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Dust Explosion Prevention

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Centrifugal Sifting

Flakes Removed from 2 to 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, N.J., is today a leading producer of specialty chemicals and unique products for the nutritional, food, personal care and biotech industries. With a 25,000-square-foot-facility designed to operate under ISO 9000-2008 and GMP 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 screen, says Paul F. Caskey, vice president, administration and operations. To solve this problem, MORRE-TEC installed a Kason 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 2,000-pound 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 airllock 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 serial 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. “Since 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 weak points. “When exposed to the proper aerodynamic conditions, the particle will fracture at its weakest point,” says Glass. “The air pressure within the vortex chamber oscillates from extremely high to extremely low within a matter of micro-seconds, 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 since 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, while 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 into a product collector from which they are metered.
Oversize agglomerates ejected from the sifter are recycled through the vortex mill.

through a rotary airlock into the inlet spout of the centrifugal sifter. A feed screw directs them into the cylindrical sifting chamber, where rotating, helical paddles that never make actual contact with the 25 mesh stainless steel screen, continuously propel them against and through apertures in the screen. 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 5 microns or smaller that can be easily dispersed in liquid.

“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 buildup, which always occurred in the same location, both Kason and our local distributor, Cino Equipment of Berkeley Heights, N.J., recommended replacement with the Quick-Clean model, which has a hinged-end cover and three-bearing shaft that cantilevers
On-size micronized powders discharge from the centrifugal sifter. Quick-Clean design allows easy removal of internal components for cleaning between production runs. Portable stand permits moving the sifter to other production lines.

External roller bearings are located at the motor end of the shaft and on a hinged cover at the discharge end 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 three-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 MORRE-TEC'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 two minutes and cleaning is quick and easy, we can use the screener for other branded micronized products such as our Dicalcium and Tricalcium Phosphates and our Creatine Monohydrate. We can also offer toll micronizing of non-hazardous ingredients for food, cosmetic, nutritional and pharmaceutical applications."

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