Consider the Advantages of Mixing Under Vacuum

Many of the advantages of mixing, blending and drying under vacuum have been recognized for years. But until recently, vacuum has also been widely misunderstood. Many processors have considered vacuum essential – and cost-effective – only for the most demanding applications. Our experience in the field and in the Ross Test & Development Center has proven that the opposite is true. Vacuum can improve the performance of almost *any* mixing, blending or drying system.

The secret is to understand all of the functions that vacuum can perform during the mixing cycle, and to find the best *technique* for applying vacuum in your application. With the right combination of equipment and technique, vacuum can make your process line more productive and your plant environment safer. Vacuum can usually improve the quality of your end products as well.

Process goals.

Deaeration – The superior visual appeal of an air-free product is often a powerful competitive advantage. Deaeration can also reduce the risk of product failures. In many cases, voids can lead to fractures when an end-product such as syntactic foam or an epoxy-based composite is subjected to stress. Vacuum mixing eliminates the need for separate units dedicated to mixing and downstream deaeration.

Deoxidation – The removal of oxygen enables us to prevent the degradation of sensitive ingredients. It also prevents unwanted chemical reactions during the mix cycle and minimizes microbial growth.

Vacuum drying – Since gentle heat is sufficient to drive off the moisture and solvent, *vacuum drying* is an excellent method for drying heat-sensitive materials without fear of thermal degradation. With vacuum we can quickly take the batch material through a series of changes in physical state – from slurry to a paste, and from a paste to a granulation or dry powder.

Solvent recovery – Solvents drawn off with vacuum are easily condensed and captured. This prevents them from contaminating the atmosphere (both inside and outside the plant). The processor can then re-use the solvents or dispose of them to meet environmental requirements.

Solid/liquid injection – Under vacuum, we can inject liquids and lightweight powders into a batch through a sub-surface port in the vessel. This accelerates the mix cycle, especially by wetting out powders instantly.

Densification – A batch that has been agitated and deaerated under vacuum winds up denser than it was initially. This often enables us to mix more efficiently and to ship the product more economically. With densification, the physical properties of the end-product are often improved as well.

"Vacuum stripping" – a useful tool to lower the temperature of your batch material by evaporation. This is especially helpful when the batch material becomes so thick that it is not in continuous contact with the vessel wall – and no longer transferring heat through the vessel wall to the cooling fluid.

Finding the right vacuum mixing system – a three-step process.

1. Define all your process parameters in detail. Make sure your equipment manufacturer understands them thoroughly.
2. Next, based on your equipment manufacturer's experience in similar applications, zero in on the equipment that will probably mix your product most efficiently – with the right combination of agitation, shear, power, heat transfer, and so on.

Finally, start testing. Be sure to test a variety of equipment and techniques in the manufacturer's laboratory, using your ingredients. (Remember, your vacuum mixing *technique* is just as important as the vacuum mixing equipment you choose to install. Often a subtle change in the way you *apply* vacuum will result in a huge improvement in production.) Quantitative test results provide the best assurance that you have optimized your vacuum mixing system – before you buy it!

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