Restructuring the shrimp value chain in India

Feeding demand for vannamei post larvae

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Merging nutrition and economics
Centrifugal sifting in processing of oily aquaculture products

The change from vibratory to centrifugal screening netted a 60-fold screening improvement, thus removing a bottleneck in the production of shrimp farm feed products.

Epicore BioNetwork produces biological and aqua feed products that nurture shrimp over their lifecycle, which necessitates producing feed particles with diameters from 300 microns (0.3 mm) through 1,200 microns (1.2 mm). It 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, the company decided to replace its vibratory unit with a centrifugal screener.

Vibratory screeners rely on gyration motion to promote the passage of on-size particles through apertures in a horizontally oriented screen. In contrast, 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 vibratory screens and being ejected as oversize clumps.

Quality holds key to aquaculture products
Shrimp farms ring 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 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.”

The formulation to nurture shrimp throughout its life cycle, includes conventional fish meal, refined ingredients, such as hydrolysed vegetable and fish proteins, vitamins, and up to 15% lipid. Feed particles are sized accordingly, in diameters of 300, 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 stored for screening. “We screen primarily for quality control immediately prior to final packaging, not for classifying, to ensure that the mixture does not contain any oversized grains or contaminants, although we also remove fines on occasion,” said Castner.

Preventing screen blinding
The company was using a 762 mm diameter circular vibratory screener with a 14 mesh (1.310 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,” said production manager Sam DeMore. “We purchased an antiblinding 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 antiblinding 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.”

Low sifting rates during the early stages of shrimp feed production were tolerated but as business grew, the company needed to boost productivity. The conversion from vibratory to centrifugal screening overcame the 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, Epicore 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
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