



A specialised solution

A specialised SMART technology was recently implemented at the newly constructed 2.5 Ml Swartruggens plant in the North West. Headstream Water Solutions' chief consulting engineer, Stephen Pickering, tells **Chantelle Mattheus** that the technology will revolutionise the local water sector.

"The technology is perfectly positioned for upgrading all the overloaded treatment works locally. It is akin to putting a turbocharger on a car," explains Pickering.

Due to the nature of the equipment and Headstream's focus on efficiency, it can be deployed very rapidly. "We can do a 50% upgrade on a plant in three to six months without major civil works," says Pickering.

SMART technology

The HYBACS process is a combined fixed biomass reactor working in conjunction with a traditional-type suspended biomass reactor – two very specific components. The HYBACS core, which we call the SMART (shaft mounted advanced reactor technology) unit, is the fixed biomass reactor.

"The fixed biomass reactor operates at a very high MLSS, or rather an effective MLSS because of the way it works. You have a large surface area reactor that is relatively small in physical terms, but through it you have an MLSS in the region of 50 000, which is huge," he continues.

The effect of having this large biomass is there is a significant shift in the mass transfer characteristics that control the core of wastewater treatment, which is the transfer of oxygen into water.

"That is the rate limiting factor in all current effluent treatment systems. Surface aerators are very popular with sectors of the industry in this country. They are virtually unused anywhere else in the world because they are inefficient as they only deliver an oxygen transfer – and I will use an approximate

number here – of about 1 kg of oxygen per kilowatt. The newer systems for suspended biomass, which would be fine bubble diffused air and similar, run at 2 kg of oxygen per kilowatt. The HYBACS core can run in the region of 6 kg of oxygen per kilowatt as each SMART unit only uses on average 1.5 kilowatts per hour (one SMART unit treats approximately 8 000 population equivalent).

Significant advantages

According to Pickering, the system delivers a significant reduction in power consumption, with a recent analysis done by a consulting engineer showing a 28% reduction in electrical power for the complete secondary and tertiary treatment. "If we can reduce the power consumption by 28% on the aeration system alone, we not only reduce our exposure to ever increasing energy costs, but also reduce demand on our already strained electricity supply," says Pickering.

However, power saving does not yet seem to be the primary focus within the industry although awareness is increasing, according to Pickering, and recent experience also shows a preference for large civil structures and an aversion to mechanical equipment. This is despite the robust nature of the equipment, better cost efficiency and operational advantages modern mechanical equipment can deliver. "Changing mindsets and encouraging people to be innovative is certainly a challenge for us." The solution also seems to have significant



cost-saving implications – theoretically. “In-depth analysis has been done by our principals in the UK on this, but they are only theoretical analysis and their estimation is that on a greenfield site you can be looking at a 30% reduction in capex and a 40% reduction in opex,” he says, adding that on an upgrade cost savings are significantly higher because the HYBACS technology is then leveraging existing infrastructure to provide a significant increase in treatment capacity and performance. “You don’t replace the entire infrastructure, you reuse it and add certain mechanical modifications and the SMART reactors.”

Straightforward and simple

Another advantage of the HYBACS process – and the installation of the SMART bioreactors – is the minimal maintenance necessitated. “Generally, the maintenance on the SMART

units is minimal: grease the bearings and change gearbox oil once a year. Very simple,” says Pickering.

The system does, however, use dissolved oxygen probes for speed control to optimise the process and although there is a built-in cleaning system, these probes should be checked manually every three months. “However, it does not impact on the general operation of the system. There are so many fail-safes built in that if the probes are not reading it still operates, it is just not fully optimised,” notes Pickering.

Swartruggens investigated

On the Swartruggens Wastewater Plant specifically, the consultant is a convert. “He saw the energy advantages, the cost savings in plant and as a result he specified the process,” he explains. The end product is discharged into local water course, so

reliability of treatment was also critical – no different to any other plant in the country.

The town is located near the Elands River and an old sewage works was already in existence at

the location. Apart from the ageing infrastructure, the development in the Bojanala Region under the jurisdiction of the Bojanala Platinum District Municipality, meant that the plant was now also under capacity. “The biggest problem across the country, in my view, is the rapid increase in service delivery in certain areas to certain sectors of the population that didn’t previously have services. Many new homes, properties and buildings have had reticulated sewage brought in and of course that increases the load on the works,” continues Pickering.

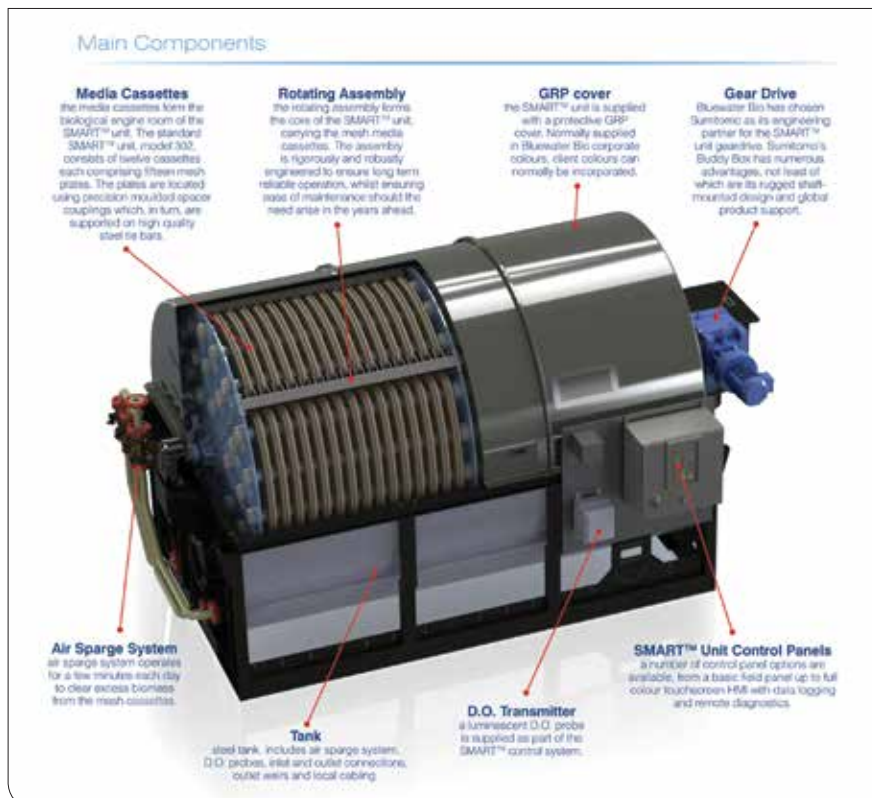
Unfortunately, in a large majority of the cases the increased load has not been addressed and the plants are therefore significantly too small. The consultant in this case opted for the construction of a new plant, utilising HYBACS technology at the core as the specified process. “We then provided to him the process designs and the consultants did the detailed design around that, including the intake works, the civil design and the plant layout, to accommodate the process.”

As Pickering explains, Swartruggens is not a big plant; it is a very small 2.5 Ml/d plant treating predominantly domestic sewage. There is not a lot of industry and not even a lot of agro-industry in the region. “There is, to a degree, a lot of tankerage coming in, which is generally quite high in concentration as opposed to the normal waterborne sewage.”

Aside from the operational advantages described, a big advantage from Headstream’s side is that instead of the traditional mechanical equipment requiring the contractors to be on-site for weeks to install it, they were in and out within a number of days because of the high degree of off-site pre-assembly with the SMART units being assembled off-site. “That is the physical core component that we supply for the HYBACS process. We supply the technology, which is the design, and the core component,” he says.

The Swartruggens plant comprises two SMART reactors and has been up and running for over a year now. According to Pickering, the effluent quality visually is excellent, with the highlight having been “just the simplicity of going in and switching it on and leaving it running. And then no come-backs after that – it was as simple as that.

“At Headstream Water, we are very interested in having a very long-term relationship with clients and the plants that we build. We are not a contractor whose services cease at the end of the responsibility period. Although we are not under contract to do so, I regularly go out to the plant to check that there are no hiccups, and that the required level of service will continue,” he concludes. **35**





HEADSTREAM

water solutions

Ideal upgrade solution to expand treatment capacity of existing overloaded wastewater treatment works (WWTWs) in a cost effective manner while delivering significant energy savings.



SMART™ units with highly concentrated Fixed Biomass

Suspended Biomass Aeration Reactor

Secondary Settlement Tanks (Clarifiers)

HYBACS Process

Introduction to HYBACS® wastewater treatment technology:

HYBACS® is Bluewater Bio's patented HYbrid ACTivated Sludge process for nutrient removal. The process consists of two biological stages followed by clarification.

- The first stage comprises Bluewater Bio's Shaft Mounted Advanced Reactor Technology (SMART™) units, containing attached biomass
- The second stage is conventional activated sludge, with suspended biomass

The very high biomass concentration in the SMART™ unit removes up to 50% of the COD / BOD in the wastewater at high efficiency. The reduction in load enables an activated sludge process to achieve better effluent quality, particularly the removal of ammonia.

HYBACS® is especially applicable to upgrading existing activated sludge plants to treat increased loads and improve effluent quality.

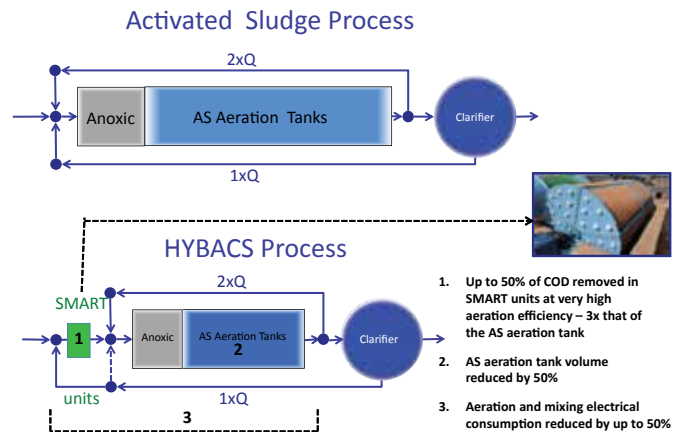
HYBACS® is commercially proven with over 25 international reference sites and 2 operating in South Africa and a third under construction. It has been demonstrated that HYBACS® can produce effluents with qualities that comply with the most stringent South African nutrient removal standards.

Key benefits of the HYBACS® process:

The core benefit of HYBACS® is that it delivers like-for-like nutrient removal performance, at reduced capital and operational costs, compared with conventional activated sludge (AS) processes (see diagram).

- Removes up to 50% COD in the first stage SMART™ units
- Reduces physical footprint by up to 50%
- Intrinsically odourless
- Reduces power consumption associated with aeration by up to 50%
- Reduces chemical consumption for nutrient removal

HYBACS vs Traditional AS



- Reduces embedded & emitted carbon
- Ideally suited to upgrade treatment capacity of existing AS plants
- Significant CAPEX savings on retrofit applications
- Modular construction enables rapid deployment
- Scalable from 0.2m³/d to >100m³/d

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Introduction to Headstream Water Solutions:

Headstream Water's mission is to provide practical and sustainable WATER technologies to protect the environment, uplift communities and make a meaningful contribution towards the efficient use of water and energy resources in Sub-Saharan Africa.

Headstream Water Solutions is the exclusive distributor of the HYBACS® process in Sub Saharan Africa and is a member of the Thebe Investment Group.

