

Bugs, Nutrients Boost Refinery's Treatment Process

Problem: An oil refinery's wastewater exceeded its limits for chemical oxygen demand and total suspended solids.

Solution: Adding trace minerals, nutrients, and microorganisms reduced chemical oxygen demand and improved biomass activity.

Nutrient deficiencies in its aeration basin prevented a Michigan oil refinery's wastewater treatment system from meeting chemical oxygen demand (COD) and total suspended solids requirements, says Bioscience Inc. (Bethlehem, Pa.), the company hired to correct the situation.

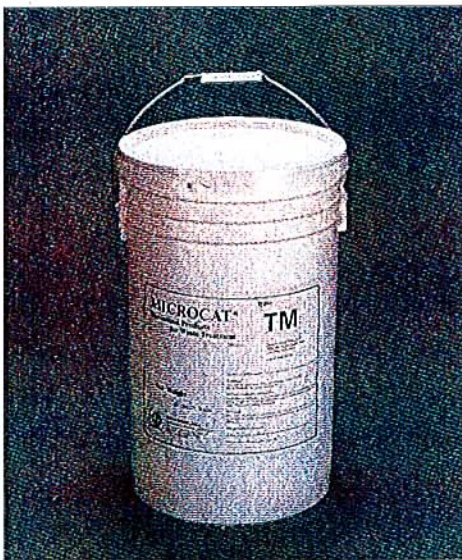
Bioscience addressed the refinery's wastewater problems by introducing a combination of its Microcat[®]-TM trace-mineral micronutrients and Microcat[®]-High Temperature (HT) bioformula to the system's indigenous biomass. Microcat[®]-TM is a blend of calcium and magnesium carbonates, iron salts, and organic nutrients. Microcat[®]-HT is a blend of "thermotolerant aerobic and facultative anaerobic microorganisms selected from nature for their ability to metabolize organics and flocculate at the high end of the mesophilic range," the company says.

The company began by assessing the refinery's wastewater treatment system, says Jay Hill, Bioscience product manager. "Treatability testing was performed at our laboratory to determine the cause of the high [COD] and toxicity in the aeration basins and also to determine the correct products to add to their system based on [our] analytical information," he says. Bioscience also investigated the refinery's wastewater treatment processes, as well as past attempts to correct the performance problems, and performed a visual inspection of the plant, he says.

According to Hill, laboratory tests indicated a deficiency of phosphorus and micronutrients in samples from the refinery's aeration

basin. "The nutrient deficiency was an inherent problem with the wastewater," he says. "It was a high-strength wastewater without much nutrient concentration. Refinery wastewater is often high in COD, but lacking important nutrients [necessary] for biological growth."

The refinery's wastewater was checked to ensure that optimal conditions existed for adding the Microcat[®] products. These include a pH level between 6.0 and 9.0, a temperature range of 10°C to 40°C (mesophilic range), dissolved oxygen levels between 0.5 and 2.0 mg/L,



and trace amounts of heavy metals, Hill says.

To improve biodegradation, Bioscience recommended a bioaugmentation program that involved adding Microcat[®]-HT, Microcat[®]-TM, and phosphoric acid to the aeration basins. "The goal of the bioaugmentation program was to improve COD reduction in the aeration basins of the treatment system and decrease suspended solids in the effluent," Hill says.

Each day, Bioscience added 5 lb (2.3 kg) of Microcat[®]-HT and 0.5 lb (0.23 kg) of Microcat[®]-TM to the refinery's wastewater. Combining the two products and adding them to the existing biomass reduced the refinery's COD,

Hill says. Specifically, Microcat[®]-TM's blend of micronutrients and microbial growth enhancers improved the rate and consistency of the biological processing of the refinery's contaminated waters, Bioscience says.

Ten hours after the initial Microcat[®] treatment, biomass respiration tests showed increased oxygen uptake, and increases continued throughout the remainder of the test, Bioscience says. After 113 hours, the COD level in the mineral-treated sample was 25% lower than in an untreated sample, according to the company.

Microcat[®]-TM "provided a 'boost' to the existing biomass," Hill explains. The product provided the necessary nutrients, minerals, and vitamins to facilitate optimum biodegradation by the naturally occurring microorganisms, he says. At the same time, Microcat[®]-HT combined "heat-tolerant microbial strains with enhanced waste degradation capability" in the thermophilic transition range (35°C to 43°C), he notes. "Due to the augmentation of these microorganisms, the treatment plant [also] achieved better flocculation of the solids and improved settling," he says.

Before turning to Bioscience, the refinery attempted other corrective measures, such as reducing wastewater flow, increasing hydraulic retention time, and increasing dissolved oxygen levels in the aeration basins, Hill says. However, none of these approaches worked because they were isolated, mechanical "quick fixes" that did not fully address the problem, he says.

According to Hill, the testing cost the refinery about \$5000 and Bioscience's products cost around \$2000 per month. The fines paid by the oil refinery prior to implementing the Bioscience system were at least 20 times higher per month than the Bioscience treatment costs, Hill says.

For more information, call Hill at (800) 627-3069, send e-mail to jhill@bioscienceinc.com, or visit the company's Web site at <http://www.bioscienceinc.com>.

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