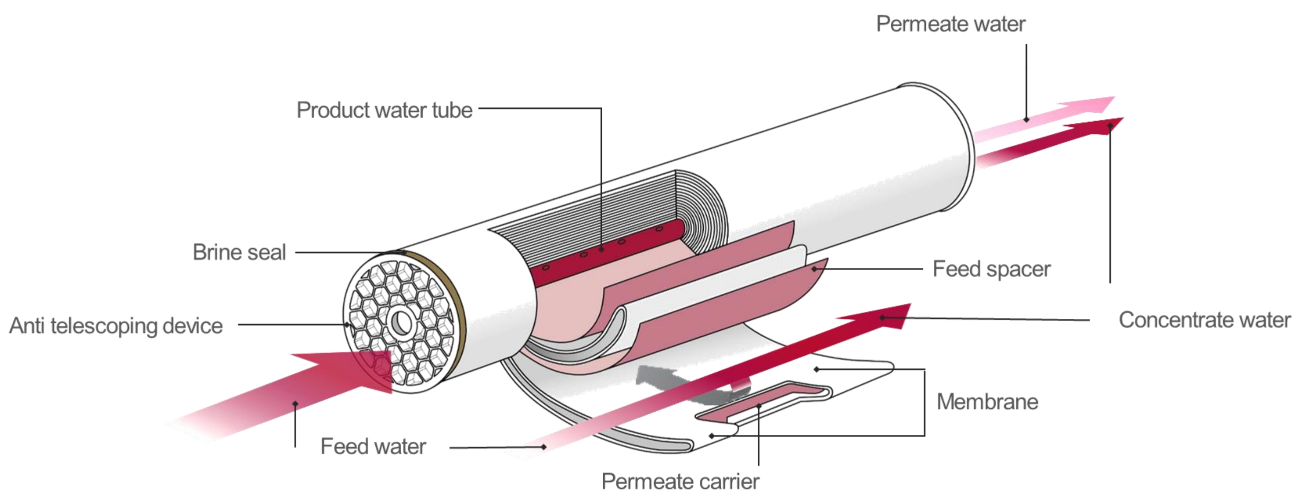
Technical Applications Bulletin 101

Effect of Feed Spacer Thickness on Reverse Osmosis (RO) Membrane Performance

In a reverse osmosis (RO) process, pressure is applied to the saline side of a semi-permeable membrane to produce low salinity water. Upon application of the feed pressure, water molecules pass through the membrane while most of the dissolved solids remain on the saline side. The saline water then travels through a channel created by a feed spacer sandwiched between two flat sheet membranes ("membrane leaves").

The primary function of the **feed spacer** is to separate the two leaves so the feed can freely flow between the membrane leaves while creating turbulence flow to minimize concentration polarization on the membrane surface. The low salinity water produced is called "permeate" and travels through the permeate channels filled with permeate carrier toward the central product water tube.

Figure 101.1 The above image depicts the construction of a typical spiral wound



Membrane elements are available with feed spacers in different thickness. 26- or 28-mil were standard spacer thickness adopted by many manufacturers in the earlier generation of membrane elements. With advancements in RO membrane manufacturing technology, it is now possible to accommodate thicker 34-mil RO feed spacer while still maintaining standard 400 square feet of active membrane area in an 8-inch diameter and 40-foot length membrane configuration.

Thickness of the feed spacer has several impacts on RO membrane performance. It has been found that when the feed flow rate is kept constant, linear liquid velocity becomes a function of the spacer thickness and a higher fluid velocity is achieved for thinner (e.g., 26- or 28-mil) spacer geometry. This thinner spacer geometry produces a higher initial pressure drop while the thicker feed spacer (e.g., 34-mil) has a lower initial feed pressure drop. More importantly, the pressure drop increase due to biofilm forma- tion was found less in the thicker spacer compared to the thinner spacer. As a result, energy can be saved by using the 34-mil feed spacer. For poor water quality with higher biofouling potential, the membrane element with the 34-mil feed spacer will not experience biofouling channel plugging as rapidly, and therefore can be more easily cleaned.

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