



DOW FILMTEC™ FORTILIFE™ XCN Elements reduce the waste salts from ZLD wastewater treatment process in the Shaanxi Yanchang Zhongmei Yulin Energy & Chemical Plant

A ZLD process of this scale generates a large quantity of waste salts that are expensive to landfill. The facility uses an innovative concept to separate NaCl from the RO concentrated brine mixture using an NF system. The purified NaCl from this process can be re-used or sold.

Site Information:

Location:

JingBian, Shaanxi
Province, China

Designed, built and operated by:

Shaanxi Research Design
Institute of Petroleum and
Chemical Industry
(SRDIPC)

Purpose:

Coal to chemical
wastewater ZLD

Performance:

Successful ion separation
for wastewater ZLD

Shaanxi Yanchang Zhongmei Yulin Energy & Chemical Plant is a large coal to chemical complex located at Jingbian City, Shaanxi province in northern China. Plant construction began in 2008 with commissioning and production starting in 2014. After a total investment of 23.25 billion Chinese yuan (RMB), the plant has an annual capacity of 1.8 Mtons of coal to methanol, 1.5 Mtons of residual oil catalytic cracking, 0.6 Mtons of methanol to olefin, 0.6 Mtons of polyethylene and 0.6 Mtons of polypropylene. These chemical manufacturing processes consume large amounts of water. In order to compensate for the limited availability of water and to meet regulatory requirements, the plant was designed for a high water reuse ratio and zero-liquid discharge (ZLD).

Shaanxi Research Design Institute of Petroleum and Chemical Industry (SRDIPC), founded in 1958, is an integrated technical research development and design company in petrochemical and chemical processing. SRDIPC not only undertakes a series of national research projects, but also provides an integrated solution package including experimental research, feasibility demonstration, engineering design, system construction, commissioning and operation. In this case, SRDIPC is the general contractor of the ZLD wastewater treatment project in the Shaanxi Yanchang Zhongmei Yulin Energy & Chemical Plant.



Figure 1. The chemical manufacturing site (Photo courtesy of Shaanxi Yanchang Zhongmei Yulin Energy & Chemical Plant)

Process

All the wastewater from chemical manufacturing processes as well as the RO concentrate from the demineralization station and cooling tower blowdown are collected for treatment. The treatment scheme for the ZLD process is shown in Figure 2. It employs lime/soda chemical softening to remove the majority of the hardness, sand filter and ultrafiltration to remove suspended solid and colloids, ion exchange resin to remove the residual hardness, two reverse osmosis (RO) systems running in series to up-concentrate the brine, nanofiltration (NF), and finally evaporation and crystallization systems to obtain crystallized salts (Figure 2). A ZLD process of this scale generates a large quantity of waste salts. To reduce expensive disposal costs, this site is using an innovative concept to separate NaCl from the RO concentrated brine mixture using an NF system. The purified NaCl from this process can be re-used or sold.

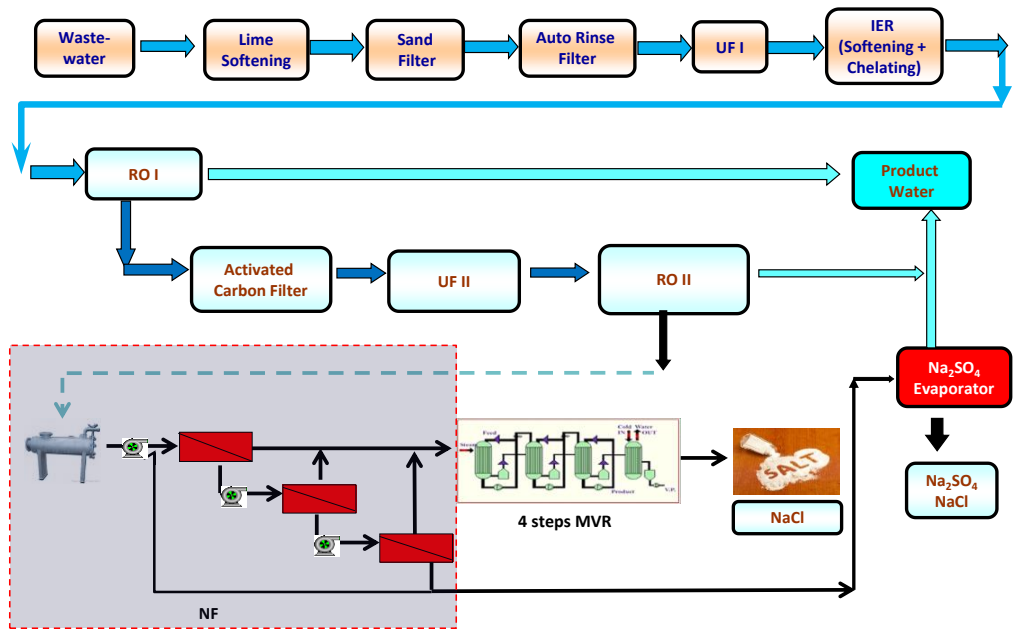


Figure 2. ZLD treatment process (schematic courtesy of SRDIPC)

Case Study

The ZLD system has a 21,600 m³/d treatment capacity and employs DOW™ Ultrafiltration (UF) and DOW FILMTEC™ membranes (Table 1) to achieve “minimal liquid discharge” and reduce the volume of water requiring expensive thermal treated. The performance of the FILMTEC™ FORTILIFE™ XC-N elements are especially noteworthy. The system is designed to convert 75% of the volume of the RO reject stream into a purified sodium chloride solution with very low color that can be further concentrated and re-used or sold. This greatly reduces the amount of waste salt generated after evaporation.

Table 1. UF and RO membranes installed in the ZLD station of Shaanxi Yanchang Zhongmei Yulin Energy & Chemical Plant.

DOW™ Module/Element Type	Installation Numbers	Year of Installation
UF SFP-2880	258 pcs	2015
FILMTEC™ BW30XFR-400/34i	972 pcs	2015
FILMTEC™ SW30HRLE-370/34i	216 pcs	2015
FILMTEC™ SW30ULE-400i	108 pcs	2015
FILMTEC™ FORTILIFE™ XC-N / NF245HP	234 pcs	2016



Figure 3. NF train photo of ZLD station. (Photo courtesy of SRDIPC)

References

- [1] Hong Su. Novel membrane technology helps the energy saving, discharge reduction, and waste resource utilization of coal to chemical wastewater reuse projects. Development Symposium of China's Coal to Chemical Industry at 13th FYP. Zhuhai, China, 2016.
- [2] Cheng Yang, Hong Su. The DOW FILMTEC™ FORTILIFE™ Membranes for Treating Challenging Wastewater. Tsingdao International Conference on Desalination and Water Reuse. Tsingdao, China. 2016.

DOW FILMTEC™

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