

Combining Technologies To Offer New Capabilities



Is it practical for commercial enterprises to use water stemming from sewage and other kinds of wastewater in their key processes? And are such solutions cost-effective and environmentally responsible?

By Alfa Laval (India) Limited

In a world confronted by huge shortages of clean water, there are substantial commercial opportunities to be found in reclaiming water that has already been used. Technologies to keep pace with these are developing rapidly.

Alfa Laval Hollow Sheet membranes for use in membrane bioreactors are one of the latest advances in implementing membrane filtration technology in wastewater treatment and recycling.

Dealing With The Dearth Of Clean Water

As urban populations grow and people’s expectations about basic amenities and living standards rise, the effective, environmentally responsible treatment of municipal and industrial wastewater is becoming a worldwide priority.

According to many experts, water reclamation is well on its way to becoming a mainstream technology. The exhaustion of many groundwater reserves, along with other practical considerations, will simply force public-sector utility companies as well as industrial enterprises to adopt a path of water reclamation and recycling.

From Treatment To Reclamation

Conventional wastewater treatment technologies are increasingly being supplemented –and in some cases even

replaced by membrane bioreactors (MBRs). These separate liquids and solids using a combination of activated sludge treatment processes and membrane filtration equipment. Although usually only installed as one particular component in wastewater processing set-ups, MBRs play increasingly important roles in modern facilities for producing high-quality effluent with specifications that mean it can be reused as clean water for use in industrial processes.

The Best Of Two Worlds

Alfa Laval has introduced Hollow Sheet membranes for use in membrane bioreactors (MBRs).

MBRs installed in wastewater treatment facilities currently make extensive use of two distinct membrane filtration technologies, based on hollow fibre (HF) or flat sheet (FS) membranes. Each provides distinct advantages, but neither is ideal.

The ground-breaking Alfa Laval Hollow Sheet membrane solution combines the best from each of these technologies into one single membrane configuration of a completely new type (patent pending).

As a unit, these Hollow Sheet membrane elements made of polyvinylidene fluoride (PVDF) are more compact than any other flat sheet membrane modules currently on the market. The unique design makes sure cleaned effluent drains from

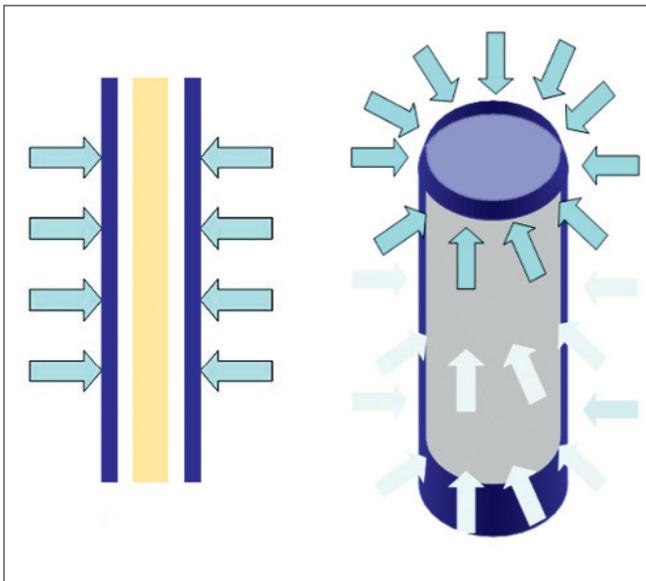


Figure 1: How HF And FS Membranes Work

the entire surface of the membrane, and emerges all the way round the edges. This results in considerably greater filtration capacity as well as 10–25% less energy consumption per unit of membrane area.

Membrane Filtration Module Units

The Membrane Filtration Modules (MFMs) consist of standardised packages of Hollow Sheet membranes placed inside a stainless steel frame fitted with the appropriate connections.

The extremely compact, stackable design of the MFM unit makes it possible to achieve exceptional packing densities within any MBR tank. This in turn makes it possible to reduce operating costs.

Accordingly Membrane Filtration Modules deliver the following benefits:

- Fouling is virtually eliminated, which means extended membrane life with hardly any cleaning
- Exceptionally large membrane area in relation to the overall footprint. This results in a remarkably compact design

- 10–25% better exploitation of scouring air per unit of membrane area, resulting in big reductions in energy costs
- Highly resistant to acids, caustic substances and oxidation processes due to special polyvinylidene fluoride (PVDF) membrane elements
- Substantially longer service life, with all-round savings on operating costs

The MFM Impact

The Alfa Laval Membrane Filtration Module (MFM) is designed to boost efficiency and reduce operating costs for filtering biologically treated wastewater, whether of industrial or public-sector origin.

The unique feature of the MFM design is that it operates with an exceptionally low trans-membrane pressure (TMP) across the entire surface of the membrane while the flow of sludge is passing through. Because Hollow Sheet membranes create



Figure 2: Alfa Laval Membrane Filtration Module With Hollow Sheet Membranes Visible

a TMP that is 75–90% lower than with conventional systems, the treatment plant is simpler, cheaper and easier to operate, with no need for complicated vacuum systems as in traditional MBR installations.

The extremely low TMP also means mixed liquor passing across the membrane does not accumulate or adhere to the surface. This significantly reduces fouling, which is usually one of the major constraints on the effective implementation of MBR technology, and in turn reduces both operating costs and downtime.

French Success Story

An example of such an installation is the Bassussary Wastewater Treatment Plant in southwest France, near the Spanish border. This is one of eight facilities operated by URA, the local inter-communal organisation for wastewater management.

As part of an ambitious programme of plant renewal, two plants have been equipped with membrane bioreactor solutions fitted with Alfa Laval Membrane Filtration Module units containing the new type of Hollow Sheet membranes.

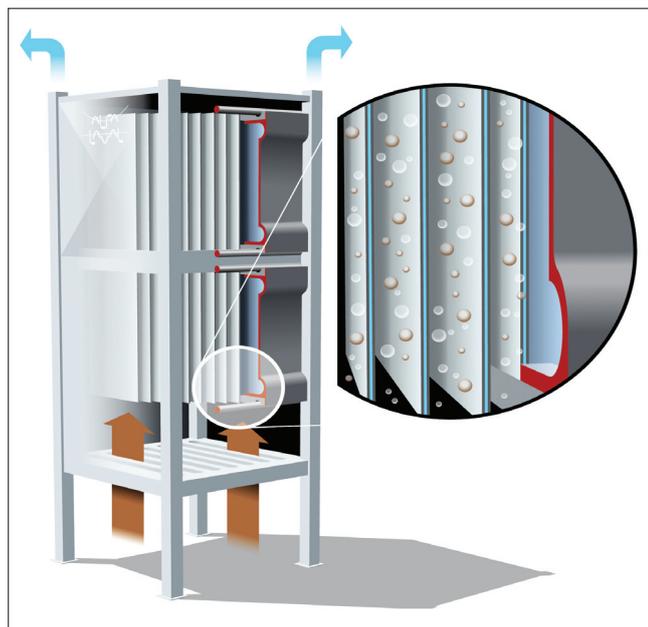


Figure 3: How The Membrane Filtration Module Works

According to Ferdinand Daguerre, chairperson of URA and Deputy Mayor of one of the local villages, for URA one of the selling points of the new Alfa Laval technology lay in the simplicity of installation. “The Hollow Sheet membrane solution is much easier to install than a conventional sewage solution, and that was very desirable. We really wanted to keep complexity to a minimum,” he said.

Hollow Sheet membranes are also particularly easy to maintain, which for URA was another consideration in their favour. This unique type of membrane works on the basis of gravity, and the lower pressure across the surface means fouling is kept to a minimum. The membranes can be cleaned in situ using chlorine, without operators needing to remove them –which has been a big practical advantage for the URA staff.

“We compared the different options and the Hollow Sheet membrane is more robust and uses less energy than other membrane solutions, so that’s another bonus,” says Daguerre.

According to Jacques Debuire, Managing Director at Loïra, the French company that designed and built the Bassussary Wastewater Treatment Plant: “The quality of the outfall is extremely high, and the system is reliable, easy to operate and simple to install. Moreover, when legislation regarding the removal of traces of xenobiotics such as prescription drugs or pesticides from treated water is introduced, MBRs will be indispensable prior to installing any system to remove them.”

“...everybody is very happy, from the local authority to the engineers and from the constructor to the operator. The solution is so efficient that in the latest analysis of treated water outfall, all key measurements were well below European norms, and biological analysis showed a total absence of bacteria.”

From Waste To Revenue & Resource

Because the Bassussary plant is equipped with a Membrane Filtration Module set-up, it has been possible to provide exit flows of even higher quality than with regular membranes. This is important for URA, which is able to generate revenue by selling treated wastewater to the prestigious Makila Golf Club nearby, to irrigate the course.

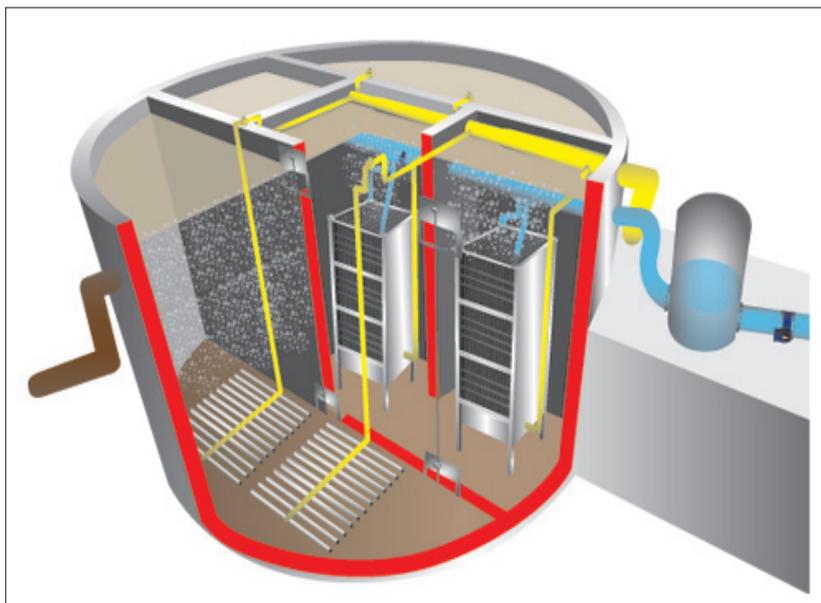


Figure 4: Membrane Bioreactor Fitted With Alfa Laval Membrane Filtration Modules

Furthermore, the treated water from the Bassussarry plant flows into a local river in which there is considerable leisure activity –including swimming– and the river is also a resource for local drinking water. “We needed to be certain there could be no questions about the quality of the wastewater outflow,” stressed Ferdinand Daguerre.

Indian Success Stories

Alfa Laval India has recently commissioned membrane installations for processing industrial effluent in the state of Gujarat and for municipal waste in the state of Maharashtra.

The ROI Argument

There are still companies with a natural reluctance to use processed wastewater in their industrial processes and other commercial activities –particularly those associated with food and beverages. But the purity of the water processed by Alfa Laval Membrane Filtration Modules makes the use of reclaimed water both safe and practically feasible in many contexts.

At the same time, the current escalating price and availability of raw water, and the costs associated with water used in cleaning

operations, rinsing processes, water for heating, etc., make the use of Membrane Filtration Modules in MBR installations the ideal way to curtail operating costs.

The higher the market price for raw water, the more limited the potential supply of clean water and the higher the costs for processing and cleaning wastewater, the greater is the return on investment from using Alfa Laval Membrane Filtration Modules in any MBR facility. This is why Alfa Laval and many other industry experts foresee rapidly increasing use of this new technology in water reclamation.

About The Article

Alfa Laval is one of the world’s leading providers of advanced-technology products and engineering solutions based on heat transfer, separation and fluid handling. Enquiries about Alfa Laval membrane filtration solutions for water and wastewater processing should be addressed to india.info@alfalaval.com.
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