Biosolids That Don't Stink (Honest!)

Using temperature-phased reduction to tackle the odor issue

Daniel Thompson

Let's face it. There isn't a can of Lysol® big enough to handle the odors that biosolids workers deal with every day. Yet odor is such an expected byproduct of the material produced that many treatment plant employees simply learn to accept it.

For the City of Tacoma, Wash., odor has always been the enemy. Perhaps it's our industrial history as a paper mill town, but at our treatment plant we have always been convinced that people don't want a product that smells bad. As a result, we have spent years looking for a better way to produce Class A biosolids that people can be proud of.

Through experimentation, we have found that dropping the heat levels during the anaerobic phase of the dual digestion process greatly reduces odors at the treatment plant and in the biosolids product itself — which can move a facility one step closer to producing something that its customers will want to use in their back yards.

How It All Started

In the wastewater treatment industry, we generally focus on eliminating odors that offend a treatment plant's neighbors. But in Tacoma, we weren't offending our neighbors; we were offending our own workers. In June 2002, the odors were so bad that we placed hydrogen sulfide meters above the belt-filter presses, because the smell was becoming a health issue for the five operators working in the 5000-ft^2 (465-m^2) press room. Although odors never reached a level where any employees had to vacate the premises, we were getting readings of 8 ppm — too close to the danger zone of 10 ppm. As operations division manager, I regularly visit the belt-filter press room to check in with staff members. After leaving the building one day that June, I realized the odor was still on my clothes. It occurred to me that until we corrected our odor problems, the strong smell left on my person would prevent me from attending other city meetings on those days.

In addition, our liquid product for commercial farmers was especially offensive. We were scheduling around warm weather and holidays to prevent losing customers because of the smell. At that point, we weren't charging for the liquid, but there were times when we couldn't even give it away.

To solve our odor problems, we initially explored designing and installing equipment to vacuum the foul air out of the building. However, this option was quite expensive and, although it would take care of our health concerns, it wasn't going to reduce the odor of the biosolids product itself.

Third Time's the Charm

In the past, the wastewater treatment industry had explored using temperature phasing for stabilization and for vector reduction, but not for odor control. And throughout its history, the biosolids industry has focused on finding ways to *dispose* of solid waste. *Creating products* — and considering aesthetic issues that come into play when creating products, such as odor — is a relatively new pursuit. The City of Tacoma has been an industry leader in developing products out of biosolids, beginning its Class A biosolids product program with the introduction of TAGRO Mix in 1989. Tacoma uses three levels of temperature phasing during the anaerobic step of the dual digestion process to virtually eliminate the odors from our biosolids. This leads to products that people want to use in their yards and indoor planters.

In temperature phasing, we gradually lower the temperature rather than leave it at the same level for the whole solids processing period. Typically, during the aerobic step of dual digestion, we keep the solids at 160°F (71°C) for 24 hours. Then, in the anaerobic step, we process the material at 130°F (54°C) for 21 days.

The thermophyllic temperature of 130°F provides an environment hospitable to methane-generating bacteria and encourages increased biological activity, raising the metabolic rate of the organisms present. The result is relatively high rates of methane production. Although the methane produces enough energy to run our boilers, it also produces sulfur compounds that can be relatively smelly.

Below the thermophyllic range is the mesophyllic range, which begins at 100°F (38°C). Here, different organisms are at work, and they produce less methane and fewer sulfur compounds. At 90°F (32°C), mesophyllic organisms dominate and are at a relatively low metabolic rate, so there's virtually no methane or sulfide gas production.

At these three temperature levels, different populations of organisms do their jobs then die off, and a different population that doesn't generate the same smelly gases takes over. It's almost like ecological succession in a 21-day period.

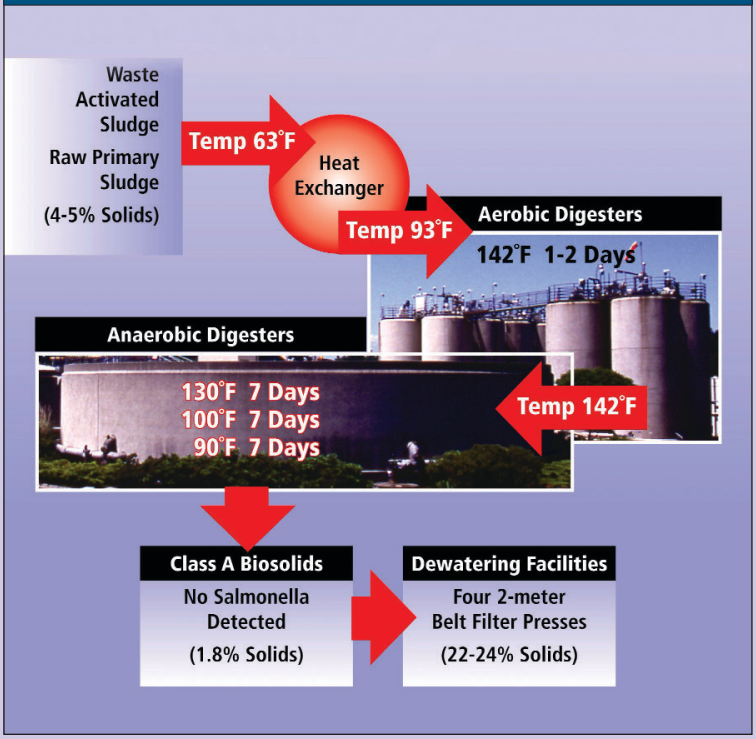
A History of Innovation

This is not the first time Tacoma has experimented with getting rid of odors. Before 1993, we used a single-phased thermophyllic process to anaerobically digest the material at 130°F (54°C) for 21 days. Then, from 1993 to 2002, my predecessor, David Hufford, used a two-phase anaerobic digestion process in an effort to improve product odor for customers. He decreased temperatures from 130°F to 115°F (46°C); the digesters would cool to these temperatures if he made no adjustments to maintain or lower them.

Although processing at these temperatures made our product more palatable for our customers during this time, it was still difficult for our workers to handle the odor — which prevented us from developing an indoor product. Building on Hufford's foundation, we tried dropping the temperature from 130°F to 100°F, and the odors decreased further. When we dropped from 130°F to 100°F and then down to 90°F, we were able to virtually eliminate the odors (see the figure, below).

My hat goes off to operations supervisor Tony Trotter, filter-press senior operator Dan Frank, and filter-press operator Dan Mathewson for their ingenuity in making the three-temperature process work at Tacoma.

Figure 1. Tacoma's Modified Dual Digestion Process



The Sweet Smell of Success

Conversion to temperature phasing has made Tacoma more innovative with its biosolids products. Eliminating the odor allowed us to successfully produce a potting soil for indoor and outdoor use, which we introduced late last summer. In addition to the potting soil, we developed a new odor-free mulch, and we now charge our commercial customers $30 a load to deliver our odorless liquid product. Customer response has been overwhelming. In April 2004, we broke all previous records, selling 3500 yd^3 (2700 m^3) of all-biosolids products in 1 month — a 57% increase over sales volume in April 2003. We literally can't keep up with product demand. Currently, we have a waiting list of 100 customers for our most popular product, TAGRO Mulch. And the liquid customers who used to complain about our smelliest product have praised us instead for the absence of odor.

We believe our employees don't want to make a smelly product, let alone try to sell a smelly product to businesses or to local residents to use in their back yards and indoor planters. The three-phase temperature process has allowed us to address our workers' health concerns and to develop high-quality products that people can be proud of.

Odor control isn't just good manners. It's good business.

PARKER WATER AND SANITATION DISTRICT

Tacoma produces three main biosolids products marketed under the name of TAGRO (short for Tacoma Grow): TAGRO Mulch, TAGRO Mix, and TAGRO Potting Soil.

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