Municipal Treatment Plant Solves Filament Problem with Bioaugmentation

Problem: Filamentous bacteria infested the plant, almost wiping out typical biomass.

Solution: A filament degrader was installed to destabilize common filamentous bacteria and replace them with healthy biomass.

The Oxford-Rochdale Sewer District, near Worcester, Mass., is a 1900-m3/d (500,000 gal/d) activated sludge facility that serves a primarily residential area. Built in 1974, it recently was expanded to accommodate a school, nursing home, and about 100 more residences. The plant averages 760 m3/d (200,000 gal/d), allows for extended treatment times, and operates well within permit requirements for effluent discharge into the nearby French River.

The plant monitors biomass present in the system microscopically, using higher life forms, such as rotifers, to indicate proper treatment conditions. When filamentous forms begin to pose a problem, the plant kills some with small doses to reduce their growth without alerting the biomass.

"We usually run with high residence times and solids content — because the sludge is incinerated — and have experimented with allowing some filamentous forms to multiply and serve almost as a stripping agent," said Mike Dupuis, assistant chief operator.

That system worked quite effectively until January 2000, when a shock load from an unknown source hit the plant during cold weather and a routine chlorine application. Plant operators discovered that filamentous bacteria had taken over, and the typical biomass was all but eliminated. Before the takeover, clumped rotifers had been almost visible to the naked eye; however, after the invasion, no higher life forms were even visible under the microscope, Dupuis said.

Using more chlorine to eradicate the bacteria would have done more damage to the plant than the havoc already wreaked by the invasion, but plant staff knew something needed to be done to remedy the problem. The normal sludge volume index (SVI) for the plant is in the 200 range, but at the height of the infestation, operators saw the volume rise to 950. The sludge was not settling and effluent biochemical oxygen demand (BOD) shot up. The only bright spot of the situation was that permit requirements were not being exceeded, because the plant was operating on winter standards, which are less restrictive than those observed during the rest of the year, said Robert Wilson, plant superintendent. They needed a solution fast.

Dupuis recalled reading a magazine article about using bioaugmentation to displace filamentous bacteria, and sent a sludge sample from the plant's clarifier to Bioscience Inc. (Bethlehem, Pa.). Based on its analysis, the company recommended installing a Microcat XF filament degrader, which uses a blended combination of microorganisms, enzymes, and biodegradable surfactants for use in domestic and food processing wastewaters.

"They recommended a dosage of 10 lb [4.5 kg] for the first 2 days, followed by 5 lb [2.3 kg] on days 3 through 10, 3 lb [1.4 kg] on days 11 through 20, and 1 lb [0.5 kg] daily for the following 21 days," Dupuis said. "The bacteria are supplied as a granular powder, which is added directly to the influent stream right after the bar screen."

It took about 2 months after the January infestation to get all levels back to the normal range, Dupuis said. By April 1, 2001, SVI was in the 140 to 150 range and stayed there during both warm and cold weather. Meanwhile, BOD and other indices are now well below permit ranges. Since the system was installed, the problem of filamentous bacteria has virtually vanished, he noted.

"Until using bioaugmentation, we had never been able to get rid of filamentous bacteria entirely, and now we have," Dupuis said. "The filaments are gone and the higher life forms are back. It works better than chlorine, and unlike chlorine, it doesn't kill anything else."