

# New Material Technology

## RO brine recovery in ZLD project

### PROJECT DETAILS

Location: Huguan County (China)  
Application: Water softening  
Capacity: 200 m<sup>3</sup>/d  
Membrane: 8 mm PVDF, CR

### PROJECT OVERVIEW

Huguan Gaoce New Material Technology Co., Ltd. was established in 2019 in Shanxi Province, China. The company's business scope includes research and development of new materials, manufacturing of special equipment, wire ropes, photovoltaic equipment and components, graphite and carbon products, non-metallic mineral products and electroplating. This facility is equipped with a pure water preparation system that produces 200 tons of RO brine per day. From the outset, implementing a ZLD system was a clear initiative for enhancing the company's environmental sustainability efforts. Additionally, China's water scarcity is a significant concern. Although China ranks sixth globally in total water resources, its large population means that per capita water availability is only one-fourth of the global average. The distribution of water resources is highly uneven, with significant shortages in large and medium-sized cities north of the Yangtze River. This imbalance poses serious challenges to regional economic and social development. To address the growing water scarcity, efforts are being made to utilize wastewater as a sustainable water resource while exploring new water sources.

### THE CHALLENGE

Chemical precipitation is a widely used physico-chemical method for removing dissolved contaminants. Commonly used chemicals include lime, caustic soda and soda ash, for precipitating hardness and silica at high pH. Liquid/solid separation is a critical step to ensure the treated water meets quality standards: this is where Berghof tubular UF membranes can have a significant impact.



For precipitation processes running at high pH, Berghof Membranes has developed its line of robust Chemical Resistant (CR) membrane modules. The resistance to a broad range of pH values means that our CR membranes are ideally suited for applications with high-strength wastewater or process streams.

Figure 3. Tubular UF system in Huguan facility

Traditional clarifiers are simple and well-established, but they are not efficient for slow-settling particles and occupy large space. After the clarifiers, media filtration and/or hollow fiber UF can be applied for polishing. This improves quality but increases footprint, investment and OPEX. Tubular UF streamlines the entire separation process into a single step.

For this project, the end-user specified very precise requirements: mature and reliable treatment process, advanced technology with a high degree of automation, simple operation, cost-efficiency and compactness. Berghof Membranes solution was clearly fulfilling all these features and outperforming the conventional approach.

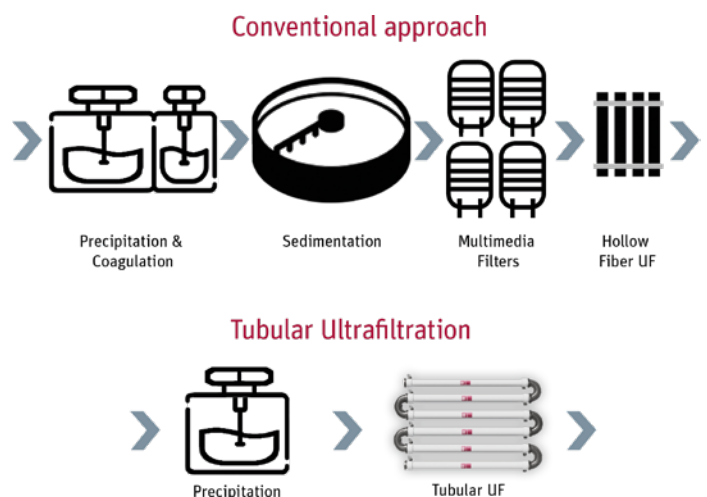


Figure 1. Tubular UF coupled to precipitation vs. Conventional approach

## THE BERGHOF MEMBRANES SOLUTION

The reclaimed water system, as shown in Figure 2, combines tubular UF coupled to chemical precipitation, reverse osmosis (RO) and evaporation. The design was based on the following influent water quality parameters: hardness = 622 mg/L, COD = 44 mg/L, sulphates = 520 mg/L and chlorides = 598 mg/L.

After equalization, the RO brine flows into the first reaction tank, where the softening agents are added, and the pH is adjusted to form precipitates of calcium carbonate and magnesium hydroxide. Simultaneously, silica coprecipitates with magnesium hydroxide. Additionally, sodium hypochlorite may be added to inhibit microbial growth. The wastewater then flows into the second reaction tank, where liquid alkali is added to fine-tune the pH, ensuring a complete reaction. The two-stage reaction tanks are mechanically stirred, and pH monitored.

After the softening reaction, the water containing the precipitates overflows into the concentration tank, which feeds the tubular UF membranes. The Berghof UF system consists of four modules in series, with 8-inch diameter, 3 meters length, and a unitary area of 27.5 m<sup>2</sup>. The UF permeate has a turbidity of less than 1 NTU, and calcium, magnesium and silica concentrations below 20 mg/L. Once the pH is adjusted back to neutrality, the UF permeate flows into a two-stage RO system. The UF reject is managed using a filter press, while RO reject undergoes evaporation and crystallization. As depicted in Figure 2, the RO brine is converted into high-quality reusable water and a small amount of solid byproduct, achieving zero liquid discharge.

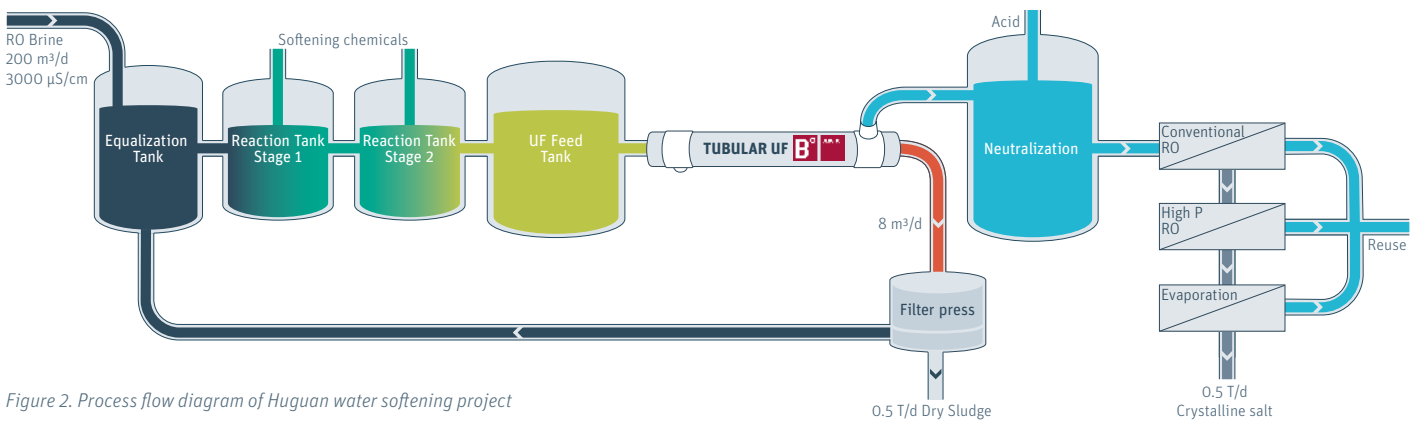


Figure 2. Process flow diagram of Huguan water softening project

## Customer benefits

- Reliable and superior effluent quality: 100 % SS removal, SDI < 3. Just one separation step before the RO.
- Less consumption of chemicals: coagulants (PAC, FeCl<sub>3</sub>...) are usually avoided. No flocculant is required. Excess lime for coagulating small precipitates is not required. 25 – 30 % savings in chemicals is common.
- Less sludge: the use of excess lime, coagulants and flocculants in clarifiers leads to a higher volume of sludge that needs to be managed.
- Polymers, which can negatively impact the performance of RO membranes, are not used in this process.
- Simplified maintenance: no need for multimedia filter (avoiding backwash water, replacement of filter media...).
- Compactness: space savings between 40 and 60 % can be achieved when compared with the conventional approach based on clarifiers, multimedia filters and hollow fiber UF.



### ABOUT BERGHOF MEMBRANES

Berghof Membrane Technology GmbH, part of the Berghof Group, is your leading manufacturer of tubular UF membrane solutions for the filtration and separation of process streams and wastewater in a variety of industries including dairy, landfills, food & beverage, chemical, pharmaceutical and oil & gas.

We at Berghof Membranes continuously “think outside the box” by not only offering tubular UF membrane modules, but we also deliver engineered filtration systems and support services to our OEM partners. From lab-scale testing, to piloting, to engineering design, to commissioning, to remote monitoring and analysis, to replace parts – we’re more than just a membrane supplier.

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