High rejection combined with high energy efficiency is useful in a number of industries. Especially if the RO process is designed in combination with another separation process like ion exchange. The benefit is based on the lower applied pressure and on the higher rejection, which leads to longer cycle times of the ion exchange units. Therefore, the typical applications are combined processes like the production of boiler feed water for power generation, zero liquid discharge (ZLD), or the production of ultrapure water. Yet, the product can also be used in innovative processes like the closed-circuit RO (CCRO process), in which the feed water composition changes with each cycle, the constant rejection is an important benefit of the HP type.

Lewabrane® High Performance (HP) Brackish Water RO Elements

Key features

The Lewabrane® high performance (HP) elements consist of an enhanced brackish water membrane to serve applications where high rejection and energy efficiency are important. With an average salt rejection of 99.7% at 2,000 ppm NaCl at 15.5 bar (225 psi) and high permeability, it is a further development of the high cross-linked polyamide membrane, which LANXESS launched in 2012. The control of the degree of polyamide cross-linking during the production process provides a small effective “pore size” that results in high rejection of solutes, regardless of their charge. By optimization of the process, the flux could be improved without compromising permeate quality. Therefore, high rejection, even at changing feed parameters like pH or salinity, can be achieved at a high flux rate.

Applications

High rejection combined with high energy efficiency is useful in a number of industries. Especially if the RO process is designed in combination with another separation process like ion exchange. The benefit is based on the lower applied pressure and on the higher rejection, which leads to longer cycle times of the ion exchange units. Therefore, the typical applications are combined processes like the production of boiler feed water for power generation, zero liquid discharge processes (ZLD), or the production of ultrapure water. Yet, the product can also be used in innovative processes like the closed-circuit RO (CCRO process), in which the feed water composition changes with each cycle, the constant rejection is an important benefit of the HP type.

<table>
<thead>
<tr>
<th>Product name</th>
<th>Permeate flow</th>
<th>Salt rejection</th>
<th>Membrane area</th>
<th>Feed spacer thickness</th>
<th>Dimensions (L/Ø/ID)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B400 HP</td>
<td>39.9 m³/day</td>
<td>99.7%</td>
<td>37.2 m²</td>
<td>0.8 mm</td>
<td>1,016/201/29 mm</td>
</tr>
<tr>
<td></td>
<td>10,500 gpd</td>
<td>99.7%</td>
<td>400 ft²</td>
<td>31 mil</td>
<td>40/7.9/1.125 inch</td>
</tr>
<tr>
<td>B440 HP</td>
<td>43.9 m³/day</td>
<td>99.7%</td>
<td>40.9 m²</td>
<td>0.7 mm</td>
<td>1,016/201/29 mm</td>
</tr>
<tr>
<td></td>
<td>11,600 gpd</td>
<td>99.7%</td>
<td>440 ft²</td>
<td>28 mil</td>
<td>40/7.9/1.125 inch</td>
</tr>
</tbody>
</table>

Elements are tested under the following conditions:
Applied pressure 15.5 bar (225 psi)
NaCl concentration 2,000 mg/l
Operating temperature 25 °C (77 °F)
pH 7 and recovery rate 15%
High rejection of critical ions

Depending on the application, different species are rated as critical. For boiler feed water silica is critical, while wastewater applications focus on nitrate or organics. The Lewabrane® HP type ensures high rejection of these ions even at changing temperature and pH levels. To ensure that this is not only the rejection of sodium chloride which is measured, frequent tests in the laboratory are conducted in order to prove the rejection of solutes like nitrate and isopropyl alcohol (IPA). Typical rejection data are given in the following table.

<table>
<thead>
<tr>
<th></th>
<th>Nitrate</th>
<th>Silica</th>
<th>IPA</th>
<th>Boron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typical rejection</td>
<td>98.5%</td>
<td>99.7%</td>
<td>95.0%</td>
<td>80.0%</td>
</tr>
</tbody>
</table>

The test conditions are the standard test conditions with 2,000 ppm NaCl and additional ions:
- 200 ppm nitrate, 5 ppm boron
- 50 ppm silica, and isopropyl alcohol at 1,000 mg/l (without NaCl)

The standard test conditions are pH 7, t = 25 °C, feed pressure 15.5 bar (225 psi), and a recovery rate of 15%.

Conclusion

Lewabrane® RO B400 HP and its companion product Lewabrane® RO B440 HP (with a 10% larger membrane area) are brackish water elements for most applications where permeate quality and energy efficiency are important. Using Lewabrane® HP elements in combination with monodisperse Lewatit® resins provides high quality produced water at low operational cost. We recommend using LewaPlus® design software to project the performance of the RO plant with HP membrane types.

Contact

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