AUSTRALIAN
BULK HANDLING REVIEW

www.BulkHandling.com.au

Volume 18 No 4 July/August 2013

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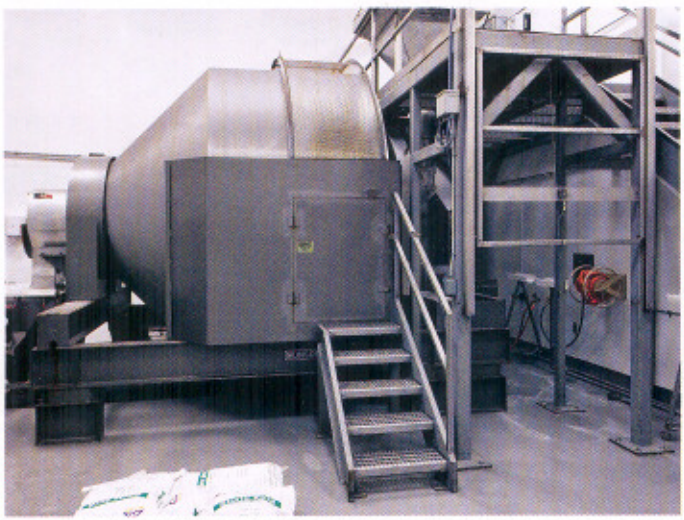
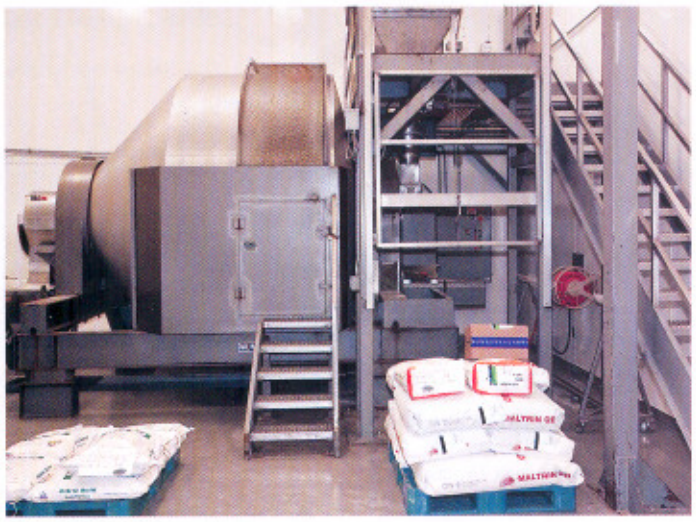
Ribbon blender and rotary batch mixer for bulk powders

To meet soaring demand for its tablets, capsules and bulk powder products, US contract manufacturer Arizona Nutritional Supplements replaced double-vee-cone blenders and a 3.5m³ capacity ribbon blender with a 14.2m³ capacity ribbon blender and a 8.5m³ capacity rotary batch mixer, both from Munson Machinery.





Munson 8.5m³ capacity rotary batch mixer achieves batch uniformity in 3 - 5 minutes, cleans quickly, and saves energy.

The mixer and blender now turn out Arizona Nutritional Supplements' (ANS) bulk powder products while the vee-cones and original ribbon blender process powders for tablets and capsules.

ANS' plant located on Chilton Drive in Chandler, Arizona focuses on protein, whey, meal replacement, and other powders packed in plastic jars, plastic stand-up-pouches and stick packs. Another ANS plant on Beck Avenue produces nutritional supplements in the form of tablets and capsules, which are packaged in bottles and blister packs.

"Due to high growth in nutritional supplements, our powder business has increased by over 500% in the last few years," said Jeff Neal, ANS plant manager and director of operations at the Chilton Facility.

"That's indicative of what's happening worldwide, and why we needed more mixing and blending capacity."

Previously, ANS was blending powders for its tablets, capsules and bulk powder products at the Beck facility using five double-vee-cone blenders and a 3.5 cu m ribbon blender.

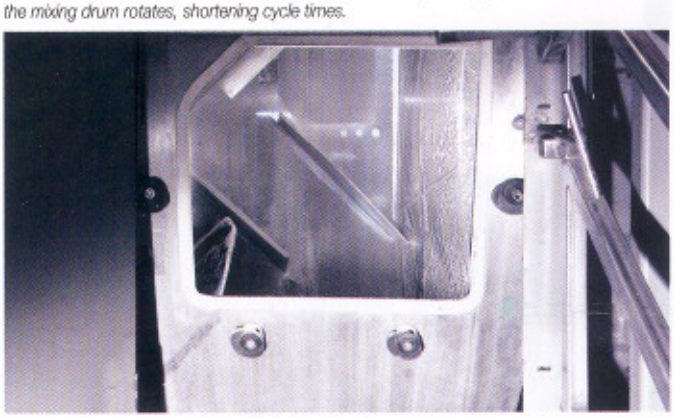
Because this equipment could not meet recent increases in demand, the company relocated the bulk-products portion of its powder processing to the Chilton plant where it installed a ribbon blender and a rotary batch mixer, both from Munson Machinery.

The move also enabled the company to dedicate the original vee-cones and ribbon blender at the Beck facility to the processing of powders for tablet and capsule production.

Capitalising on the differences between stationary and rotary mixers

ANS fills custom orders for over 200 customers worldwide and performs numerous product changeovers daily. It was therefore critical for the new mixing and blending equipment to achieve uniform blends comprised of materials having diverse particle sizes and flow characteristics and to do so across a wide range of batch sizes. Equally important was preventing cross contamination and minimising downtime between production runs.

Bulk ingredients are fed into the mixer's intake chute through a hopper at mezzanine level as the mixing drum rotates, shortening cycle times.



Mixing flights are continuously welded to the stainless steel drum's interior, which is polished to a mirror finish for rapid, thorough sanitising.

To satisfy these and other requirements, ANS installed two types of bulk solids blenders: a 14.2m³ ribbon blender, and a 8.5m³ rotary batch mixer. All product contact surfaces of both machines are stainless steel with large weld radii ground and

Powders are manually added to the 14.2m³ capacity ribbon blender in which ANS mixes whey, soy, protein and greens requiring high shear.

polished to mirror finish.

"They're designed for easy, fast and effective washdowns," Neal explained.

Two machine types were specified because each yields significantly different advantages.

The ribbon blender, which consists of a stationary, U-shaped trough and a ribbon-shaped agitator blade that is forced through the material, is "ideally suited to products requiring high-shear such as whey, soy, protein, and greens. High shear also creates friction which causes sugar- and fructose-based powders, such as drink mixes, to heat and form clumps. The rotary mixer, on the other hand, can handle both," Neal said.

The mixing vessel of the ribbon blender is larger than that of the rotary batch mixer's, but its overall output of approximately 22.5t per day is about the same, due to longer mixing and cleaning cycles.

In terms of cleanability, the ribbon blender has a shaft penetrating both sidewalls of the mixing chamber through seals which contact material and require cleaning. In addition, at the end of each production run, a "heel" of material remaining at the bottom of the trough must be manually removed before sanitising the machine.

However, Neal said "thanks to tight tolerances between ribbon blades and blender trough, product heel is minimal.

"One thing I like about the ribbon blender is that it's less expensive than the rotary mixer, and gives us good return on the batch sizes we run."

The rotary batch mixer cleans faster, operates more quickly, and uses dramatically less energy, according to Neal: 30kW to rotate the drum, versus 74.5kW to drive the blades of the ribbon blender.

"Where a ribbon blender may take 20 minutes to achieve batch uniformity, the rotary unit takes only three to five minutes, which is a huge difference," Neal pointed out.

The shorter cycles are the combined effect of four machine characteristics: 1) rapid gravity feeding of ingredients through a hopper into the front of the machine, 2) gentle but rapid four-way mixing action inside the unit – tumble, turn, cut and fold, 3) the ability of the machine to continuously mix during loading and discharge, and 4) fast and complete discharge after mixing – as little as 20 seconds per 2,000kg batch.

As for changeovers, two internal spray jets facilitate cleaning as the drum rotates. Also aiding cleaning, the mixing flights are continuously welded to the drum wall and the interior is surfaced to a mirror finish.

Further, each batch discharges completely, meaning no product heel remains, allowing the unit to be immediately washed and sanitised with the required fluids.

"In my view, rotary is the way of the future, and why we're trying to transition more of our customers in that direction. But some still insist on using ribbon blenders for their products, so we offer both," Neal said.

Taking a pharmaceutical approach to quality control

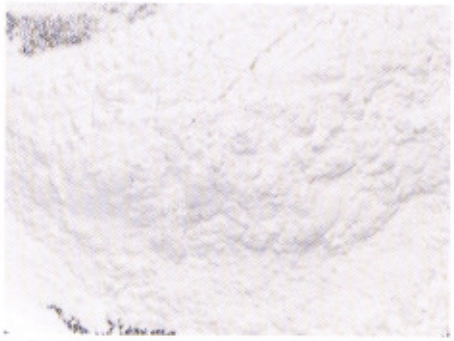
ANS's two facilities, which together span 18,580m², have an inventory of some 3,000 raw materials, each of which arrives in 22 - 26kg plastic bags or plastic-lined boxes.

They pass through the Beck facility first, where the quality control lab tests for potency and purity. Powders are then measured and weighed according to the customer's recipe, and sent to Chilton for processing and final packaging. The lab also tests samples of finished product before shipping.

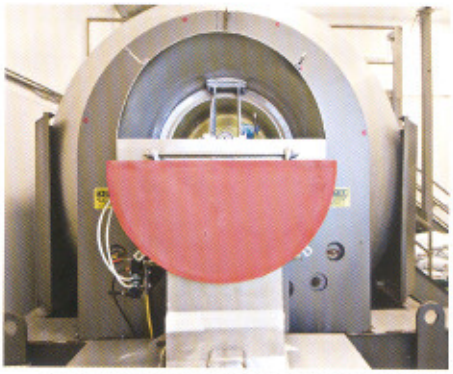
After discharging from the Munson units, finished powder is fed by a 203mm diameter auger into 600kg bulk bags and transported to the filling area.

There, the bags are lifted, and the finished product is gravity fed into other hoppers that supply the various packaging lines, which include one stick line, three pouch lines, and three jar lines, one of which is dedicated to small runs.

To help prevent cross contamination and allergen risk between products, the mixing/blending and packaging departments are separate from one another, as are the machines they contain. Each individual room maintains a negative air pressure.



Powdered raw materials pass quality control lab tests prior to mixing with other ingredients.



The mixing drum rotates continuously during discharge, preventing segregation of the blended batch.

"We have adopted the same kind of mind set as the pharmaceutical industry," Neal said.

Finished sizes range to 20gm for stick packs, 60 to 100gm for stand-up pouches, and 100gm to 2.2kg for jars.

Neal said he has been very pleased with the performance of the rotary batch mixer and ribbon blender since they were installed.

He is also pleased that more people are opting for things like healthy protein, whey, soy, vegetable and other shakes for breakfast instead of pancakes or bacon and eggs.

"It's good for them, and for us." ■

Contact: Munson's Australian distributor: iBulk – www.iBulk.com.au