



FILMTEC Membranes

Basics of RO and NF: Membrane Performance

Membrane Performance

FILMTEC™ thin film composite membranes give excellent performance for a wide variety of applications, including low-pressure tapwater use, seawater desalination, brackish water purification, chemical processing and waste treatment. This membrane exhibits excellent performance in terms of flux, salt and organics rejection, and microbiological resistance. FILMTEC elements can operate over a pH range of 2 to 11, are resistant to compaction and are suitable for temperatures up to 45°C. They can be effectively cleaned at pH 1 and pH 13. Their performance remains stable over several years, even under harsh operating conditions.

The membrane shows some resistance to short-term attack by chlorine (hypochlorite). The free chlorine tolerance of the membrane is < 0.1 ppm. Continuous exposure, however, may damage the membrane and should be avoided. 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, FilmTec recommends removing residual free chlorine by pretreatment prior to membrane exposure. Please refer to [Chlorination / Dechlorination \(Section 2.6.3\)](#) for more information.

The parameters which characterize the performance of a membrane are the water permeability and the solute permeability. The ideal reverse osmosis membrane has a very high water permeability and a zero salt permeability. The ideal nanofiltration membrane has also a very high water permeability, but the ideal permeability of solutes might be zero or some positive value, depending on the solute and on the application; for example zero permeability for pesticides and 50% permeability for calcium ions.

Membrane systems are typically designed and operated at a fixed average flux, see [System Design – Introduction \(Section 3.1\)](#), Membrane System Design. Membranes with a high water permeability require a low feed pressure and thus a low energy to operate at a given flux. Table 1.2 shows a comparison of the performance of different membranes based on a given flux as typically encountered in membrane systems.

Table 1.2 Performance of some FILMTEC membranes

	SW30HR	BW30	XLE	NF270
Feed pressure (psi)	370	150	70	50
Feed pressure (bar)	25	10	5	3.5
Rejection (%)				
Sodium chloride NaCl	99.7	99.4	98.6	80
Calcium chloride CaCl ₂	99.8	99.4	98.8	50
Magnesium sulfate MgSO ₄	99.9	99.7	99.2	99.3

At 18 GFD (30 l/m²h), 2,000 mg/l solute concentration, 25°C, pH 7-8, 10% recovery per 40-inch element.

Membrane Performance (cont.)

As a general rule, membranes with a high water permeability (low feed pressure) also have a higher salt permeability compared to membranes with lower water permeability. The permeability of solutes decreases (the rejection increases) with an increase in the:

- **degree of dissociation:** weak acids, for example lactic acid, are rejected much better at higher pH when the dissociation is high
- **ionic charge:** e.g. divalent ions are better rejected than monovalent ions
- **molecular weight:** higher molecular weight species are better rejected
- **nonpolarity:** less polar substances are rejected better
- **degree of hydration:** highly hydrated species, e.g. chloride, are better rejected than less hydrated ones, e.g. nitrate
- **degree of molecular branching:** e.g. iso-propanol is better rejected than n-propanol.

FILMTEC™ Membranes For more information about FILMTEC membranes, call the Dow Water Solutions business:

North America: 1-800-447-4369
Latin America: (+55) 11-5188-9222
Europe: (+32) 3-450-2240
Pacific: +60 3 7958 3392
Japan: +813 5460 2100
China: +86 21 2301 9000

<http://www.dowwatersolutions.com>

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