

Innovation and cost reduction drive market for MBRs

The membrane bioreactor (MBR) market has grown and continues to grow vigorously, driven by strict discharge limits, water scarcity and the growing demand for reuse and recycling. The technology continues to be the best solution to meet stringent treated effluent standards in wastewater treatment and reuse applications while offering various key advantages. As a small footprint process it can be fitted into restricted sites with the capability to containerise if needed, and the high quality of the effluent meets even the strictest nutrient limits. This means that permeate can be safely discharged to sensitive environments to meet demanding discharge consents, or used for irrigation.

MBRs are also straightforward to retrofit and can provide a relatively simple

upgrade for existing wastewater treatment systems. Also, the long solids retention times provide improved treatment that can cope with high levels of mixed liquor suspended solids while simultaneously excelling at the biological removal of ammonia.

Jacopa's experience in designing and building MBRs began with the construction of the UK's first municipal wastewater MBR plant in 1994 and since then the popularity of the technology has increased significantly in line with innovations that have delivered cost reductions and much-improved resistance to fouling.

Today the MBR remains one of the most cost-efficient options for high quality wastewater treatment across several markets. In the utility sector the MBR is a popular choice

for Sewage Treatment, often to extend and enhance an existing WWTW's capacity to treat increased domestic flows. Likewise in wider industrial markets MBR remains the technology of choice for the UK's high volume process water users including the meat, dairy and general food processing sectors.

Sewage Treatment

The majority of MBR wastewater treatment provision is in the municipal market, and it is both where most research has focused and where the largest plants are to be found. The Jacopa MBR has enjoyed significant success in this sector as it produces a very high quality disinfected effluent. Raw sewage generally only requires screening (with a maximum aperture of 2mm) and de-gritting prior to enter-

ing the membrane bioreactor tank. The process requires no primary or secondary settlement stages and no additional tertiary treatment or UV stages to achieve quality typically better than 5:5:5 mg/L BOD: Suspended Solids: Ammonia.

The Jacopa MBR system has inherent design advantages: it does not remove the solids by settlement, so the biomass can operate at very high levels of mixed liquor suspended solids (MLSS), generally in the order of 12,000-18,000 mg/L. This high concentration enables a low tank volume and a long sludge age to be utilised, which reduces sludge production and ensures a compact footprint that is appreciated on sites where space is a constraint.

The MBRs' long solids retention times (SRTs) and the

physical barrier itself also offer significant protection against micropollutants, which are an increasing issue as more is discovered about their effects on the environment, aquatic species and the population.

Dairy

The dairy market is particularly buoyant because EU constraints on milk production were relaxed recently with some UK producers subsequently doubling or tripling the size of their plants. For many businesses, this expansion brings with it the need to reconsider treatment options and the ability of MBR systems to resolve a range of important issues puts them high on the agenda.

Jacopa's MBR solution offers major benefits because the water being removed from milk during processing is laden with organic milk products, plus minerals, proteins, sugar (in the form of lactose) and fat. These are all highly biodegradable and in waterways may deplete oxygen levels. For example, lactose promotes the growth of filamentous slimes known collectively as sewage fungus. This is why BOD5 concentrations are strictly limited in discharge consents, as is turbidity, which is an associated issue.

Producers have a range of aims that relate to effluent treatment and reuse. Not least of these, as a low-margin industry, is recovering as much usable protein as possible at an early stage and converting it to product. The opportunity to recover milk solids that

were formerly discharged is a major driver: milk loss in wastewater is estimated at between 0.5 to 2.5% of processed milk. There's also an increasing interest in recovering condensate from evaporation of dairy products (known as "cow water") for reuse, as there is potentially a rapid return on investment (ROI). Removing protein is also important for another reason: if organic nitrogen remains in waste streams, it converts to inorganic forms such as ammonia, with the ammonium, nitrite and nitrate ions subsequently causing eutrophication in receiving waters.

Further, as the waste sludge is difficult to settle it is not well suited to normal secondary treatment, due to issues such as the amount of foam, low resistance to shock loading, and the challenge of removing high levels of fats, oils and grease (FOG). Frequent changes in effluent volume and content in different product cycles are also challenging for traditional biological systems. All of these problems can be overcome with the addition of a Jacopa MBR to the treatment train.

Key strategic issues for the industry when adopting Jacopa MBRs include their environmental sustainability: dairy factories use vast amounts of water, in the process and for cleaning and sanitation. There has been a realisation that even though water may not appear expensive per cubic metre, in the volumes that are used there is a significant potential for saving from

MBRs have numerous advantages: they provide high effluent quality and can cope with wide variations in flows, and are a compact, advanced solution that can fit easily into, or instead of, existing treatment processes. In terms of BOD, COD, suspended solids and pathogens, the quality of the treated effluent is outstanding



reuse, not just to benefit the environment but also in pure cost. The reduction in treated water use can be up to 45% of the total wastewater produced with consequent reductions in wastewater going to the sewer. Recovering product also means that effluent stream strength is reduced, which will also lower trade effluent charges.

Reducing waste also potentially reduces energy use, which is a larger expense to consider—depending on the process, wastewater reuse may mean less cooling or heating is required, and less pumping. Processes that concentrate or dry milk are extremely energy intensive, and a high-quality effluent can be useful in a number of ways, not least because it may contain residual heat that can be usefully harnessed. Reducing water use can also demonstrate continual environmental improvement, which is a key element when implementing an environmental management system (EMS).

Jacopa MBRs teamed with nanofiltration downstream can provide highly effective food and dairy wastewater treatment, with a rate of return up to or greater than 32%, given a two-year membrane life. MBR advantages are well known: they are compact, modular, with little excess sludge, high sludge retention time (SRT), and complete removal of even high levels of suspended solids regardless of settleability, and they have no problems with toxicity or high temperatures. Effluents are so clean they can be used directly for irrigation

or cleaning purposes, and when combined with a disinfection stage will often meet potable water standards and can be used in food contact areas.

Meat

The meat processing industry has similar issues to dairy producers, with high-strength effluents containing significant levels of fats and proteins, and therefore challenges such as high BOD, COD and turbidity (suspended solids). There is an increasing national focus on delivering environmental benefits, and a challenging requirement to bear in mind the impact of changes on the quality, quantity and price of food. The Government is driving better environmental outcomes, with payment for "results and outcomes" becoming the focus, rather than prescribed activities, which leaves the door open for innovation.

Sustainability in general is important to this industry, though there is still a message to be heard that recycling means considerably more than dealing effectively with packaging waste. Many major international brands have targets to reduce waste across a range of areas that will certainly include water, though process water use varies widely depending on the specific part of the sector involved. The ability to recycle process water, for example in wash-down, not only enables such targets to be met but also reduces costs, with similar arguments as those outlined for the dairy industry.



resilience for the municipal sector, which the dairy sector has noted with interest, and opportunities for reuse and recycling where the high-technology Jacopa MBR can be more widely employed as a strategy.

MBRs have numerous advantages: they provide high effluent quality and can cope with wide variations in flows, and are a compact, advanced solution that can fit easily into, or instead of, existing treatment processes. In terms of BOD, COD, suspended solids and pathogens, the quality of the treated effluent is outstanding. The attraction of the technology is proved by the fact that MBRs are used throughout the world in both industrial and municipal settings – the market is said to be

growing exponentially at between 11.5 and 13% per year as costs come down and confidence in the technology grows.

Also, in the long term, to remain viable, cost effective replacement membrane panels must be available. Recognising the need for a robust, efficient and commercially attractive option we recently introduced our own range of panels. The innovative flat-plate membranes were trialled on site at a UK treatment works, where they matched and often exceeded the performance of established installations.

The standard size panels are designed to suit the vast majority of existing installations.

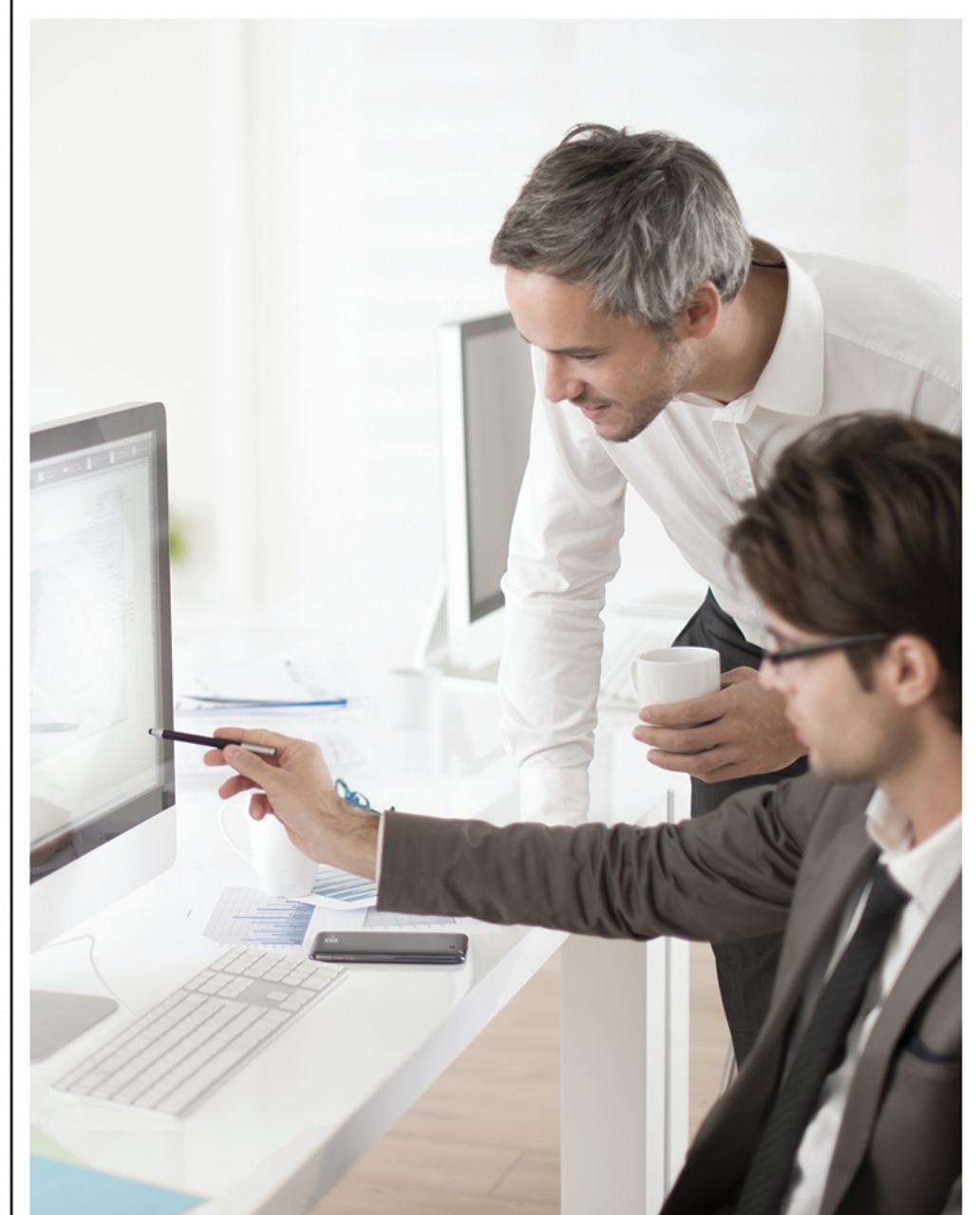
Tel: 0121 5112400
www.jacopa.com



The Future

The Environment Agency's recent report on water resources and water quality paper notes: "All industry should look at cost-effective ways to use water more efficiently, and to invest in resilience to climate change." It highlights the shortfalls without major investment and behavioural change now, noting: "Climate resilience is not just a necessary precaution, it's an investment," which implies that adding resilience to the production process is a forward-thinking strategy that not only increases the robustness of the process, but also helps to drive down costs and prepare for climate change effects.

This approach also echoes government policy on



Jacopa Technical and Process Support

We Love Meat & Dairy

With over 20 years experience designing and building industry leading Membrane Bioreactor (MBR) plant, Jacopa understands the wastewater treatment challenges facing the Meat and Dairy sectors. Our innovative technologies ensure reliable, robust and economic solutions backed by leading technical support.

New Installations Complete treatment packages • Meet/exceed compliance standards • Expert project management

Existing Installations Increase capacity • Convert out-dated conventional systems to MBR • Improve compliance • Optimise process efficiency

Jacopa Membranes Easy replacement • High fouling resistance • Low maintenance • Rapid delivery • Three year warranty • Competitive price

jacopa
MBR



jacopa
CLEARLY WASTEWATER

Serving the wastewater treatment needs of the Agrifood sector
Jacopa - MBR but better

Call: +44 (0)121 511 2400
or visit: jacopa.com