Increased Domestic Wastewater Reuse via Bioaugmentation

Enhanced plant operation and discharge quality Using Microcat ® - XF BioBlend –
QM Study 124

The Plant

In a state that leads the nation in water reuse this city is in a class by itself. Its Water Reclamation Facility, which treats an average of 11.365 M^3 of wastewater, won the David W. York Water Reuse Award in 1997. Since that time, it has more than doubled the amount of reuse water supplied to golf courses, recreation facilities, agricultural irrigation and over 4,000 residents, according to the Water Resources Manager (WRM). "In 1997 we provided 12.113 M^3. Now the figure is 24.227 M^3, including supplementation with groundwater," he said. He attributes the continued success of the program to control of filamentous bacteria and improved sludge settling using “green” bioaugmentation methods only.

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The city's wastewater treatment plant (WWTP) consists of an older conventional activated sludge package plant, plus a newer oxidation ditch treatment unit. The package plant handles about 35 percent of total flow, depending upon the volume of influent received.

The package plant receives influent from a splitter box, and treats a higher percentage of flow when total influent flows are high and a lower percentage during low-flow periods. This pattern results in variable and at times lower food-to-microorganism (f/m) ratios than most plants experience. In addition, the package unit is equipped with air-lift pumps to re-circulate and to waste sludge. The intermittent nature of these procedures makes it difficult to measure organic loadings and sludge wastage flows accurately.

The Problem

Both the oxidation ditch plant and the package plant were suffering from infestation with Nocardia, a filamentous bacteria that results in surface foam and in poor sludge settling. Norcardia is often the result of high concentrations of fat, oil and grease (FOG) in the influent. This is a developing problem where there are growing discharges from a burgeoning fast food industry. "We're getting some better restaurants now, but about all we had for a while was fast food," the WRM comments.

Search for Solution

The use of bioaugmentation to enhance plant operation began in the spring of 2007 with a search for an environmentally friendly method of reducing waste sludge, the disposal of which was a major operating cost for the treatment plant. "I came across Bioscience, Inc. which offered a biological formulation for waste sludge reduction" the WRM said. "They were very helpful in analyzing our problem with laboratory tests, and made several recommendations, not only about products but also in terms of operating the plants."

Both plants had been operating at low f/m's. Because of the difficulty of measuring and controlling return activated sludge and waste activated sludge in the package plant, its variable loading, and other causes, the package plant showed much poorer settling than the oxidation ditch facility. Bioscience technical support recommended increasing the f/m in this unit by increasing the waste rate by 20 percent for a target mixed liquor suspended solids (MLSS) of 3500 mg/l.

Microscopic examination of the biomass from both plants showed a mixture of filamentous bacteria, including Nocardia, known to be promoted by low f/m's among with other factors. Mixed liquor contained floc that was open-structured due to high filament content. Protozoa, including stalked and crawling ciliates and rotifers, indicated a mature to over-mature sludge (low f/m). While protozoa are helpful in reducing sludge production, they also feed on floc-forming bacteria. Thus, high protozoan populations can sometimes adversely affect floc formation. Insufficient aeration and resultant low dissolved oxygen levels, plus high influent FOG levels and nutrient imbalances, can also encourage filament growth and poor settling.

The Bioaugmentation Program

Based on laboratory analyses, a sludge reducing formulation, MICROCAT - SR Sludge Reduction Bioformula, was recommended for use in the oxidation ditch plant, and a filament controlling formulation, MICROCAT-XF Filament Control Bioformula, in the package unit. The filament controlling product, MICROCAT-XF, is a dry powder applied directly to the aeration zone of a WWTP. It contains a combination of aerobic and facultative anaerobic microorganisms selected from nature for their ability to break down a broad range of substances contained in domestic and food processing wastes, including FOG. It also contains natural enzymes and other ingredients that destabilize many filamentous forms of bacteria, making it easier for floc-forming microorganisms to proliferate and win the competitive struggle in the biomass.

BEFORE

AFTER

Results

Bioaugmentation, along with recommended operational changes, began on both plants in the summer of 2007. Settling in the packaged unit improved dramatically, almost immediately, with a clear line of demarcation separating settled sludge from a "crystal clear" supernatant, the WRM said. The filament controlling formulation improved settling and reduced sludge volume so well that it was decided to use it instead of the sludge reducer in the oxidation ditch plant. Results there have also been excellent, he reports. Both plants produce little foam, and odors due to dried-on foam in the clarifiers have been eliminated. FOG still presents a problem in piping at the plant, and another “green” bioaugmentation program aimed at degradation of solid FOG deposits, which formerly required regular mechanical cleaning, has begun. Overall, the program has meant that the plant can now discharge more treated water for reuse than prior to solving the FOG/Nocardia infestation problems.

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