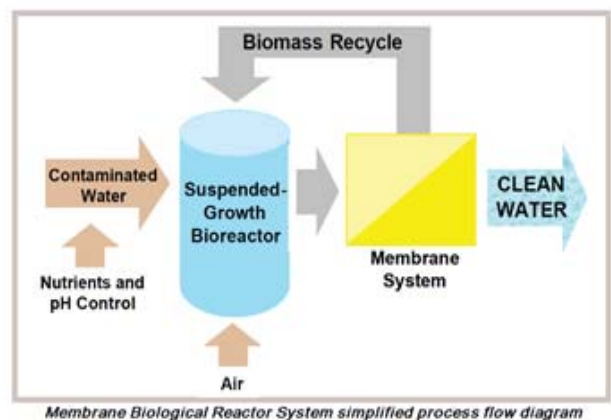


Membrane Bioreactor (MBR) with External Ultrafiltration Membranes

Envirogen Membrane Bioreactors combine an aerobic suspended growth bioreactor with an external membrane liquid/solids separation unit to provide an advanced level of organic and suspended solids removal from wastewater streams.

Following the biological treatment of the contaminated stream, the contents of the bioreactor (mixed liquor) are pumped to the membrane unit where the solids and liquids are separated, clean effluent discharged, and concentrated mixed liquor pumped back to the bioreactor. Our experts will specify the reactor size and pair with the ideal membrane system for peak performance in your application. System effluent can be recovered and reused or discharged.



Membrane System Features and Benefits

Feature	Benefit
Biological Reactor	Difficult contaminants degraded, long solids retention time and minimal generation of biosludge; High-quality effluent produced in a small footprint; Fast system start-ups and minimal operating labor required
Membrane flows from inside to out	More effective cleaning; longer life; No exterior abrasion
Membranes are external to the bioreactor	Lower mechanical stress on the membranes, reducing failure due to collapse, delamination or kinking that occur with submerged membranes, and prolonging membrane life; Lower volume of chemicals used for cleaning
Modular system	Sized to meet your flow requirements; Scalable
Unique Helix technology (HF type membranes only)	For enhanced membrane flux; more turbulence for reduced membrane fouling
High Quality Effluent	The clear water permeate has no suspended solids. The effluent is discharged or forwarded for reuse or additional treatment.

Biological Process Characteristics

- Maintains a high biomass concentration in the suspended growth bioreactor
- High performance with mechanical simplicity, low operator demands, and a capability to treat difficult streams with changing compositions.
- The external ultrafiltration membrane solids-liquids separation unit provides highly efficient biomass separation allowing the biomass concentration within the upstream reactor to be up to ten times greater than the concentration normally attainable in a conventional suspended growth system.

Membrane Characteristics

- Hydrophilic polyvinylidene fluoride (PVDF) membrane on a polyester woven/non-woven carrier
- 0.03µm (30 nm) pore size (High Flow) and 0.01 µm (200 kD) pore size (Low Flow)
- Asymmetric microporous structure
- High performance and resistant to fouling
- Polyvinylchloride (PVC-C) membrane housings and piping
- Drinking water quality Potting EP resin
- Low Flow Modules - 4" x 3-meter (horizontally oriented)
- High Flow Modules - 8" x 3-meter (horizontally oriented)
- Optional – High Flow membrane elements can be backpulsed for efficient membrane cleaning and a higher average product flux

MBR Applications

- The process is well-suited to:
 - ✓ Wastewater or groundwater streams with recalcitrant organics
 - ✓ High contaminant concentrations
 - ✓ Highly variable influent composition
 - ✓ For streams where system footprint is a concern
- Applications have included:
 - ✓ Batch chemical plant effluents
 - ✓ MTBE in groundwater
 - ✓ Landfill leachate
 - ✓ Chlorinated solvents in manufacturing plant wastewaters
 - ✓ Oily wastes
 - ✓ POTWs with space restrictions
 - ✓ Phosphorous control
 - ✓ Pharmaceutical intermediates

Membrane System Specifications

Low Flow/High Strength - 8 mm Tubular Membranes

- Flow range from 9000 to 27,000 Gallons per Day (6 to 19 GPM)
- 6.4 m² surface area per module
- Single bank systems with 2 to 6 modules per bank

High Flow Systems – 8 mm Tubular Membranes with Helix Technology

- Flow range from 32,000 to 285,000 Gallons per Day (22 to 400 GPM)
- 27 m² surface area per module
- 2 to 6 modules per bank
- Systems consist of 1 to 3 banks depending on flow requirements

Membrane System Operating Conditions

-Max. system pressure	1-10 bar (LF); 600kPa/87 psi; 6 bar @ 20-60C (HF)
-Max. transmembrane pressure	-60 to +250kPa/-9 to 36 psi/-6 to 2.5 bar @ 20C
-Max. permeate pressure	650kPa/94 psi/6 bar @ 20C; 300kPa/43 psi/3 bar @ 60C
-Maximum Temp	60°C /140 °F
-	

Cleaning Chemical Resistance

NaOCl (active chlorine) 500 ppm max.	Phosphoric acid pH \geq 1
H ₂ O ₂ 1000 ppm max.	EDTA pH \leq 11
NaOH pH \leq 11	Citric acid
Nitric acid pH \geq 1	Enzymatic compounds

Note: It is recommended to keep the pH between 1 and 11 and not exceed a temperature of 40 °C during cleaning and/or disinfection

Replacement membrane modules and ongoing service plans are available.

MBR-NA-0119



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