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From vibratory to centrifugal screening

A US producer of aquaculture feed used centrifugal sifting from Kason to eliminate bottlenecks in processing its oily products.

Converting from vibratory to centrifugal screening netted a 60-fold screening improvement at Epicore BioNetworks Inc., removing a bottleneck in the production of the company’s shrimp farm feed products.

The New Jersey company produces biologicals and aquaculture feed products that nurture shrimp over their lifecycle, which necessitates producing feed particles in diameters from 300 microns (0.3 mm) through 1,200 microns (1.2 mm).

The feed is a combination of grains, nutrients and oils. Epicore had been using a 762 mm diameter circular vibratory screener to scalp oversize particles prior to packaging, but oil in the feed caused particles to agglomerate and plug or “blind” apertures in the screen. After attempts to rectify the problem, Epicore decided to replace its vibratory unit with a centrifugal screener.

While vibratory screeners rely on gyratory motion to promote the passage of on-size particles through apertures in a horizontally oriented screen, centrifugal screeners utilise rotating paddles that accelerate the flow of particles against the interior wall of a horizontally oriented, stationary screen cylinder.

In addition to boosting the rate at which on-size particles pass through the screen, increasing the speed at which particles impact the screen also serves to break-up soft agglomerates of the type that were plugging Epicore’s vibratory screens and being ejected as oversize clumps.

Quality holds key to aquaculture products

Shrimp farms ring the equatorial regions of the world from Belize and Ecuador to Thailand and Vietnam. “Our microbes and enzymes enable shrimp farms to grow more and healthier shrimp, suppress the outbreak of disease, and also clean up their ponds after harvest,” said plant manager William Castner.

Epicore originally supplied products to control pollution and clean ponds after the harvest. It resolved to enter the feed business when it found that low-grade feed products encouraged the buildup of harmful bacteria. “We decided to make a premium grade of shrimp feed that would promote faster, healthier growth and at the same time reduce the pollution load,” Castner explained.

Epicore’s recipe starts with conventional fish meal, then adds refined ingredients, such as hydrolyzed vegetable and fish pro-
teins, vitamins, and up to 15 percent lipids. "It's all the things shrimp need for quality growth," said Castner.

The feeds are formulated for nurturing shrimp over their lifecycle, from hatchlings and post-hatchlings to fully grown adults. Feed particles are sized accordingly, in diameters of 500, 500, 700, and 1,200 microns.

The production process starts with a ribbon blender in which grains, lipids, vitamins, and other nutrients are combined. After mixing, the feed exits the blender's discharge at the bottom of the trough and travels to a hammer mill, which reduces the feed to a consistent size. It is then extruded under mild heat and chopped into 1,200 micron (1.2 mm) pellets and dried. The feed is then reground in the hammer mill to specific particle sizes appropriate for the growth stage of the shrimp for which it is intended.

At this point, the particles are packaged in 25 kg plastic bags which are palletised and stored for screening. "We screen primarily for quality control immediately prior to final packaging, not for classifying," said Castner, "to ensure that the mixture does not contain any oversized grains or contaminants, although we also remove fines on occasion."

Converting to centrifugal screening prevents screen blinding

Epicores was using a 762 mm diameter circular vibratory screener with a 14 mesh (1310 mm openings) screen. The vibrating screen separated on-size material from oversize particles which were ejected for re-milling. The high lipid content of the feed caused grain particles to agglomerate, ball and blind the vibrating screen.

"We tried a number of solutions," production manager Sam DeMore related. "We purchased an anti-blinding device that essentially acted like a set of rubber windshield wiper arms that swept across the vibrating screen to remove particles lodged in the apertures. We also tried anti-blinding rings, which vibrated against the underside of the screen. Both helped, but not enough.

"We typically filled one 20 kg drum per hour of our high lipid feed, or about 150 kg per hour of our lower lipid feed," said DeMore. "Of course, throughput was highly dependent on the lipid content of the feed."

Epicores could tolerate low sifting rates during the early stages of shrimp feed production, but as business grew, the company needed to boost productivity.

The conversion from vibratory to centrifugal screening overcame Epicores' screening bottleneck.

"Throughput was always dependent on the oil content of the feed, but the typical output of the circular screener was 150 kg per hour, and the worst case was about half of that. To confirm anticipated improvements prior to purchasing its screener, Epicores tested a Centri-Sifter model MO centrifugal screener at Kason Corporation, manufacturer of the equipment. "We scheduled a demonstration at the Kason test lab using 45 kg of our bagged particles," DeMore recalled. "In 17 seconds, the Centri-Sifter screener processed what would have taken over 17 minutes with our circular vibratory screener."

Rotating paddles prevent agglomeration

The centrifugal sifter consists of a vertically mounted feed inlet and a horizontally-oriented, cylindrical sifting chamber. As material enters the feed inlet, a feed screw redirects it into the cylindrical screen where a rotating helical paddle assembly continuously propels the material against the screen without coming in contact with it. Particles either pass through apertures in the screen, break apart and then pass through the screen, or in the case of oversize particles, travel to the open end of the cylinder where they are ejected through an "overs" discharge spout.

Epicores' model MO Centri-Sifter is a medium capacity unit developed for food, dairy, and pharmaceutical applications. It has a cantilevered shaft mounted on three external roller bearings located on the motor end, near the material feed point, and at the hinged cover at the discharge end. When the cover swings open, the other two external bearings support the shaft. This allows internal components to slide freely from the opposite end for rapid cleaning, screen changes, and inspection. During operation, the shaft is supported on both end bearings for vibration-free operation at high speeds required for high capacities.

The Kason screeners are powered by a 2.25 kW direct drive motor, and uses nylon screening media, which is more economical than stainless steel and works well with the soft shrimp feed.

DeMore designed a waist-high support for the screeners, and a 1.8 m high platform above
it. Forklifts now deliver 1,000 kg pallets of bagged extrudate to the top of the platform. One employee works on the top of the platform, opening bags and pouring their contents through a magnetic screen (to trap any metal contaminants) and into the sifter. A second employee below weighs the sifted product and rolls it onto a conveyor for shipment.

The new centrifugal sifter has resolved the plant’s production bottleneck, enabling Epicore to meet growing demand for its premium shrimp feeds. The equipment’s reserve capacity is also expected to accommodate the company’s projected expansion over the next several years.

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