The Importance of Mixer Testing and Selection

If you haven't tested a variety of mixers during the last few years, forget all the rules you used to rely on to distinguish one mixer from another. According to the old rulebook, mixers fell into neat categories according to their capabilities and the requirements of your application. Once you identified the viscosity of your materials, for example, the shear required and the target particle or droplet size, you could quickly narrow your equipment choices to one or two likely candidates. Well, those days are over. During the recent past, profound advances in design and engineering have made mixers in most categories ("categories" such as rotor/stator High Shear Mixers, Double Planetary Mixers, and Multi-shaft Mixer hybrids) far more versatile than they were before.

- New agitator designs have emerged.
- New technology has allowed us to combine dissimilar agitators more effectively for better control of flow, heat transfer and shear.
- New auxiliary devices have evolved, too, that have revolutionized such mixing functions as powder induction, wetting out, and dispersion.

The result of this burst of innovation is that the capabilities of these familiar mixers now *overlap* far more than ever before. Today we often encounter applications for which two, three or even four different types of mixers can conceivably provide an optimal tool to achieve your process goals.

What will this mean for you the next time you need to specify a mixer? Terrific gains in production, end-product quality and cost-efficiency may be possible – but only if you play by the new rules of mixer specification!

Rule #1: Make no presumptions.

If you set out to replace one of your present mixers with something similar, you'll find that newer models are much more productive. Mixing the same product you've made for years, a new Double Planetary Mixer, for example, can outperform a 10-year-old design by a wide margin. That's not very surprising. It's also not very productive. If you simply ask, "What's new in Double Planetary Design," you won't get the answer you really need – just a predictable, conservative boost in efficiency. Instead, ask: "What's new in change-can and fixed-tank mixing?" The answer will indeed surprise you, because there is now a spectrum of mixers to choose from for "high viscosity mixing," and they all offer unique advantages that you'll need to weigh against your process goals. By switching from the Double Planetary to a completely different type of mixer, you just might collect a huge gain in production and an equally large savings in capital equipment costs and operating expenses.

A case in point: mixing viscous gels.

Many applications these days involve the mixing of viscous gels and pastes, including such ingredients as epoxy resins and silicone-based polymers. Viscosities typically range upward to several million cps (centipoise), and this could easily be handled by an economical Dual Shaft Mixer, a Triple Shaft Mixer, a Double Planetary or a PowerMix, which is a hybrid that combines a high speed disperser and a planetary blade orbiting the mix vessel on a common axis.

Which would you choose?

The conservative choice is the Double Planetary. It doesn't threaten the shear-sensitive polymers with excessive shear, and it certainly offers enough power.

Occasionally, manufacturers use the Double Planetary for the initial phase, then finish the dispersion in a high shear device, such as a high speed disperser or Three-Roll Mill. But in many cases the PowerMix hybrid is a better choice, because you can control shear, maintain levels that are within safe limits – and carry out both mixing steps in a single mixer. The additional high shear mixing step is eliminated. The PowerMix can also wet out powders much faster than the Double Planetary. This can drastically reduce batch time, producing the equivalent of an increase in capacity – with less equipment! On the other hand, if large batch capacity is a priority, you ought to withhold judgment until you've also tested a triple shaft mixer like the Ross VersaMix. With extremely rugged engineering, this mixer can handle surprisingly high levels of viscosity, and fixed tank models offer capacities up to 4,000 gallons – far beyond the practical working capacity of a change can mixer. In extremely large sizes, change can designs such as the Double Planetary and the PowerMix become prohibitively expensive. The fixed-tank VersaMix is far more economical.

Rule #2: Test!

For most applications today, the only way to know for sure what kind of mixer will work best in your application is to test several designs in a controlled setting and evaluate the results quantitatively.

1. **Consult a mixer manufacturer with a well-equipped testing laboratory.**

   Make sure there are test units on hand to evaluate a variety of designs thoroughly. If you use vacuum on your process line, for example, include it in your test.

2. **Use your own ingredients.**
   Control as many variables as you can.

3. **Evaluate your results quantitatively.**
   Instead of shipping samples back to your plant for analysis, insist on using lab equipment on hand such as a particle size analyzer. Don't leave anything to intuition! And don't bother testing in a "lab" that isn't equipped for on-site analysis that will enable you fine-tune your mixing process on the fly. Without analytical test equipment, you're testing in the dark.

3. **Steer clear of manufacturers who claim to know what the answer will be before any tests have been run.**
   When an experienced mixing engineer goes into the lab, he may have an idea which type of mixer will be the winner. But no one knows for sure without testing – and you've got too much riding on the choice to rely on someone's hunch!

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