MBR technology with proven results

A South African pharmaceutical, nutritional product manufacturer has taken the lead with their decision to improve the quality of their wastewater. Debbie Besseling discusses the project that was undertaken by WEC Projects for Aspen.

ASPEN NUTRITIONALS, a subsidiary of Aspen Pharmaceutical, runs a manufacturing plant in Clayville, Johannesburg that produces baby formula. This is a 24-hours a day, seven days a week operation that discharges 4 000 ℓ of effluent per hour into the system.

The processed water contains caustic soda, acid and infant formula mix. Jannie Blignaut, manufacturing manager for Aspen Nutritionals says, "Aspen is aware of the impact of its operations on the environment.

The management team decided to take the necessary steps to eliminate the effects of the effluent (which initially was not substantial) and the project was approved without hesitation." According to Karl Juncker, director of WEC Projects, Aspen Pharmaceutical's requirements were simple from the outset.They wanted to improve the quality of their wastewater discharge to the municipal collection.

"Very early in our dealings with Aspen it was apparent that they are concerned about the environment in which they operate, and as a responsible and conscientious company, took the decision to lead by example."

Project phases

Graham Hartlett, the marketing manager for WEC Projects explains that the initial phase of the project involved taking samples of the effluent. The analytical data suggested that a biological treatment process would be required, but on a small footprint. The Membrane Bio-Reactor treatment plant was the obvious solution as it can provide the necessary results on a small footprint/area.

The proposal was accepted in November 2008. Within two weeks of the order being received, Jim Ritchie (project manager) and Karl Juncker had finalised the design of the plant.

Procurement

Ritchie commenced with the procurement of long-lead items (in particular the submerged membranes which were imported from Malaysia). During the following two to three weeks, WEC Projects placed orders on all the major components required for the fabrication of the plant e.g (steel, mechanical and electrical components, hand railings etc).

Fabrication

WEC Projects has a 30-strong workshop fabrication staff. The workshop was tasked with the fabrication of the major steel structures for the plant, which included the DAF tank, the aerated buffer tank, the MBR tank, and refurbishment of the blower container. Fabrication of all the major tanks lasted approximately six weeks.

Assembly

WEC Projects typically preassembles all plants before shipment and delivery. This enables them to minimise the time required on site for installation and erection of the plants.

Mechanical installation

The installation of the plant was managed by project manager Ken Beyl, which lasted approximately two weeks.

Electrical installation

Richard Fredericks of PFC Engineering was responsible for the electrical design and electrical installation of the plant. He spent approximately one week on site during the electrical installation at Aspen.

Commissioning

Mike Haig is WEC Projects biotechnologist.He provides insight into design criteria. His input is valuable when it comes to understanding the biology inherent in the treatment processes employed, particularly at Aspen.

Haig ensures the smooth running of the Aspen plant, and fine tunes its operational parameters regularly. A pioneering plant like the MBR will need some slight modifications and process adjustments during the initial months after commissioning.

Monitoring

WEC Projects actively monitors the performance of the plant. A full-time staff member is allocated to the plant and is responsible for the upkeep and monitoring of the plant.

Production capacity

Currently, production is running to capacity and the company intends expanding their operations over the next four years. The plant is modular and has been designed in such a way that capacity can be increased easily.

Juncker comments, "The design also took into account future expansions to Aspen's facilities and the possible impact of additional waste discharge and the treatment thereof."

Parties involved in project

WEC Projects

Graham Hartlett (marketing manager) and Karl Juncker (director): formulation of the proposal, initial investigations and

Type of plant	Submerged MBR
Design flow per day	120 m^3
Objective	Primarily to reduce fats and oils, suspended solids and reduce COD
No. of submerged membranes	8 hollow fibre membranes
Process units	fat trap (original) DAF unit Aerated buffer tank MBR unit Sludge digester Dosing and disinfection systems
Utilisation of plant	5 m^3 per hour
Project costs	Less than R3 million.

Aspen's wastewater was previously treated through a fat trap that was implemented in 2006. The fat trap has been included as a primary treatment stage for the plant - any fats that are not removed in the fat trap are removed in the DAF Unit

sampling and preliminary design. Karl Juncker (director): Final plant design and project director
Jim Ritchie: Project management
Ken Beyl: Site Installation
Craig Hopson: Workshop fabrication
Mike Haig: Monitoring, operation and maintenance
Richard Fredericks (PFC Engineering): Electrical design, electrical installation and instrumentation

Aspen
Jannie Blignaut: Manufacturing manager: Commercial and most activities pre-award
Sean Mostert: Maintenance manager: Installation and erection and most activities post-award

Challenges

According to Juncker, "Because we are treating industrial effluent, we are faced with fluctuations in the characteristics of the effluent. For example, there are large fluctuations in pH levels which our plant needs to accommodate, particularly because it is a biological treatment plant sensitive to pH fluctuations. We installed pH monitoring and pH corrective dosing equipment (before the DAF unit). The 85 m^3 aerated buffer tank homogenises the effluent." In closing, Juncker comments, "We are very excited about pioneering MBR plants in South Africa and the future of MBRs". Blignaut comments on the project as a whole, "The team from WEC Projects were professional from day one. Everything was well analysed and WEC projects insisted on extensive sampling of the effluent from the start. They made sure all their homework was done. We were informed of all processes and kept informed at all stages. This is a well-designed, well-engineered plant that is working extremely well." Operations manager Sean Mostert mentions that Aspen intends recycling the effluent produced from the plant for irrigation purposes, instead of discharging it to the sewers.

Definition: MBR
Submerged Membrane Bio-Reactor Treatment Plants are those which remove dissolved and suspended organic and chemical constituents through biodegradation, as well as suspended matter through physical separation where effluent is treated through a series of submerged membranes. A biological process integrated with membrane separation is one of the fastest growing technologies in the wastewater industry. MBR technology can aid both the portable and industrial users by conserving their current water supplies and energy use, as well as helping them meet and maintain stringent regulatory requirements for irrigation, industrial, aquifer injection and other non-portable uses and applications. The membrane modules are submerged in a biological tank or side-stream tank, with the water being drawn through the membranes under vacuum, leaving the suspended biomass material in the biological aeration tank. These systems have a smaller footprint than CAS systems, produce consistent effluent quality even in varying influent conditions, and provide effective treatment for high BOD levels in wastewater. MBR plants allow the biological process to operate at long sludge ages (typically 20 to 100 days) and increases mixed liquor suspended solids (MLSS) concentrations range 8 000 to 12 000 mg/ℓ. High MLSS concentrations and low SRT promote numerous process benefits including stable operation, complete nitrification, and reduced bio solids production. High MLSS concentration also reduces biological volume requirements to only 20 to 30% of conventional biological processes. Further, the membrane tanks provide extremely space-efficient solids separation and do not require a clarifier in the system. 3S
Source: WEC Projects