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.
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.

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

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

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


DOW FILMTEC™

For more information about DOW™ resins, call the Dow Water & Process Solutions business:
North America: 1-800-447-4089
Latin America: (+55) 11-5188-9222
Europe: +800-3-694-6367
Italy: +800-783-825
South Africa: +0800 99 5078
Pacific: +8007776 7776
China: +400 889-0789
http://www.dowwaterandprocess.com

Dow

Notice: No freedom from infringement of any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. The product shown in this literature may not be available for sale and/or available in all geographies where Dow is represented. The claims made may not have been approved for use in all countries. Dow assumes no obligation or liability for the information in this document. References to “Dow” or the “Company” mean the Dow legal entity selling the products to Customer unless otherwise expressly noted. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.