

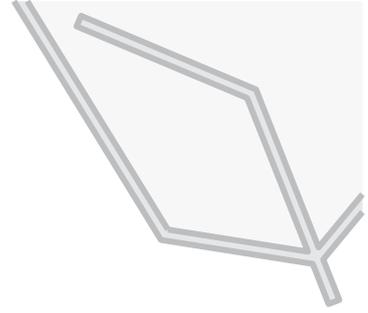
THEMATIC REPORT 08

# China Water Treatment Membrane Industry

Edited by China-Italy Chamber of Commerce



Camera di Commercio Italiana in Cina  
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# 1. Analysis of the Development Environment of Water Treatment Membrane industry

## 1.1. Analysis of Industrial Policy Environment

As China has attached more and more importance to the membrane material industry, the government departments at all levels have issued a series of policies aiming at promoting the development of membrane material preparation and application industries.

In 2012 the *12th Five-Year National Development Planning for the Strategic Emerging Industry* was issued by the State Council. It included the "high-efficiency membrane materials and components", as a development priority in the advanced environmental protection industry, and the "high-performance membrane materials" as a development priority in the new functional material industry. In addition, *the Guidelines for Priority Development of Key Hi-Tech Industrialization Areas* jointly issued by the National Development and Reform Commission, the Ministry of Science and Technology, the Ministry of Commerce and other departments in 2011 included "membrane materials and components" into the key area of "new materials". *The 12th Five-Year Special Planning for the Development of High-Performance Membrane Materials Technologies* issued by the Ministry of Science and Technology made comprehensive layout for high-performance membrane materials. In respect to the field of water resources, it focused on making breakthroughs in large-scale preparation technologies concerning high-performance reverse osmosis membrane for desalination uses, nano-filtration membranes for water purification uses, wastewater treatment membranes and bioreactor-specific membrane materials.

In 2015, *the Made in China 2025 Plan* included membrane products into key engineering projects. By 2025, the hollow fiber membrane applied in tap water production, wastewater treatment, and other fields, will exceed 10 million tons per day, with a membrane area of more than 20 million m<sup>2</sup>. In December 2018, the Ministry of Industry and Information Technology included among the key new materials the high-strength PTFE hollow membranes, high-pressure reverse osmosis composite membrane materials, high-selectivity nano-filtration composite membrane materials, bipolar membrane electrodialysis membranes and other membrane materials. In April 2019, the National Development and Reform Commission issued *the Catalogue for Guiding Industry Restructuring (2019 Version, Draft for Comments)*, which incorporated ceramic membrane, nano-filtration membrane and reverse osmosis membrane – pure water equipment, and submerged membrane bioreactor (at a COD removal rate of above 90%) into the encouraged industries.

During the period of the 13th Five-Year Plan, high-performance separation membranes would continue benefiting from policy supports, with high-performance reverse osmosis membranes for seawater desalination and water treatment membranes remaining as development priorities.

## **1.2. Analysis of Technical Environment for the Water Treatment Membrane Industry**

The industrial standards for the membrane technology industry in China are constantly being improved. Over the last decade, China has systematically carried out standardization work in the membrane technology industry, has organized and guided the China Membrane Industry Association to establish its standardization committee, has compiled the diagrams of standard system for the membrane technology industry, and has listed 117 national and industrial standards.

Since the late start of the membrane technology industry in China, there has been relatively few national and local standards for separation membranes. Until September 2019, China has formulated 74 membrane standards, including 19 national standards and 55 industrial standards. The majority of these industrial standards are 34 marine industry standards (HY), while the others include 7 environmental protection industry standards (HJ), 4 urban construction industry standards (CJ), 5 chemical industry standards (HG) 6 other industry standards, and 3 local standards. The release and implementation of these standards and specifications have promoted the rapid development of membrane technologies in China, have contributed to improve the quality and level of membrane products, have expanded the application fields and scale, as well as have pushed forward the formation and development of the membrane industry.

### **1.2.1. Ultrafiltration Membrane Standards**

China has issued 8 ultrafiltration membrane standards, including 2 national standards and 6 standards issued by the State Oceanic Administration. The standards comprise ultrafiltration membrane testing methods, flat ultrafiltration membrane for spiral ultrafiltration technology, spiral ultrafiltration module for spiral ultrafiltration technology, methods for testing the integrity of hollow fiber ultrafiltration membrane module, hollow fiber ultrafiltration membrane testing method, hollow fiber ultrafiltration membrane module, methods for determination of breaking tensile strength of hollow fiber ultrafiltration membrane and other fields.

### **1.2.2. Reverse Osmosis Membrane Standards**

At present, China has issued 9 reverse osmosis membrane standards, including 2 national standards and 7 standards issued by the State Oceanic Administration. They involve reverse osmosis membrane test methods, methods for testing the hydrophilicity of reverse osmosis membrane, spiral-wound polyamide composite reverse osmosis membrane elements, spiral-wound reverse osmosis membrane module test methods and other fields.

### **1.2.3. Nano-filtration Membrane Standards**

China has issued 3 nano-filtration membrane standards, including 2 national standards and 1 standard issued by the State Oceanic Administration. They involve nano-filtration membrane testing methods, Zeta potential testing method for nano-filtration membrane surface, flow potential method, nano-filtration membrane and its modules and other fields.

#### **1.2.4. Hollow Fiber Membrane Standards**

Regarding hollow fiber membranes, China has issued 4 national standards and 16 industrial standards. The national standards mainly involve hollow fiber curtain membrane modules, hollow fiber ultrafiltration membrane test methods, general technical specifications for hollow fiber membrane bioreactor, methods for testing the integrity of hollow fiber ultrafiltration membrane and microfiltration membrane module, hollow fiber hydrophobic membrane for membrane distillation and other fields. The promulgation of these standards is of great significance in strengthening the standardized management of the membrane market and improving economic benefits.

The industrial standards include 12 standards issued by the State Oceanic Administration, 2 standards issued by the Ministry of Industry and Information Technology, 1 standard issued by the Ministry of Environmental Protection, and 1 standard issued by the National Energy Administration. The standards issued by the State Oceanic Administration mainly consist of hollow fiber reverse osmosis membrane, ultrafiltration membrane and microfiltration membrane testing methods, hollow fiber reverse osmosis module and testing methods, hollow fiber ultrafiltration membrane module, hollow fiber microfiltration membrane device, hollow fiber membrane N<sub>2</sub>-H<sub>2</sub> separator, polypropylene hollow fiber microfiltration membrane, methods for measuring breaking tensile strength of hollow fiber ultrafiltration/microfiltration membrane and other fields. The standards issued by the Ministry of Industry and Information Technology mainly involve column hollow fiber membrane modules, while the standard issued by the Ministry of Environmental Protection mainly involves hollow fiber membrane bioreactor assembly. Finally, the standard issued by the National Energy Administration mainly involves the acceptance of hollow fiber ultrafiltration water treatment equipment in thermal power plants.

#### **1.2.5. Water Purification Equipment Standards**

At present, China has issued 11 industrial standards relating to water purification equipment, which involve water purification straight drinking machine dedicated for drinking fountains, reverse osmosis water purifiers, water softeners, central water purification equipment, water purification straight drinking machine, gravity water purifiers, drinking water treatment equipment and other fields.

In November 2017, the General Administration of Quality Supervision, Inspection and Quarantine and the Standardization Administration of the PRC officially released the first mandatory national standard in the water purification industry, i.e., the *GB34914-2017 Water Efficiency Limit Value and Grade for Reverse Osmosis Water Purifiers*, which came into force from November 1, 2018. Based on this standard, the reverse osmosis water purifiers with a water purification rate lower than 35% are prohibited from sale. This would drive the increase of water purifier manufacturers' demands on high-efficiency reverse osmosis membranes.

## 2. Demand Analysis and Forecast of China Water Treatment Membrane Industry

### 2.1. Development of Water Treatment Membrane Industry

According to GEP Research data, the gross output of the membrane industry in China has increased rapidly, with an annual output value rising from RMB 200 million in 1993 to RMB 200 billion in 2018. It is expected that the annual output value of the membrane industry in China would exceed RMB 320 billion in the next five years. In 2018, the annual output value of the water treatment membrane industry was about RMB 110 billion, accounting for about 55% of that of the membrane industry. The market scale of the water treatment membrane industry in China, which is still in the growth stage, reached RMB 85.2 billion in 2018.

### 2.2. Analysis and Forecast of the Market Capacity of China Water Treatment Membrane Industry

#### 2.2.1. Market Scale and Forecast

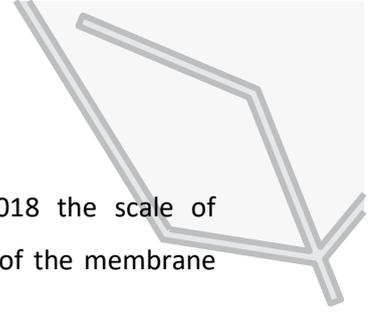
In recent years, the market of water treatment membrane industry in China has maintained a steady growth. According to GEP Research data, from 2015 to 2018, the average annual compound growth rate of the industry reached 18.7%. In 2018, the market scale of the water treatment membrane industry in China reached RMB 85.2 billion, with a year-on-year growth rate of about 20%. GEP Research estimated that from 2018 to 2020 the market scale of the water treatment membrane industry in China will grow at an annual compound growth rate of about 20%, and by 2020 the market scale of the water treatment membrane industry in China will reach RMB 122.7 billion. GEP Research also forecasted that from 2020 to 2025 the market scale of the water treatment membrane industry in China will grow at an annual compound growth rate of about 15%, and by 2025, the market scale of the water treatment membrane industry in China will reach RMB 246.8 billion.



Figure 1 2015-2025 Market Scale and Forecast of China Water Treatment Membrane Industry (Unit: RMB 100 Million).  
Data source: GEP Research.

#### 2.2.2. Market Demand Structure

According to GEP Research data, the market of water treatment membrane industry in China could be



divided into membrane product market and membrane engineering market. In 2018 the scale of membrane product market was RMB 32 billion, accounting for 37.3%, while the scale of the membrane engineering market was RMB 53.2 billion, accounting for 62.7%.

According to GEP Research data, the market scale of the membrane product market in China has increased from RMB 19 billion in 2015 to RMB 32 billion in 2018, with a compound growth rate of 19%. It is estimated that from 2018 to 2020 the annual compound growth rate of the membrane product market in China would be about 13.2%, while its market scale would reach RMB 41 billion by 2020. GEP Research estimated that from 2020 to 2025 the membrane product market in China would grow at a compound annual growth rate of about 15.1%, while its market scale will reach RMB 83 billion by 2025.

### **2.2.3. Driving Factors**

#### *2.2.3.1. Environmental Pressure on Water Resources*

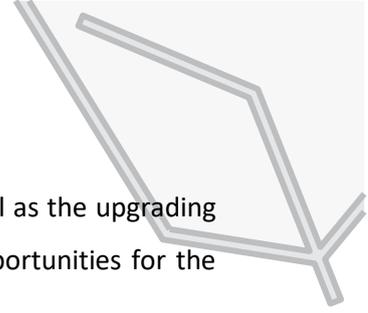
China has to face the issues of environmental pollution and water shortages. According to *the 2018 China Water Resources Bulletin*, the national water consumption volume in 2018 slightly reduced compared with that of 2017. It also pointed out that water efficiency increased, with an optimized water structure and a generally improved water quality situation. In 2018, the national total water supply volume was 601.55 billion m<sup>3</sup>, which decreased by 2.79 billion m<sup>3</sup> compared with that of 2017. The water supply volume from surface water sources increased by 720 million m<sup>3</sup>, while the water supply volume from underground water sources decreased by 4.03 billion m<sup>3</sup>. The water supply volume from other water sources increased by 520 million m<sup>3</sup>. The decrease in water supply volume indicated that the demands on water reuse will further increase in China in the future, thus driving the market demands for water treatment membranes.

#### *2.2.3.2. Policies as drivers of change*

As China has put more and more emphasis on water resource environment, the state and competent authorities in various industries have issued a series of policies aiming at promoting sewage treatment and the development of resource-based industries. At present, the construction, upgrading and reconstruction of urban sewage treatment plants, the increase in recycled utilization water facilities, the expansion of urban water supply scale, the upgrading and reconstruction of water supply plants, the increase in sewage treatment charges, the rise in running water prices, the construction and improvement of supervision system, and the expansion of seawater utilization scale will provide continuous growth momentum for the water treatment membrane market in the next 5-10 years.

#### *2.2.3.3. Improvement of Water Quality Standards*

China has promulgated and continuously improved many relevant aspects, such as water treatment standards for tap water supply, urban domestic sewage treatment, and industrial wastewater treatment. The improvement of the sanitary standards for drinking water, the revision of the pollutant discharge standards for urban sewage treatment plants, the continuous improvement of industrial wastewater



discharge standards, the upgrading and reconstruction of tap water supply plants as well as the upgrading and reconstruction of urban sewage treatment plants will bring great development opportunities for the membrane market.

#### *2.2.3.4. Water Price Increase Promotes Membrane Penetration*

The water price increase will improve the current operating conditions of water treatment enterprises and will be conducive to the upgrading and transformation of the water treatment industry. Consequently, it will promote the penetration rate of membrane technology in the industry. The water supply side in China is currently in the stage of water quality upgrading and the use of membrane technology could fully meet the requirements of the new version of *the Sanitary Standards for Drinking Water*. However, the use of membrane treatment will increase the operating cost of water supply by about RMB 0.3 to 0.5 per ton. Since the water plants have worried about profitability, the completion of technological upgrading entirely depends on government subsidies. As a result, the current tap water standard enhancement has been carried out only in Shanghai, Beijing, Jiangsu, Zhejiang and by some of the richest cities in the Pearl River Delta. If the current water supply price increase by 10-20%, the operating costs for water supply, increased due to membrane treatment, will be made up.

### **2.3. Analysis of the Development Trend of China Water Treatment Membrane Industry**

#### **2.3.1. High-End Development Trend of Membrane Element Production**

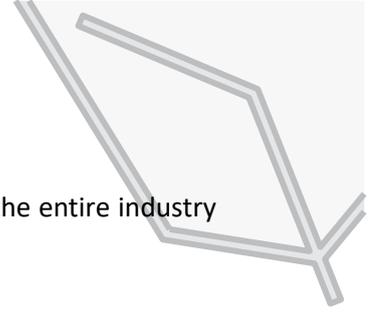
The production, research, and development of membrane elements have been the technical core of the entire membrane water treatment industry chain, occupying the top position of the profit pyramid. Today the degree of localization has gradually increased in the low-end membrane market. However, because of the decline in technical barriers and fiercer competition, the profit margin has gradually decreased. On the contrary, because of technological gaps, most of the market share in the high-end membrane market is still occupied by international brands, thus the profit margin remains at a high level. High profits would definitely attract more enterprises to enter the high-end membrane market and the high-end oriented development of membrane element production represents the general trend.

In the future, there would be “domestic substitution” opportunities in the high-end membrane market. The enterprises manufacturing high-end membrane element with core technologies and research, and development capabilities will gain high profits in the industrial competition.

#### **2.3.2. Extension to the Entire Industry Chain**

Membrane water treatment industry chain consists of membrane element research, development and production, membrane module production, complete solution provision, operation, and maintenance. Starting from one point and extending to the entire industry chain, it could rapidly increase the operating income and total profit of enterprises. It could bring about high-speed enterprise growth, shape brand

image, improve anti-risk capabilities, and reduce average costs. Therefore, extending to the entire industry chain is another major trend in the industrial development.



### **3. Analysis of Supply and Competition in China Water Treatment Membrane Industry**

#### **3.1. Analysis of Supply in China Water Treatment Membrane Industry**

##### **3.1.1. The Number of Enterprise in the Water Treatment Membrane Industry**

Today in China there are more than 100 scientific research institutes and universities engaged in separation membranes researches, more than 400 membrane product manufacturers and nearly 1,000 engineering companies. Among them, there are more than 300 manufacturers engaged in ultrafiltration membrane elements, modules, and devices businesses, more than 100 enterprises engaged in reverse osmosis elements, modules and devices, as well as more than 10 enterprises engaged in nano-filtration membrane elements, modules, and devices.

There are many operating enterprises in the water treatment membrane industry. Most domestic enterprises mainly provide water resources recycling solutions, without engaging in independent research, development, and production of membrane products. Enterprises from developed countries, such as Japan and the U.S., as well as domestic enterprises with competitive capabilities, have the ability to develop and produce membrane products, while providing water resources recycling solutions. Some enterprises occupy a dominant position as they have mastered the formulation technology, the manufacturing technology, the membrane water resources recycling application technology and other relevant technologies.

##### **3.1.2. The Production Capacity of the Water Treatment Membrane Industry**

The design production capacity of ultrafiltration membrane, reverse osmosis membrane, and nano-filtration membrane in China has reached 157 million m<sup>2</sup>, with a production capacity under construction exceeding 65 million m<sup>2</sup>.

#### **3.2. Analysis of Industry Profitability**

Membrane elements have the highest profit in this industry. Production, research, and development are the technical core of the entire membrane water treatment industry chain, with a revenue and profits accounting for nearly 50% of the entire industry chain. While the high-end market for membrane elements has been monopolized by foreign giants with huge profits, the low-end market has fierce competition and no monopoly for the time being. Membrane products offer higher profits than membrane engineering.

At present, the gross profit margin of the water treatment membrane industry in China is relatively high, at about 30-40%. According to GEP Research data, from 2015 to 2018, the average gross profit margin levels of membrane enterprises were respectively 37.5%, 35.5%, 35.5% and 33.9%, with relatively strong industry profitability.



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