SUPPLIERS' TIPS

How can drying impact the flow properties of my hygroscopic material?

Drying can impact any material's flow properties, hygroscopic or not, so we'll look at the effect of drying on a generic material, then incorporate hygroscopic considerations into the answer. For starters we have to make some assumptions. Let's assume we're looking at drying water from a wet powder, resulting in a dry(er) powder. We'll also assume that we're removing the moisture by applying heat to the material at atmospheric pressure.

When moisture is removed from a wet powder, regardless of hygroscopicity, generally the powder becomes less cohesive and more free-flowing. The material's angle of repose will typically decrease, and, depending on the initial wetness and amount of moisture removed, the dried material may become dustier than it was before the drying process. Ultrafine powders may still be cohesive after being dried, depending upon initial and final moisture levels and other properties. If the material is granular or contains larger-sized particles and only minimal drying is performed, a change in flow properties may not be detectable.

A *hygroscopic material* is one that absorbs moisture from its surrounding atmosphere. If the atmosphere is humid and the material has high hygroscopicity, the material can sometimes re-absorb the moisture removed during the drying process. Therefore, it's essential to evacuate the moisture from the surrounding air after drying a hygroscopic material. Storing or packaging the material in the absence of humidity can also abate moisture re-absorption issues.

If you know the desired flow properties of your material before drying, you'll want to consider certain types of drying processes over others. Knowing these considerations will help you achieve both the final material moisture and the desired flow characteristics required for your process. Thoroughly review and discuss the final desired material characteristics for your application with the dryer manufacturer. Choosing a dryer manufacturer that provides many different dryer types and various material flow manipulation processes can be very helpful, especially when your application requires specific material flow properties.

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The answer to this question is material dependent. Take, for example, table salt, which the Morton Salt Co. produces in a cake-free form and has aptly promoted with the slogan "when it rains it pours." A key to making salt "cake free" is the drying step. If salt is heated too quickly or to too high a temperature, the material's particles will rehydrate and cake together when they cool. A multistage vibrating fluid-bed dryer will be able to heat the material gradually and then cool it as quickly as possible, minimizing the heat history on the crystals and reducing the material's tendency to clump.

Another example, yeast, is created by agglomerating particles using a single-stage spray dryer, which is commonly used to recirculate fines over a multinozzle atomizer, producing particle clusters (agglomerates) that are less dusty, less hygroscopic, and more free-flowing than the fines. These larger wet particles can then be further dried and cooled using a two- or three-stage fluid-bed dryer process that introduces dehumidified air over extended retention times to ensure optimal flow properties.

In some food applications, you may want to maximize the retention of oils in flavors, which can be hygroscopic and heat sensitive. In these applications, spray dryers are often used to produce agglomerates. Since this dryer type has a short retention time (measured in seconds), it can reduce the oil content of the flavors. To maintain as much oil as possible after the initial drying step, a two-stage vibrating fluid-bed dryer with a long retention time (measured in minutes) can be used after the spray dryer to dry and cool the material at lower temperatures, maximizing flavor retention.

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