

Membrane Bioreactors for Industrial Wastewater Treatment

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ABSTRACT

Increasing competition for limited water resources and continual pressure to reduce costs are huge challenges for the water treatment industry. In addition, requirements for discharge of wastewater are becoming more stringent. One technology that is addressing many of these challenges is the membrane bioreactor (MBR). Instead of separating the biological treatment process and the membrane filtration step, the latest wastewater treatment plants combine both processes in an MBR. The membranes are integrated with biological process, where the membranes separate the treated water from the activated sludge. Advantages of this process are that a clarifier is no longer needed and the plant footprint is reduced significantly. In addition, the effluent quality is excellent, frequently enabling the effluent to be reused.

This paper will discuss several examples where MBRs are being used for industrial applications, in applications around the world. These include a research facility in New York, a brewery in Tanzania, and a slaughterhouse in France. These applications highlight the use of a relatively new membrane module design that incorporates a single header with central aeration of the membranes improve the efficiency of the process.

Research Facility, NY

The new MBR plant is upgrading a conventional wastewater treatment system to achieve more stringent effluent requirements including nutrient removal. An equalization tank and bioreactor are located below grade, pumping up into a new MBR membrane building with gravity return to the bioreactor. The research facility does animal testing generating a relatively small wastewater stream from cage washdown, which has significant amounts of hair. The balance of the wastewater flow is generated from sanitary waste. The owner has some experience with MBRs using dual header modules, and has seen issues with clogging of the top header, typically attributed to hair and other fibers in the wastewater. After successful piloting and demonstration of the single header design in 2008, the plant selected the modules for the upgrade. The plant will treat 78,000 gpd ADF, and will be commissioned in Q2, 2009.

Brewery, Tanzania

The effluent of the brewery was originally treated through an anaerobic digester followed by a conventional activated sludge treatment process. The existing activated sludge step was converted to an MBR with ultrafiltration membranes, thereby producing a treated stream sufficiently advanced that it can be treated directly by RO. The RO permeate is utilized in the service water system and as an alternative class of water for specific points of use within the brewery. The stream is polished further by activated carbon adsorption prior to being disinfected and stored for reuse.

Slaughterhouse, France

The MBR/RO system was installed in January 2007 and has a capacity of 0.25 mgd. The influent has a COD of 1780 mg/L and total phosphorus of 5.7 mg/L. The MBR reduces the COD to less than 10 mg/L and the Total-P to less than 1 mg/L. The RO then polishes the MBR effluent to achieve a COD of < 10 mg/L and Total-P of less than 0.1 mg/L.

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