples of your powder blend can help you determine *how* to take samples.

In powder blending, taking samples to determine when your powders are adequately blended is a vital step in the process. But if you're like most powder processors, you've probably wondered about your sampling method's effectiveness: *How can I be sure that I'm getting a truly representative sample of the blend? How do I know I'm using the right sampling device for my application? And how do I decide at what point to sample the blend — during blending or as the mixture leaves the blender?*

As important as these questions are, your initial questions about sampling should be more about *why* and *what* than *how*. Begin with these questions: *Why do I need to take a sample? What information do I need?*

If you take samples from your blender to decide whether the batch has reached the desired mixture uniformity, you must take the samples at specified times during the process, called *intermediate* sampling. But if you take samples of the blend to maintain records of the final product batches, then you need to take samples after blending is finished and as near your packaging operation as practical.

Intermediate sampling during blending

How to take intermediate samples (that is, samples at points throughout the blending cycle) to determine mixture uniformity depends on your blender type and even on

your powders. For example, many blenders and many powders blend quickly, sometimes in less than 1 or 2 minutes, and often in less than 50 revolutions of the blender or its agitator. To collect a series of samples during blending so you can observe mixture uniformity changes, you need to quickly start and stop the blender (and lock it out for safety), sometimes before it can reach normal operating speed. But the blender's rapid blending speed can be a real challenge to your ability to analyze a blending trend or endpoint from the samples: Small quantities of an important ingredient in the samples (such as an active ingredient in a pharmaceutical) or small differences between samples may not be measurable by the analytical method you're using. So before you take samples during the blending process, know what you're measuring and how well you can analyze it to make sure that any mixing changes between the samples will be observable. [**Editor's note:** For more information on analyzing mixture samples, see the later section "For further reading."]

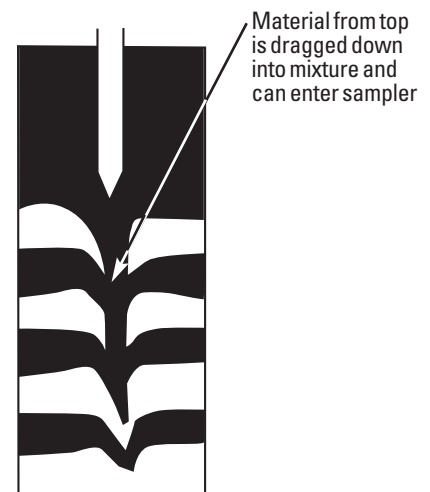
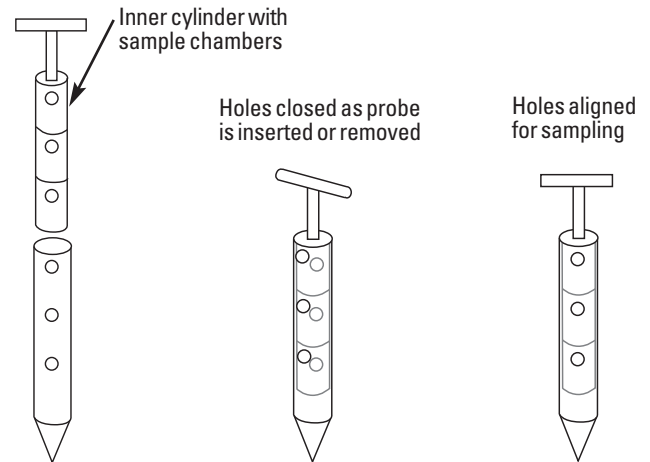
Because in many cases the material in the blender quickly reaches mixture uniformity, it may be more practical to sample for *exceptions* to uniformity. In any blender, poorer mixing conditions exist in some locations, such as at the blender's sides or ends, at the center of rotation for a tumbling blender or an agitating blender, or near the discharge. Intermediate sampling in these locations will better show any mixture nonuniformity by showing whether a minor ingredient is not present or present in excess. A well-blended batch should be uniform at these poorly mixed locations within the batch's product-quality limits.

Sampling devices. Whether you need to take intermediate samples to test for mixture uniformity or exceptions to uniformity, aim for simplicity. Various manual devices are commonly used to take samples from both batch and continuous mixers after they're safely shut down:

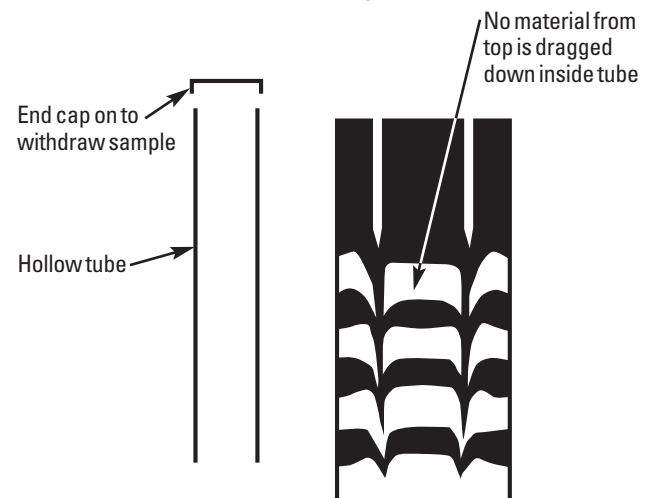
Figure 1

Powder blend samplers

a. Thief sampler



b. Core sampler



- A cup or scoop is an effective device for removing a sample, especially if you carefully remove the surface layer of material in the blender before using the device. In a blender location with less-well-mixed material, the surface layer can contain more large particles, so removing this layer can ensure that you obtain an undisturbed sample.
- Another common device is a thief sampler, as shown in Figure 1a. The thief sampler has an inner cylinder with sample chambers, each with a hole in the cylinder wall, and an outer cylinder, also with holes and pointed tip. Before the sampler is inserted into the bulk, pointed tip first, the inner cylinder is twisted so that its holes don't align with the outer cylinder's holes; when the sampler reaches the proper location in the bulk, the inner cylinder is twisted again so that the inner and outer cylinder holes align, which allows the powder to enter the sample chambers. The inner cylinder is twisted once more to close the holes before the sampler is removed from the bulk, and the samples are removed from the chambers. A problem with the thief sampler is that it often drags material from the surface down into the bulk (Figure 1a), thus collecting a distorted sample with a composition different than that at the mixture's center.
- A core sampler, as shown in Figure 1b, can be a more effective device. This sampler consists of a hollow tube and an end cap. The hollow tube is first inserted without the end cap into the bulk; then the end cap is placed on the tube, creating a vacuum that holds the material in the tube as the sampler is withdrawn. Because the sampler doesn't push material from the surface down into the bulk that's collected inside the tube, the core sampler doesn't create a distorted sample.

Sample quantity. No matter what device you use to take intermediate samples during blending, make sure that the total amount of material removed for sampling is less than 10 to 15 percent of the total batch to avoid changing the remaining blending process.

Sampling after blending is done

For maintaining records of the blend quality of the final product batch after blending is complete, you should take at least three samples during the mixture's discharge from the blender, as close to your packaging operation as practical. Take the first sample as discharge begins, the second about halfway through, and the third as discharge ends. Depending on the discharged material's flowrate and accessibility, any of the sampling devices previously discussed can be suitable for sampling the discharge, as long as it keeps the operator safe.

If your final product will be filled into small packages, such as a powdered drink mix packet, the sample should be equal in size to one entire packet. For a very small final product, such as a pharmaceutical tablet or vitamin, the sample size should equal one tablet. With larger packages, such as bags, bulk bags, and drums, take samples from a convenient point

just before or after the material enters the final package; the samples should be large enough to be analyzed properly but small enough to avoid affecting the package weight.

Sampling's cost

Another consideration for any sampling method is its cost — in time or money. The cost of analyzing the samples is often the most significant component of the sampling cost. Thus, a cost-saving strategy can be to take many blend samples and retain them for your records but analyze only a few for each batch. For example, it may be fast and economical to take several small samples from a batch, or from one location in a batch blender, or during packaging. As long as you conduct an initial analysis on one entire set of samples in which you analyze all the samples and find that all the samples are similar and of acceptable quality, you may be able to obtain the batch quality information you need in the future by analyzing just one sample from a batch.

Point of use: The final blend quality measure

Whatever your reasons for sampling your powder blend, remember that the end-use customer is the ultimate judge of the blend's effectiveness. The best blend discharged from the blender is only as good as the blend the customer actually receives, and we all know that good blending results are often lost during shipping and storage. So be sure that your quality control efforts include testing samples of the packaged product shipped to your customer. Also test effects of long shelf life on your packaged products, which you can do by analyzing samples of packaged product you've retained for your records. **PBE**

For further reading

Find more information on mixture sampling and analysis in articles listed under "Mixing and blending" in *Powder and Bulk Engineering's* comprehensive article index (in the December 2010 issue and at *PBE's* Web site, www.powderbulk.com) and in books available on the Web site at the *PBE* Bookstore. You can also purchase copies of past *PBE* articles at www.powderbulk.com.

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Learn more about sampling powder mixtures

Blending and sampling powders will be a conference topic at *PBE's* 2011 Northeast Conference & Exhibition in Somerset, N.J., in May. For more information, visit www.powershow2011.com.