Blending tests simulate production conditions

Continental Products' test center shows car-wash detergent manufacturer how to clean up its blending problems.

Continental Products Corp. designs and manufactures batch-blending systems and operates a test center at its plant in Milwaukee. The company's blending systems all include the Rollo-Mixer,® a drum blender that gently tumbles, turns, and crossmixes batches of solid materials, with or without liquid additives.

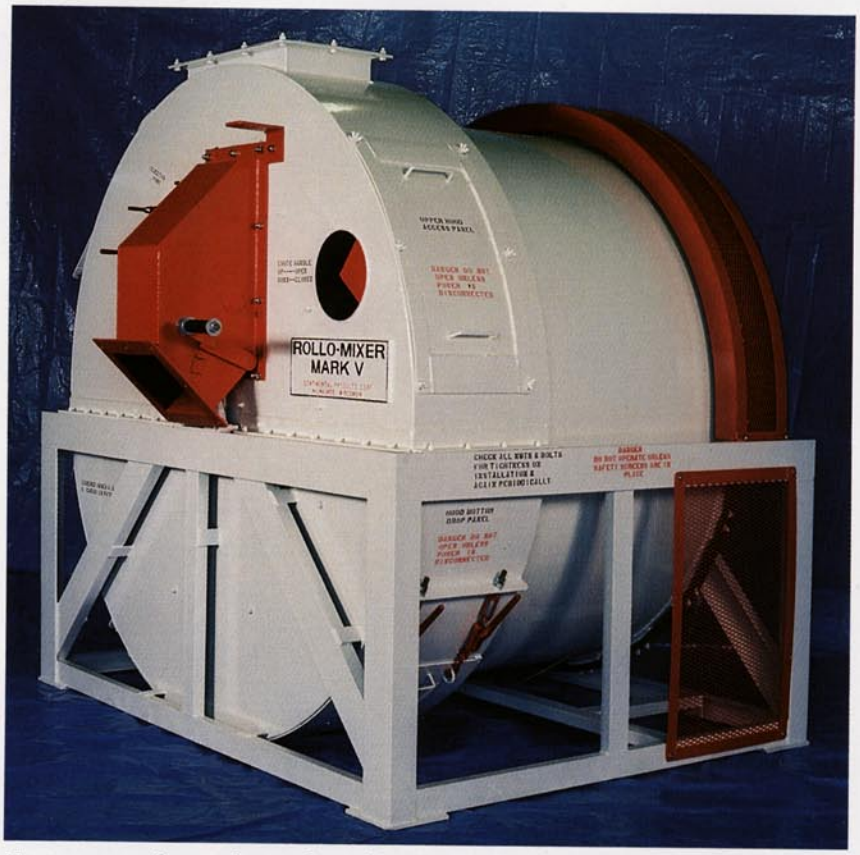
Early last spring, John Cunningham, president of KO Manufacturing, Inc., Springfield, Mo., contacted William Callaghan, Continental's engineering director and test center manager, in search of alternative blending equipment. KO Manufacturing produces more than 40 car-wash detergents, which it sells to car washes throughout the US.

Blending problems and possibility of expanded production prompt search for new blender

KO had moved into a larger facility and was considering expanding production. To produce its detergents, the company uses a single-trough horizontal paddle blender with a batch capacity of 3,000 pounds. Daily production is limited to 24,000 pounds and the blender creates several blending problems, such as uneven dispersion of sticky liquid surfactants onto powders, inconsistent blends, caking, and density changes.

Cunningham was looking for a batch blender that would meet KO's expansion needs and solve its blending problems. KO had already tested several blenders, including cone-and-auger types and dual-trough paddle blenders.

After their conversation, Callaghan sent Cunningham some literature on Continental's products. In late April, Cunningham called Callaghan and set a date for a series of detergent blending tests at the Continental test center. At this point, Phil Padron, KO's chemist, took charge of the project. He sent material samples and Material Safety Data Sheets to the test center; the center's staff reviewed the MSDS's and approved the materials for



Tests are performed on a drum blender similar to this one. Loading and discharging equipment can be set up to simulate production conditions. The blender can also be fitted with a liquid-adder system.

handling. The staff then determined the flow properties and handling characteristics of the material samples. Once this was done, Padron shipped Continental 6,000 pounds of detergent ingredients in 400-pound drums, then flew to Milwaukee in May to supervise the tests.

Drum blender's capabilities checked in four separate tests

Padron drew up a schedule for four tests — the first three would produce detergents that cause problems in KO's paddle blender. The fourth would test the drum blender's ability to hydrate a single detergent ingredient. To ensure simulation of production conditions, the tests were performed with a Rollo-Mixer drum blender with a working capacity of 40 cubic feet or 2,400 pounds. The drum blender rotates at a constant 3 rpm; the interior is equipped with vanes that lift the material and guide it into streams that cross through each other as they fall.

First test. The first test blended five dry ingredients — sodium tripoly phosphate (STPP), soda ash, tetrasodium pyrophosphate, trisodium phosphate crystals, and sodium metasilicate — with 15 percent nonionic liquid surfactant. The total batch weight was 1,500 pounds.

In KO's paddle blender, the high surfactant load causes problems. In addition, the mixture gets very thick and pasty due to the paddle blender's shearing action, and KO is unable to obtain a free-flowing product. This causes major problems when the detergent is packaged. The mixture also cakes on the paddle blender's walls and paddles, making it difficult to clean the blender between batches.

The goal of the first test was to see if the drum blender could apply the surfactant evenly and produce a free-flowing product. To accomplish this, the drum blender was equipped with liquid injector lances fitted with spray nozzles. The nozzles direct a spray of finely atomized liquids at the continuous free-falling curtain of dry material inside the blender.

Four of the dry ingredients were added to the blender, which was then started. The surfactant was sprayed onto the powder and the remaining dry ingredient added. After the blender ran for 10 minutes, the test center staff took a sample. The product was much drier and more free-flowing than that produced by the paddle blender. The gentle blending and intimate contact of spray and powder enabled the powder to absorb the surfactant quickly and efficiently. The interior of the drum blender was also much easier to clean.

The blender's free-fall impregnation system sprays liquids onto a falling curtain of solid material, providing fast, even dispersion.

Second test. The second test blended STPP, soda ash, sodium metasilicate, caustic soda beads, and preblended nonionic and anionic surfactants. The total batch weight was 1,500 pounds.

KO normally keeps its paddle blender running while packaging this mixture, but the blender generates heat, which makes the mixture sticky. "The mixture won't flow, which causes the packaging line to stop, making that phase of our operation a nightmare," Padron said.

In the test, the ingredients were added to the drum blender, which was left running for 30 minutes. Due to the low shear and gentle blending action, the mixture didn't heat up or get sticky and remained free-flowing.

The test center's staff took samples from the blender at 3 minutes, 15 minutes, and 30 minutes. Padron later tested the samples for pH, total alkalinity, bulk density, surfactant content, and phosphate level. The results showed that the mixture remained uniform throughout the test: pH and bulk density stayed the same, alkalinity varied 0.3 percent, surfactant load varied only 0.1 percent, and the phosphate level varied 0.6 percent.

Third test. The third test presented another challenge, caused by different bulk densities and flow properties in the raw materials. The test blended soda ash, which consists of needle-like particles; sodium metasilicate beads; sodium chloride crystals; anionic surfactant flakes; and optical brighteners and an anti-redeposition agent, which are fine powders. A liquid nonionic surfactant was also added. The total batch weight was 1,800 pounds.

"The main problem encountered with this mixture is the demixing that occurs during blending and when discharging the product," Padron said. With the paddle blender, a typical batch of this mixture can vary 5 percent in total alkalinity, depend-

The rear access door allows the test center's staff to take samples from the blender at any time during a test.

ing on where the sample is drawn. A variance this large affects the cleaning ability of the finished detergent.

The goal of the third test was to determine if demixing occurred in the drum blender. The soda ash was loaded into the blender and the liquid surfactant sprayed on, then the remaining ingredients were added. The mixture was blended thoroughly for 3 minutes and a sample was taken. The product was then discharged, packaged in drums, and shipped back to KO's plant, where three additional samples were taken from three different drums. Padron tested the alkalinity of each sample, including the one drawn after 3 minutes, to check the mixture's consistency. The collective alkalinity varied slightly by a range of 1.3 percent, much better than the 5 percent variance that occurs with the paddle blender.

Fourth test. The final test of the day determined the ability of the drum blender to hydrate STPP. The test center staff loaded 900 pounds of STPP into the drum blender, then 145 pounds (16.1 percent) of water were sprayed onto the powder through the blender's injector lances. Samples taken from different locations in the drum blender proved that the blender evenly dispersed the water onto the powder. After witnessing other manufacturers' methods of applying liquids onto dry materials, Padron felt that free-fall impregnation dispersed liquids more uniformly.

Tests judged successful by detergent manufacturer

The tests proved that a drum blender could successfully blend KO's products and eliminate its blending problems. The drum blender dispersed liquids evenly onto powders, creating consistent, free-flowing products that were easy to package. The mixtures containing various particle sizes and densities were blended without any demixing. The blender was also easily cleaned between each batch.

In addition, the drum blender's throughput is as high as 40,000 pounds per day, and the unit can be used to agglomerate and dry products. These features would allow KO to increase production and develop new products.

"Some of the other blenders we tested were faster," Padron said, "and some blended as well, but they didn't perform as well in other areas. The Rollo-Mixer does everything we need. We're seriously considering purchasing one for our production line." **PBE**

Facts about Continental Products' test center

Continental's test center is located at its plant in Milwaukee. It occupies 800 square feet and has a staff of five that conducts between 40 and 50 tests per year. An average test takes 1 or 2 days. For instance, while each test for KO Manufacturing took between 2 and 3 hours for loading, mixing, sampling, discharging, and cleaning, all four were finished in 1 day.

Prior to blending tests, customers must send samples of their products along with the pertinent Material Safety Data Sheets. The test center won't handle toxic, explosive, or other hazardous materials.

Depending on how the customer handles its raw materials — bags, barrels, bulk containers, or bulk bags — the test center can change the filling and discharge systems on the drum blender to ensure a dust-tight environment from start to finish. This preparation allows the test to simulate an actual production run.

Customers should plan to observe the entire test procedure. Once testing and sampling is completed, blended products are returned to the customer for lab analysis or other purposes.

Continental does not maintain an analysis lab at its test center — instead, it encourages customers to use their own analysis equipment and techniques (or an independent lab) to evaluate the results of the blending tests. This way, test results for different blenders can be compared on an equal basis.