dedusters

Selecting the right tablet deduster for your application

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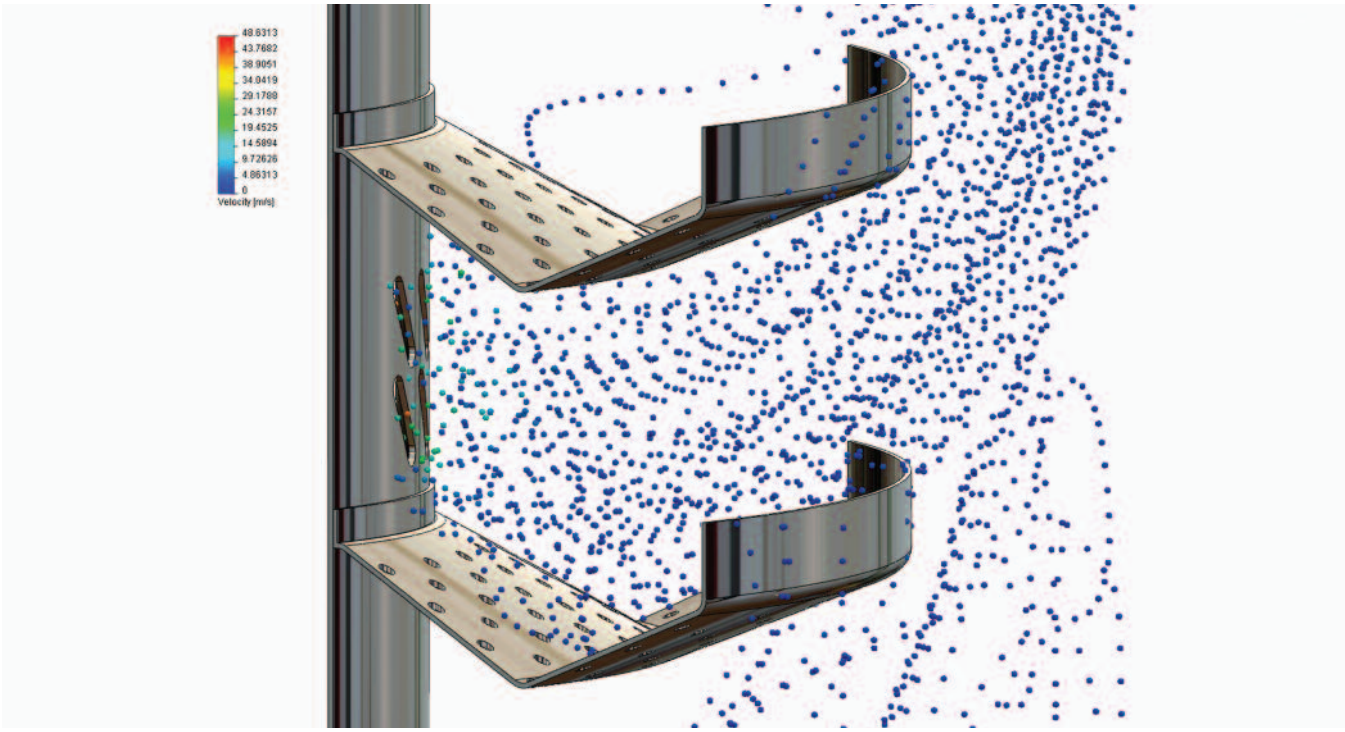


Is dust pervasive in your tablet press rooms? Is the packaging area dusty, causing equipment to malfunction or leading to poor seals on bottles and blister packages? If so, this article will help you select a tablet deduster to keep production areas cleaner and reduce rejects.

When compressing powders into pharmaceutical and nutraceutical tablets, dust sometimes becomes a byproduct, adhering to the tablets as they exit the tablet press. In addition, the gap between the press punches and dies can allow burrs to form around tablet edges. Both the powder and the burrs lead to unwanted dust in downstream processes. Removing this dust as the tablets leave the press allows process and packaging equipment to work more efficiently with less maintenance and keeps the work area cleaner.

Dedusters are fairly simple devices, but their simplicity belies the importance of specifying the correct type and size of unit for your application. The two biggest complaints about dedusters—especially those improperly specified or installed—are their inability to keep up with the tablet press' output and inefficient dedusting. Perhaps because they are ancillary to the process, dedusters too often become an afterthought when budgeting for a tablet press. Then, in the scramble to "find" money for this critical equipment, a poor decision is made: A machine is selected to fit the budget, not the application. Since "You get what you pay for," a better idea is to spend the time and money to obtain the performance, service life, and trouble-free operation that your application requires.

Six primary requirements

Before contacting a vendor, assess your needs by following these six steps:

1. Identify your minimum and maximum tablet sizes. Their size, along with the speed at which they enter the deduster, determine the machine volume required to transport and dedust the tablets effectively.

2. Know the maximum output of the tablet press for each size tablet you make. That information allows the vendor to determine the deduster capacity your operation requires.

3. Know your tablets' hardnesses and the nature of the dusts since tablet hardness factors into deduster size.

Chewable or effervescent tablets, for example, may require very different dedusters. Soft tablets, such as effervescents, could be damaged if the deduster must operate at its capacity limit (too much vibratory force). As for the dust, is it hazardous or toxic? If so, the deduster may need dust-tight containment to prevent exposing press room personnel. It may also require a wash-in-place or wet-in-place system to prevent worker exposure when the equipment is cleaned following a batch.

4. Determine whether a metal detector should accompany the deduster. A metal detector requires roughly 10 inches of height, which must be accounted for when specifying the deduster.

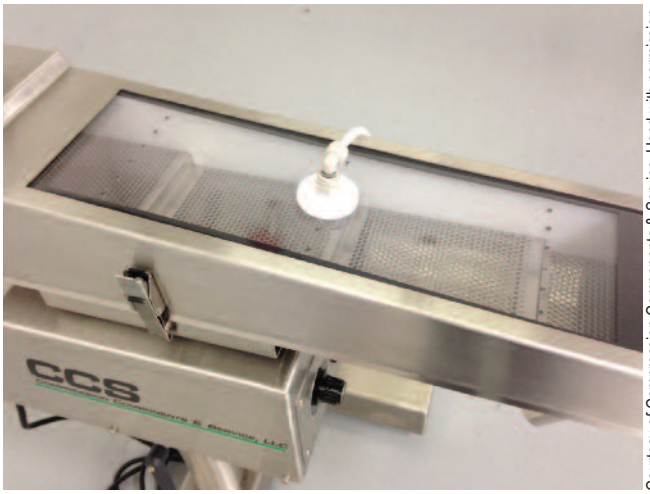
5. Decide how many containers will collect the dedusted tablets. If they must be collected in two or more containers, a diverter will be needed, which adds to the overall height; which must be taken into account.

6. Determine the outlet height of the press and the inlet height of the collection container(s). To calculate this, measure the distance from the floor to the bottom of the tablet outlet chute and from the floor to the top of the collection container. These two distances determine the deduster's conveying height—the height required to reach the collection container.

Once you have all this information, familiarize yourself with the different dedusting methods. Each of them—horizontal, vertical, and brush-type—has its own advantages and disadvantages.

Horizontal, vertical, or brush-type: What's the difference?

Horizontal dedusters. These use a perforated stainless steel plate or perforated tube that vibrates from side to side. The plate or tube isn't actually horizontal but slopes downward slightly so that the tablets descend as they are conveyed by vibration over a distance of about 1 meter. As the tablets travel that distance, vibration dislodges the dust, which drops through the perforations and is pulled away by the suction of a dust collector. Some horizontal dedusters direct compressed air into the tablets. This helps dislodge the dust and keeps it airborne, enabling the dust collector to capture it more efficiently.



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A horizontal deduster

Low cost is the biggest advantage of horizontal dedusters, but choosing a deduster based on price alone is seldom the right decision. You might save initially, but the drawbacks of horizontal dedusters may have a negative impact on your facility:

- They can be noisy;
- Tablets spend only a short time on the perforated plate/tube, and a short residence time may limit the equipment's efficiency when dedusting your product(s);
- Their rather big footprint may require more space inside the press area or press suite than is available; and
- They can use only small tablet collection containers—2 feet tall or less. Typically, press outlets are about 3 feet off of the ground. Thus, once the tablets pass through the deduster and drop through the metal detector, they are nearly at floor level. This limits the size of the tablet container and may pose ergonomic issues for the operators, who must remove and replace the small containers frequently.

Vertical dedusters. There are two types of vertical dedusters: vertical downward conveying dedusters and vertical upward conveying dedusters.

Downward conveying. An older style of deduster, these units function similarly to the horizontal type: Tablets enter at the top, descend through several perforated plates, then bounce around until they find the exit and drop to the next plate. After passing from plate to plate, the tablets drop out near the machine's base. Vertical downward dedusters are relatively inexpensive and their disadvantages are comparable to those of horizontal dedusters, including height limitations when used with metal detectors and tablet collection containers. They usually include a compressed-air blow-off capability to boost dedusting efficiency.

A downward conveying vertical deduster

Upward conveying. These dedusters use a helical perforated tray fixed to a central column. The tray slopes upward, and vibration conveys the tablets up the slope. As they gently ascend the spiral pathway, the tablets rub against each other, shedding dust and burrs. Some units use a blast of air to assist in dedusting and to keep the dust airborne, which makes it easier for suction from a dust collector to extract the dust. Some machines extract the dust through the central column (diagram, page 22), while others draw it through the spiral's outside perimeter. Some upward conveying dedusters use a V-shaped helix profile, while others use a flat helix made of either tried-and-true stainless steel or plastic.

A big advantage of vertical upward conveying dedusters is their small footprint, which minimizes the loss of production space. Because they convey upward, the units also extend the residence time of the tablets, meaning more dedusting time. While horizontal dedusters have a conveying path of no more than 1 meter, the shortest path of a vertical upward conveying deduster is 5 meters. This is an important point because the longer the path, the longer the residence time and the better the dedusting efficiency. In fact, a vertical deduster that raises tablets 1.6 meters has a 20-meter-long path. In addition, vertically conveying the tablets allows you to discharge them into much larger containers, such as drums and intermediate bulk containers (IBCs). Since the industry trend is to make bigger batches at faster press speeds, the ability to accommodate large containers is a distinct advantage.

An upward conveying vertical deduster

The cons of vertical conveying dedusters are their higher initial cost and the likelihood that they'll require more time to set up since there are two parameters to ensure proper tablet vibration: resonance frequency and speed. Some suppliers offer an automatic controller that determines the optimal resonance frequency and minimizes operator involvement. The type of control used is also important because it determines how precisely vibration is monitored and adjusted. That's a critical detail when the unit is handling friable and soft tablets because too strong a vibration can damage them.

Brush-type. Brush-type dedusters are available in horizontal and vertical configurations. They comprise a helically wound brush located inside a stainless steel tube—similar to a screw conveyor—driven by a variable-speed motor. The tablets/capsules enter at one end of the tube and, as the brush turns, it propels the tablets through the tube until they reach the deduster's discharge at the end or top. A port on the housing or tube allows you to connect to a dust collector to draw the dust out of the machine.

The advantages of the brush method include low upfront cost and inclined or vertical conveying. On the downside, the method uses plastic brushes that can impart an electrostatic charge to the product. The brushes also wear, which raises the question of where the residual particles and broken brush fibers go. Some particles exit with the dust, but some stay with the tablets/capsules, a definite drawback. The brushes also can be difficult to clean, which may require using product-dedicated brushes.

Before considering brush-type conveyors, it's important to note that they are generally a better option than other dedusters for processing capsules, and they may also work well with very hard tablets. They're good for capsules because the friction of the brush polishes them and leaves them shiny, which manufacturers like.

The decisive factors

Aside from cost, the factors most important to selecting a deduster are efficiency and the ability to handle the production volume of a tablet press operating at full speed. With the industry trending toward larger batch


A brush-type deduster

Picture courtesy of MG America. Used with permission.

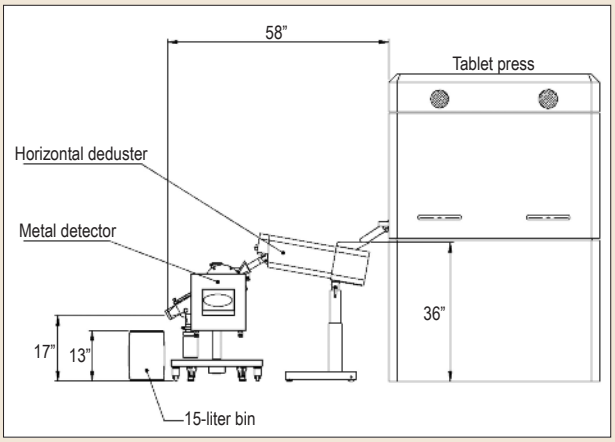
sizes and continuous manufacturing, the ability to collect a large volume of tablets is important. How large a container you can use depends on the discharge heights.

If, for example, the tablet press discharge chute is 36 inches from the floor and the tablet collection container is 36 inches tall, you could place the container right next to the press, presuming there is no need for a deduster or metal detector. That's not usually the case, however. In fact, with a horizontal deduster and metal detector combination, there is typically an 8- to 10-inch drop through the deduster, with an additional 10-inch drop through the metal detector. In that setup, you could only use a container 16 inches tall or less, a severe restriction on how many tablets the container can hold. See Figure 1a.

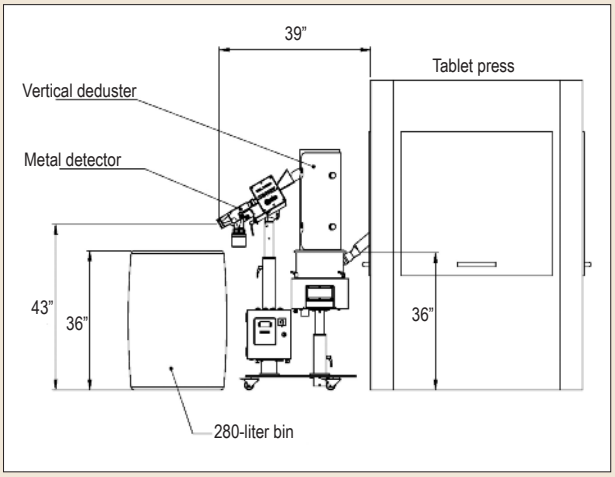
A vertical upward conveying deduster, on the other hand, raises the tablets from the 36-inch-high discharge in increments of roughly 10 inches and then drops them through the metal detector. That additional 10 inches compensates for the 10 inches that the metal detector requires, thereby enabling you to use a 36-inch-tall container with a 36-inch-high press chute (Figure 1b).

FIGURE 1

Comparison of typical layouts for a tablet press using a horizontal and a vertical upward conveying deduster



a. Horizontal deduster



b. Vertical upward conveying deduster

If a vertical deduster with a taller conveying path is used, the tablets can be discharged into yet larger containers, even ones that stand higher than the press outlet. That means a stainless steel or plastic IBC or a flexible IBC could be used, reducing the number of containers needed per batch and the number of containers you need to handle, store, and track.

Deduster problems and pitfalls

One of the biggest complaints about dedusters when they don't work properly is caused by the low volume and vacuum of the plant's dust collection system. That's to be expected, since no matter how effectively a deduster dislodges dust from tablets, if the dust collector doesn't remove dust from the machine, it won't be long before the tablets are no longer dedusted at all.

Another complaint is about dedusters that cannot convey the tablets quickly enough, limiting tablet press speed (output). Few operators or managers like to slow the press to accommodate an underperforming deduster, since doing so crimps production capacity.

Purchase price, while important, should not be the paramount criterion, because that puts you at risk for substantial equipment downtime. Dedusters, after all, operate at 30 to 60 vibrations per second, a rate that could shake apart poorly designed machines. Thus, look for higher-quality machines, ones that are designed to operate 24 hours per day for years at a time with no downtime. These machines typically also carry long-term warranties.

You have many choices in tablet dedusters, many of which look similar. But they don't all perform as well as they should. Use the information outlined here and you can make a better informed decision about the next deduster you buy. *T&C*

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