SCREEN tips

News and application reports on screening, sifting, scalping, dewatering, and fluid bed drying, cooling, moisturizing

FROM KASON CORPORATION VOL.17, NO.2

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Sifting precious metals from dental lab scraps 90% faster

AMBRIDGE, PA—Atlantic Precious Metals Resources reduced sifting time by 90% when it went from hand sifting of scrap and sweepings from dental laboratories to screening with a 24-in (610 mm) diameter circular vibratory separator.

The timesavings helped the foundry accommodate a recent doubling of business. The VIBROSCREEN® separator from Kason Corporation paid for itself in less than nine months out of labor savings.

APM recovers and refines particles of silver, gold, platinum and palladium from scraps and sweepings purchased from dental laboratories and offices. The scraps come from workbenches, suction unit filters, floor sweepings, and vacuum cleaner bags. After screening, the particles are smelted in APM's four furnaces, and sold as bars or ingots to precious metal processors.

Sifting dental laboratory scraps

About 20% of incoming batches must be sifted since they arrive mixed with large pieces of paper towel shreds, straw from brooms, paper clips, plaster pieces, and plastics from impression trays. Batches containing fewer foreign pieces are not sifted prior to smelting.

Dental laboratory scraps are unloaded into top 10-mesh screen of 24-in (610 mm) diameter Kason VIBROSCREEN® circular vibratory separator.

Previously, APM operators took three hours to sift a typical 50 to 100-lb (22.7 – 45.4 kg) batch manually using kitchen-type strainers. Now, one operator, in 30 minutes, separates equivalent batch sizes by emptying the contents of 5-gal (18.9 l) buckets onto the top screen deck of the VIBROSCREEN® circular screener. The unit is positioned adjacent to a dust collector, which evacuates dust during operation. "We leapfrogged from Gold Rush days into the 21st Century with the new equipment," owner Don Mappin, Jr. jokes.

The circular vibratory screener is equipped with an imbalanced-weight gyratory motor positioned beneath the screening chamber. The motor imparts multi-plane inertial vibration to the two spring-mounted screening decks, causing oversize particles to vibrate across the screen surface in controlled pathways to the screen periphery where they are discharged. Screening efficiency improves by forcing material to pass over a maximum amount of screen surface. Undersized particles pass rapidly through the screen to a feed tray that directs them to the screen beneath.

The top 10-mesh screen separates the large pieces, which exit the top frame discharge, and are sent out for incineration.

From screener to smelter

The material falling through the 10-mesh upper screen and retained by the 40-mesh lower screen exits through the middle frame discharge port into 5-gal (18.9 l) containers for smelting. The below-40-mesh precious metal dust exits the bottom frame discharge port in similar fashion.

Batches of the 10-to-40-mesh particles, which are sometimes combined with the below-40-mesh dust, are then blended

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Technical Library now on-line

More than 150 technical editorials and case history articles indexed by industry and application are now on-line at kason.com

The library includes technical editorials on the latest advances in screening and processing, preventing equipment failure and maximizing operational efficiency. Case history articles reveal how processors and manufacturers solved problems specific to industries and applications.

Industry segments covered: chemical processing, chemical waste, food processing, food waste, animal feed, metals and minerals processing, mining and quarrying, paper and allied products, pharmaceuticals and cosmetics, plastics and rubber, primary metal, pulp and paper, miscellaneous processing and miscellaneous waste treatment.

Applications covered: screening (sifting, scalping, de-dusting, classifying, dewatering, de-agglomerating), fluid bed processing (drying, cooling, moisturizing), spheroidizing and powder coating.

All articles can be e-mailed as links and/or printed in HTML or PDF format.

Circular fluidized bed dryers: Latest entrant on dryer scene creates new application niche

By Henry Alamzad

The large and growing list of methods to dry bulk materials has narrowed the applications in which each category of dryer excels. The latest example is fluid bed drying, where circular fluid bed designs have intruded on turf previously dominated by rectangular units. This article updates specifiers by comparing fluid bed dryers with other methods in general, and circular fluid bed designs with rectangular designs in particular.

Comparing fluid bed dryers with spray dryers, rotary, flash, and tray dryers is highly application dependent. Usually the nature of the drying problem dictates the type of dryer to use, or limits the choice to two or three possibilities.

This 48-in (1220mm) diameter fluid bed dryer reduces moisture content of 50-mesh size ceramic particles from 7% to 2% at a continuous rate of 1000 lb/hour (454kg/hour). Temperature remains below 100˚C (212˚F). In addition to a heater, blower and cyclone separator, this system incorporates a CENTRI-SIFTER® centrifugal separator upstream of the fluid bed unit for continuous de-agglomerating of incoming material.

Considerations for selection include the feed's moisture content and form of the feed—liquid, semi-solid, or free-flowing. What is its sensitivity to heat, agitation? What is the dryer's ability to handle the feed? What is the capacity requirement? Can the feed be preconditioned?

Where fluid bed dryers fit among available choices hinges on how closely your process parameters and material characteristics dovetail with the dryers' capabilities. Various dryers occupy niches for high-water-content or solid feeds. Fluid bed dryers mainly handle solid feeds comprised of discrete particles, but with exceptions. Fluid bed processors can also cool or moisturize when the heating unit, located between the blower and fluid bed processing unit, is substituted with a remote chiller, or a moisturizer.

Dryers for high-water-content feed

Liquid and pumpable semi-solid feeds, such as slurries, are best suited for spray, rotary, or drum dryers.

A spray dryer dries liquid or slurry feeds at high rates. The slurry is atomized, and the droplets are dried in contact with a hot air stream. Moisture is rapidly vaporized from the droplets, leaving residual particles of dry solid. Dwell time is very short, permitting drying of heat-sensitive materials. Since the droplets must not strike solid surfaces before drying is complete, drying chambers are necessarily large – 8-30 ft (245-915 cm) diameter, with dryer heights as great as 80 ft. (24 m). Much heat is lost in the discharged gases, reducing efficiency of spray dryers.

A rotary dryer processes liquid, pumpable and non-pumpable semi-solids, and free-flowing particle feeds at high throughputs. The dryer consists of a rotating cylinder, slightly inclined from horizontal, in which a hot air stream dries flowing parallel or counter to the feed. As the cylinder rotates, internal flights lift and shower down the solids through the interior of the shell.

The dryer can also operate under vacuum for drying heat-sensitive materials at a lower temperature. The rotary dryer's horizontal configuration, however, can consume much floor space. It is energy intensive, and incurs relatively high initial cost.

Dryers for solid feeds

Flash, tray, rotary tray and fluid bed drying are among the most popular methods for drying solid and semi-solid feeds in the form of cakes, powders, and granules.

A flash dryer dries preconditioned particles at high throughput rates. A heated pneumatic conveying system entrains the particles in a hot air stream. Temperature is high (up to 1200˚F [649˚C]) at the flash dryer inlet, but the feed temperature rarely rises above 90˚F (32˚C) because residence time is short—between 0.5 and 10 seconds. Thus, flash drying can process heat-sensitive materials that otherwise would require indirect drying by a lower temperature method. (Indirect drying transfers heat through a medium such as pipes or retaining wall, as opposed to direct contact with the hot gas or air.) A flash dryer is energy intensive, requiring high volumes of hot air. Configurations range from a single long tube to a loop design, to a series of cyclones. Its vertical configuration may require a costly multiple floor support structure.

Tray dryers are useful for low capacity applications, and for material that cannot be agitated. A tray dryer consists of a housing into which shelves or trays of material are manually loaded, around which a hot air stream circulates. Labor required for loading and unloading can make them costly to operate.

For precise temperature control, a rotary tray dryer houses a stack of rotating circular trays within a hot air stream creating different temperature zones. After one tray revolution, a wiper sweeps the material to the next lower tray, with the same action repeating for the entire stack of as many as 20 trays. The feed discharges as dry product at the bottom of the housing.

Fluid bed drying

In general, fluidized bed drying is suited for products containing 40% or less moisture, the point at which most products become free-flowing enough to fluidize in the fluid bed chamber. The feed needs to be in the form of discrete particles, i.e., free-flowing powder, granules, crystals, flakes, or pulverized material that can be fluidized.

Material vibrates on screen within a rising column of heated, cooled or moisturized air. The continuous airflow and vibration separate and fluidize individual particles, maximizing surface area of the material, and, accordingly, the rate at which drying, cooling or moisturizing occurs.

Fluidized bed drying, depending on the application, may provide less expensive drying and a simpler process than spray, rotary, flash and other methods. It has the fewest moving parts and is therefore simple to operate and maintain. Energy consumption is low, further reducing operating costs.

Fluid bed operation can be batch or continuous. Continuous operation requires a feed control device such as a screw feeder, belt feeder, or rotary valve. Batch processing normally employs a discharge spout gate that remains closed while the batch is being dried, and opens after the drying run is complete.

Fluidized bed drying produces high thermal efficiency, while preventing overheating of individual particles, making it a good choice for temperature-sensitive products.

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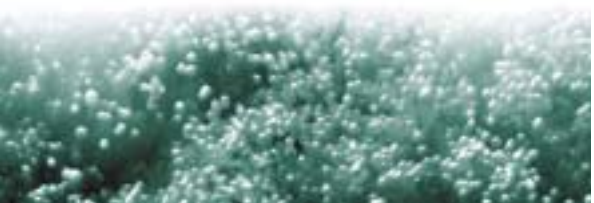

Centrifugal sifters, flexible conveyors meet HACCP demands in transferring starch-based blends

GALESBURG, IL—In expanding its blending operation for starch-based stabilizers, Opta Food Ingredients, Inc. installed a bulk transfer system consisting of two centrifugal sifters and three flexible screw conveyors to move as many as 12 ingredients at a high rate discharging from two plough blenders for bagging. The fully enclosed, dust-free system is a central component of the company's HACCP (Hazard Analysis and Critical Control Points) program for food safety and quality, ensuring that final packages contain uniform size particles that are free of foreign matter.

In the first line, a flexible screw conveyor transfers blends from a 45 cu ft (12.6 cu m) capacity plough blender to a Kason Model KO CENTRI-SIFTER® centrifugal screener. From the screener, a second flexible screw conveyor moves the screened material through a metal detector to a bagging station.

The smaller line consists of one conveyor moving blended intermediate material from the second plough blender to a second centrifugal sifter that discharges directly into bags that are weighed manually.

Bulk densities vary

The transfer system moves a variety of blended materials having bulk densities of 25 to 60 lb/cu ft (400 to 960 kg/cu m), and moisture contents from 1 to 11 percent. Twelve thousand pounds (5400 kg) of material per day pass through each sifter at a rate of 25 lb/minute (11.3 kg/minute).

The operation produces some 200 starch-based blends of dairy product additives that thicken, bind, stabilize, enhance texture or impart other properties. Ingredients include gums, whey protein, salt, mono- and digylcerides, starch, dextrose, among others. Some, like soy, lecithin and sugar, are heat sensitive or hygroscopic, and tend to agglomerate. The centrifugal screener breaks down soft agglomerates, as well as scalps all remaining oversize material, bag scraps and other foreign matter from the on-size material.

Components clean quickly, easily

The centrifugal sifters are constructed of stainless steel with polished welds for easy cleaning. Opta Foods performs wet cleaning of the sifters every few weeks. An operator opens the side access door and end cover, both fitted with hand knobs allowing quick and easy access without tools, removes the screen, and sprays the interior with cleaning solution prior to rinsing.

A Kason CENTRI-SIFTER® centrifugal separator discharges on-size material into 50-lb (22.5 kg) bags.

Centrifugal sifter operation

The centrifugal screeners employ rotating helical paddles that impart centrifugal force to the particles, propelling them continuously against and through the 40-mesh nylon cylindrical screen. The on-size powder falls through the center of the separator. Less than 2% of the flow constitutes "overs," which are collected in a bag and discarded.

The transfer system runs practically maintenance free, says Frank Mallee, plant manager. "We haven't changed the screen since installing the first CENTRI-SIFTER® screener in 1999. It just works, and you forget about it."

Prior to installing the screening system, Kason's area representative, Bob Steiner, of Windum Process Equipment, St. Charles, IL, had samples sent to Kason's laboratory, which demonstrated screening capability at the desired production rate.

Precious metals cont. from page 1

Circular screener separates scraps and sweepings for smelting. Top 10-mesh screen separates large, unusable pieces. Middle frame port (right) discharges below-10 mesh to 40-mesh precious metal particles. Bottom frame port (rear of unit) discharges below-40-mesh precious metal dust.

with flux and smelted in one of four 18-in (457 mm) diameter gas-fired furnaces. The melt is poured from the crucible into a cone mold. After cooling, the metal (mostly gold and palladium) is capped off, assayed and sold as bars or ingots.

Kason's representative Solid Solutions, Inc., McMurray, PA, specified and installed the separator and dust collector.

As APM's business grows, its next goal will be to add furnaces. "We could quadruple in volume before having to add another circular vibratory screener," Mappin says.

Fluidized bed dryers cont. from page 3

In operation, material vibrates on a screen or perforated surface within a rising column of heated air. The continuous airflow and vibration separate and fluidize individual particles, maximizing the surface area of material and, accordingly, the drying rate. The hot air surrounding each particle rapidly transfers heat. Particle fluidization eases material transport for gentle handling of the feed. Fluidized bed drying produces high thermal efficiency, while preventing overheating of individual particles, making it a good choice for temperature-sensitive products.

Residence time of products within a circular fluid bed dryer operating continuously ranges from 30 seconds to 15 minutes. For heat sensitive materials, shorter residence times are preferred. Air temperature can also be reduced to below the material's temperature limit as a precaution.

Residence times for batch fluid bed drying can extend as long as necessary to attain the desired drying level, and can be varied using an adjustable gate at the discharge spout called a "weir."

Exceptions to the rule

Although semi-solid lumpy or caked feeds are normally handled by rotary, tray, flash, plate, or conical dryers, a fluid bed dryer can be utilized, providing a granulator, de-agglomerator or centrifugal sifter is installed upstream to precondition the material into discrete particles.

Conclusion

Circular fluidized bed dryers make a good choice when the drying rate matches that of rectangular fluid bed dryers, due to their smaller size, lower energy use, and easier cleaning. The circular design has no corners or crevices for material to lodge and cause contamination or hamper cleaning. Rectangular fluidized bed dryers of equivalent capacity occupy about twice the space of circular units, and require higher airflow, consuming more energy. Compared with rectangular fluid bed dryers, a circular fluid bed dryer's initial and operating costs are lower.

The circular design is inherently stronger than rectangular designs, permitting lightweight construction at less cost; materials can be down-gauged, and motors and associated components can be downsized, reducing initial and operating costs. A circular fluid bed drying system can also be self-contained on a skid. Equipped with casters, it can be mobile for multiple duties.

1. McCabe, Warren L., et al, Unit Operations of Chemical Engineering. Fifth Edition. New York, McGraw-Hill, 1993.
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3. Traub, Darren A., "Fluid Bed Dryers," Process Heating, May 2001
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Kason equipment on display at Northwest Food Manufacturing and Packaging Exposition

Booth #119

Kason and Pacific Northwest area representative ABM Equipment (abmequipment.com) will exhibit at the Northwest Food Manufacturing and Packaging Exposition, Seattle, WA, January 13 to 15, 2003.

Kason equipment on display:

- VIBROSCREEN® Circular Vibratory Separator
- Low profile/high capacity FLO-THRU VIBROSCREEN® Separator
- Bag Dump Station with integral screening deck and dust collector
- CENTRI-SIFTER® Quick-Clean Centrifugal Screener with 3-bearing cantilevered shaft

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