TECHNOLOGY BRIEF:

Consider upgrading your emulsification and homogenization processes to an ultra-high shear mixer to obtain finer droplet sizes and handle higher viscosity emulsions.

Improve pharmaceutical emulsification and homogenization with an ultra-high shear mixer.

High shear emulsification

Throughout the food, cosmetics and pharmaceutical industries, rotor/stator mixers are commonly used for the preparation of emulsions – from flavorings and colorants to creams, ointments and gels. Available in batch or inline configurations, rotor/stator devices, also called high shear mixers, are typically comprised of a four-blade rotor that turns at high speeds within a stationary stator. As the blades rotate, materials are continuously drawn into one end of the mixing head and expelled at high velocity through the openings of the stator. The resulting hydraulic shear promotes fast mixing, disintegrates solid agglomerates and reduces the size of droplets in emulsions.

The main drawback of rotor/stator mixers is insufficient product turnover at elevated viscosities. As the batch material approaches 20,000cP, a conventional rotor/stator system may start to exhibit poor product flow within the vessel, often resulting in localized heating of materials near the high shear zone. In addition, the mixing intensity generated by this type of device is sometimes not adequate for producing extremely fine droplet size distributions for certain emulsions. Depending on the formulation, some manufacturers are forced to move their emulsification process to expensive and low-throughput high pressure homogenizers.

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Delta rotor/stator technology

To address the abovementioned limitations, Ross developed the PreMax, a top-entering batch mixer with Delta ultra-high shear rotor/stator technology (US Patent No. 6,000,840).

The Delta rotor is specially contoured for high pumping capacity and shear intensity. Product is drawn from above and below the rotor and expelled radially through the stator slots at high velocity. This generates upper and lower vortices allowing for extremely efficient powder additions and rapid turnover rates. Very fine droplet sizes are achieved while solids are quickly wetted out instead of floating on the liquid surface. The PreMax is typically used as a stand-alone unit and does not require supplemental agitation for products up to 50,000 cP. For higher viscosity products, it can be used in combination with an anchor agitator in a multi-shaft mixer arrangement.

If the equilibrium droplet size achieved in your conventional rotor/stator is larger than preferred and high pressure homogenization is not desirable for your process, consider switching to a higher energy rotor/stator mixer. In addition to the PreMax, Ross also offers inline ultra-high shear mixers for use in continuous or recirculation mode. Testing is available to confirm if your specific application can be finished in a Ross ultra-high shear mixer.

Sample Application: Gel Emulsions

In side-by-side tests, the PreMax has been shown to produce low-viscosity and high-viscosity emulsions up to six times faster than a conventional rotor/stator mixer. The graph below shows average droplet sizes of a pharmaceutical-grade cosmetic gel emulsion prepared on a high shear rotor/stator mixer and on the PreMax ultra-high shear mixer.