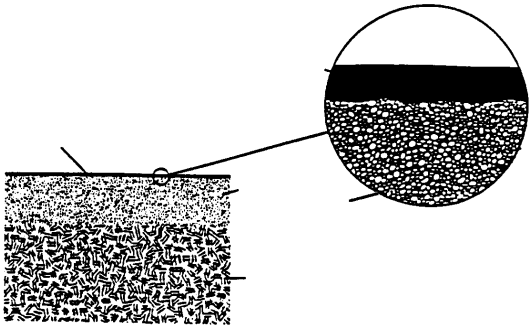
FILMTEC Membranes

Basics of RO and NF: Membrane Description

Membrane Description

The FILMTEC™ membrane is a thin film composite membrane consisting of three layers: a polyester support web, a microporous polysulfone interlayer, and an ultra thin polyamide barrier layer on the top surface. Each layer is tailored to specific requirements. A schematic diagram of the membrane is shown in Figure 1.10.

Figure 1.10 Schematic cross-section of a FILMTEC thin film composite membrane

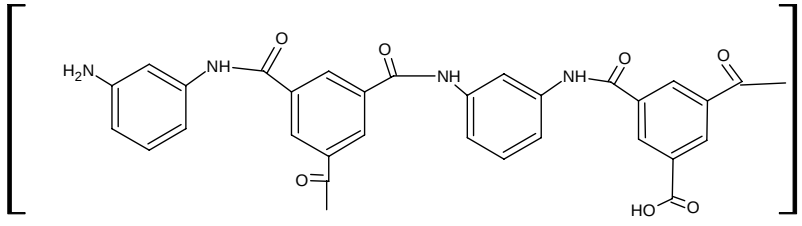


Polyamide, Microporous Polysulfone, Polyester Support Web, Ultrathin Barrier Layer
0.2 micro-m, 40 micro-m, 120 micro-m

FilmTec produces two different types of polyamide membranes for use in water purification. The first is the FT30 chemistry, which is an aromatic polyamide and is used in all FILMTEC reverse osmosis membranes and the NF90 nanofiltration membrane patented by John Cadotte at FilmTec in 1969. The second type is a mixed aromatic, aliphatic polyamide used in all nanofiltration membranes and was also initially developed by John Cadotte at FilmTec. Thirty years of further innovations at FilmTec have led to the broadest range of nanofiltration and reverse osmosis membranes in the industry. FILMTEC membranes cover a flux performance range from 0.04 to 0.55 gfd/psi (1 to 14 l/m^{2}h / bar). This 14 fold difference in water permeability is covered by two polyamide types with small changes in composition and larger changes in the water content of the membrane: the aromatic FT30 membrane and the aliphatic/aromatic nanofiltration membrane. The latter type is sometimes referred to as polypiperazine membrane.

Figure 1.11 represents the approximate structure of the FT-30 aromatic polyamide membrane. The presence of both amine and carboxylate end groups are shown.

Figure 1.11 Barrier layer of the FT30 aromatic polyamide membrane



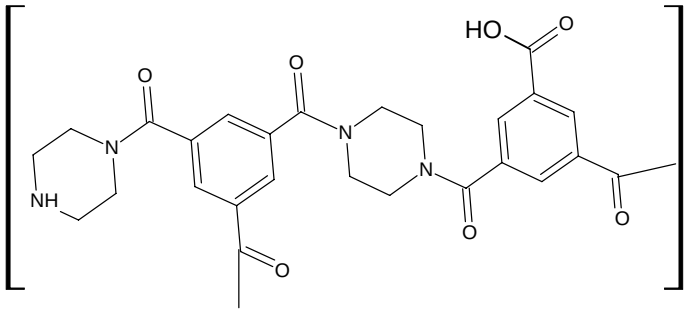
Free Amine Carboxylate

Membrane Description (cont.)

The FT-30 membrane is an aromatic polyamide made from 1,3 phenylene diamine and the tri acid chloride of benzene. This remarkably chemically resistant and structurally strong polymer contains carboxyllic acid and free (not reacted) amines at different levels. High chemical stability makes it the most durable and easy to clean membrane material available.

The approximate structure of most of the FILMTEC nanofiltration membranes is shown in Figure 1.12. This is an aromatic/aliphatic polyamide with amine and caboxylates end groups.

Figure 1.12 Barrier layer of the aromatic/aliphatic polyamide nanofiltration membrane



Free Amine

Carboxylate

Because of the trace additives and the different dissociation constants of the piperazine found in this polymer we are able to have a wider range of both monovalent and divalent salts transporting through this polymer. This has allowed us to design a wide range of nanofiltration membranes that have different salt selectivity for different separations.

The major structural support is provided by the non-woven web, which has been calendered to produce a hard, smooth surface free of loose fibers. Since the polyester web is too irregular and porous to provide a proper substrate for the salt barrier layer, a microporous layer of engineering plastic (polysulfone) is cast onto the surface of the web.

The polysulfone coating is remarkable in that it has surface pores controlled to a diameter of approximately 150 Angstroms. The barrier layer, about 2,000 Angstroms thick, can withstand high pressures because of the support provided by the polysulfone layer. The combination of the polyester web and the polysulfone layer has been optimized for high water permeability at high pressure.

The barrier layer is relatively thick; making FILMTEC membranes highly resistant to mechanical stresses and chemical degradation.

FILMTEC Membranes
For more information about FILMTEC membranes, call the Dow Liquid Separations business:
North America: 1-800-447-4369
Latin America: (+55) 11-5188-9222
Europe: (+32) 3-450-2240
Pacific (ex. China): +800-7776-7776
China: +10-800-600-0015
http://www.filmtec.com