

MCQ Question · mcqquestion.com

Membrane Bioreactors

Free · Share

Membrane Bioreactors

Water leaves a busy building full of soap and food waste. **An MBR cleans it with microbes, then a fine filter.**



An aeration tank running the activated sludge process at a sewage treatment plant in Bengaluru. This is the biological half of an MBR system. Photo: Vraj Acharya, WELL Labs, CC BY-SA 4.0, via Wikimedia Commons.

At a Glance

Four facts to hold on to.

01
Two steps in one

Microbes clean the water. A membrane filters it.

02
No settling tank

The membrane replaces the secondary clarifier.

03
Smaller footprint

About 8,000–12,000 mg/L of biomass.

04
UPSC 2024

Asked as a wastewater technology.

Bioreactor A tank where microbes do the cleaning.
Activated sludge A mix of water, microbes, and fine solids kept in air.
Permeate The water that passes through the membrane.
Fouling A layer of sludge that clogs the membrane.

Follow the Wastewater

Must Know

What is an MBR?

- **MBR means membrane bioreactor.** It joins a living treatment step with a fine filter.
- The living step uses microbes, mostly bacteria, to eat biodegradable waste. The tank where this happens is the **bioreactor**.
- The mix of water, microbes, and fine solids is called **activated sludge**. Air helps the microbes work.
- The membrane then separates clean water from the sludge. The clean water is the **permeate**. The microbes stay in the tank.

One drop's journey

1. **Incoming wastewater:** used water arrives from homes, hotels, or industry.
2. **Fine screen:** rags and grit are removed before they harm the membrane.
3. **Biological tank:** air and microbes break down biodegradable waste.
4. **Membrane:** water passes through. Sludge and most bacteria stay behind.
5. **Treated water:** operators test it. Some uses need disinfection or more filtering.

- Extra sludge leaves the tank for separate treatment and disposal.
- Flow based on the US EPA MBR fact sheet.

What changes from a conventional plant?

Step	Conventional activated sludge	Membrane bioreactor
Biology	Microbes work in an aeration tank.	Microbes still work in an aerated tank.

Step	Conventional activated sludge	Membrane bioreactor
Separation	A large secondary clarifier lets sludge settle by gravity.	A membrane holds the sludge back.
Microbes in the tank	Fewer, about 2,000–4,000 mg/L.	More, about 8,000–12,000 mg/L.

- **The membrane does not replace the microbes.** It replaces the settling step.

> **Quick check 1.** Membrane Bioreactors are discussed in the context of reproductive and vaccine technologies. *(True or False?)*
>
> See answer ↓

The Filter and Its Care

Good to Know

What do the tiny pores do?

- MBRs commonly use **microfiltration** or **ultrafiltration** membranes. Their tiny holes keep out suspended solids and many microbes.
- The biological tank removes much of the biodegradable waste. It can also remove nitrogen if the plant has the right treatment zones.
- The membrane alone does not remove dissolved salts.
- **Usually reduced well:** suspended solids, many bacteria, and waste that microbes can break down.
- **May remain:** dissolved salts, some small chemicals, and some viruses. Removal varies by design.

- **MBR water is not automatically drinking water.** Extra steps may include disinfection or reverse osmosis. See this virus-removal review.

Why can the tank be smaller?

- A settling tank struggles when too much sludge is mixed in. A membrane holds that sludge back.
- Some MBRs run with about **8,000–12,000 mg/L** of mixed solids. A conventional system often uses about 2,000–4,000 mg/L.
- The unit **mg/L** means milligrams of material in one litre of water.
- These are example ranges, not a rule for every plant. A stronger mix treats more waste in less space.
- Source: California State Water Resources Control Board.

Where can the membrane sit?

- **Submerged MBR:** the membrane sits in the tank or a nearby membrane tank. A gentle pump draws water through it. Air bubbles sweep its surface.
- **Side-stream MBR:** a pump sends the sludge mixture through a separate membrane unit. It is easier to service. Pumping can use more energy.

What is fouling?

- **Fouling** is a layer of sludge or other material on the membrane. It slows the flow of water.
- Operators first screen the incoming water and scour the membrane with air.
- Many systems also use **backwashing**. Clean water briefly flows backward through the membrane.
- Periodic chemical cleaning removes what these steps cannot lift.

- Blowers, pumps, cleaning, and membrane replacement cost money. They often use more energy than a settling tank.

> **Quick check 2.** MBR systems maintain roughly 8,000–12,000 mg/L of biomass, much higher than the 2,000–4,000 mg/L of conventional systems. *(True or False?)* See answer ↓

> **Quick check 3.** An MBR membrane removes dissolved salts, so its water is always safe to drink. *(True or False?)* See answer ↓

Exam Edge

Previous Year Question

UPSC has asked about this technology once.

Think it through: why might a learner confuse an MBR with a vaccine bioreactor?

The word bioreactor appears in many fields. But this question uses the full term, membrane bioreactor. Here it means a wastewater tank paired with a membrane filter. Follow the water's path to remember the answer.

Quick check 4. In an MBR system, the membrane replaces the secondary clarifier used in conventional treatment plants. *(True or False?)* See answer ↓

Real Uses and Trade-Offs

Great to Know

Where does India use this idea?

- **Building reuse:** a case study describes a 300-kilolitre-per-day MBR at a Bengaluru hotel. It reused water for flushing, landscaping, and cooling. Invest India case study.
- **Textile industry:** a 2022 Ahmedabad plant paired MBR with reverse osmosis for reuse. The MBR removed biological waste and solids. Reverse osmosis handled dissolved material. Vendor case study.
- **Pharmaceutical cluster:** a vendor case study describes a 750-kilolitre-per-day MBR near Ahmedabad. It treats shared wastewater from pharmaceutical sites. Toray case study.
- **Municipal planning:** a NITI Aayog report proposed an MBR-based reuse scheme for Ballari. A design report is a plan, not proof the plant was built. Ballari design report.

When is MBR a good choice?

- MBR helps when land is scarce or treated water will be reused. Its clear permeate can make disinfection easier.
- The trade-off is more equipment, energy, and membrane care. Thick sludge must still be removed.
- A poor screen or a sudden change in incoming wastewater can disrupt treatment.
- **The right choice depends on the water, the reuse goal, the land, and operating skill.** MBR is not a cure for every pollutant.

> **Quick check 5.** MBR systems are used in India only for municipal sewage, not in industries like pharmaceuticals or textiles. *(True or False?)* See answer ↓

Quick Q&A

What does an MBR combine?

Microbial treatment and membrane filtration.

What does the membrane replace?

The secondary clarifier.

What is permeate?

Water that passes through the membrane.

What is fouling?

Sludge clogging the membrane.

Does an MBR remove dissolved salts?

No. Reverse osmosis does.

Practice: Membrane Bioreactors

6 verified questions from this topic.

More Environment and Ecology Practice

Related Topics

All Environment and Ecology Articles

Namami Gange Programme

Swachh Bharat Mission (Urban)

PFAS: The “Forever Chemicals”

Practice MCQs

1. Membrane Bioreactors are most often discussed in the context of which technology area?

A. Vaccine production technologies

B. Drug delivery nanotechnologies

C. Assisted reproductive technologies

D. Wastewater treatment technologies

See answer ↓

2. What two processes does a Membrane Bioreactor combine?

A. Activated sludge biological treatment and membrane filtration

B. Reverse osmosis and chlorination

C. Solar evaporation and sand filtration

D. Ozonation and UV disinfection

See answer ↓

3. In an MBR system, what does the membrane replace, compared to a conventional treatment plant?

A. The intake pump

B. The secondary clarifier or settling tank

C. The aeration tank

D. The chlorine dosing unit

See answer ↓

4. Why do Membrane Bioreactor plants generally need a smaller physical footprint than conventional treatment plants?

A. They skip the filtration step entirely

B. They only treat small volumes of water

C. They can run at much higher biomass concentrations, reducing reactor size

D. They use no biological process at all

See answer ↓

5. Which of the following is a key advantage of MBR-treated water over conventionally treated water?

A. It is unsuitable for pharmaceutical or textile industry applications

B. Its higher effluent quality makes it suitable for reuse in irrigation or industrial processes

C. It requires additional chlorination before any use

D. It cannot be reused for any purpose

See answer ↓

6. Membrane Bioreactors are often discussed in the context of: (UPSC CSP 2024)

A. Assisted reproductive technologies

B. Vaccine production technologies

C. Wastewater treatment technologies

D. Drug delivery nanotechnologies

See answer ↓

Answer Key

1. **D.** Membrane Bioreactors are an advanced wastewater treatment technology, integrating biological treatment with membrane filtration.

↑ Q1

2. **A.** A Membrane Bioreactor integrates the conventional activated sludge process, where bacteria break down organic matter, with membrane filtration such as microfiltration or ultrafiltration.

↑ Q2

3. **B.** The membrane in an MBR system acts as a physical barrier, replacing the secondary clarifier or settling tank used in conventional activated sludge plants.

↑ Q3

4. **C.** MBR systems maintain much higher biomass concentrations (roughly 8,000-12,000 mg/L) than conventional systems (2,000-4,000 mg/L), allowing smaller reactor volumes for the same treatment capacity.

↑ Q4

5. **B.** An MBR membrane's small pore size removes suspended solids, bacteria, and even some viruses, producing effluent of high enough quality for reuse in irrigation or industrial processes.

↑ Q5

6. **C.** A Membrane Bioreactor integrates the activated sludge biological process with membrane filtration, replacing the secondary clarifier and producing high-quality, reusable treated water.

↑ Q6

Quick-check answers

1. **False.** ↑ 1
2. **True.** ↑ 2

3. **False.** ↑ 3

4. **True.** ↑ 4

5. **False.** ↑ 5

Curated by Arsalan Zuberi · mcqquestion.com

Scan to read online

https://mcqquestion.com/articles/enveco0064-membrane-bioreactors/