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Gypsum dust management with a bulk bag discharger and flexible screw conveyors

South Pacific Seeds (SPS) is one of the world’s largest vegetable seed companies. In the 2011-2012 crop year it produced 2930t of vegetable seeds from its facilities in Australia, New Zealand, Chile and the US. However, processing the seeds with gypsum generated large quantities of dust at the company’s Griffith treatment plant in New South Wales, Australia. Here David Boger, Flexicon Corporation’s vice president of global business development and marketing describes how the problem was solved by installing a bulk bag discharger and flexible screw conveyors, manufactured by Flexicon Corporation (Australia) Pty Ltd.

In order to prepare them for packaging and sale, vegetable seeds are turned into pellets with a combination of gypsum powder and glue. Seed pellets are easier to plant than single seeds and can be coated with a film-containing colourant, fertiliser, fungicide or pesticide. However, dust is generated at the start of the pellet production process, as the gypsum powder is extremely free-flowing, with a bulk density of 400g/L. SPS solved the dust problem by installing a Flexicon bulk bag discharger and two flexible screw conveyors (Figure 1). The enclosed process has essentially eradicated the dust problem, according to Peter Pearson, SPS operations manager.

Production process
The Griffith plant receives untreated seeds, which are emptied into steel, wheeled V-bins that move the seeds through a series of process steps for the removal of plant material, soil, insects, stones and light, undesirable seeds. The main processes are:

- Cleanup by size, using an air screen cleaner that has a series of screens for scalping and sieving.
- Sorting by length, using an indented cylinder that can pick up either the seed or contaminant.
- Separation by weight, using a gravity table. The seeds pass over an inclined, oscillating mesh deck with a fan that blows air up through the seed.

Following cleanup, the seeds are dried to less than 7% moisture content in drying bins and are delivered to the pelletiser by a V-bin, ready to be pelleted.

The plant receives gypsum powder in bulk bags of around 350kg. Each bag is loaded by a forklift into the bulk bag discharger frame (Figure 2), where it is unloaded into a 140L, V-shaped floor hopper. The

Right - Figure 1: The gypsum powder travels from the blue bulk bag discharger through the inclined flexible screw conveyor, which transitions to a horizontal flexible screw conveyor and discharges into the red pelletiser.
bag is opened, the inner liner is cut and the gypsum is discharged through an iris valve. Bag discharge is aided by Flexicon's Flow-Flexer™ bag agitation device, two pneumatically-driven plates that raise and lower opposing edges of the bag to direct material to the outlet. As the bag empties, the stroke of the plates increases, forming the bag into a V-shape, promoting total evacuation. According to Pearson, the iris valve essentially eliminates dust at the Griffith plant. SPS also uses Flexicon's Bag-Vac™ dust containment system, which is attached to the discharger frame and removes any residual dust.

The gypsum is removed from the bottom of the hopper by a flexible screw conveyor. An agitator and vibrator in the bottom of the hopper help to move and direct the gypsum to the conveyor inlet. The flexible screw conveyor contains a rotating, stainless steel centreless screw that is housed in a durable polymer tube. The tube measures approximately 6m long by 80mm (outer diameter) and is powered by a 2.2kW three-phase motor that is located just beyond the discharge point, eliminating material contact with the bearings or seals. From the hopper, the conveyor moves the material at a 45° incline at 3.5kg/min to one side of the rotary treater. The gypsum is discharged through a small transition hopper into a second, identical flexible screw conveyor that carries it horizontally to an inlet cone on the side of the rotary treater.

In the rotary treater the gypsum is mixed with the seeds and glue binder. The pellets are formed by the rotating action.

The combination of the bulk bag discharger with the flexible screw conveyors assures that the delivery of the gypsum to the rotary treater is consistent and uniform. According to Pearson, the screw conveyors also reduced the amount of floor-space required for the coating machine.

Left - Figure 2: The bulk bag discharger. The iris valve shown prevents uncontrolled bursts of gypsum and dust when the bag spout is inverted. The Flow-Flexer™ plate raises and covers the bag to promote complete gypsum evacuation.

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