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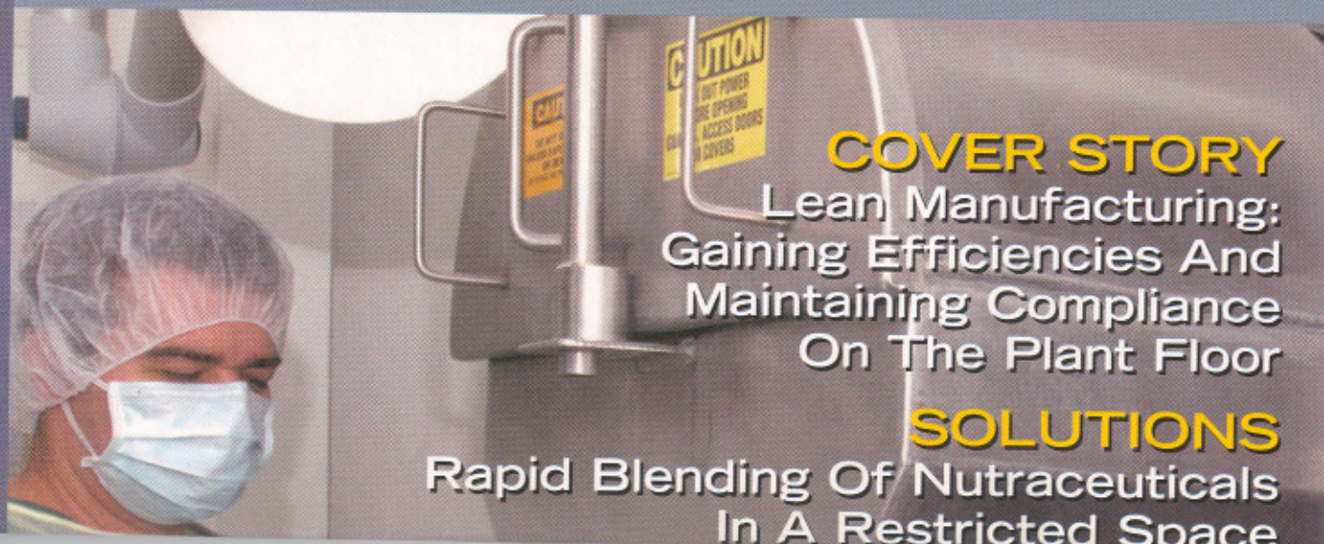

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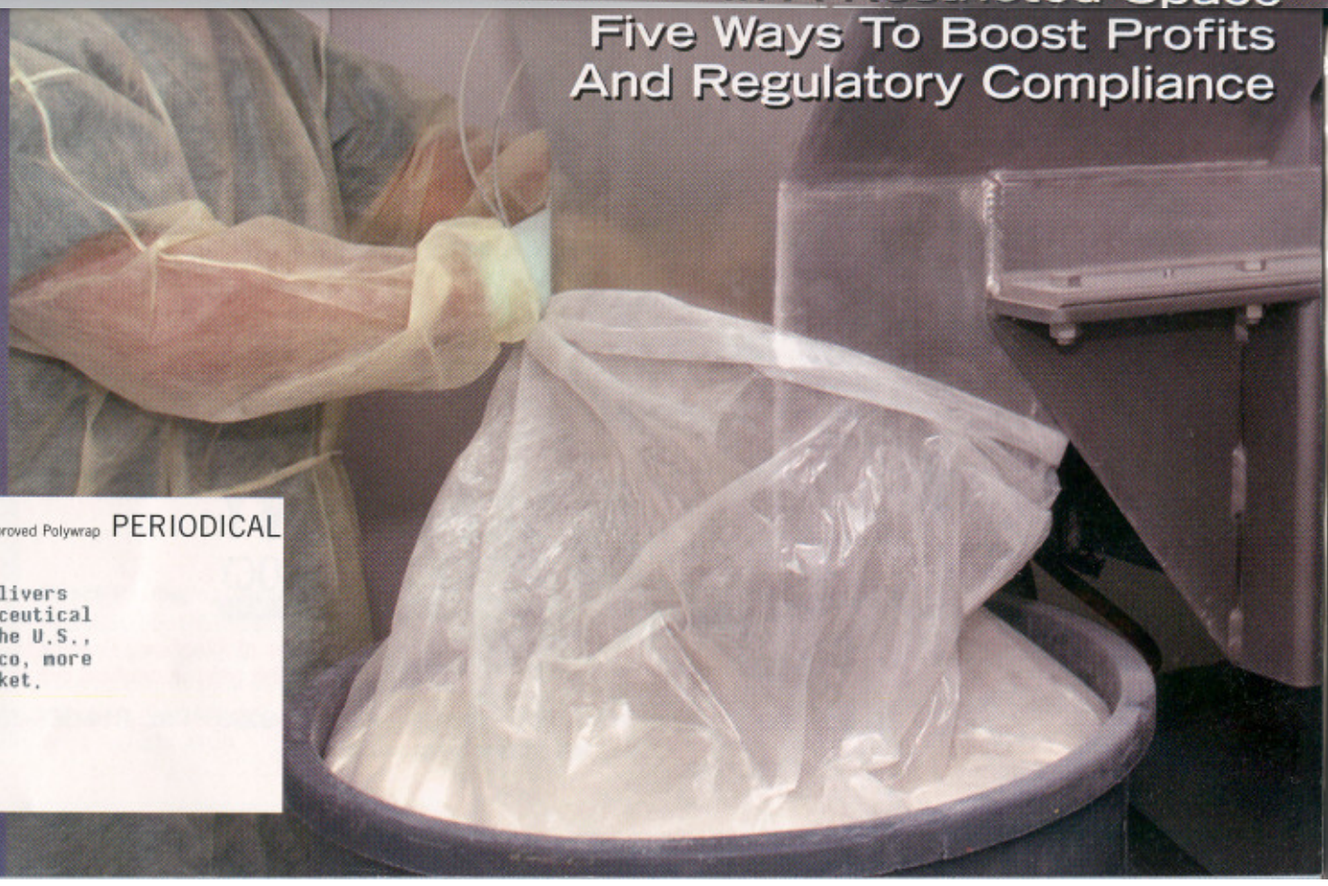

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Solutions

Rapid Blending Of Nutraceuticals In A Restricted Space

Although vitamins and minerals have long been a mainstay in health maintenance, a new category of health maintenance products has created an entirely new market over the last two decades. The term "nutraceutical" was first defined in 1989 by Stephen DeFelice, M.D. as "... food, or parts of a food, that provide medical or health benefits, including the prevention and treatment of disease." Since that first characterization, the word has expanded to cover almost all dietary supplements that have specific health benefits - everything from acidophilus to zinc.

Market research experts disagree widely on the size of the current global nutraceuticals market. Fredonia Group estimated in a 2004 study that world demand for nutraceutical chemicals will reach $9.6 billion in 2008, with nutritional products at $173 billion. Business Communications Company estimated in a 2003 study that the global nutraceuticals market would reach $74.7 billion by 2007. The disparity most likely exists due to various segments such as supplemented foods that may or may not be counted. Experts agree, however, that business is booming.

Nutri-Force Nutrition, a manufacturer of private-label nutritional supplements, vitamins and over-the-counter drug products, has nearly doubled production each of the four years it has been in business. Anthony Alfonso, R.Ph, MBA, president and owner, attributes the growth primarily to the burgeoning market, plus the company's customer service and turnaround time.

To meet demand, Nutri-Force purchased an additional warehouse and expanded its plant, adding a laboratory facility and processing equipment that included a blender, tablet press, automated packaging line and an encapsulation machine.

The company needed a higher capacity blender to minimize the cost per volume of material processed. "Each production run incurs time for loading, blending, unloading, quality assurance testing and cleaning," says Alfonso, "so the higher the capacity of the blender, the lower the labor cost and downtime as a percentage of output." Compactness of the mixer was also critical because a large piece of equipment would increase the extent of the plant expansion.

Nutri-Force considered several blenders, deciding on a 40 cu. ft. (1.13 cu. m.) capacity Munson rotary batch mixer. Gilberto Diaz, Nutri-Force's Operations Director, explains, "I've worked with all types of blenders—slant cone, double cone, V-blenders, and ribbon. For the space we have and the output we require, the rotary blender is the optimum choice."

Balancing space and capacity

The Munson rotary mixer meets both capacity and space requirements, with the added advantage of allowing mixing to begin while ingredients are still being added, effectively increasing daily capacity by shortening batch mixing time.

At 6 ft (1.8 m) tall, the rotary blender was the most compact of all the blenders considered fitting into a space approximately 6 ft (1.8 m) wide by 10 ft (3.0 m) long. The 5 ft (1.5 m) high in-

Top: A Munson rotary mixer installed at Nutri-Force Nutrition achieves homogeneous blends in approximately three minutes.

Bottom Left: Precision measurement of ingredients on a pharmacy scale ensures batch accuracy for compliance with FDA standards for food-grade supplements.

Bottom Right: Nutri-Force's plant expansion included a fully automated packaging line that meets increased demand for the company's nutritional supplements, vitamins, and over-the-counter drug products.

Solutions

Over 20 million capsules per month are produced by Nutri-Force, part of the multi-billion dollar global market for nutraceuticals, vitamins, and over-the counter drug products.

take chute is accessible for manual dumping of ingredients. Diaz points out that a multi-axial or other type of mixer with an equivalent batch size of 1,323 lb. (600 kg) would be two to three times larger than the rotary blender. A height of 12-15 ft. (3.7-4.6 m) would require a two-story space with a catwalk mezzanine for top feeding, creating safety and logistical concerns.

With over 300 different formulations, rapid blending to a homogeneous mixture is a critical attribute that increases overall plant production. The blender's rapid mixing cycles enabled the company to achieve its desired output. "The rotary blender achieves 100 percent batch uniformity in approximately three minutes, ten times faster than other mixers we considered," says Diaz. Typical production is 11,023-15,432 lb. (5,000-7,000 kg.) of a single product in an eight-hour shift, or 4,409-6,614 lb. (2,000-3,000 kg.) when running several products with sanitizing between batches.

By comparison, the company's existing multi-axial batch blender must be stopped during loading and unloading, and requires 30 to 45 minutes of blending time per 441 lb. (200 kg.) batch. "The only time the rotary blender stops is for cleaning during a product changeover," says Diaz.

Preventing degradation, heat build-up and contamination

According to Diaz, the rotary blender produces a homogeneous mixture while gently folding and tumbling the material, preventing product degradation. The unit's internal mixing flights alternate in direction for "back flow blending," an active, gravity-driven cascading of the material back and forth as it passes through the vessel, which is turning at low rpm. The resulting mixing action is said to preclude the product degradation and heat build-up associated with ribbon blades, paddles, or plows being forced through material contained in stationary mixing vessels.

The rotary batch mixer is constructed of 304 stainless steel with food grade finish required for production of nutraceuticals and is fully enclosed, preventing contamination of the product and plant environment. Since it evacuates the batch fully, it minimizes the possibility of cross contamination and allows faster, easier sanitizing.

Sanitizing to FDA standards

As an FDA-licensed facility, Nutri-Force sanitizes equipment between runs of different products, and requires rapid, thorough washdowns. Cleaning the rotary mixer involves adding hot water followed by a pharmaceutical-grade cleaning solution, and rotating for 5-7 minutes. The drum is drained and rinsed, and then a solution of alcohol and water is agitated for 5-10 minutes. After draining, the blender may be air dried, which

takes 15-20 minutes, or blown with hot air for 5 minutes. Total cleaning time is about an hour.

Miguel Tang, a PhD microbiologist in the process of validating the cleaning procedures, says, "The rotary blender has proven easy to clean. Independent laboratory testing has demonstrated good results, with no residue of products or detergents left in the blender after cleaning."

Loading of ingredients to discharging of blended batches

The mixer is equipped with a large, stationary intake chute for manual feeding, with an operator weighing out ingredients on a pharmacy scale and manually dumping the materials from bags, drums, and cans. The inlet chute is large and stationary, with an unobstructed pathway into the blender. For automated feeding, the inlet design can also be configured to receive material from bulk bag unloaders, weigh batching systems and other upstream sources.

The blender handles all types of powders, including those with high oil content typically associated with the vitamin formulations, produced by Nutri-Force.

Internal spray heads facilitate the addition of oils or coatings to the blend, the tumbling action ensuring uniform distribution. Diaz estimates that the batch blender with spray nozzles yields three- to four-times greater capacity in a smaller space than a typical tablet coater having a 48-inch (122-cm) pan.

Internal mixing flights of the rotating drum tumble, fold and cut the material while directing it into the discharge spout, facilitating total evacuation of the batch.

The 700-TH-40-SS consists of a horizontal, rotating drum that has a stationary inlet at one end and a stationary outlet with a discharge gate at the other. The mixing vessel is supported by two oversized trunion rings, which ride on heavy-duty alloy roller assemblies. Material is charged via the inlet chute while the drum is rotating. Mixing flights or vanes tumble the batch materials in a multi-directional manner, while simultaneously moving the material toward the outlet.

Munson says the mixing action produces a "fluidized zone" with random dynamics that results in uniform mixing without segregation. At the same time, the mixer is an "extremely gentle blender" that will not degrade the size or shape of particles. When the blend is complete, the discharge gate pivots into the machine and directs the material down a discharge spout.

After blending in the rotary mixer, powders are manually fed to an encapsulation machine (shown), a tablet press, or directly to the packaging line.