There are many reasons to coat tablets, granules, and particles, and a variety of factors determine which coating process to use. This article summarizes the characteristics of three types of coating machines: fluid-bed processors, mixers, and drum coaters.

When applying a coating, the goal is to modify the surface properties of tablets or particles. Pharmaceuticals are often coated to protect them from the effects of exposure to water or moisture. In other cases, coatings protect the formulation from the effects of gastric juices in order to extend the release of the active ingredient. Coatings also add color and lubricity and mask unpleasant tastes and odors.

The basic steps in applying a coating are mixing, spraying, homogenizing, forming (in the case of sugar coating), drying, and polishing. Depending on the product and process, the steps may repeat several times, and they can be performed in a variety of machines, including fluid-bed processors, mixers, and drum coaters. The size of the core strongly influences which coating process to use. Fluid-bed processors and mixers are best suited to coating powders and other products whose median particle size is less than 1 millimeter. Drum coaters are usually the best choice for tablets.

**Fluid-bed processors**

For complex applications and/or sensitive products—such as coating an active pharmaceutical ingredient (API)—fluid-bed processing is the best choice. In a fluid-bed processor, warm air flowing through a distributor plate at the base of the process vessel moves through the product bed. As it does, a mist of coating is sprayed. As the liquid coating contacts the particles, the fluidizing air dries it, and the vapor is exhausted from the vessel. The process continues until the particles are coated as desired. The Wurster method is the most widely used fluid-bed coating technique. It uses one or more cylindrical inserts in the process vessel that cause the particles to flow in a cyclic pattern as the coating is sprayed from below.

The fluid-bed process is adaptable to suit a variety of applications. For example, it can apply the coating from the top or bottom of the process vessel and, in some cases, tangentially [1]. With tangential application, the coating enters the product bed directly. In so doing, the process provides the same advantages of the Wurster technique while minimizing the amount of coating that must be applied. Using a tangential spray instead of a standard Wurster technique also eliminates the need for inserts in the process vessel and allows the distributor plate to remain in place between batches. This reduces the size of the product-contact area, which simplifies cleaning. Furthermore, processes that use a tangential spray typically require only one vessel, whereas many commercial installations based on the Wurster principle require a second process vessel. Nonetheless, many products are still made using the Wurster process because that was the equipment used for validation.

**Plowshare mixers**

The need to coat particles isn’t limited to the pharmaceutical industry. Many dietary supplement ingredients also require encapsulation in a coating to prevent them from losing flavor from exposure to moisture and/or oxygen. The practice, however, is only slowly gaining
ground because of its cost: A common fluid-bed processor is roughly five times the price of a conventional mixer. In addition, because of the large amounts of air that fluid-bed processes use and their need for air conditioning equipment, they cost much more to operate than other coating equipment.

Plowshare mixers [2] offer a lower-priced and reliable alternative, so long as the drying step of the process is managed to prevent abrasion from damaging the coating. Unlike fluid-bed processors, plowshare mixers fluidize powders and granules mechanically. As a result, using mixers as coaters requires precise control of the process parameters, including agitator speed, batch size, temperature, and rate of nitrogen addition.

Mechanical coaters also offer more flexibility than fluid-bed systems. Capitalizing on that flexibility, however, requires that you decide at an early stage which processes the mixer will perform and then design the machine for that purpose. Possibilities include powder blending, granulation, and drying. Ideally, the machine would perform more than one process, thereby minimizing handling and the need for containment.

**Drum coaters**

While fluid-bed processors and horizontal mixers are the best choices for coating small particles, drum coaters are better for large particles, including tablets. (They are also used in some food applications.) Drum coaters adapt easily to meet the needs of special applications and sophisticated products. For instance, it's possible to modify these coaters to provide high containment. In fact, the entire process can be contained, which is the best way to protect people, products, and the environment. The coaters can also be made explosion-proof and can include built-in cleaning systems.

In recent years, pharmaceutical manufacturers have been seeking more efficient coaters, as well as systems that are more user-friendly, easier to clean, and easier to manage. Realizing those objectives requires that each sub-process—spraying, mixing, and drying—be well thought out. My company's LC series of coaters, for example, operate as much as 40 percent faster than conventional drum coaters. This is due to the drum's geometry, specifically the diameter and length of the perforated area, which provides a large surface over which to spray. As a result, it's possible to use more spray guns than in conventional drums, which allows the coater to apply more of the coating suspension to the tablets per unit of time. The drum's design also boosts process volume and shortens drying time, thereby reducing overall coating time. Because processing is faster—and product quality consistent—manufacturers can specify smaller coating machines and decrease capital expense.

While most drum coaters apply polymer-based film coatings, interest in applying sugar coatings has increased. Ideally, the same equipment would apply both coating types without requiring major conversions. If you think sugar coating may be required, raise the issue with the equipment supplier you're considering. Reputable suppliers should be able to offer you a single unit with enough flexibility to apply both.

**References**

1. LFP fluid-bed processor from Lödige.
2. Ploughshare is a registered trademark of Lödige.

Reiner Lamperle is sales manager at Gebr. Lödige Maschinenbau, Paderborn, Germany. The company is represented in the USA, Puerto Rico, and Canada by Modwave, 1020 Monterey Boulevard, Suite 2, Hermosa Beach, CA 90254. Tel. 310 918 6772. Website: www.modwave.com.