

# Pollution Engineering

APRIL 2006

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# It Takes a *Soft* Touch

**Environmental restoration product manufacturer requires a gentle blending of powdered microbes, enzymes and nutrients.**

**T**he microbial formulations produced by United-Tech Inc., Tulsa, Okla., are used to break down or detoxify a broad array of complex, and often toxic organic compounds, greasy spills and other contaminants in a variety of environments, leaving behind mostly CO<sub>2</sub> and water. The company's powdered formulations, which look and feel like flour, contain proprietary blends of microbial cultures, enzymes, various micro- and macronutrients, and flow-enhancing additives.

"These products are designed to speed the bacterial degradation processes that already occur in nature, without the addition of any chemicals and with no further damage to the environment," said Art Barnard, who founded the company in 1993.

Blending bacteria with additives in ratios as low as one part to 40 presents unusual challenges. The bacteria will be destroyed unless handled gently and blended rapidly, yet the distribution of bacteria throughout the batch must be 100-percent uniform. Also critical is the

ability of the blender to fully discharge each batch and to quickly and thoroughly sterilize it between runs of different products. After evaluating several types of blenders against these criteria, Barnard decided in favor of a rotary-style batch mixer.

#### **Giving nature a boost**

While most environments contain indigenous bacteria capable of degrading a range of organic compounds, the particular microbes at a site are often not best suited or voluminous enough for the particular contaminant load. Bioaugmentation solutions aim to maximize natural bacterial degradation processes by delivering a targeted bacterial population, and supplying micro- and macronutrients to sustain the bacterial population and enzymes that act as catalysts, promoting and accelerating the bacterial degradation of complex organic compounds.

The Tulsa company's bioaugmentation formulations are being used to treat chemical- and petroleum-laden soil and

groundwater; to remove unwanted organics and reduce sludge volumes in both industrial and municipal wastewater-treatment facilities; to remove organic sludges from drain lines, grease traps and septic systems; and even to clean floors in settings such as automotive repair facilities, machine shops and restaurants that are prone to grease buildup.

In recent years, these formulations have also been adopted by operators of commercial shrimp farms and fisheries, and are being used to improve water quality, and break down organic bottom sludge in decorative ponds, swimming pools and spas.

#### **Bacteria, enzymes require gentle blending**

The products are produced in powdered formulations that are easier to store and transport than liquids. They are typically mixed with water and sprayed on contaminated media. The company first cultivates the target bacterial cultures in sterile biofermentation reactors. After harvesting the biomass, the desired bacteria cells are

"We guarantee consistent ratios and uniform distribution of ingredients," said Barnard. "Whether customers buy a 50-lb box, a 55-gallon drum or a tote of our products, they typically use it just one pound at a time, and must be assured that it contains bacteria, enzymes, nutrients and other additives in the correct proportion."

concentrated through gentle centrifugation.

A two-step freeze-drying process then removes 95 percent of the moisture, creating a dry, powdered form of the bacteria that is easily blended with other ingredients. According to Barnard, this freeze-drying, coupled with a patented micro-encapsulation step "puts these rugged little guys into a state of suspended animation or dormancy," and protects the bacteria from potential damage or deactivation that might otherwise occur during periods of extended storage.

**Bioaugmentation solutions aim to maximize natural bacterial degradation processes by delivering a targeted bacterial population...**

For years, the company had been outsourcing the blending of its raw ingredients to a third-party vendor. But in 2002, to save money and streamline its manufacturing operations, the company brought its blending in-house. Of course, that meant finding a blender.

United-Tech evaluated blenders according to their ability to provide specific criteria:

- Precise and consistent blends containing its target microbial load
- Rapid mixing to maximize manufacturing throughput
- Rapid, thorough cleaning for rapid changeovers
- Gentle blending with minimal friction and shear to protect bacterial cells and other friable ingredients from mechanical degradation

After rejecting various types of ribbon and paddle blenders – "too much friction," said Barnard – and V-cone blenders – "excessive cycle times" – the company

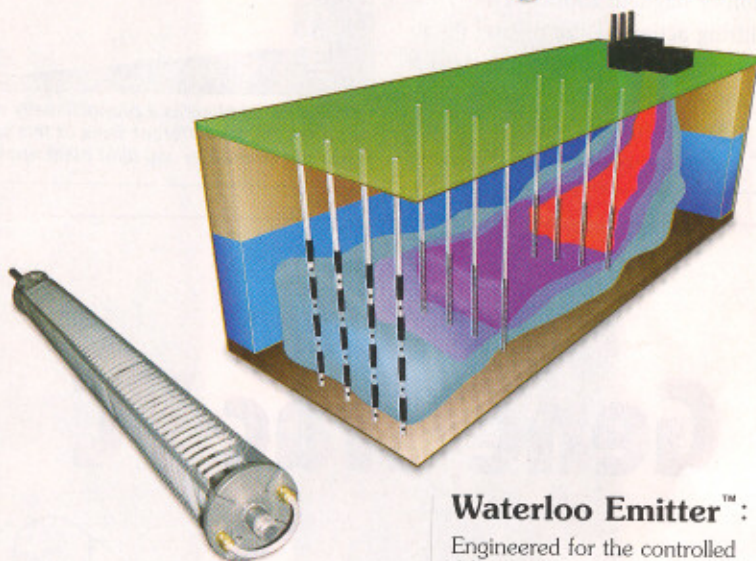


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## Soft Touch

chose a Model MX-10-SS Mini Mixer from Munson Machinery Inc., Utica, NY. The rotating mixing drum of the unit had a total volume of 22 cubic feet and a blending volume of 11 cubic feet. Designed for laboratory mixing, pilot plant applications, pre-blending operations and relatively small production runs, the unit was a scaled-down version of Munson's rotary batch mixer.

The mixing vessel has no internal moving parts; rather, its interior is fitted with evenly spaced baffles that gently tumble, turn, cut and fold the powdered ingredients as the drum rotates. This cascading action creates a fluidized condition that ensures uniform blending, minimizes product degradation, and prevents the formation of stagnant zones.

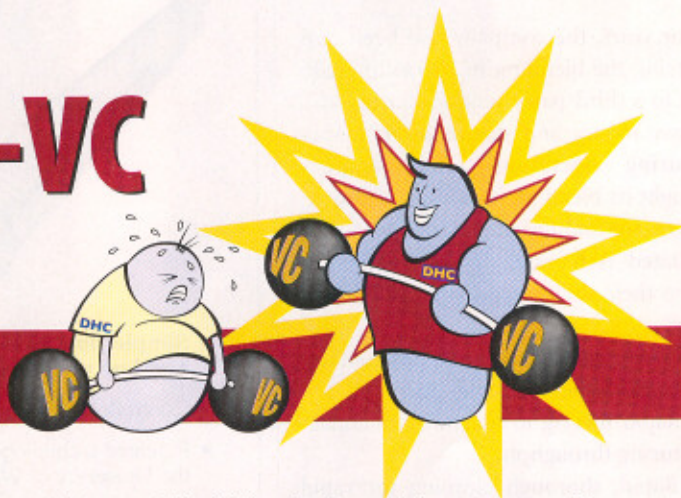
The lifting action of the mixing flights also serves to direct the material to the discharge spout, which, when open, promotes 100-percent evacuation of the batch. "The mixer consistently discharges



Munson's Mini Mixer is a proportionally scaled version of the company's widely used Rotary Batch Mixers. Six different sizes of this small-scale mixer are available, for small batch operations, and laboratory and pilot plant applications.

## Introducing Gene-Trac-VC

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\* Exclusive License Agreement with Stanford University  
US Patent Application US 6,059,450 (Spormann and McCarty)

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United-Tech blends 500 lb. every 3 to 5 minutes. By unloading quickly, the blender maximizes the number of batches they are able to blend. Evenly spaced baffles inside the rotating drum set powdered ingredients in motion with a gentle cascading action.

completely, leaving no residual material behind," said Barnard. "By comparison, ribbon blenders leave a heel of material along the bottom of the trough.

"We manually dump raw materials into the mixer and discharge finished blends into the hopper of an enclosed screw conveyor feeding an automated line that fills packages ranging from one-pound Mylar

**The products are produced in powdered formulations that are easier to store and transport than liquids.**

foil pouches to 400-pound fiber drums," he continued. "We can blend 500 lbs. every three to five minutes with this blender, and have found it to be equally effective in blending batches that comprise only a small percentage of rated capacity. The fact that it unloads quickly and thoroughly maximizes the number of batches we are able to blend, the only downtime being between product changeovers when we sterilize the unit using steam and a cleaning solution."

The mixer has run without incident since 2002, according to Barnard, who is ordering a number of the units for United Tech's other facilities. "Once we standardize all of our worldwide mixing operations on Munson's Mini Mixer, our engineers in the U.S. will be able to work closely with their colleagues

overseas, to assist in training, operation and troubleshooting," he said. **PE**

For more information, contact Munson Machinery Co. Inc. at (315) 797-0090 or visit [www.munsonmachinery.com](http://www.munsonmachinery.com), and United-Tech Inc. at (918) 610-5205 or visit [www.united-tech.com](http://www.united-tech.com)

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