Simple tests to help you develop clean-label tablets and capsules

Driven by consumers, the quest for clean labels continues. If your goal is a clean—that is, organic or natural—product and label, chances are your active is considered clean and the excipients aren’t, which means you’ll need to learn how changing them will affect the performance of your tablet press and capsule filler.

While excipients like magnesium stearate, silicon dioxide, calcium silicate, and titanium dioxide have long been the “go-to” excipients, many consumers deem them synthetic. Thus other ingredients, such as rice-based excipients from Ribus, are being used as lubricants, flow agents, and fillers.

While they aren’t “nature identical,” the ingredients offer manufacturers options. “Our first generation of ingredients opened the door, and now as we launch our second generation of enhanced lubricants, we expect easier conversion for manufacturers,” said Steve Peirce, Ribus president.

Begin with a 1-to-1 swap of the current excipient for its replacement and then compare the flowability, compaction, and particle size of the old and new formulations. The key metrics include angle of repose, Carr index, bulk density, and particle size distribution.

**Flow**

Determining the angle of repose is a simple and inexpensive way to assess flowability, which relates to weight variation. According to Podczeck and Jones [1], flow is excellent when the angle is 25 to 30 degrees, good at 31 to 35, fair at 36 to 40, passable at 41 to 45, poor at 46 to 55, very poor at 56 to 65 and very, very poor when the angle is 66 degrees or more.

**Compaction**

Changing ingredients can also change how the powder compacts during tabletting and capsule filling. In both operations, good compaction properties are key, and the Carr index of compressibility will help with this assessment. It’s also a simple test. First, determine the bulk and tapped densities of your powder. Next, subtract the bulk density value from the tapped density value and divide the result by the tapped density. Any result of 15 or less indicates free flow, while 15 to 25 indicates good flow, 25 to 35 acceptable flow, and 35 or more extremely poor flow. If you find significant differences between the old and new formulas, you’ll likely need to adjust the compression setting of the press or the tamping force of the capsule filler.

**Particle size**

Changing ingredients also changes the particle size and the particle size distribution of your powder. To get a sense of that, check the certificate of analyses of the old and new ingredients. But the best way to understand particle size and particle size distribution is to perform a sieve analysis using equipment like W.S. Tyler’s RoTap. According to Tousey [2], the best particle distribution contains no overs (particles of 850 microns or more), has 70 to 80 percent intermediate particles (425 to 125 microns), and 10 to 20 percent fines (75 microns or less). Most formulas won’t achieve this, but if you’re running your current formula successfully, try to come as close as possible to that same particle size distribution.

If changing excipients makes your powder harder to work with, try retrofitting your equipment with mechanical aids, suggests my engineering colleague Brent Payne. “They can help decrease weight variance in the final product. And attachments such as scraper blades and powder cones can help distribute powder evenly throughout the dosing area of automatic capsule fillers.” On large, fast machines, a steep angle of repose in the powder bowl can cause weight variations between the inside and outside bores. “We can now adjust those tamping depths and independently bring those weights closer together. We’re also developing modified tamping rings using high-molecular-weight polymers to deal with heat-sensitive products.”

In short, replacing synthetic ingredients may pose challenges, but a few simple tests will help you quantify and assess them. Once you know what you’re up against, talk to your ingredient and equipment suppliers about how they can help you overcome those challenges.

**References**


Tim Bellio is product manager at Right Stuff Equipment/Dr. Pharm USA, 1605 E. 69th Ave., Denver, CO 80229. Tel. 303-782-7826. Website: www.drp harm-usa.com. The company supplies solid dosage manufacturing equipment.