Hollow-fiber membrane element and module for industrial/municipal wastewater treatment

Sterapore™ 5000 Series

Water recycling plant in China

**Challenge**

As water shortage in urban areas in China is becoming a serious problem due to growing population in such areas, effective use of treated water is needed as a countermeasure to solve this problem.

**Solution**

The purpose of this treatment system is reuse of the treated water, allowing the treated water to be discharged into the upstream of the dam. To this end, MBR that can cut off SS almost 100% to obtain excellent water quality has been used.

**Benefits**

The sewage treated water by SBR(Sequencing Batch Reactor) is treated by MBR(Membrane Bio Reactor) and then being discharged into the dam serving as a water supply resource.

**Process flow diagram**

- Influent
- Screen
- Aeration tank
- Membrane separation tank
- UV
- Discharge to river head

**Location**

China

**Furnished by**

Beijing Origin Water Technology Ltd.

**Capacity**

45,000m³/d

**Application**

Domestic Sewage

**Operation started**

2006

**Product**

STERAPORE™ 5000

Membrane Department Membrane Division
Mitsubishi Chemical Aqua Solutions Co., Ltd.

10F, Gate City Ohsaki East Tower, 1-11-2, Osaki, Shinagawa-ku, Tokyo, 141-0032 Japan
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E-mail:membrane@m-chemical.co.jp
URL:https://www.m-chemical.co.jp/sterapore/en
Hollow-fiber membrane element and module for industrial/municipal wastewater treatment

**Challenge**

This plant is located near Seoul, a growing megacity with a population of over 10 million, and its treatment capacity needs to be increased from 150,000 to 180,000 m³/day; however, there is not enough land space.

**Solution**

A significant land-saving is a critical factor for this project. Membrane Bio-Reactor (MBR) can reduce about 60% land space compared with conventional activated sludge process because MBR can eliminate a secondary clarifier.

**Benefits**

MBR makes it possible to utilize the limited land. Also, the MBR treated water can be discharged to riverhead for improvement in the quality of river water.

**Process flow diagram**

- **Influent**
- **Screen**
- **Anoxic tank**
- **Anaerobic tank**
- **Aerobic tank**
- **Exhausted tank**
- **UV**
- **Discharge to riverhead**
Industrial water recycling plant in Japan

Challenge
Need to reduce industrial water quantity as part of the client’s CSR programs.

Solution
Reuse a part of the treated water for CIP makeup water and beer bottle container washing using reclaimed water from production lines with Membrane Bio-Reactor (MBR) and Reverse Osmosis (RO) technologies.

Benefits
Lower the client’s water and wastewater bills in addition to contribution to their CSR activities.

Process flow diagram

Location
Japan

Capacity
720m³/d

Application
As a part of production facility

Operation started
2010

Product
STERAPORE™ 5000
Hollow-fiber membrane element and module for industrial/municipal wastewater treatment

**Challenge**

The initially installed MBR system equipped with a flat-sheet membrane was operated at a water flux rate higher than normal to process the influent more than originally planned. This situation brought an unstable MBR system operation such as frequent chemical cleanings and membrane replacements in a shorter period than expected. Therefore, a retrofit of this MBR system with the minimum CAPEX to realize a stable operation and minimize OPEX was highly anticipated.

**Solution**

Replace the flat-sheet membrane module with the STERAPORE™ hollow-fiber membrane module to increase the membrane surface area per footprint to secure a sufficient influent treatment capacity without a tank and blower expansion.

**Benefits**

Through the membrane replacement, the MBR system has gained more capacity under operation at an appropriate water flux rate accompanied by the following cost saving:

- **CAPEX**: No membrane tank and blower capacity expansion
- **OPEX**: Less membrane maintenance and replacement

**Process flow diagram**

![Process flow diagram](http://www.mrc.co.jp/sterapore/english)

**Location**

Japan

**Furnished by**

Atakadaiki Engineering Co., Ltd.

**Designed Capacity**

420m³/d

**Application**

Domestic Sewage

**Year Operation Started**

2011

**Product**

STERAPORE™ 5000

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**STERAPORE™ 5000 Series**

**Industrial wastewater treatment plant in Korea**

**Challenge**
Reduce or eliminate sludge carry-over to the final effluent dealing with significant fluctuations in the inlet water composition.

**Solution**
Retrofit the existing conventional activated sludge process with Membrane Bioreactor (MBR) featuring the Mitsubishi Rayon hollow fiber membrane.

**Benefits**
Realize hassle-free STP operation and maintenance while getting the better quality final effluent especially in terms of BOD and SS.

**Water analysis**

<table>
<thead>
<tr>
<th></th>
<th>Influent</th>
<th>DAF treated water</th>
<th>MBR treated water</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>5-10</td>
<td>5-10</td>
<td>5-10</td>
</tr>
<tr>
<td>BOD₅</td>
<td>1,500</td>
<td>500</td>
<td>&lt;2</td>
</tr>
<tr>
<td>COD₅</td>
<td>600</td>
<td>220</td>
<td>&lt;10</td>
</tr>
<tr>
<td>SS</td>
<td>800</td>
<td>200</td>
<td>&lt;1</td>
</tr>
<tr>
<td>T-N</td>
<td>100</td>
<td>49</td>
<td>&lt;5</td>
</tr>
<tr>
<td>T-P</td>
<td>30</td>
<td>14</td>
<td>&lt;1</td>
</tr>
<tr>
<td>n-H</td>
<td>30</td>
<td>10</td>
<td>&lt;5</td>
</tr>
</tbody>
</table>

**Process flow diagram**

**Location**
Korea

**Furnished by**
CJ Korea Express Co.

**Capacity**
1,000m³/day

**Application**
Industrial Wastewater (Dairy Plant)

**Operation started**
2008

**Product**
STERAPORE™ 5000

**Membrane Department**
Membrane Division
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Challenge
On June 5, 2008, the newly revised Taihu Lake Water Pollution Prevention Regulation was brought into effect. However, the footprint of this facility was too small to comply with the stringent regulation by increasing of the existing conventional activated sludge process capability without overloading.

Solution
Apply membrane bioreactor (MBR) to meet the effluent standard with the limited land.

Benefits
Compliance with the standard with no overload concern and less manual operation.

Water analysis

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Influent</th>
<th>Treated water</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD&lt;sub&gt;Cr&lt;/sub&gt; mg/L</td>
<td>360</td>
<td>33.2</td>
</tr>
<tr>
<td>SS mg/L</td>
<td>400</td>
<td>&lt;5</td>
</tr>
<tr>
<td>T-P mg/L</td>
<td>5</td>
<td>0.3</td>
</tr>
<tr>
<td>NH&lt;sub&gt;3&lt;/sub&gt;-N mg/L</td>
<td>38</td>
<td>1.3</td>
</tr>
<tr>
<td>T-N mg/L</td>
<td>43</td>
<td>11.1</td>
</tr>
</tbody>
</table>

Process flow diagram and water quality

Location
Jiangsu Province, China
Furnished by
Jiangsu Origin Water Technology Co., Ltd.
Capacity
30,000m<sup>3</sup>/day
Application
Sewage (30% of Domestic Wastewater and 70% of Industrial Wastewater)
Operation started
2011
Product
STERAPORE™ 5000
Hollow-fiber membrane element and module for industrial/municipal wastewater treatment

Sterapore™ 5000 Series

Petrochemical plant wastewater recycling

Challenge
• Reuse purified terephthalic acid (PTA) plant wastewater as cooling tower makeup to reduce the environmental load associated with effluent disposal and to cut the water bill
• Install all the membrane modules in the existing 10 meter depth tank without a shutdown of the WWTP

Solution
• Retrofit of the existing WWTP with an MBR-RO system to obtain reusable water for the purpose
• Use of the existing beam to hang membrane modules to eliminate the guide pipe foundation work which requires a WWTP shutdown

Benefits
• Reuse up to 70% of the wastewater (4,200m³/day) as cooling tower makeup
• No WWTP downtime

Process flow diagram

Location
Ningbo, China

Furnished by
Mitsubishi Chemical Engineering Co.

Capacity
6,000m³/day

Application
Petrochemical Plant Wastewater

Operation started
2012

Product
Sterapore™ 5000

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Challenge
Increase the processing capacity of the existing WWTP by 68.5% without footprint expansion

Solution
Installation of an MBR system through the use of one of the existing aeration tanks to boost the WWTP capacity with no overload, additional settling tank

Benefits
The target was successfully achieved having an extra 25% MBR capacity for future expansion

Location
Hiroshima, Japan
Furnished by
Nippon Rensui Co.
Capacity
2,000m³/day
Application
Industrial Wastewater
Operation started
2013
Product
STERAPORE™ 5000
Hollow-fiber membrane element and module for industrial/municipal wastewater treatment

**Sterapore™ 5000 Series**

**Electronics industry wastewater treatment plant in Vietnam**

**Challenge**
This facility is located in an industrial park in Vietnam. Need to construct the integrated wastewater treatment facility in the industrial park due to lack of capacity. Treated water directly discharge to the river. The criteria is BOD<24mg/L, COD<41mg/L.

**Solution**
A treated water high quality is a critical factor for this project. Membrane Bio Reactor (MBR) can adhere the strict effluent standards of this river.

**Benefits**
The treated water by MBR directly discharge into the river for protecting the environment.

**Process flow diagram**

Influent → Screen → Fenton tank → Aeration tank → MBR → Treated water

**Location**
Vietnam

**Furnished by**
Goshu Kohsan Co., Ltd.

**Capacity**
500m³/day

**Application**
Electronics Industry Wastewater

**Operation started**
2012

**Product**
Sterapore™ 5000

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**Challenge**

The raw wastewater is mixed effluent from chemical and pharmaceutical plants. The wastewater treatment facility cannot stop because the plant is running all year. The existing settling tank agitator has damaged by aging facility.

**Solution**

Without stopping the existing facilities, adding a membrane tank, modifications were carried out. Membrane Bio-Reactor (MBR) was equipped.

**Benefits**

MBR does not require settling tank and it also raised load. The water quality of the MBR process is very good and stable. Our client said that ‘wastewater treatment by MBR is the best choice’. **Water analysis**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Raw wastewater</th>
<th>Diluted wastewater</th>
<th>MBR treated water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>m³/h</td>
<td>4.0 (2.5—8.0)</td>
<td>—</td>
</tr>
<tr>
<td>COD</td>
<td>mg/L</td>
<td>8,000 (1,000—15,000)</td>
<td>2,000</td>
</tr>
<tr>
<td>T-N</td>
<td>mg/L</td>
<td>800 (5—1,000)</td>
<td>125</td>
</tr>
<tr>
<td>pH</td>
<td>—</td>
<td>8.0 (8.5—9.0)</td>
<td>8.0</td>
</tr>
<tr>
<td>SS</td>
<td>mg/L</td>
<td>—</td>
<td>1.2</td>
</tr>
</tbody>
</table>

**Process flow diagram**

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