Case Study: Bioaugmentation Improves Performance of Brewery Waste Treatment Plant

Introduction

This packaging plant finishes "heavy" beer, a liquid concentrate, into the well-known canned and bottled products. The plant handles 50,000 barrels per week and generates over 350,000 gallons of wastewater per day. Wastes are treated at the plant's 0.5 MGD waste treatment facility which operates under a standard discharge NPDES permit.

Waste beer is the main constituent of the plant's waste stream. In addition, there are cleaners, sanitizers, and various chemicals used to maintain the sanitary conditions necessary for the packaging operation. Less than 2% of the waste stream is domestic wastewater.

Modern Treatment Plant Design

The treatment plant is a two-train plant with equalization basins, aeration basins, and secondary clarifier influent to aid in the settling and adds nutrients (anhydrous ammonia and phosphoric acid) which are typical deficiencies in brewery waste treatment plants.

Initially, the aeration basins were seeded with sludge from a municipal waste facility. Biomass was established in the normal time frame and BOD removal efficiency was in the 90% range.

The Treatment Process Experiences Upsets

Almost from the beginning of full-scale packaging operations, the treatment plant experienced operating difficulties. First, polymer demand far exceeded projections. Next, the plant experienced regular shock loadings. These loadings caused upsets in the biomass and made it difficult to stabilize treatment plant operations. In some instances, the upsets caused biomass destruction to the point that total reseeding was necessary. The sludge additions, however, significantly increased the costs of sludge handling (both for transport and within the process) and were effective only until the next shock load.

The end result was chemical costs and sludge handling costs prohibitively expensive and subsequent permit violations became almost intolerable.

Initial Corrective Steps Prove Ineffective

One of the first steps in searching for a permanent solution was to try an off-the-shelf species of bacteria sold by its polymer supplier that was supposed to be resistant to upsets. After a three month trial program, they saw no positive results.

A Risk-Free Trial

After studying the problem, technical specialists at BIO-SYSTEMS Corporation and the client worked out a 60-day trial program to meet the following goals:

1. Maintain a more stable biomass that was resistant to shock loads/upsets, and which could recover quickly should an upset occur.
2. Improve settling of suspended solids in the secondary clarifier.
3. Reduce polymer demand for settling enhancement.
4. Reduce sludge generated per pound TOC/BOD removal.
5. Reduce permit violations caused by upsets.
6. Meet or exceed specific values for turbidity, BOD, and polymer use.

The key to the program was the client would pay for the work and use the recommended bioaugmentation system only if positive results were achieved during the 60-day trial.

The Program

After thorough characterization of and laboratory testing on plant wastewater, a formulated product was produced. This product consists of natural and selectively adapted bacteria--three strains of Pseudomonas aeruginosa, Pseudomonas stutzeri, and three strains of Bacillus subtilis combined with Escherichia hermainii in an aerobic blend. BIO-SYSTEMS packaged the bacteria in 1/2 pound soluble pouches--a totally soluble package that is simply tossed into the aeration basins.

Dramatic and Impressive Results

It took exactly 15 days to recognize that BIO-SYSTEMS was the answer to the problem.

Approximately three days after the first seeding with BIO-SYSTEMS, suspended solids, turbidity and BOD dropped to the lowest levels recorded at the plant. Polymer usage dropped from the 300 to 400 mg/L range to less than 150 mg/L within three weeks. A daily maintenance dose of two pounds of BIO-SYSTEMS was used after 20 days of seeding.

The real test came around September 15 when the treatment plant experienced a severe shock loading. Although some of the biomass was killed, recovery was accomplished by increasing the amount of BIO-SYSTEMS added to the process for about five days. Even under the upset conditions, BOD, TSS, and turbidity remained within permit compliance due to the enhanced response obtained with the bacteria. In addition to being able to withstand the waste loadings, BIO-SYSTEMS enhanced degradation and improved floc formation to produce a more compact sludge.