



COMPACT PLANTS FOR MUNICIPAL WASTEWATER TREATMENT

Using MBR technology

COMPACT PLANTS FOR MUNICIPAL WASTEWATER TREATMENT

SIRMET S.A. has an extensive experience in the field of wastewater treatment and offers integrated, efficient and reliable compact biological treatment units for small hotels and lodgments with **capacities ranging from 25 m³/d up to 300 m³/d** in standard container-like metallic structures. The systems offered can also be modified to treat sewage in the case of remote residences.

The plants are delivered ready for installation, connection and start-up with all equipment pre-mounted onto a compact tank.

The ideal solution for the following cases:

- ✓ **Condos**
- ✓ **Small and medium-sized hotels**
- ✓ **Tourist lodgments**
- ✓ **Camping and recreational camps**
- ✓ **Small or medium-sized housing settlements**
- ✓ **Remote military camps**

The systems offers apply the MBR process, which combines the conventional process of activated sludge with filtration (microfiltration or ultrafiltration – MF or UF). Compared to the classic treatment systems, the MBR technology can achieve the best possible effluent quality (fully disinfected) in a simple and cost effective manner, thus allowing its use for irrigation or firefighting purposes. The effluent quality is such that complies with the strictest environmental legislation in Europe.

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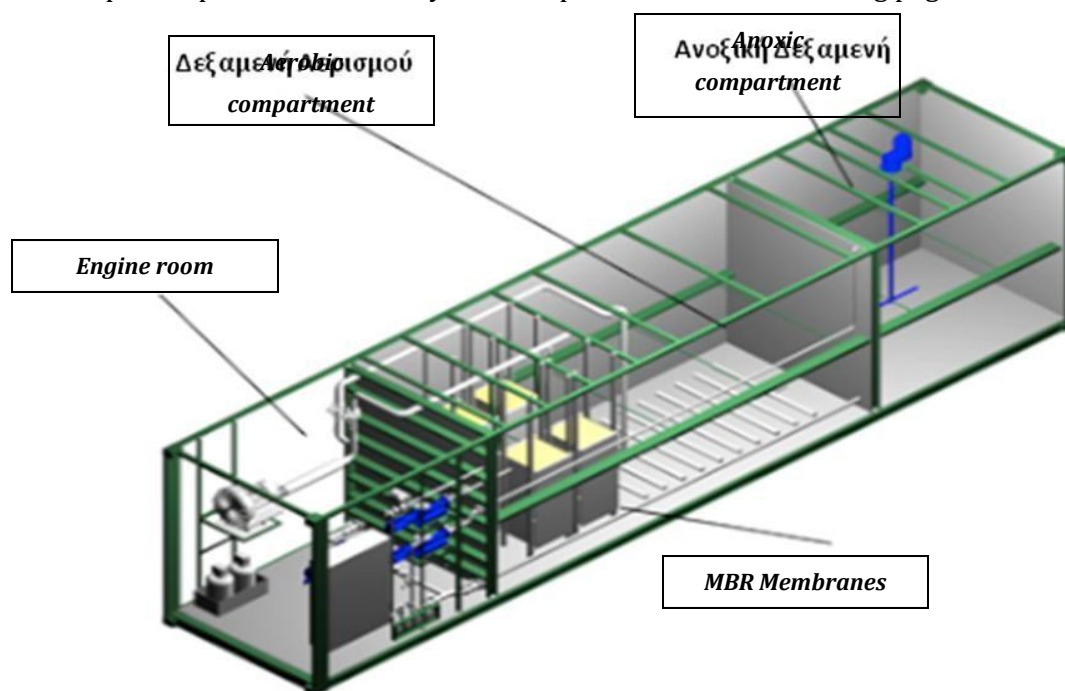
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The MBR technology stands out for the following benefits it offers:

- ✓ Low cost of operation.
- ✓ Fast, easy, instant and odorless operation. The offered plants are lidded and ventilated, with the possibility to be connected to de-odorizing filters upon request.
- ✓ No monitoring / operator needed and minimal maintenance required.
- ✓ Flexibility in influent variations (quantitative-qualitative).
- ✓ Small space requirements with the possibility for underground installation to avoid visual impact.
- ✓ Exploitation of treated effluent for irrigation, firefighting or industrial uses
- ✓ Membrane lifetime varies from 6 to 10 years and the performance remains unaffected from fluctuations of the hydraulic and organic load.

Parts of the compact plant

All plants offered are ready for installation and connection in a form of container. This includes all treatment phases, meaning a compartment of anoxic zone, an aerobic zone that also includes the membranes' module for filtration and solids retaining (MBR module), a collection tank for the treated effluent and a space for the installed electromechanical equipment (engine room). Sodium hypochlorite is dosed in the tank of treated waste, as an additional means of disinfection. The treatment phases performed in the system are presented in the following page.



Indicative arrange of the plant compartments

5 steps of the process

INLET



Wastewater inlet

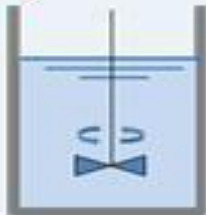
Wastewater flows into the septic tank initially, which serves as a buffer tank. Here the depositing solids and suspended oil and grease are removed.

The wastewater then passes the following steps until it is completely purified:

1. Denitrification

Raw wastewater is pumped to the anoxic tank where denitrification is being performed.

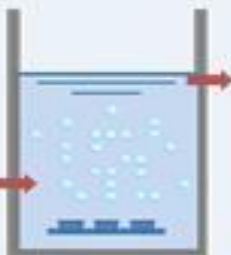
INLET



Step 1 - Denitrification

2. Aeration

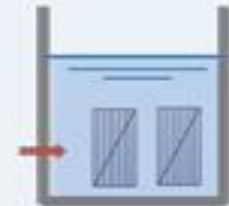
Wastewater is pumped to the aeration tank, where biomass development is taking place. The demanded aeration is offered by fine bubble diffusers.



Step 2 - Aeration

3. Ultrafiltration

Ultrafiltration takes place in the same tank with aeration. Air demand for this process is offered by the same blower that serves aeration needs for biomass development.



Step 3 - Sedimentation

4. Return of sludge

Part of the settling sludge is recycled to the anoxic zone. Recycling preserves the amount of activated sludge constant in the aerobic zone. The rest of the sludge is discharged.

INLET



Step 4 - Recycle

5. Treated water

Treated water is pumped to a separate tank in the ancillary chamber for storing and irrigation use. In this tank, treated water is chlorinated in order to ensure safe discharge.

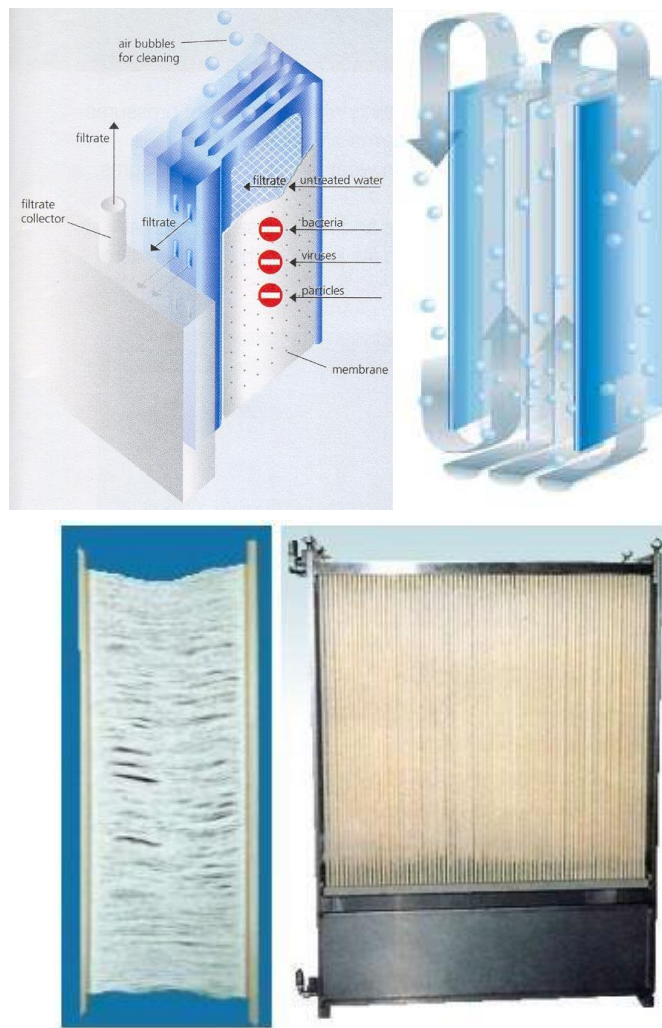
OUTLET



Step 5 - Treated water storage

The MBR technology

The membranes that the MBR technology uses are made of plastic materials (PES, PAN, PE, PVDF), placed on special frames which are mounted in sequence to form a membrane module. According to the manufacturing process, the membrane elements can be made either Flat Sheet or Hollow Fibers, with various porosities. SIRMET Ltd has a reference of installations with many major membrane manufacturers (Mitsubishi, Kubota, Weisse, etc). Independently of the membrane type, the wastewater flows from outside through each membrane towards the frame and is then pumped by the main container with low pressure/ pumping. Particles and bacteria are retained in the tank. The pores of the membranes range from 0.4 μm (microfiltration) to 0.04 μm (ultrafiltration), so as to avoid permeation of solid particles and microorganisms (bacteria) at a rate of 99.9999%!



Flat sheet membrane/elements (above) and Hollow Fiber membrane element and module (below).

A special air diffusion system under the membranes provides for the self-cleaning of the membranes from sludge (scouring), ensuring they remain clog-free for large amounts of time. In addition, at regular intervals, backwashing with the treated waste is performed automatically. Membranes' maintenance consists of a chemical cleaning with a thin hypochlorite solution, once or twice per year.

Influent - Effluent Characteristics

Urban wastewater usually has the following features:

DAILY FLOW	Q_{m}	150 l/eq.d
ORGANIC LOAD CONCENTRATION	BOD ₅	~340 mg/l
TOTAL SUSPENDED SOLIDS	TSS	~350 mg/l
TOTAL NITROGEN	N	~40 mg/l

The compact biological cleaning plants with MBR technology ensure maximum performance possible, achieving better effluent quality compared to the conventional systems or to the quality required by regulations for reuse for irrigation (DIN 19650, Joint Ministerial Decision [JMD] 145116, Government Gazette [GG] 345/B/2011):

		Performance	JMD 145116 - GG 354/B/2011 (limit values for unlimited irrigation)
BOD	mg/l	≤10	<10 to 80% of the samples
COD	mg/l	<50	
TSS	mg/l	<5	<10 to 80% of the samples
TKN-N	mg/l	<10	
pH		6.5-8	
TURBIDITY	NTU	< 0,2 NTU	<2 median value

The performance of the unit requires proper maintenance and operation according to the directions of SIRMET S.A.

Unit description

The treatment plant is made of a metal body, made of mild steel (St37.2) and coated with epoxy paints, in the form of an ISO container. The container has a closed top with manholes to facilitate its embedment under the ground level and to avoid emission of foul odours. The manholes on the roof are located at points that allow easy removal of the equipment (pumps, mixers, MBR modules), in the event of maintenance or failures. All systems include ventilation that can be guided to a place where odours cause no nuisance. The operation of the plant is fully automatic, through a PLC-based panel and a touch screen installed inside the container. With the exception of the machinery room, the rest of the space is configured in tanks that house the biological treatment (denitrification - aeration - MBR).

Pictures of similar units

- *Compact industrial wastewater treatment, capacity of **100 m³/d**, for the soft drinks factory of EPSA SA in Volos, Greece (2010).*



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- *Compact wastewater treatment plant, capacity of **1.000 m³/d**, for the soft drinks factory of PEPSICo - IVI SA in Viotia, Greece (2011).*



- *Compact wastewater treatment plant, capacity of **25 m³/d** at 'La Luna' hotel in Skiathos island, Greece (2011).*



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- *Compact wastewater treatment plant, capacity of **60 m³/d** for 'Grand Forest' hotel in Metsovo, Greece (2013).*



- *Compact wastewater treatment plant for the municipal wastewater of the aluminium industry of ELVAL SA (capacity of **75 m³/d**) in Viotia, Greece (2013).*





- *MBR wastewater treatment plant, capacity of 25 m³/d in 'Alas Resort' hotel in Lakonia, Greece (2012).*



Standard unit sizes

	S25	S50	S100	S150
DAILY FLOW (m ³ /d)	25	50	100	150
EQUIVALENT POPULATION (150 l/eq.d)	167	334	667	1000
No. OF CONTAINERS	1xISO20'	1xISO20'	1xISO40'	1xISO40' 1xISO20'

	S200	S300
DAILY FLOW (m ³ /d)	200	300
EQUIVALENT POPULATION	1350	2000
No. OF CONTAINERS	2xISO40'	3xISO40'

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The above standard sizes **can be combined** where the application allows it, e.g. for 500 m³/d it is efficient to use 1xS300 + 1xS200 working in parallel. **The daily capacities are maximum values**, i.e. for the treatment of 250 m³/d the appropriate model is the S300.

INCLUDED EQUIPMENT: MBR modules, recirculation pumps (1 working and 1 stand-by), extraction pumps (1 working + 1 stand-by), backwash pumps (1+1, where applicable), anoxic mixer, aeration/scouring blower (1 working + 1 stand-by), aeration network (fine bubble diffusers), hypochlorite dosing pumps (1 for disinfection and 1 for cleaning the membranes –where applicable), ventilation, electrical board with PLC and touch screen, with outputs for connection to SCADA/BMS. All necessary instrumentation and automation (level sensor, pressure gauges, flow switches, flow meter and pneumatic valves).

The delivery of the systems includes also a manual of operation and maintenance (English), as well as supervision of installation / connections, start-up and training. The civil engineering works (such as the construction of a base for placement) and the septic tanks are not included and they are considered to be an obligation of the employer / pre-existing. The above quote does not include the wastewater supply pumps or any provision for the treated effluent, which are considered within the scope of the employer.

TERMS OF DELIVERY:

- The systems offered come with a 12-month mechanical guarantee for the electromechanical equipment and 24 months guarantee for the membrane modules, after successful electrical/hydraulic start-up.

Certifications

SIRMET S.A. currently runs its 28th year of a successful, continuous and developing activity and the services and products they offer are certified with the international standard EN ISO 9001:2008.