

RECOMMENDED MIXING EQUIPMENT FOR Sunscreen and Sun Tan Lotions

APPLICATION SUMMARY:

Mixing is a critical step in the production of sunscreen, largely because proper dispersion of the active ingredients and additives directly impacts the end product's efficacy and stability.

This bulletin describes several high shear mixing technologies utilized in the manufacture of sunscreen and sun tan lotions. Mixer selection is based on a number of factors, primarily viscosity profile and shear input.



Ross High Shear Mixers and Multi-Shaft Mixers

Pharmaceutical manufacturers rely on a range of high speed mixers to accomplish dispersion and emulsification. In the processing of sunscreen, for instance, High Shear Mixers are utilized for dispersing active ingredients like titanium dioxide and zinc oxide, hydrating gums and thickeners, reducing the median droplet size of the base emulsion and dissolving additives. The basic single-stage High Shear Mixer features a four-blade rotor turning at tip speeds around 3,000-4,000 ft/min within a close tolerance fixed stator. It imparts mechanical and hydraulic shear by continuously drawing product into the rotor and expelling it radially at high velocity through the openings in the stator. Built-in powder induction mechanisms like the Solids/Liquid Injection Manifold (SLIM) Technology extend the High Shear Mixer's functionality by enabling more convenient raw material additions, faster dissolution/dispersion and more efficient hydration of thickeners.

Formulations that undergo multiple phases of heating/cooling, elevated viscosity, and deaeration are more commonly batched in Multi-Shaft Mixers. These versatile machines are equipped with two or more independently-driven agitators working in tandem to deliver a combination of high shear agitation and laminar bulk flow. One common configuration is the Triple-Shaft Mixer featuring a low-speed anchor, rotor/stator assembly and saw-tooth disperser blade. The agitators can be engaged in any combination and at any speed for any interval. The rotor/stator is generally run during the early stages of mixing wherein the batch is low in viscosity. Meanwhile, scrapers attached to the wings of the anchor agitator continuously contact the vessel surfaces for tighter temperature control and enhanced product turnover. The saw-tooth disperser generates a vortex in the liquid surface for quick incorporation of solid ingredients and, along with the anchor, agitates the batch as it transitions into a viscous paste consistency.

Ross supplies a full range of mixing equipment to the Pharmaceutical Industry:

- High Speed Dispersers
- High Viscosity Dispersers
- High Shear Mixers
- Ribbon Blenders
- Paddle Blenders
- Vertical Blenders
- Tumble Blenders
- Multi-Shaft Mixers
- Vacuum Homogenizers
- Double Planetary Mixers
- Planetary Dispersers
- Discharge Systems
- Kneader Extruders
- Static Mixers
- Three Roll Mills
- Control Systems
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Ross Ultra-High Shear Mixers

Depending on the type and nature of active ingredients present, a sunscreen formulation may require agitation at elevated shear levels to achieve the desired efficacy and stability. When conventional rotor/stator and multi-shaft mixing devices fall short in producing the desired particle size distribution, the next practical step is to evaluate an Ultra-High Shear Mixer. Several designs are available including the Ross X-Series (US Patent No. 5,632,596), an advanced rotor/stator engineered to run at tip speeds over 11,000 ft/min. It forces product to move through multiple channels and concentric rows of intermeshing teeth. The extremely close tolerance between adjacent surfaces of the X-Series rotor and stator is adjustable for fine-tuning shear levels and flow rates. In many formulations, this Ultra-High Shear Mixer outperforms expensive colloid mills and high pressure homogenizers in terms of smaller particle size, tighter size distribution, greater throughput and simpler maintenance.



Batch High Shear Mixer with SLIM (Powder Injection) Technology



Inline SLIM Mixer



Inline SLIM Skid System



X-Series Ultra-High Shear Mixer



Triple-Shaft Mixers