



The K-Tron Process Group and G2 Material Handling Inc. developed a contained processing/packaging system to protect plant employees from narcotics that could spill or become airborne.



By Kate Bertrand Connolly



## MATERIAL HANDLING EQUIPMENT KEEPS THINGS MOVING FOR PHARMACEUTICAL AND NUTRACEUTICAL MAKERS

The operational demands on manufacturers of pharmaceuticals and nutraceuticals are diverse. In addition to ensuring containment of active ingredients and meeting high industry standards for equipment sanitation, these companies—

like those in every industry—need to keep their lines running with minimal down time for routine cleaning, removing clogs and changing over between products.

Material handling equipment, particularly conveying systems, plays a central role in helping them meet all these requirements.

Containing the product and its active ingredients is a fundamental requirement. The manufacturer, "in many cases, must be able to contain the compound being processed in order to protect both the product from the outside environment as well as protect the operator from high toxicity of the product," explains Sharon Nowak, global business development manager, food and pharmaceuticals, at K-Tron Process Group, Pitman, N.J. "When designing convey-

ing, material handling and feeding equipment, such designs must often be integrated using containment systems such as split butterfly valves or glove boxes/isolators."

### SPLIT VALVES AID TABLETING

Product containment was the driver for a major pharmaceutical manufacturer, which prefers not to be named, when it recently reconfigured the material handling system of a tableting suite in one of its Northeastern U.S. facilities.

A central goal of the project was to protect plant employees from a Schedule II narcotic that the company presses into tablets. Working together with G2 Material Handling Inc., Springfield, Mo., the pharmaceutical company devel-

oped a fully contained system that features split butterfly valves and robotic handling of intermediate bulk containers (IBCs). This was the first time the company had used a robot for tableting.

IBCs filled with product in powder form are moved on pallet trucks through an air lock passageway to the tableting suite where the robot positions two of the filled IBCs in docking stations above the tablet press. The robot, supplied by KUKA Robotics Corp., Clinton Township, Mich., also removes bins from the press when they are full of tablets.

A split valve supplied by GEA Pharma Systems, Southampton, UK, assures containment as the product is transferred from the IBC to the press. GEA's patented Buck HC (High Containment)

split valve consists of an active valve on the discharge station feeding the tablet press and a passive valve on the IBC. When the two valves dock and the active valve is opened, the product flows into the press. The passive valve remains shut until the active valve is actuated, assuring a dust-free seal.

Because of the robot, whose movements are exactly the same on each pass to and from the tablet press, tight tolerances were required as G2 built the IBCs, discharge and docking stations,

dedusts them. The tablets gravity feed from the deduster through a mag check (magnet-based metal detector) and into a surge hopper above the tablet bin. Operators move the filled tablet bins out of the tableting suite through the air lock to be packaged elsewhere in the plant.

### CONTAIN AND CONVEY

Pneumatic conveying technology provides another method for containing material and operating dust-free. This type of conveying can be used to move

its throughout processing steps such as milling and sieving provides ample benefits in this environment. In addition to protecting employees, this type of system prevents the waste of expensive active ingredients—which can be as much as several thousand dollars per ounce—and promotes the use of Good Manufacturing Practices (GMPs).

Pneumatic systems also minimize dust. This generates productivity benefits as dust particulates in the air can accumulate on equipment surfaces, slowing down or causing premature wear of equipment and tooling. Additional benefits include shortened cleaning time between batches and reduced labor costs.

From a safety standpoint, dust reduction is a key factor in minimizing the risk of fire or explosion. According to the National Fire Protection Association's (NFPA) "Guidance for Identifying and Mitigating Dust Hazards in Pharmaceutical Industry" ([www.nfpa.org/assets/files/PDF/Foundation%20proceedings/Steve\\_Meszáros.pdf](http://www.nfpa.org/assets/files/PDF/Foundation%20proceedings/Steve_Meszáros.pdf)), "Most of the powders handled in the pharmaceutical industry are likely to be combustible and should be handled with basic safety controls to minimize the risk of an explosion or fire."

Pneumatic conveying can be used in a variety of activities to realize these productivity and safety benefits. For example, to meet the needs of a vitamin tableting company that required dustless conveying for its tablet press, Quadro provided a compact Quadro Vac® sanitary pneumatic conveyor that was small enough to fit into the limited space over the press. The pneumatic conveyor feeds the two hoppers supplying the tablet press. A mechanical sensor stops the pneumatic system's operation when the hopper is full.

The result is dust-free conveyance of powdered ingredients from drums to the press. Quadro reports this reduced the



### Assuring Quality With X-ray Inspection

installed five SmartChek x-ray inspection systems supplied by Tampa, Fla.-based Mettler-Toledo Safeline. The x-ray systems are used to inspect stick packs, foil pouches in a carton and blister packs wrapped in foil.

CPC develops, manufactures and packages premium pharmaceuticals, over-the-counter drugs and dietary supplements for brand owners such as Bayer and GlaxoSmithKline and for retailers such as Walgreens and CVS.

The company annually produces more than four billion tablets, softgels and two-piece hard shells, plus powdered products, at its three manufacturing facilities and one packaging location. CPC currently handles about 300 active products, changing over each line once per day, on average. The packaging plant runs three shifts per day, five days per week.

The SmartChek x-ray system uses

an electronically controlled low-powered x-ray generator and proprietary data and image analysis software to identify objects with a density different from the product. The system identifies foreign particles such as metal, glass and plastic and automatically removes contaminated products from the packaging line.

Although CPC hasn't had any problems with contamination, the x-ray systems ensure that if it were to occur, the faulty product would be caught before it left the plant. In contrast to metal detectors, the x-ray equipment "can see right through the foil and still find very small pieces of metal—as small as one millimeter," says Harold Zeltner, president of Chester, N.J.-based Reliant Packaging Systems Inc., the manufacturer's representative agency that sold CPC the SmartChek system.



A KUKA robot removes bins from the press when they are full of processed tablets.

pick-up/alignment ports for robot attachment and other components of the suite. In fact, the dimensions of all the IBCs needed to be within a fraction of an inch so the robot would align properly with them.

"Everything had to be within 1/16 of an inch because the robot comes back to the same spot every time," explains Geary Gorrell, president of G2 Material Handling. For the project, G2 built 19 IBCs, and "they all had to be exactly identical to fit in the same spot every time. It was quite a project."

From the press, the tablets directly discharge into a vibratory conveyor that

pharmaceutical or nutraceutical ingredients to the processing operation and also from processing to packaging.

"One of the changes in the pharmaceutical industry in the past few years is that the efficacy of the drugs has become greater and greater. Thanks to the changing technology in that industry, extremely powerful active ingredients are being produced. These must be contained. Operator safety is very important," says Barry Watson, development and applications manager at Quadro® Engineering, Waterloo, Ont.

A pneumatic conveying system that can provide low operator exposure lim-

time needed to clean the room after each production run and eliminated cross contamination from airborne dust. The vitamin company went on to purchase 10 of the pneumatic conveying systems—one to feed each of its 10 tablet presses.

The Quadro Vac also can be used for one-step, dust-free milling in pharmaceutical and nutraceutical applications. The company has developed an in-line system in which powders or wet granules are pneumatically conveyed to and through a Quadro Comil® conical screen mill which delumps, finishes and/or mills the material. From there the pneumatic conveyor moves the conditioned material to the next processing stage or to the packaging line, depending on the application.

Similarly, the Quadro Vac can be coupled with a Quadro FlexSift in-line security screener/delumper after milling and before packaging, for a dust-free system that ensures incoming ingredients are free from foreign materials and impurities that could damage downstream equipment and contaminate the final batch.

### SOLVING A STICKY PROBLEM

Pneumatic systems, in addition to providing containment, can be useful for handling sticky materials. Graminex LLC, which manufactures formulations of flower pollen extract for pharmaceutical, nutraceutical, food and cosmeceutical applications, uses air-handling and vacuum systems at its plant in Deshler, Ohio, to ensure total containment and reduce blockages, providing continuous flow through the material processing system.

"Pollen is a sticky product. It sticks to pipes or anything you want to use to transfer it," explains Heather J. May, Graminex's chief operating officer. "To ensure that we don't clog up our systems, we use air-handling and pneumatic



This processing area at Graminex is where the pollen is sifted out from all the other waste plant material via pneumatic conveying.

equipment to move the product so nothing gets stuck anywhere. We also monitor temperature and humidity very closely."

Graminex uses a large-scale agricultural air-handling system to move ground-up plant material from its drying facility into 285,000 cubic feet of silos designed by Laidig Bulk Storage and Reclaim Systems, Mishawaka, Ind. Then, in the plant's processing area, pneumatic (vacuum) conveying is used to separate the pollen from waste. This system uses cyclones and blowers to generate suction to draw the material through the system.

The congruous plant material is drawn through Allgaier Group, Uhingen, Germany, sieves using air suction. The material that remains after sieving is pneumatically conveyed through a filter box that separates the material further. From there, the sticky, abrasive pollen is metered into bulk bags that are then placed into cold storage.

The pollen is further processed to remove allergens and foreign matter, leaving Graminex with a high-grade raw material that can be made into tablets or capsules or sold in powdered raw form to contract manufacturers.

In addition to conquering the stickiness problem, vacuum conveying

addresses pollen's fly-away characteristic. "Pollen is so light, any slight breeze will blow it away," May says. "So we've had to make sure that all the way from the field to our plant to the package we are not losing any of this pollen. Because pneumatic conveying is vacuum driven, it pulls everything through. Everything that goes in one end comes out the other."

After the tablets and capsules have been made, they are loaded into hoppers connected to pneumatic conveying systems, meeting the cGMP definition of a sanitary and controlled environment. Customized hoppers and fittings, designed by Saginaw Control & Engineering, Saginaw, Mich., prevent the pollen from sticking to hoppers or creating a clog where the vacuum conveyor meets the hopper.

A PIAB conveying system, supplied by Täby, Sweden-based PIAB AB and installed by Bulk Handling Equipment Co., Northfield, Ohio, feeds into Graminex's 10-channel laser counter, which is integrated with an automated filler. The tablets or capsules drop from the hopper onto vibratory channel plates that separate the tablets and capsules into 10 channels, which feed the laser counter.

The plates vibrate the pills toward the

front of the counter at varying rates, set by the operator. May reports that the laser counter, supplied by CVC Technologies, Fontana, Calif., provides 100 percent accuracy when filling retail size bottles as well as commercial bulk packs.

Conventional mechanical conveyors move the empty containers to the filler from the desiccant inserter (desiccant sachets are necessary to protect the humidity-sensitive pollen from atmospheric moisture). From the filler, the bottles are mechanically conveyed through either a CVC screw capper or a custom-built snap capper supplied by Inline Filling Systems Inc., Venice, Fla. The capped bottles then travel through a CVC labeler, Marburg shrink bander, CVC cartoner and Videojet laser coder for batch marking.

CVC designed and installed the majority of Graminex's 11-part packaging line, which can run at up to 120 bottles per minute but is currently operating at 60 bottles per minute.

### EQUIPMENT SANITATION

The need for product containment doesn't end once the product is manufactured. Even during clean-up, operator safety must be considered and dust needs to be controlled.

"Due to the extensive sanitary design requirements, equipment designed for the pharmaceutical industry is indeed unique from that of other industries," says K-Tron's Nowak. "Options such as retractable spray balls are incorporated to allow for a complete wash-in-place (WIP) system. Ease of dismantling and accessibility for cleaning is always a design priority, incorporating quick-access triclover clamps, easy removable filters and quick disconnects on electrical devices and instrumentation."

She explains that material handling equipment can be designed with ports compatible with the manufacturer's portable clean-in-place system, or it can be equipped with built-in cleaning features such as spray balls.

"If the material is really toxic, and they can't open up the system at all without being suited, they can use these retractable spray balls, which are outside the device. When the spray is initiated, the spray ball pops into the toxic environment and sprays the equipment from the inside," Nowak says. "They can do a wash in place without any exposure of the operator to the material."

This type of design also is

useful for cleaning equipment that conveys or holds non-toxic powder. The spray balls wet the inside of the machine before it is opened for cleaning, eliminating the dust hazard.

K-Tron's "PH" pharmaceutical-design equipment addresses these sanitation requirements. The most recent design changes on the company's P series of conveyors include easy access clamp designs on the filter receiver body as well as swing-away filter receiver heads for easy filter removal. All feeders and conveyors can be equipped with WIP spray ball assemblies, if desired.

Thus, cleaning is fast and thorough. The risk of operator exposure or explosion is minimized, and production keeps clipping along. With continuous processing gradually displacing batch processing in this industry, design features like these, which reduce down time while assuring adherence to cleanliness standards, are an ideal fit. **PMT**

Kate Bertrand Connolly has written about packaging, technology and marketing for more than 25 years.



These vibratory channel plates separate tablets and capsules into 10 channels which flow into a laser counter. This provides Graminex with 100 percent accuracy. Tablets are then counted (seen above) and bottled.