Working Smoothly Together

Steffen Krill
Acrylic Monomers Innovation Management Evonik: “The real work begins when you start hooking together the reactor stages. Small by-product volumes add up to substantial volumes in the process loop.”
How to Remove Agglomerates

Centrifugal Sifter for Micron-Size Particles

You are looking for an equipment which is the ideal choice for continuous scalping of dry or moist materials, even those that tend to ball or agglomerate? This case study features a centrifugal screening device which combines high performance with easy maintenance.

Established in 1987 as the exclusive distributor of bromine-based compounds produced by the Dead Sea Bromine Group of Israel, Morre-Tec Industries of Union, New Jersey/USA is a leading producer of specialty chemicals and other products for the nutritional, food, personal care and biotech industries. With a 2,325 m² facility designed to operate under ISO 9000-2008 and cGMP standards, the company also provides custom blending, grinding, and repackaging services for non-hazardous and food-grade chemicals and natural products. One of the Morre-Tec’s services is a patented process for reducing solid particles to uniform micrometer size without damaging their crystalline structure. This “micronizing” process is used to produce a proprietary product called MicroPhyle that is used to lower cholesterol levels in the blood. The material, a solid plant sterol, is insoluble in water, but once reduced to an average particle size of 3 μm it forms a stable emulsion that will not settle out.

A key step in the proprietary process is “soft milling” of the initial plant extract, which reduces incoming particles averaging 40μm in diameter to particles averaging 2-5 μm. 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 Kason Centri-Sifter centrifugal screener that removes the over-size particles.

The plant extract is delivered to Morre-Tec facility in 907 kg bulk bags. These 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 an airlift 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

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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 through a rotary airlock into the inlet spout of the centrifugal sifter. A feed screw directs the material into the cylindrical sifting chamber, where rotating helical paddles propel the particles through apertures in a 25 mesh (700 μm) stainless steel screen. The paddles never make actual contact with 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 measuring 5 μm and smaller.

“The centrifugal sifter 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 Hasbrouck Heights, Nj, recommended replacement with the Quick-Clean model, which has a hinged end cover and a three-bearing shaft that cantilevers for 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 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 More-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 sifter 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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