

Technologies of the circular economy: Anaerobic digestion

The circular economy needs a commercially viable technology base capable of transforming and reprocessing waste into usable products and resources. Veolia Water Technologies' Chris Braybrooke discusses the strategic importance of anaerobic digestion, a tried-and-tested technology family in the sewage and effluent treatment space.

Veolia Water Technologies' goal for South Africa's wastewater treatment facilities with suitable COD effluent conditions is to help these plants become 100% energy self-sufficient by utilising their waste as an energy source. In addition to the obvious advantages this will bring to operating and waste disposal costs, it will also help reduce energy demand on South Africa's national power grid, and, by extension, reduce requirements for coal-based energy, thereby lowering carbon emissions.

The science behind one of the key technologies of such plants is simple: use anaerobic biological digestion to compost organic matter that produces biogas (mostly methane), which is then harvested and used as a fuel for the plant's heating and cogeneration requirements.

Such systems have been installed or are being piloted by Veolia South Africa for companies in the food and beverage and municipal sectors, including Distell and the Ethekewini Municipality respectively.

Effluent treatment applications in biofuels, chemical processing, pharmaceutical and pulp and paper are also key industries that could utilise anaerobic digestion to optimise their treatment requirements, and achieve greater energy self-sufficiency.

Veolia Water Technologies covers the complete range of anaerobic digestion applications with specialised technology solutions:

- **Anaerobic wastewater treatment**
Veolia's Memthane® Anaerobic Membrane Bioreactor is designed for treating high-strength effluents such as high concentration streams (up to 250 000 ppm), ethanol

waste, fat, oil and grease streams, starch slurries and high COD chemical applications. Memthane® is being used to achieve up to 100% energy and heat requirements in applications such as distilleries through biogas production, while efficiently treating complex compounds and reducing disposal costs.

- **Completely Stirred Tank Reactor (CSTR)**
For industrial effluents with significantly high amounts of suspended solids, Veolia manufactures the Biobulk CSTR, the anaerobic equivalent to the conventional activated sludge digestion system. This solution is used by Distell to lower the COD load in the outfall to the Stellenbosch Municipality, harvest the energy in the wastewater for reuse and lower the overall cost of effluent treatment.
- **Upflow Anaerobic Sludge Blanket (UASB)**
Veolia's Uphane™ UASB treatment system has been used to develop over 500 energy-neutral sewage treatment plants – and other low-strength wastewater applications – across the world utilising anaerobic microorganisms. The biogas contains approximately 75% methane and

can be used to provide the energy needs of the entire WWTP in a combined heat and power unit.

- Completing Veolia's anaerobic treatment range are its Integrated Fixed Film Activated Sludge System (AnoxKaldnes™ Hybas™); Moving Bed Biofilm Modular Reactor (AnoxKaldnes™ Z – MBBR); and Expanded Granular Sludge Blanket (Biobed®) systems.

This family of treatment technologies is assisting the wastewater treatment industry to become a pioneer of the circular economy approach in South Africa's modern cities, where wastewater treatment plants produce their own energy and minimise their solid waste. With greater treatment efficiency, circular energy requirements and reduced demands on bulk electricity, these plants will be key assets in our sustainable future.

Creating syngas from sludge

Veolia's Research & Development team in France is currently experimenting with a new tiered gasification technology to transform sewage sludge into energy-rich synthesis gas. In gasifying sewage sludge using a mixture of steam and oxygen at 700° – 1 000°C, results



Memthane® combines anaerobic biological wastewater treatment and ultrafiltration in a single process that is ideal for high-strength wastewaters resulting in crystal clear effluents.

to date have demonstrated the technical feasibility of the process by producing a high energy potential gas, rich in hydrogen and methane. □



Veolia's Biobulk Completely Stirred Tank Reactor (CSTR) is used by Distell to treat effluent and harvest biogas for use as a fuel.

Trickling filter technology for Ngwenya Lodge

Veolia Water Technologies South Africa supplied a 400 m³/day civil-based sewage treatment plant that uses trickling filter technology to treat sewage water at the Ngwenya Lodge in Komatipoort, Mpumalanga.

"Our sewage treatment plants and trickling filter technology treat sewage to RSA General Standards for Discharge", says Veolia Water Technologies' business development manager, Vashlin Govender. "Just a single package plant can treat domestic sewage for up to 4 000 residents".

Veolia's civil-based sewage treatment plants are easy to install and commission, making them ideal for remote locations. The technology is simple, so automation and control requirements can be kept to a minimum, which allows for a reliable and robust solution that requires no skilled operators to operate the plant.

Fully containerised sewage treatment plants with trickling filter technology are rapidly becoming vital for the African tourism industry. Trickling filter technology can accommodate large fluctuations in quality and volume of inflow, including shock loads. The system also reduces sludge production to approximately



Above: Veolia's 400 m³/day civil-based sewage treatment plant.

Right: Veolia's trickling filter system technology.

a third of its original volume.

Trickling filter plants are compact; reduce odour; improve water colour; and can be designed to meet client specific discharge requirements. In addition to being affordable and robust, the technology is simple and reliable; requires minimal maintenance and lower energy input; allows flexibility of effluent load; and systems recover faster after power outages. □



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