**Making Micronizing Manageable**

*Flakes removed from 2–5 micron crystalline particles with centrifugal sifter.*

Established in 1987 as the exclusive distributor of select bromine-based compounds produced by the Dead Sea Bromine Group of Israel, MORRE-TEC Industries of Union (New Jersey, USA) is, today, a leading producer of specialty chemicals and unique products for the nutritional, food, personal care and biotech industries. With a 2238 square meter facility designed to operate under ISO 9000-2008 and cGMP standards, the company is also a provider of custom blending, grinding and repackaging services for non-hazardous and food grade chemicals and natural products.

One of the company’s services is a patented process for micronizing, or reducing to uniform micron size, solid particles without damaging their crystalline structure. The process is currently being used to produce a proprietary product called Microphyte plant extract, a solid phytosterol that is insoluble in water but, once reduced to an average 3 micron size, will form a stable emulsion that will not settle out. When added to liquid nutritional products, it acts to lower cholesterol levels in the blood. A key step in the proprietary process is “soft milling” of the initial plant extract, which reduces incoming particles averaging 40 microns in diameter to particles averaging 2–5 microns. However, particles agglomerating into flakes on the walls of the vortex mill, and further compacting in the product collector, “were balling up and sitting on top” of the original circular vibratory screener, says Paul F. Caskey, Vice President, Administration and Operations. To solve this problem, MORRE-TEC installed a Rason Centri-Sifter centrifugal screener that removes the oversized particles.

**Soft Milling Prevents Particle Degradation**

The plant extract is delivered to the MORRE-TEC facility in 907 kg bulk bags, which are gravity discharged into a horizontal feeder equipped with a dust collector to prevent valuable product from escaping into the atmosphere. The material is then fed by compressed air through a special airlock into the micronization chamber. The patented micronization technology, licensed from Super Fine Ltd of Israel, is known as Vortex Milling. “Unlike jet milling, which relies on collision and abrasion to reduce particle size, the process creates rapid axial changes within a vortex chamber to replicate tornado-like conditions that cause the particles to fracture along their weakest fissure lines,” explains Leonard Glass, President of MORRE-TEC Industries. “Because the particles never actually touch each other, they are reduced to their optimum size without being exposed to destructive forces that can affect crystal morphology.”

The process is effective because every particle has inherent structural weaknesses. “When exposed to the proper aerodynamic conditions, the particle will fracture at its weakest point,” says Glass.

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Figure 2: On-size micronized powders discharge from the centrifugal sifter. Quick-Clean design allows easy removal of internal components for cleaning between production runs and the portable stand permits moving the sifter to other production lines.
"The air pressure within the vortex chamber oscillates from extremely high to extremely low within a matter of microseconds, creating a pressure differential inside and outside the particle that causes it to crack. The process continues until each particle reaches its strongest crystalline structure." Because the process relies on pressure differential rather than abrasion, the hardness of the material has no significant effect on its ability to fracture. "Materials that soften with heat can be micronized without external cooling, as no exothermic heat is generated by friction," says Glass. "In fact, the process is slightly endothermic and works well for materials that are sensitive to heat and would otherwise require cryogenic cooling. Materials that contain water of hydration within their crystalline structure can be milled with no detrimental drying effect, whereas the process yields an extremely narrow particle size distribution."

**Centrifugal Force Prevents Agglomeration**

Once the particles have been micronized, they are transported by compressed air up a pneumatic line to a product collector from which they are metered through a rotary arbor into the inlet spout of the centrifugal sifter (Figure 1). A feed screw directs them into the cylindrical sifting chamber, where rotating, helical paddles that never make actual contact with the 25 mesh (707 micron) stainless steel screen, continuously propel them against and through apertures in the screen (Figure 2). The oversize agglomerated flakes and hard particles are propelled through the open end of the cylindrical screening chamber and a discharge spout, to be recycled in the vortex mill, leaving only particles of 5 microns or smaller that can be easily dispersed in liquid (Figure 3).

"The centrifugal screener is mounted on a stand with wheels for easy transfer to other production lines," says Caskey. "It meets all applicable FDA, USDA and other standards, and removable end housings with rubber gaskets permit cleaning in just a matter of minutes. When our original centrifugal sifter experienced screen breakage caused by material build-up, which always occurred in the same location, both Kason and our local distributor, Cino Equipment of Hasbrouckle Heights (New Jersey, USA), recommended replacement with the Quick-Clean model, which has a hinged end cover and three-bearing shaft that cantilevers for the quick removal of internal components."

External roller bearings are located at the motor end of the shaft and on a hinged cover at the discharge and for maximum support and vibration-free operation. When the end cover is hinged open, the shaft becomes a cantilever supported by a third externally mounted roller bearing located between the motor-end bearing and material feed point, allowing internal components to slide freely from the opposite shaft end. "The sturdier 3-bearing design, and switching from nylon to stronger stainless steel screen baskets, eliminated the screen breakage problem," says Caskey.

The sifter also eliminated a problem that Mono-Toe's customer was experiencing with agglomerated particles clogging their equipment. "Since we installed the centrifugal sifter, we have had zero complaints," says Caskey. "Because screen changes can be accomplished in less than 2 minutes and cleaning is quick and easy, we can use the screener for other branched micronized products such as our dicacium and tricalcium phosphates and our creatine monohydrate. We can also offer loft micronizing of non-hazardous ingredients for food, cosmetic, nutritional and pharmaceutical applications."

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**For more information**

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**Figure 1:** From each bulk bag unloader, particles are micronized in the vortex mills (on the floor), pneumatically conveyed into the product collector and screened in the centrifugal sifter below it.

**Figure 3:** Oversize agglomerates ejected from the sifter are recycled through the vortex mill.