Enviroquip® MBR
Submerged Membrane Bio-Reactor (MBR) Systems for wastewater treatment and reuse

Key features & benefits

• Fully integrated, complete solutions (Systems) to wastewater treatment and solids handling problems
• Demonstrated lowest total installed (constructed) cost
• Sustainable (green) solutions with reduced equalization, concrete, energy and chemical requirements
• The easiest System to operate, troubleshoot and optimize

How we create value

• Bringing more, true MBR System experience to new projects than any other company
• Tailoring solutions using proven integrated design and automation techniques
• Developing energy saving technologies and control strategies
• Offering storm flow management and pure oxygen designs
• Providing 24/7 real-time customer support (EQuipTech®), web-based services (EQVue®) and a network of certified contractors
Membrane Bioreactors have been used for the successful treatment of municipal, commercial and industrial wastewaters for discharge and reuse since the 1980s. With thousands of installations operating worldwide, MBR technology is shaping the way we view wastewater treatment and water conservation across the globe.

Submerged within each MBR are membranes that physically reject pathogens and other suspended solids. Additional biological processes are required to removal contaminants such as Biochemical Oxygen Demand (BOD), nitrogen and phosphorous. As such, MBRs have traditionally been just one part of a system designed for the biological treatment of wastewater. However, as a provider of complete Waste Water Treatment Plants (WWTPs), Ovivo understands that systems, not just components, must operate simply and reliably as a whole. That is why we offer complete MBR systems, not just their constituent parts, and supply the most user-friendly Submerged Membrane Unit (SMU) on the market today.

Enviroquip® MBR

MBR Systems

Membrane Bioreactors have been used for the successful treatment of municipal, commercial and industrial wastewaters for discharge and reuse since the 1980s. With thousands of installations operating worldwide, MBR technology is shaping the way we view wastewater treatment and water conservation across the globe.

Submerged within each MBR are membranes that physically reject pathogens and other suspended solids. Additional biological processes are required to removal contaminants such as Biochemical Oxygen Demand (BOD), nitrogen and phosphorous. As such, MBRs have traditionally been just one part of a system designed for the biological treatment of wastewater. However, as a provider of complete Waste Water Treatment Plants (WWTPs), Ovivo understands that systems, not just components, must operate simply and reliably as a whole. That is why we offer complete MBR systems, not just their constituent parts, and supply the most user-friendly Submerged Membrane Unit (SMU) on the market today.
The Membrane Bioreactor (MBR)
A membrane bioreactor is an activated sludge process that uses membranes to filter out suspended solids including harmful microorganisms such as viruses, bacteria and cysts. In an MBR, SMUs are connected via common permeate, air supply and diffuser cleaning pipes.

The Submerged Membrane Unit (SMU)
Each SMU is comprised of an integral air diffuser assembly and one or two membrane cassettes. The diffuser provides air for scouring, mixing and cellular activity. A membrane cassette contains between 25 and 200 membrane that are connected to, or form, a common permeate manifold. Multiple SMU are connected to a common header in each MBR.

The Membrane Cartridge
Each membrane cartridge is constructed by ultrasonically welding a sheet of thin polymeric metal to the front and back of a support panel. Between the panel and the membrane material is a porous spacer material that distributes water to a series of grooves that channel filtered water to the top of the cartridge.

Biofilms
In an Enviroquip® MBR system, flat sheet membranes are used to filter a concentrated mixture of organisms commonly referred to as mixed liquor. The microorganisms consume BOD, nutrients and refractory organic compounds such as NDMA. They also attach themselves to the membrane’s surface to form a thin film called a biofilm. Within seconds, the biofilm begins to function as a dynamic membrane. Properly maintained, this biofilm protects membrane material from fouling and creates a second, densely packed barrier to pathogen breakthrough.

Biohydraulics
Irrespective of the type and shape of membrane, biofilms do most of the filtering and create the most resistance to water flow. Maintaining biofilm thickness and porosity through effective air scouring and proper biological process control is key to optimizing the hydraulic performance of any submerged membrane technology in MBR applications. The link between biological process conditions and membrane hydraulics referred to as biohydraulics.

Our SMU are engineered to maximize air-scouring efficiency and eliminate opportunities for hair and debris to accumulate. Efficient, even air-scouring dramatically reduces the pressure it takes to filter solids from treated wastewater, often referred to as transmembrane pressure (TMP).

Operating at a low TMP reduces the propensity for membrane fouling and eliminates the need for weekly chemical cleanings or backpulsing common to other systems, meaning that our flat sheet membranes last longer.

How it works
Submerged Membrane Units

Bottom: Multiple barriers – membranes and biofilms.

1 - Filtered Permeate
2 - Membrane Cartridge
3 - Microorganisms
4 - Air Bubbles
5 - Biofilm
6 - Crossflow
Enviroquip® MBR

The Enviroquip® MBR System

Enviroquip® MBR systems include multiple, proven technologies allowing for flexible, adaptable operation. The ability to operate over a range of different conditions improves overall system performance as compared to conventional treatment processes and MBRs that use hollow fiber membranes.

Enviroquip® MBR systems can include:

Headworks
Complete packages including roughing screens, fine screens and grit removal.

Proven Membrane Technology
Our SMUs are installed in more MBR plants around the world than any other MBR technology.

Digestion / Thickening
Membrane-based systems designed to digest and/or pre-thicken waste-activated sludge. Class B systems also available.

Ancillary Process Equipment
A full complement of proven components for a fully functioning MBR system including pumps, blowers, mixers etc.

Integration and Controls
Supervisory Control and Data Acquisition (SCADA) packages to reduce energy costs, maximize membrane performance and allow for remote plant control.

Pure Oxygen & Peak Flow Management Systems (Optional)
Pure oxygen systems (DOCS™ + SDOX™) and side-stream physical/chemical treatment technologies (using iSEP™) are available to achieve smaller footprints and reduce project costs.

Enviroquip® MBR versus conventional treatment processes
- Fewer unit operations
- Smaller footprint
- Reduced UV dosage required
- Superior water quality

Enviroquip® MBR versus hollow fiber processes
- Better process control
- Easier to operate
- Smaller footprint
- No side-stream screening
- Fewer recycle streams
- Reduced maintenance
- Higher peaking capabilities
MBR Process Train (UNR® 1)
Features and Benefits

Single-Source Responsibility
- Comprehensive, integrated wastewater treatment solutions
- Standardized, proven automation with operator approved feature sets
- Membrane-based solids handling technologies
- Extended warranty options and service plans including process guaranties

Cost Effective, Green Solutions
- Demonstrated lowest total installed (capital) cost
- Reduced equalization, concrete, energy and chemical requirements
- Energy saving strategies backed by guarantees
- Storm flow management and pure oxygen designs

The Most Reliable Systems
- > 250 Systems in some stage of design, commissioning or operation
- ~30% less instrumentation, rotating equipment and control valving
- ~90% fewer failure points within membrane modules versus hollow fiber systems
- Manual control options built into fully automated systems for emergency operation
- Gravity filtration option and infrequent clean-in-place (CIP) only for routine maintenance

Highest Effluent Quality
At the heart of an Enviroquip MBR system is a tailored biological process that virtually eliminates pollutants such as Biochemical Oxygen Demand (BOD), nitrogen and phosphorous that can cause fish kills and algae growth (eutrophication).

The UNR<sup>®</sup> Ultimate Nutrient Removal process has been developed to meet the most stringent nutrient limits. Different treatment levels, and their corresponding typical effluent qualities, are shown in the tables below.

Microorganisms (created during biological uptake of dissolved pollutants) are filtered through multiple protective barriers and reduced to levels that are generally undetectable by standard methods. Fecal coliform concentrations are normally non-detectable in MBR permeate before post-disinfection, as compared to 100,000 cfu / 100 ml in traditional secondary effluent.

### Permeate Quality

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Typical Values</th>
<th>Achievable Values&lt;sup&gt;a,c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD&lt;sub&gt;5&lt;/sub&gt;</td>
<td>&lt;2.0 mg/l</td>
<td>Non-Detect&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ammonia</td>
<td>&lt;1.0 mg/l</td>
<td>Non-Detect&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total Nitrogen</td>
<td>&lt;10.0 mg/l</td>
<td>&lt;3.0 mg/l</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>&lt;1.0 mg/l</td>
<td>&lt;0.03 mg/l</td>
</tr>
<tr>
<td>TSS</td>
<td>&lt;2.0 mg/l</td>
<td>Non-Detect&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Turbidity</td>
<td>&lt;0.1 NTU</td>
<td>&lt;0.05 NTU</td>
</tr>
<tr>
<td>Fecal Coliform</td>
<td>&lt;2.2 CFU/100ml</td>
<td>Non-Detect&lt;sup&gt;b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>SDI</td>
<td>&lt;3</td>
<td>&lt;2</td>
</tr>
</tbody>
</table>

<sup>a</sup> Contingent on plant design and operation.
<sup>b</sup> Assuming Standard Methods of detection.
<sup>c</sup> Requires UNR<sup>®</sup> Process.
<sup>d</sup> Post-disinfection may be required.

### Typical Guarantee Limits<sup>e</sup>

<table>
<thead>
<tr>
<th>UNR Level</th>
<th>BOD&lt;sub&gt;5&lt;/sub&gt;</th>
<th>Ammonia</th>
<th>Total Nitrogen</th>
<th>Phosphorous&lt;sup&gt;g&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt;5.0 mg/l</td>
<td>&lt;1.0 mg/l</td>
<td>&lt;10.0 mg/l</td>
<td>&lt;1.0 mg/l</td>
</tr>
<tr>
<td>2</td>
<td>&lt;5.0 mg/l</td>
<td>&lt;1.0 mg/l</td>
<td>&lt;7.0 mg/l</td>
<td>&lt;5.0 mg/l</td>
</tr>
<tr>
<td>3</td>
<td>&lt;5.0 mg/l</td>
<td>&lt;1.0 mg/l</td>
<td>&lt;3.0 mg/l</td>
<td>&lt;1.0 mg/l</td>
</tr>
</tbody>
</table>

<sup>e</sup> Limits are a function of process design and are dependent on operating conditions.
<sup>f</sup> Assuming Standard Methods of detection and an average of at least four 24-hr composite samples.
<sup>g</sup> Assumes combination of enhanced biological phosphorus removal and chemical coagulation.
Applications

Core MBR Technology
For over 15 years Ovivo has been supplying our core MBR technology to the world using widely accepted design guidelines and conventional diffused aeration technologies. We can offer simple membrane equipment packages to meet project specifications or complete solutions to wastewater treatment problems.

ECOBLOX™
The latest innovation from Ovivo in biological systems is our MBR System using high purity oxygen (HPO). Unlike other HPO based technologies, our patent pending method of saturating influent using oxygen generated onsite eliminates all safety, siting and regulatory concerns. These safe, easy to operate systems are based on military applications requiring extreme reliability in the most adverse conditions. ECOBLOX Systems are specifically designed for ease of operation but the biggest advantage to end users is ultimately reduced cost of ownership.

STORMBLOX™
The Achilles Heel of MBR Systems in general remains short-term, dilute peak flows that generally occur during storm events. In fact, peak flows in excess of three times the rated capacity of a plant can often make MBR technology cost prohibitive. Ovivo has recently developed a means of handling storm events using direct membrane filtration followed by activated carbon and zeolite; all known, proven commodities. Trimming off peak flows can dramatically simplify operations, reduce energy bills and create new funding opportunities given ease of future expansion.

Reclamation: Irrigation, stream augmentation, aquifer recharge, sewer mining, RO pre-treatment

Industrial: Food processing, pharmaceutical, manufacturing

Commercial: Shopping centers, office buildings, casinos, restaurants

Municipal: New construction, retrofits, upgrades, sludge thickening

Satellite Plants: Private developments, resorts, golf courses, rest stops, parks
Our Expertise

Our multidisciplinary staff draws on over forty years of experience to integrate state-of-the-art technologies into custom plants or pre-engineered packages (MPAC®) to maximize energy efficiency, optimize process control and protect membrane equipment. Our goal is to provide customers with comprehensive solutions to their wastewater problems.

Starting with proven, reliable headworks technologies and ending with membrane-based solids handling systems, Ovivo can provide Single Source Responsibility (SSR) for your MBR system. SSR ensures the prompt, comprehensive support you need as part of the industry’s best warranty plan.

Support and Aftermarket Care

We realize that our continued success depends on customer satisfaction and ultimately, plant performance. We take great pride in delivering superior design support during the engineering and construction phases of a project and in maintaining reliable after sales support.

Using advanced remote monitoring technologies, we stay in constant contact with our plant operators. We offer ongoing technical training through workshops and site visits, keeping our customers up-to-date and informed of the latest technical information.

Simple in design and easy to operate, an Enviroquip MBR System offers all the benefits of membrane technology without the usual complications. From point-of-use package plants (see the MPAC brochure) to custom municipal installations, our experienced, professional staff has supported the design and commissioning of more than 250 MBR Systems.

Equipped to handle your specific requirements, we can help you to customize your plant using an array of different options as shown in the diagram below.
Enviroquip® MBR Installations and Customer Testimonials

“There’s just not a lot of moving parts on an Enviroquip® MBR System. It’s a lot more forgiving than my SBR and conventional activated sludge systems.”
Charlie Evans, Operator
Environmental Management Services

“It’s amazing how easy it is to start up and operate one of these IMBRI plants.”
Warren Felton, Superintendent
The Bandon Dunes WRF, Oregon

“During the snow melt, my MBR system handled higher than design flows at lower than expected temperatures for over a month. When it counted, the system performed.”
Kevin Maughan, Lead Operator/Assistant Fire Chief
The Hyrum WRF, Utah

Fort Flaggler WWTP, WA
Maximum Month Flow: 25,000 GPD
Operating Mode: Pumped (Suction)
Commissioning Date: 06-01-2009
Engineer: Parametrix

Coppermine WRF, GA
Maximum Month Flow: 1.0 MGD
Operating Mode: Gravity
Commissioning Date: 01-19-2009
Engineer: ARCADIS

Rio Del Oro WWTP, NM
Maximum Month Flow: 200,000 GPD
Operating Mode: Pumped (Suction)
Commissioning Date: 01-26-2006
Engineer: J. Samora & Associates; B. Crockett, Inc

Leoni WWTP, MI
Maximum Month Flow: 3.6 MGD
Operating Mode: Gravity
Commissioning Date: 08-08-2010
Engineer: OMM