

## MANUFACTURING TECHNOLOGY

# Liquid Glucosamine Goes Mainstream

**New high-speed mixing technology is helping one leading manufacturer meet soaring demand for joint health products.**

By Ken Langhorn

The recent Glucosamine/Glucosamine Arthritis Intervention Trial (GAIT) has surely interested many Americans with ordinary joint pain who have become wary of conventional pharmaceutical pain relievers. Awareness is rising. Further increases in sales will certainly follow. But for executives at Botanical Laboratories (Ferndale, WA), a manufacturer of liquid glucosamine, the trend under way is much more profound than just another upward step in sales.

### MEET THE NEW GLUCOSAMINE BUYER

"We are seeing a mass shift in public interest," says Carl Sell, president and CEO of Botanical Laboratories. "Dietary supplements like glucosamine are taking off among mainstream Americans, and the impact in sales will be exponential."

The prospect of exponential gains in sales would be enough to prompt any manufacturer to start working overtime, but the management team at Botanical Labs sees this as a much greater challenge—and a much bigger opportunity.

"Botanical Labs has grown by about 30% annually during the last few years, and we project even greater growth this year," Sell says. "But here's the real challenge: Our new customers are coming to us with mainstream attitudes about the brands they choose on store shelves."

The brand-centric vision at Botanical



**Powdered glucosamine and chondroitin are predispersed in a liquid stream of filtered water. This in-line SLIM mixer replaced a batch mixer and serves two 1500-gallon vessels.** Photos courtesy of Botanical Laboratories.

Labs is evident both inside and outside the packaging that surrounds its flagship product, Joint Movement Glucosamine. Outwardly, it is presented more like a sports drink than a medicine. Inside the bottle, buyers find glucosamine, chondroitin, MSM, collagen, and other nutrients in a form that is a refreshing alternative to the usual tablets found on store shelves.

"Liquid glucosamine is the rising star in the glucosamine market for obvious reasons," says Sell. "Research tells us that 25–30% of Americans have trouble swallowing large pills—

and despite their size, most glucosamine/chondroitin pills come in a dosage that requires users to take three each day.

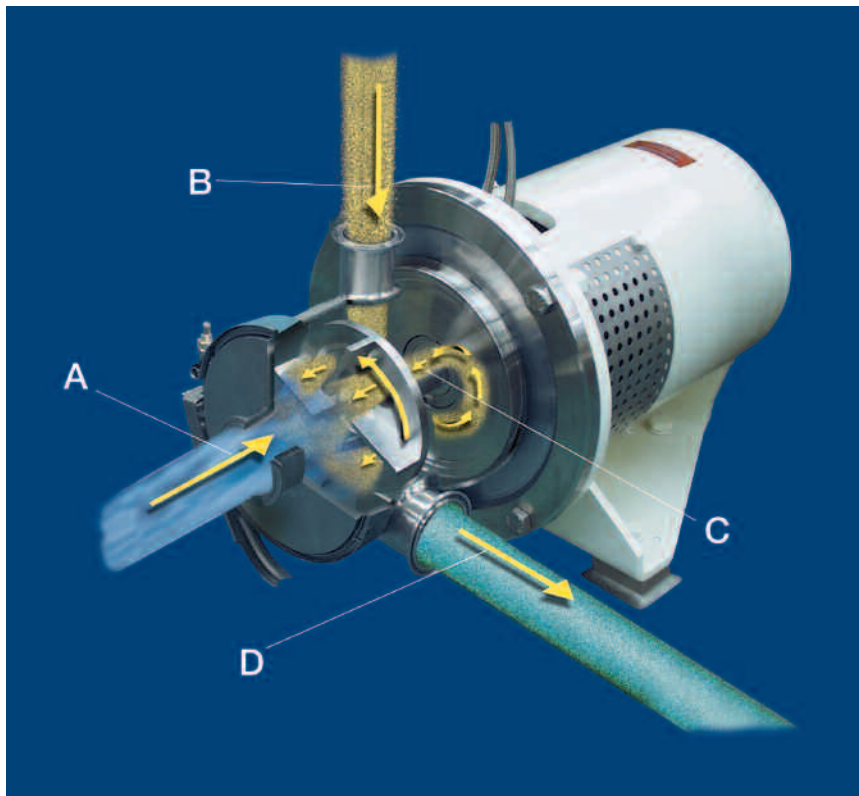
"But even for those who can swallow large pills comfortably, liquid is preferable. It's an easy way to consume a concentrated dose at once without any discomfort. With a great flavor and texture, we've transformed a daily chore that many people dreaded into a pleasant part of their daily routine."

The stores themselves in which Joint Movement Glucosamine is displayed also reflect the company's big-brand thinking. The product is now sold in major outlets online and also in many leading retailers and club stores across the country. According to IRI (Chicago) data, retail sales of Joint Movement Glucosamine increased by more than 100% during the last year.

### MARKETING OPPORTUNITIES AND MANUFACTURING CHALLENGES

The success at Botanical Labs required a big boost in production to keep up with the demand of its high-volume channel partners. This triggered a search for new mixing technology that might offer great leverage on the process line—an economical mixer that would generate a large gain in capacity without consuming much space on the plant floor.

But to Sell and his team, smart production involves more than just



As filtered water enters the mixer (A), solids are drawn into the rotor/stator generator by a powerful vacuum (B). They are redirected into the high shear zone (C), where they are instantly dispersed and expelled at high speed (D). Photos courtesy of Botanical Laboratories.

throughput. It's another opportunity to make the company more nimble, competitive, and capable of pleasing its customers.

"Our whole focus is on delighting our customers," says Sell. "On the production line, mixing is a vital part of this process because its effect is pervasive. It influences overall throughput, process flexibility, and end-product quality. With the right mixing equipment on the floor, we are prepared to delight our

channel partners by meeting their needs with competitive prices and reliable delivery—while we delight our customers with a drink that is thoroughly satisfying every morning."

### THE ORIGINAL MIXING PROCESS

During a pilot manufacturing program, Botanical Labs mixed its Joint Movement Glucosamine product in a single vessel, using a batch rotor/stator mixer. Powdered glucosamine

and chondroitin were simply added to filtered water in a 400-gal batch, along with such minor ingredients as MSM, collagen, vitamins, and natural flavor.

Since the Joint Movement Glucosamine product delivers a highly concentrated dose (2000 mg glucosamine and 1200 mg chondroitin plus other nutrients in a single ounce), the dispersion was heavily loaded. Even with a batch-type rotor/stator mixer, a long period of agitation was required to complete the process. Following the mixing cycle, the product was pumped downstream to bottling equipment.

### ANALYSIS

Batch mixers are versatile and efficient, but in certain cases, in-line high-shear mixers equipped for high-speed powder induction can deliver superior performance:

1. Many solids, such as fumed silica, gums, alginates, and starches, are hard to wet out. When they are added to an open vessel, they often float persistently on the surface, even when subjected to vigorous agitation.

2. Many solids, such as carrageenan, will eventually submerge in the batch but form agglomerates that are notoriously difficult to break down.

3. In the case of Botanical Labs, the dispersion process was far too time-consuming using a batch mixer. For heavily loaded dispersions, an in-line alternative saves time by driving solids into suspension faster than a batch mixer.

4. In-line mixing systems can also enable a dramatic increase in batch size. For companies like Botanical Labs that have an urgent need for increased capacity, this can be an extremely efficient strategy for boosting throughput on the process line.

5. Manufacturers such as Botanical Labs must also focus on the final particle size and uniformity of their dispersion. Particle size is a critical determinant of the texture and mouthfeel that customers perceive, and it is therefore one of the key parameters in food mixing.

### REINVENTING THE MIXING PROCESS

Botanical Labs has used rotor/stator high-shear mixers manufactured by Charles Ross & Son Co. (Hauppauge, NY) since 1990. According to plant manag-

### High Speed Solid/Liquid Injection

With a rotor/stator generator specially modified to include progressive spiral porting, the Ross SLIM mixer draws powder from an overhead hopper directly into the high-shear zone. There, the powder is simultaneously combined with the liquid stream and subjected to intense shear. It is then expelled from the mixer at high velocity—with sufficient force that an auxiliary pump is generally not required to propel the material downstream.

The SLIM system is particularly well suited to mixing heavily loaded products. Because the apparent viscosity of pseudoplastic (shear-thinning) materials drops in the high-shear zone, these materials can tolerate heavy solids loading—reaching viscosities up to 50,000 CP without the clogging that plagues eductor-based systems. This is why extremely high-throughput gains are possible in many systems with SLIM injection.

er Doug Hughes, they are used in many applications, from liquids to creams and gels, in both production and R&D.

"We use the Ross high-shear mixers in many processes that would be tough for a simple agitator—mixing sugar or syrup, for example. Because of that track record, when we set out to build our new production line for the Joint Movement Glucosamine product, we called Ross."

Replacing the pilot 400-gal vessel, the new line is equipped with two 1500-gal vessels. Ross provided a single in-line high-shear mixer that serves both vessels. The new mixer, called the SLIM (solid/liquid injection manifold), continuously injects powder into filtered water at high speed (see sidebar).

Powdered glucosamine and chondroitin are now predispersed into a moving stream of filtered water as it enters the mix vessel. Injected under vacuum and intense mechanical and hydraulic shear, the powders are instantly reduced to extremely small particle sizes and dispersed in the stream. When they enter the primary mix vessel, the chief cause of delay in the original process has already been eliminated. Inside the vessel, only a simple turbine mixer is required to keep the batch agitated while it is discharged to downstream bottling equipment.

## ANALYSIS

The new system completes a 1500-gal batch in the same time that the original batch system required to process 400 gallons. This represents an increase in throughput of 275%. The new system has also given Botanical Labs plenty of flexibility. While one 1500-gal vessel is mixing, the other can be discharging to the bottling line, making the process virtually continuous.

The system is set up to allow recirculation through the mixer. In many applications, additional passes through the rotor/stator generator can improve the dispersion by producing a smaller average particle size and a narrower particle size distribution. But in this case, optimal results are achieved in a sin-



**Solids in the mixer's overhead hopper are drawn under vacuum directly into the high shear chamber, where they are instantly dispersed into the liquid stream.** Photos courtesy of Botanical Laboratories.

gle pass through the high-shear mixer.

Changeover is fast, too. Since the mixer and piping can all be cleaned easily, the production crew can shift gears quickly and respond flexibly to demand for numerous products on this line. "The Ross SLIM mixer has played an important role in our success," says Sell. "It gave us the throughput increase we needed to serve our mass-market channel partners. And just as important, with a finer dispersion it has really helped us to perfect our Joint Movement Glucosamine product."

Botanical Labs recently launched two new products, and one—a liquid calcium

supplement called Calexcel—is also produced using the SLIM mixer. "We're all about innovation," says Sell. "We're listening to our customers. We're exploring new products, new ways to perfect them, and new ways to build on our success. Our category is about to explode, and when it does, we will be ready." ❖

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