Corn Wet Miller Uses Efficient and Economical BVF®/SBR Wastewater Treatment System

ADM Corn Processors (formerly Minnesota Corn Processors) selected ADI Systems Inc. to provide on-site wastewater treatment facilities for its plant in Columbus, Nebraska. The plant produces syrup, starch, and ethanol, using corn as raw material.

The readily degradable wastewater from these processes is well suited for biological treatment. Since a simple, efficient, and reliable system was desired, the ADI-BVF® anaerobic reactor was recommended and chosen, along with an ADI-SBR (sequencing batch reactor) for aerobic polishing of the anaerobic effluent.

The design of the first wastewater treatment plant in 1992 included an 8.4 million gallon patented* ADI-BVF® reactor followed by an ADI-SBR system comprised of two 700,000-gallon basins. Meanwhile, the processing plant was expanding rapidly, and only two years later, in 1994, a second plant was constructed. It consisted of a 14 million gallon ADI-BVF reactor and a 2 million gallon ADI-SBR in two tanks. The second plant was designed to operate in parallel with the first one.

The design of the anaerobic digesters allows them to easily handle sudden variations in waste characteristics without upset. They also provide the additional benefit of acting as a "sludge reservoir" and digester for the excess aerobic sludge.

Sludge wasting from the reactor was not anticipated for at least two years. In fact, no sludge was wasted from the system until seven years after start-up of the first WWTP. Ongoing wastage will be minimal due to the low net rate of bios generation in the BVF® reactors.

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*US Patent Nos. 5,505,848; 5,587,080; Canada Patent Nos. 1253266; 2,096,852

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The floating, insulated, geomembrane cover on the BVF® reactors, in addition to providing a means of collecting all biogas produced, prevents the escape of odors to the surrounding area. The insulated cover also ensures heat retention within the reactor, which is desirable for optimal performance.

The biogas generated in the anaerobic process is utilized in flash dryers to offset natural gas usage. Based on the average loadings to treatment for the year 2000, 250 million Btu/d of energy were available to offset energy costs in the gluten flash dryer. At a fuel value of $5.00 per million Btu, the energy savings would be $450,000 annually.

The BVF/SBR system combination is recognized as an efficient, economical application of state-of-the-art wastewater treatment principles. The large volume of the BVF digester allows it not only to pretreat raw wastewater, but to serve as flow equalization, which complements the batch operation of the SBR.

A programmable logic controller (PLC) controls and monitors all operations and changes to the entire system. The software (known as ADI-APM), also provided by ADI, allows the operator to easily change operating parameters and to closely monitor every component of the system. With modem link to ADI's head office, data interpretation and changes to the program can be made very quickly by treatment specialists at ADI.

ADI provided all engineering services from conceptual design through facility commissioning and start-up, including process design, detailed design, control systems, development of specifications and drawings, and production of a process operating manual. In addition, ADI Systems Inc. supplied and installed certain proprietary materials and equipment and continues to provide operational assistance and support through an Aftercare Service Agreement (ASA).

The design and year 2000 average and peak loadings to the treatment plant are summarized in Table 1. In 2000 the plant treated COD and TSS loadings 20 percent and 375 percent above design and handled peak COD and SS loadings 67 percent and 920 percent above design.

Table 1 - Design and Year 2000 Average and Peak Loadings

Parameter	Design (Avg)	Design (Peak)	Year 2000 (Avg)	Year 2000 (Peak)
Flow (mgd)	3.5	4.25	3.2	3.96
COD (lb/d)	48,000	60,000	57,700	100,200
TSS (lb/d)	1,500	2,500	5,600	22,960

The design and year 2000 final effluent characteristics are provided in Table 2. It shows that in spite of treating COD and TSS loadings well above design, the system produced an excellent final effluent quality.

Table 2 - Design, Expected, and Year 2000 Average Final Effluent Characteristics

Parameter	Design mg/l (lb/d)	Expected mg/l (lb/d)	Year 2000 Avg mg/l (lb/d)
COD	—	—	55 (1820)
BOD	200 (5840)	20 (580)	5.5 (180)
TSS	100 (2920)	30 (880)	27 (890)