



SIRMET

ENGINEERING & MANAGEMENT



COMPACT WASTEWATER TREATMENT PLANTS

Using MBR technology

COMPACT WASTEWATER TREATMENT PLANTS

SIRMET S.A. has 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 50 m³/day up to 400 m³/day** in standard container-like metallic structures. The offered systems 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 offered systems 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.

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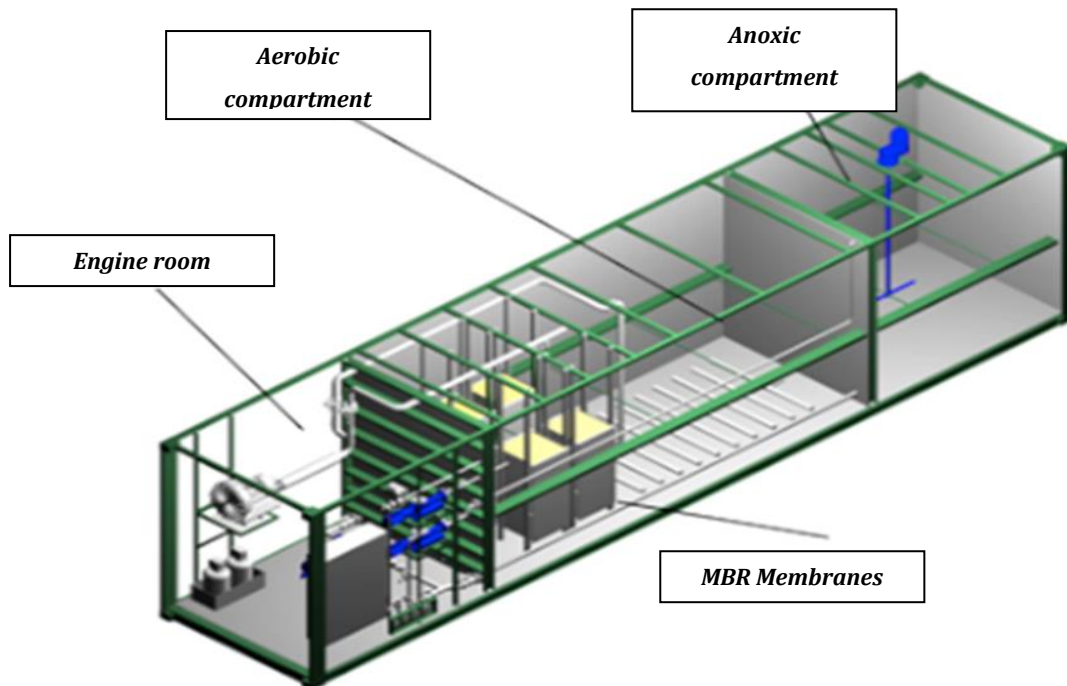
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The MBR technology stands out for offering the following benefits:

- ✓ Low operational cost.
- ✓ Fast, easy 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.
- ✓ 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 operating as 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 electromechanical equipment (engine room). Sodium hypochlorite is dosed in the treated waste tank, as a means of disinfection. The treatment phases performed in the system are presented in the following page.



Indicative arrangement of the plant compartments

5 steps of the process

INLET



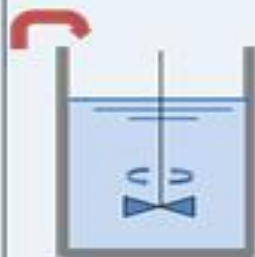
Wastewater inlet

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

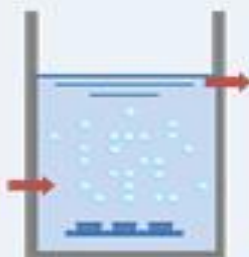
Raw wastewater is pumped to the anoxic tank where denitrification is being performed.



Step 1 - Denitrification

2. Aeration

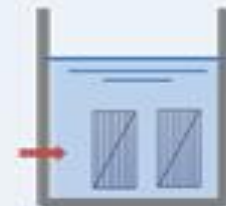
Wastewater is pumped to the aeration tank, where biomass development is taking place. The demanded aeration is offered by fine bubble diffusers.



Step 2 - Aeration

3. Ultrafiltration

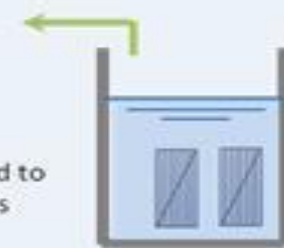
Ultrafiltration takes place in the same tank with aeration. Air demand for this process is offered by the same blower that serves aeration needs for biomass development.



Step 3 - Sedimentation

4. Return of sludge

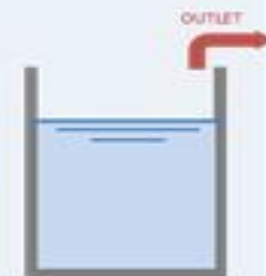
Part of the settling sludge is recycled to the anoxic zone. Recycling preserves the amount of activated sludge constant in the aerobic zone. The rest of the sludge is discharged.



Step 4 - Recycle

5. Treated water

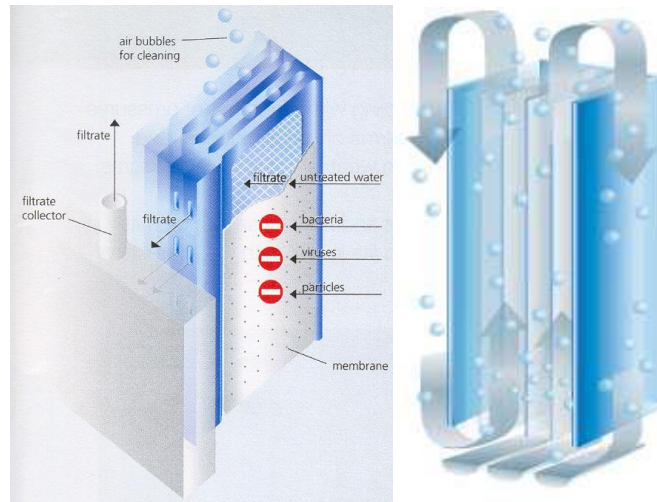
Treated water is pumped to a separate tank in the ancillary chamber for storing and irrigation use. In this tank, treated water is chlorinated in order to ensure safe discharge.



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. 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 are $0.4\ \mu\text{m}$ (microfiltration), and due to the development of a thin protein film on the membrane surface, the pore size is further reduced at $<0.01\ \mu\text{m}$.



Flat sheet membrane/elements (above)

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 cycle with a thin hypochlorite solution, once or twice per year.

Influent - Effluent Characteristics

Typical characteristics of urban wastewater:

DAILY FLOW	Q _{lit}	150- 400 Lt/ eq/ day
ORGANIC LOAD	BOD ₅	67 gr/ eq/ day (~ 340 mg/l)
TOTAL SUSPENDED SOLIDS	TSS	70 gr/ eq/ day (~ 350 mg/l)
TOTAL NITROGEN	N	11 gr/ eq/ day (~ 40 mg/l)

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

Performance		
BOD	mg/l	<10 to 80% of the samples
TSS	mg/l	<10 to 80% of the samples
TN	mg/l	≤ 10
pH		6,5-8
TURBIDITY	NTU	≤2

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 coated with epoxy paints, in the form of an ISO container. The container has a closed top with manholes to facilitate its installation 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 directed 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).

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Pictures of similar units

- *MBR wastewater treatment plant, capacity of 50 m³/d for International Olympic Academy, Ancient Olympia, Greece (2021).*



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



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- *Compact wastewater treatment plant for the municipal wastewater of the aluminium industry of ELVAL SA (capacity of **75 m³/d**) in Viotia, Greece (2012-2013).*



- *MBR wastewater treatment plant, capacity of **70 m³/d** of CABLEL S.A. in Thiva Voiotias Greece (2014).*



- Two MBR wastewater treatment plant, capacity of **15 m³/d** and **25 m³/d** of SOVEL S.A. in Almyros Volou Greece (2015).



Standard unit sizes

	S50	S100	S200	S300	S400
EQUIVALENT POPULATION	250	500	1000	1500	2000
DAILY FLOW Q (m³/d)	50	100	200	300	400
No. OF CONTAINERS	1	1	2	3	4
Container Dimensions	10x2,5x2,5	15x2,5x2,5	13x2,5x2,5	11x2,5x2,5	13,4x2,5x2,5

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 concrete base for placement of the container unit) and the septic tanks are not included and they are considered to be an obligation of the employer / pre-existing. The above quote

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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:

- Delivery time is set to 10-12 weeks from the date of the order.
- Delivery place is ex-works Piraeus port. Transportation and insurance fees are considered within the scope of the employer.
- The offered systems 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 SA currently runs its 32 year of a successful, continuous and developing activity and the services and products they offer are certified with the international standard EN ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007

