Innovative Lewabrane® – RO Elements for Brackish Water Treatment

**Key features**

Lewabrane® ASD types like RO B400 LE ASD, RO B400 ULP ASD, and RO B400 FR ASD are reverse osmosis (RO) elements assembled with a tailor-made feed spacer based on an alternating strand design (ASD).

The feed spacer is a crucial component of spiral wound elements, as it influences both the height of the feed channel and the flow. Compared to the standard spacer, the new feed spacer has different thread filament heights. Thick and thin filaments alternate. Thus, the feed-channel height can be defined, and at the same time, sufficiently strong turbulences can be generated with thinner filaments in order to reduce the concentration polarization on the membrane surface. Simulations show that this leads to fewer areas with stagnated flow. Laboratory experiments and pilot tests have shown that this results in less biofouling in the feed channels.

**Performance and design of feed spacers**

The feed spacers incorporated in the membrane elements are multifunctional. They create space between the membrane surfaces for fast-flowing water, support the membrane in the process, and cause turbulent water flow. The optimal design of the feed spacers, therefore, is of critical importance to the properties of the elements and their performance in the application. Filaments or strands of different thickness are used for the new feed spacers in contrast to standard-type feed spacers with equal strands. The product family is named after this alternating strand design (ASD). The design is shown in the following picture.
Confirmation tests with wastewater

The tests of the ASD spacer were performed in a wastewater treatment plant. The pilot unit consisted of two separate lines in order to allow the comparison of different process conditions. Following the biological stage, the wastewater was pretreated by precipitation or flocculation followed by ultrafiltration (UF). The first line consisted of RO elements with a standard spacer, while in the second, elements with the ASD spacer were installed. After around 200 days in operation the elements were removed and the fouling of the lead elements measured. The ASD elements showed less fouling. Most of this fouling was of an organic nature.

Advantages during operation

ASD-type products are made with a 34 mil ASD-type feed spacer, which offers a low pressure drop. The impact on, for instance, the specific energy (kWh/m3) required for water production can be easily calculated by using LewaPlus® design software.

The open structure of the ASD feed spacer in general reduces clogging of the feed channel and ultimately allows good cleanability. The key feature of the new spacer is the lower tendency of biomass accumulation due to fewer areas of stagnated flow. This was confirmed by a flow cell experiment with biomass accumulation.

![Pressure difference during biomass accumulation](image)

<table>
<thead>
<tr>
<th>Biomass accumulation</th>
<th>Pressure drop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard feed spacer</td>
<td>RO element with standard feed spacer</td>
</tr>
<tr>
<td>ASD feed spacer</td>
<td>RO element with ASD feed spacer</td>
</tr>
</tbody>
</table>

Fouling weight [g]

<table>
<thead>
<tr>
<th>Lead element</th>
<th>Fouling weight [g]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RO element with standard feed spacer</td>
<td>400</td>
</tr>
<tr>
<td>RO element with ASD feed spacer</td>
<td>150</td>
</tr>
</tbody>
</table>

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