



## COMPACT MUNICIPAL WASTEWATER TREATMENT PLANT

using MBBR 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 **50, 100, 200, 500 and population equivalents (M50, M100, M200, M500 & M1000 respectively)**. 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 offered utilize the Moving Bed Bio-Reactor (MBBR) method, which combines the conventional process of activated sludge (suspended growth) with the attached growth of biomass inside special plastic carriers inside the mixed liquor. Compared to the conventional biological treatment systems, the MBBR technology can achieve high quality effluent using smaller footprint reactors, allowing the re-use of the treated wastewater for irrigation or firefighting / secondary uses purposes. The effluent quality is such that complies with most environmental legislation in Europe for wastewater re-use.

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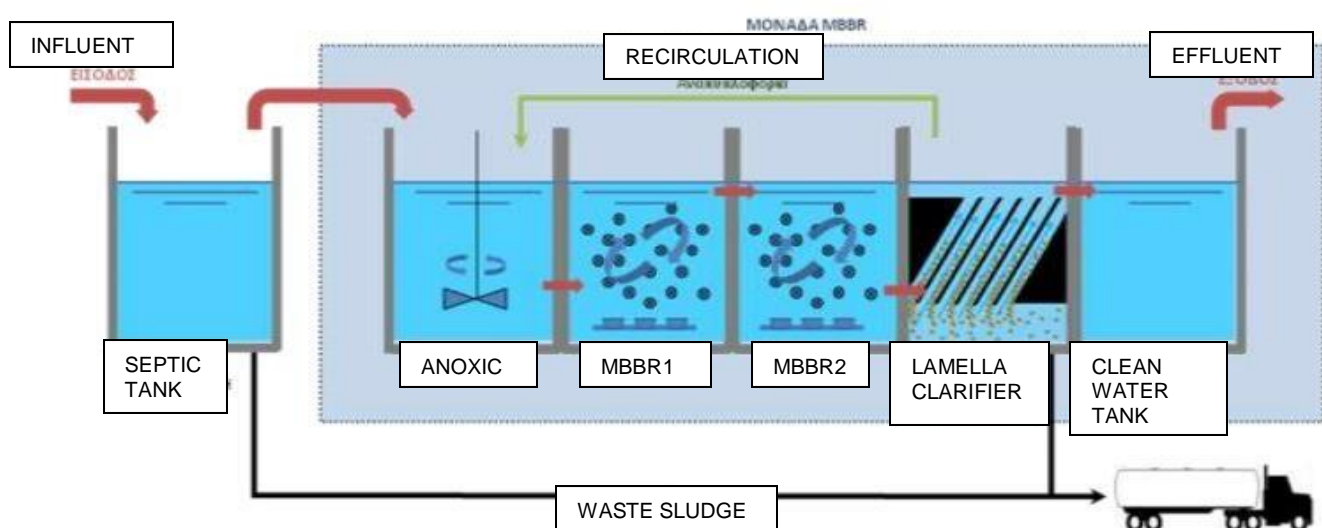
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The MBBR technology stands out for the following benefits it offers:

- ✓ Low cost of operation – no chemicals required.
- ✓ Fast, easy, instant and odorless operation. The offered plants are covered and ventilated, with the possibility to be connected to de-odoring filters upon request.
- ✓ No monitoring / operator needed and minimal maintenance required.
- ✓ Flexibility in influent variations (quantitative-qualitative).
- ✓ High performance process – reduced energy requirements
- ✓ Small space requirements with the possibility for underground installation to avoid visual impact.
- ✓ Exploitation of treated water for irrigation or firefighting purposes

### Parts of the compact plant

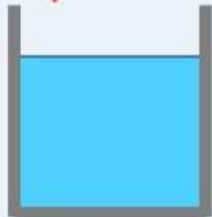
All plants offered are ready for installation and connection in a form of container. This includes all treatment phases, meaning a compartment of anoxic zone, 2 compartments of an aerobic zone that also includes the membranes' module for filtration and solids retaining (MBBR module), a sedimentation tank, a collection tank for the treated waste and a space for electromechanical equipment (engine room). Sodium hypochlorite is dosed in the tank of treated waste, as usually provided for the environmental licensing for disposal. The treatment phases performed in the system are presented in the following page.



*Indicative arrangement of the plant compartments*

## 5 steps of the process

INFLUENT



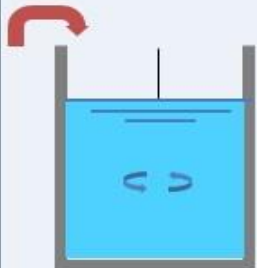
Charging...

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

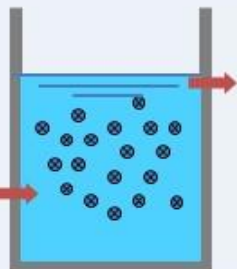
Raw wastewater is pumped to the anoxic tank where denitrification is being performed.



Step 1 : Denitrification

### 2. Aeration

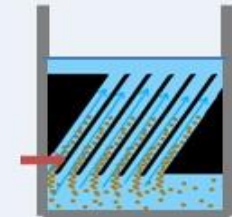
The wastewater is pumped to the aeration tank which consists of two chambers. The aeration is performed through fine bubble diffusers, so that a lot of oxygen is dissolved in the water and keep the biomedica suspended. With the help of this oxygen, the microorganisms (activated sludge) reduce the pollutants and proliferate.



Step 2 : Aeration

### 3. Sedimentation

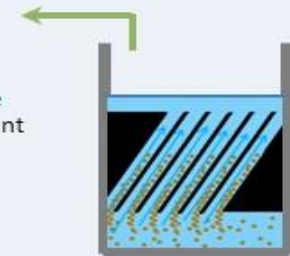
Wastewater settles for a while and sludge is accumulated in the bottom of the tank, using lamellas. In the upper area, a zone of clarified water is generated.



Step 3 : Sedimentation

### 4. Return of sludge

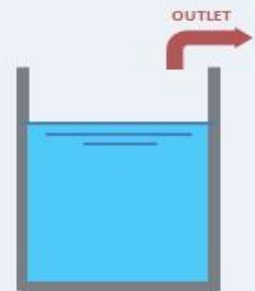
Part of the settling sludge is recycled to the anoxic zone. Recycling preserves the amount of activated sludge constant in the aerobic zone. The rest of the sludge is discharged.



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 MBBR technology

MBBR technology refers to the biomass development both in suspended form inside the reactor, and inside plastic carriers with high surface area, which are kept in suspension thanks to air provided in the tank. These carriers are placed inside the bioreactor and provide increased internal surface for biomass to grow, hence increased treatment capacity in smaller reactor sizes. Their special structure offers the appropriate conditions for the development and protection of biomass in significantly smaller reactor volumes than those required in conventional systems.

The incoming organic load is decomposed while contacting the biomass inside the plastic carriers. The decomposition is immediate towards the production of carbon dioxide and biomass, which sustains the decomposition of new incoming organic load.



**Carriers inside the reactor**



**Detailed view of the carrier with the biomass developed in its protected surface**

## Influent – Effluent Characteristics

Urban wastewater usually has the following features:

<b>DAILY FLOW</b>	$Q_{in}$	150-250 Lt/ PE/ day
<b>ORGANIC LOAD CONCENTRATION</b>	BOD <sub>5</sub>	67gr/eq/day (~340 mg/l)
<b>TOTAL SUSPENDED SOLIDS</b>	TSS	70gr/eq/day/ (~350 mg/l)
<b>TOTAL NITROGEN</b>	N	11gr/eq/day (~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	≤25	<10 to 80% of the samples
COD	mg/l	<50	
TSS	mg/l	<50	<10 to 80% of the samples
TKN-N	mg/l	<5	
pH		6.5-8	
TURBIDITY	NTU	< 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. The manholes on the roof are located at points that allow easy removal of the equipment, in the event of maintenance or failures. All systems include ventilation that can be guided to a place where odors cause no nuisance. The operation of the plant is fully automatic, through a PLC 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/ MBBR). Depending on the size of the plant, the MBBR reactor can be divided in two compartments, each with different loading design, in order to provide high quality effluent.



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*Pictures of indicative compact plants for the treatment of municipal wastewater in hotels and industrial installations.*

### Standard unit sizes

All compact units are delivered with all the necessary electrical and hydraulic equipment ready to be connected with the sewage flow, the effluent and the electrical power.

	M50	M100	M200	M500
DAILY FLOW (m <sup>3</sup> /d)	7.5 - 12.5	15 - 25	30 - 50	75 - 100
EQUIVALENT POPULATION	50	100	200	500
CONTAINER VOLUME (m <sup>3</sup> )	23	26	37	70
TANKS DIMENSIONS (L X W X H m)	4,5x2,0x2,4	4,5x2,3x2,4	6,5x2,3x2,4	11,0x2,3x2,6

### INCLUDED EQUIPMENT:

Special high specific surface carriers (different types for nitrogen and carbon/organic load removal), anoxic mixer, aeration blower (1 working + 1 stand-by), aeration network (coarse bubble diffusers), hypochlorite dosing pump for disinfection, ventilation, electrical board with PLC and touch screen, with outputs for connection to SCADA/BMS. All necessary instrumentation and automation (level switches, pressure gauges, flow switches, flow meter and pneumatic valve).

In order to remove TSS content and disinfect the effluent, the compact MBBR units of the following table include the following equipment that comprises two parallel (1 in duty +

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1 stand-by) lines of tertiary treatment. The sizing of the equipment is so that it satisfies the maximum flowrate capacity of each compact MBBR plant:

- 2 pcs multimedia sand filters (quartz gravel, quartz sand and hydroanthracite), each with a time-programmed multi-valve. The filters' array is arranged so that when one filter enters the backwash cycle, the other enters into service.
- 2 pcs of high pressure pumps (max 5 bar) for feeding and backwashing each filter.
- 2 pcs of cartridge (PE) filters with a 20 micron mesh
- 2 pcs of UV sterilization systems.

The delivery of the systems includes also a manual of operation and maintenance (Greek / English), as well as supervision of installation, connection, 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. H currently runs its 28<sup>th</sup> 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.

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