

PureBox™ CMBR

Containerized Membrane Bioreactor

The RODI Systems PureBox™ Containerized Membrane Bioreactor (CMBR) is a fully self-contained wastewater treatment system housed in an intermodal shipping container. The CMBR is designed to treat domestic wastewater (sewage) while providing an effluent of superior quality. It is designed with simplicity and durability in mind and is easy to transport, install, operate, and maintain. The CMBR is suitable for a number of applications:

- **Emergency Relief**
- **Small Communities**
- **Remote Work Camps**
- **Military Facilities**
- **Hotels and Resorts**

Benefits

RODI Systems' CMBR process uses aerobic digestion as does a conventional system. However, with the CMBR process, a submerged membrane module is used to separate the treated wastewater from the biomass in the bioreactor. Use of the membrane offers several advantages:

Small Size - Membrane separation of liquid and solids allows the biomass in the bioreactor to be as high as 25 grams per liter. This results in a bioreactor a fraction of the size as that necessary in a conventional system of the same throughput.

Longer Sludge Retention - Longer sludge retention in a membrane bioreactor means easier sludge handling and less sludge for disposal. Membrane bioreactors are less sensitive to changes in wastewater quality.

Superior Effluent Quality - Since the treated wastewater passes through a membrane, the quality of the effluent is superior and virtually devoid of any suspended solids. Effluent from a membrane bioreactor may be fed directly to a reverse osmosis unit with no additional treatment.

Features

The PureBox™ CMBR incorporates these features:

Small Footprint and Portability - The CMBR unit consists of a standard intermodal container housing the bioreactor, blowers, recirculation pump, membrane modules, and controls. This results in a compact system that requires a minimum of site preparation and a shorter installation time.

Self-Contained - The CMBR is designed to operate as a portable, self-contained treatment system. All necessary treatment equipment and supplies are furnished as part of the container housing the treatment system.

Ease of Maintenance - The CMBR utilizes submerged flat-plate membrane modules which are continuously air-scoured to reduce fouling. Specialized control sequences allow "relax" intervals which further protects the membrane from flux loss due to particulate fouling. When operated properly,

the CMBR membrane modules will provide superior flux rates for extended periods with no maintenance necessary.

Automatic Control - The CMBR is equipped with a computerized control system. This system may be remotely monitored via cellular modem. The automatic control system is equipped with manual overrides should manual control be necessary.

Economic Operation - While membrane bioreactors tend to be more energy intensive to operate vs. conventional plants, the CMBR is designed to be as energy efficient as possible. Variable frequency drives are used on the blower motors to allow operation at maximum energy efficiency. Automatic controls minimize labor costs.



The RODI Systems PureBox™ CMBR systems incorporate a number of specifications which make them a high quality choice for your wastewater treatment and recycling application.

Bioreactor - The bioreactor is comprised of polypropylene or steel tanks. On smaller systems, the bioreactor is mounted inside the equipment container. On larger systems, the bioreactor is mounted inside an open top container and is designed to be located next to the equipment container. The bioreactor is furnished with all of the necessary piping connections.

Equipment Container - The blowers, filtrate pump, recirculation pumps, instrumentation, and control system are housed in a modified dry cargo shipping container. Modifications include waterproof flooring, insulation on ceiling and walls, overhead lighting and power outlets, and air conditioning and heating (if necessary).

Membrane Modules - The CMBR utilizes submerged flat-plate membrane modules. These modules are constructed on an advanced polymeric material and

are capable of rejecting suspended solids greater than 0.04 microns in size. This results in a superior effluent quality with less than 5 mg/l BOD and less than 1 mg/l total suspended solids.

Electrical — All electrical construction is done to recognized standards. Rigid or flexible PVC conduit and PVC junction boxes are used to prevent corrosion. Only NEMA 4X non-metallic enclosures are used. All electrical systems are thoroughly tested before the treatment system is shipped.

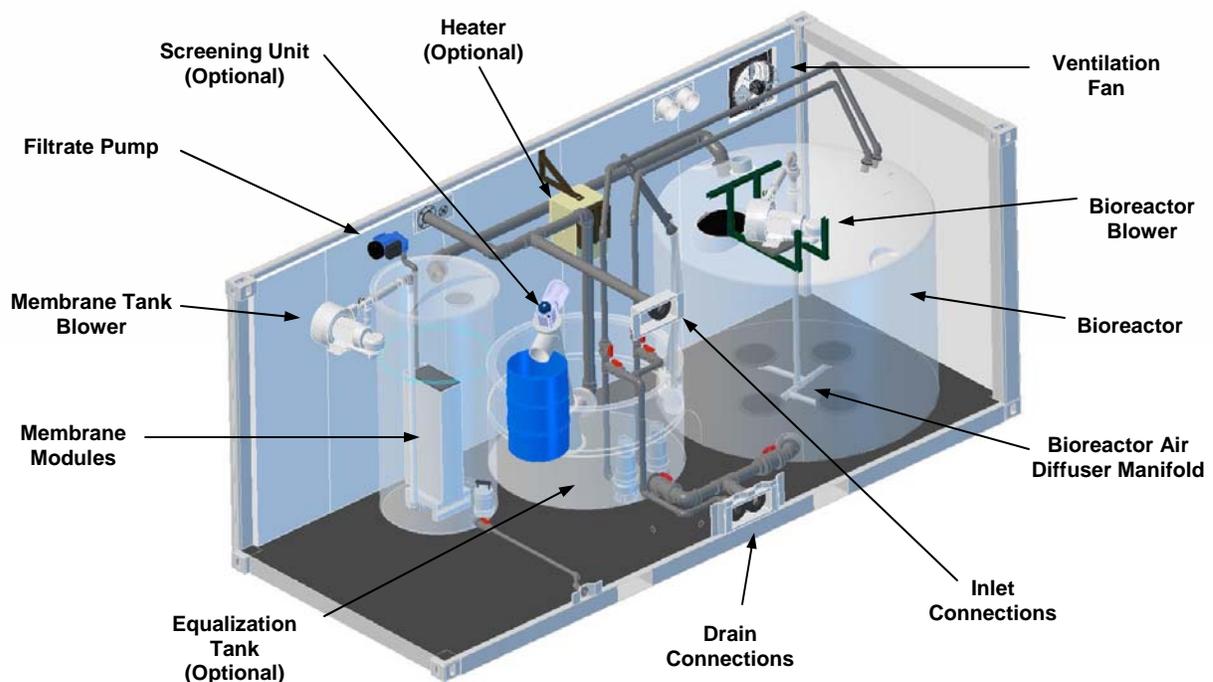
Controls - The CMBR is equipped with a computerized control system with an LCD touch screen operator interface. Manual overrides are available for all control functions. All necessary operating data is monitored and logged.

Data is available for local download or remote troubleshooting via telephone, cellular, or satellite modem.

Documentation — All systems are provided with a complete set of documentation which includes component O&M manuals and wiring diagrams.



Major Components, 2500 GPD System



PureBox™ CMBR

Performance

PureBox™ CMBR Typical Performance

Parameter	CMBR Inlet	CMBR Outlet
Temperature	15-25 °C	15-25 °C
pH	6.5 - 8.5	6.5 - 8.5
BOD	<1,500 mg/l	<5 mg/l
COD	<5,000 mg/l	<50 mg/l
Amm-N	<50 mg/l	<5 mg/l
Total-N	<200 mg/l	<20 mg/l
Total-P	<25 mg/l	<1 mg/l
TSS	<1,500 mg/l	<5 mg/l



RODI's CMBR systems utilize high performance membrane technology to provide effluent of exceptional quality.

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Options

The RODI Systems PureBox™ CMBR water treatment systems are available with a number of options. This allows clients to customize a system to fit their particular water treatment application.

Equalization Tank — If necessary, any CMBR system can be equipped with an equalization tank. This option is required if the system is equipped with the optional mechanical screening unit.



Screening Unit — The mechanical screening unit is used to separate and dewater non-organic solids before they enter the bioreactor. Proper screening is essential for MBR operation to prevent blocking of the feed space between the membrane envelopes.



Hypochlorite Injection — A chemical injection system can be provided to inject sodium hypochlorite (bleach) into the CMBR filtrate to insure disinfection of the effluent. The hypochlorite injection system includes an injection pump and chemical day tank.

Climate Control — The container housing the system can be equipped with approximately 2 inches of solid foam insulation covered with rigid waterproof plastic. The container may also be equipped with an electric heater.

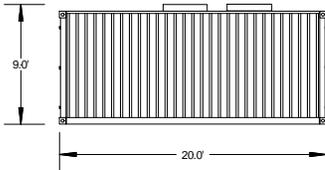
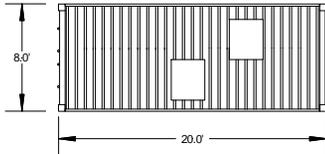
Ultraviolet Treatment — Additional bacterial protection can be provided in the form of a UV treatment system on the filtered water before final chlorination.

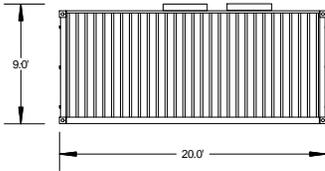
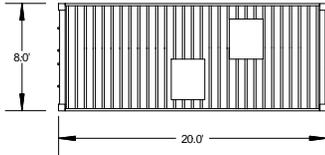


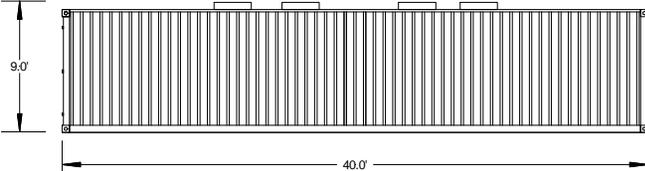
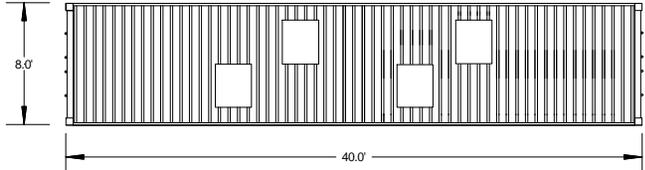
Operator Training — Training is available at RODI's facility for those individuals responsible for operating and maintaining the PureBox™ systems. Training and technical support are also available on site for most locations.



Remote Monitoring — This option allows the system to be monitored remotely via the GSM cellular phone network.

Nominal Treatment Capacity (at 350 mg/l BOD)	2,500 GPD	<i>Elevation View</i> 	<i>Plan View</i> 
Container Size (L x W x H)	20 ft x 8 ft x 9 ft		
Approximate Dry System Weight	8,500 lbs		
Bioreactor Size (L x W x H)	Inside Container		

Nominal Treatment Capacity (at 350 mg/l BOD)	5,000 GPD	<i>Elevation View</i> 	<i>Plan View</i> 
Container Size (L x W x H)	20 ft x 8 ft x 9 ft		
Approximate Dry System Weight	11,000 lbs		
Bioreactor Size (L x W x H)	Inside Container		

Nominal Treatment Capacity (at 350 mg/l BOD)	10,000 GPD	<i>Elevation View</i> 
Container Size (L x W x H)	40 ft x 8 ft x 9 ft	
Approximate Dry System Weight	20,000 lbs	<i>Plan View</i> 
Bioreactor Size (L x W x H)	Inside Container	

NOTE: These diagrams for general information only. Do not use for construction.

Nominal Treatment Capacity (at 350 mg/l BOD)	25,000 GPD	<i>Elevation View</i>	
Container Size (L x W x H)	40 ft x 8 ft x 8.5 ft		
Approximate Dry System Weight	32,000 lbs	<i>Plan View</i>	
Bioreactor Size (L x W x H)	40 ft x 8 ft x 8.5 ft		

Nominal Treatment Capacity (at 350 mg/l BOD)	50,000 GPD	<i>Elevation View</i>	
Container Size (L x W x H)	40 ft x 8 ft x 8.5 ft		
Approximate Dry System Weight	43,000 lbs	<i>Plan View</i>	
Bioreactor Size (D x H)	40 ft x 8 ft x 8.5 ft		

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The basic version of the RODI Systems PureBox™ CMBR is illustrated in the diagram below. NOTE: This diagram is for general information only. Certain components on the actual system will vary depending upon system size and selected options. Refer to the system proposal or quotation for specific information on a given system configuration.

