**Aquaporin Inside® Membranes**

**Hollow fiber forward osmosis element**

*Product type*

The Aquaporin Inside® HFFO2 element is designed for Forward Osmosis (FO) applications. Biomimetic hollow fiber element comprising an active layer of polyamide thin film composite (TFC) with integrated aquaporin proteins. The addition of aquaporin water channels into the rejection layer makes the Aquaporin Inside® FO membrane capable of rejecting difficult contaminants and preserving valuable components. The use of hollow fibers allows for a very high packing density.

*Product specifications*

<table>
<thead>
<tr>
<th>Membrane area</th>
<th>Fiber ID</th>
<th>Permeate flow rate</th>
<th>Water flux</th>
<th>Specific reverse salt flux</th>
</tr>
</thead>
<tbody>
<tr>
<td>m²</td>
<td>mm</td>
<td>GPD</td>
<td>L/h</td>
<td>g/L</td>
</tr>
<tr>
<td>HFFO2</td>
<td>2.3</td>
<td>&gt; 219</td>
<td>&gt; 34.5</td>
<td>&gt; 15</td>
</tr>
</tbody>
</table>

The stated product performance is based on 1 M NaCl (5.8 wt %) draw vs. DI water (FO mode) at 25° C / 77° F in a single-pass operation.
Aquaporin Inside® HFFO2 element

Element dimensions

Feed inlet

11.8" / 300 mm

Housing material:
Polycarbonate

Lumen 0.25" / 6.4 mm
threaded female Leur

Draw outlet

Outer diameter (OD)

0.25" / 6.4 mm

Element connections:

0.32" / 8 mm Inner diameter (ID)

Concentrate outlet

Guidelines for feed and concentrate quality

<table>
<thead>
<tr>
<th>Component</th>
<th>Feed</th>
<th>Concentrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particle size</td>
<td>≤ 50 µm</td>
<td>-</td>
</tr>
<tr>
<td>TSS</td>
<td>≤ 200 ppm</td>
<td>≤ 500 ppm</td>
</tr>
<tr>
<td>Viscosity</td>
<td>≤ 40 cP</td>
<td>≤ 90 cP</td>
</tr>
<tr>
<td>TOC (dye solution)</td>
<td>≤ 50,000 ppm</td>
<td>≤ 100,000 ppm</td>
</tr>
<tr>
<td>TOC (pharmaceutical effluent)</td>
<td>≤ 8,000 ppm</td>
<td>≤ 20,000 ppm</td>
</tr>
<tr>
<td>TOC (alginate, organic foulant)</td>
<td>≤ 300 ppm</td>
<td>≤ 1,000 ppm</td>
</tr>
<tr>
<td>COD (pharmaceutical effluent)</td>
<td>≤ 50,000 ppm</td>
<td>≤ 90,000 ppm</td>
</tr>
<tr>
<td>Silica (soluble)</td>
<td>≤ 500 ppm</td>
<td>≤ 1,000 ppm</td>
</tr>
<tr>
<td>Oil &amp; grease</td>
<td>≤ 20 ppm</td>
<td>≤ 100 ppm</td>
</tr>
</tbody>
</table>

* Under certain conditions, the presence of free chlorine and other oxidizing agents will cause premature membrane failure. Since oxidation damage is not covered under warranty, Aquaporin A/S recommends removing residual free chlorine by pre-treatment prior to membrane exposure.

Operating specifications

**Recommended operating conditions**

- Counter-current flow
- Feed flow inside lumen: 60 L/h
- Draw flow on shell side: 25 L/h
- Transmembrane pressure lumen to shell (TMP): 0.2 bar / 2.9 psig
- Temperature range: 10-30°C / 50-86°F
- pH range: 2-11 (short term exposure)

**Maximum operating conditions**

- Transmembrane pressure lumen to shell (TMP): 4 bar / 58 psig
- Temperature range: 5-50°C (41-122°F)
- Free chlorine tolerance*: < 0.1 mg/L

**Additional information**

- It is recommended to rinse the elements for 1 hour, prior to first use.
- It is advisable to pre-treat the feed solution to remove suspended solids. Particles might damage the fibers and possibly cause a decrease in performance.
- Run feed solution prior to draw solution to avoid osmotic drying of the membrane.
- Do not allow element to run dry as this will compromise membrane performance.
- Immediately flush the element on lumen side with clean water for ≥ 30 min after use (shell side connections open).
- The element can be stored at room temperature, but preferred storage is at 4°C.
- Keep out of direct sunlight

- To prevent biological growth during prolonged system shutdowns, membrane elements should be immersed in a preservative solution. Rinse thoroughly before re-use.
- Keep elements moist at all times after initial wetting.
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- Not yet approved as food contact material (FCM).