LFC

Low Fouling Composite Membrane Technology

LENNTECH
info@lenntech.com Tel. +31-152-610-900
www.lenntech.com Fax. +31-152-616-289

Technical Applications Bulletin – TAB 108
June 2005

Introduction

Product innovation is our charter at Hydranautics! Continuously pushing the envelope with regards to membrane technology, performance and understanding our customer needs, Hydranautics has further expanded its LFC membrane series with the introduction of the new LFC3-LD (Low differential pressure). Using the same unique hydrophilic chemistry and high performance of the LFC1 and LFC3, Hydranautics has developed the LFC3-LD to address those difficult applications where more than one type of fouling mechanism may exist. The LFC3-LD combines Hydranautics proven low fouling membrane chemistry with an increase in brine spacer thickness to reduce differential pressures.

Hydranautics first introduced the low fouling composite (LFC) membrane in 1998. Thousands of LFC1 membrane elements have been installed and successfully treat difficult waters worldwide. The most notable long term operation is Bedok, Singapore, where LFC1 membranes have operated since 1998 and produce over 2.6 MGD (10,000 m3/day) of potable water from a wastewater source. This membrane is suited for the treatment of municipal and industrial surface and wastewaters, and other difficult feedwaters, which up to now required significant pretreatment prior to subjecting them to any composite RO membrane.

Low Fouling Membrane Chemistry

The LFC technology is characterized by a low surface charge and a hydrophilic membrane surface characteristic. ***Figure 1*** presents the difference between the surface charge potential of a conventional composite polyamide RO membrane and the new LFC membrane, both as a function of pH.

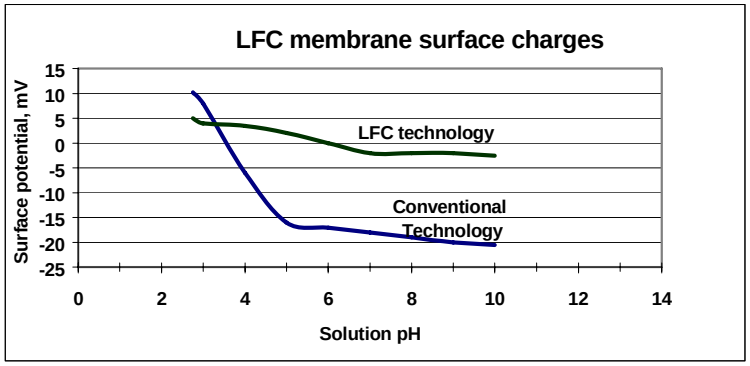

Figure 1. Comparison of membrane surface charge (surface potential) for LFC and conventional polyamide membranes at different pH.

The surface charge of the LFC membrane is significantly less negative (more neutral) as compared to the surface charge of conventional composite membranes. This characteristic can be directly translated to the affinity of the LFC membrane to dissolved organic constituents. ***Figure 2*** demonstrates this quite effectively. When subjected to a wide range of surfactants, the LFC retained its flux significantly better than conventional RO membranes.

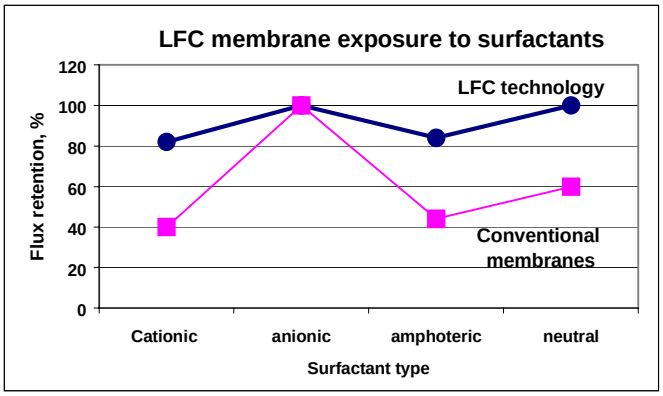

Figure 2. Ability of LFC and conventional membrane to recover flux after exposure to various surfactant types.

To confirm this observation, the LFC membrane was operated opposite a conventional low pressure composite polyamide membrane. Both membranes were subjected to municipal effluents treated by ultrafiltration capillary membrane technology at Water Factory 21, CA.

Figure 3 represents the operation of both membrane types with respect to feed pressure and temperature versus time. Results point to the fact that the LFC membrane experienced little to no fouling when operated on municipal effluent, which is generally considered problematic for conventional RO membranes. The LFC membrane was not cleaned, during the 8 month operating period, due to performance stability.

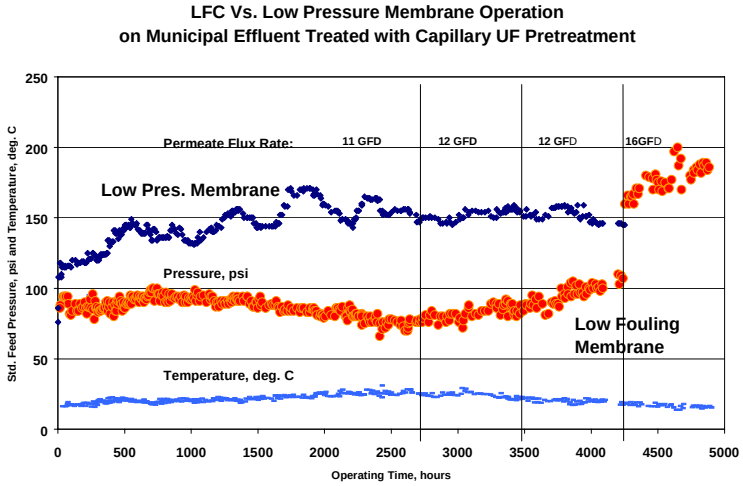

Figure 3. Feed pressure for LFC operating in parallel with conventional membrane on UF treated, secondary municipal waste water.

Low Differential Pressure

The introduction of the LFC3-LD builds upon the proven LFC membrane technology by addressing the problem of high differential pressures often associated with difficult feed waters. The LFC3-LD with 31 mil brine spacer as opposed to the typical 26 to 28 mil brine spacer greatly reduces differential pressures and increases cleaning effectiveness. Thanks to improved element design and automated manufacturing, the increase in brine spacer thickness is done without loss in surface area. **Figure 4** below demonstrates the clear reduction in Dp for the LFC3-LD when compared to the standard LFC3.

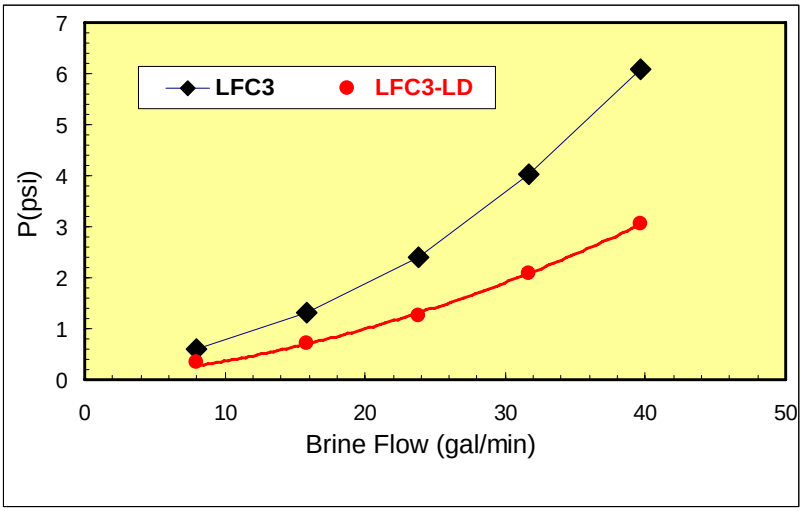

Figure 4. Differential pressure (Dp) through the LFC3 and LFC3-LD element at various brine flows.

The introduction of the LFC3-LD to Hydranautics widely accepted line of low fouling membranes gives the RO designer an increased range of options to address the different fouling issues associated with challenging surface and waste waters. Depending on the fouling characteristics of the water being targeted and the desired system performance in terms of pressure and rejection, the RO system designer can choose from the LFC products found in **Table 1** to obtain the following advantages:

- Combined hydrophilic membrane chemistry and neutral surface charge resulting in lower affinity to organic fouling.
- Low feed pressure, low differential pressure, and/or high rejection.
- A significant increase in membrane life and system operation.
- Prolonged periods between cleaning and a significant reduction in cleaning costs.

Product Type	Brine Spacer	Application	Performance	
			Flow GPD (m^3/d)	Rejection (avg.)
LFC1	26 mil	Municipal and industrial surface and waste water applications where low pressure is a priority	11,000 (41.6)	99.5%
LFC3	26 mil	Municipal and industrial surface and waste water applications where high rejection is required	9,500 (36)	99.7%
LFC3-LD	31 mil	Municipal and industrial surface and waste water applications where high rejection and low differential pressure is required	11,000 (41.6)	99.7%

Table 1. Comparison of Hydranautics Low Fouling Composite Membranes.

For additional information about Hydranautics' LFC membrane products, please contact your sales representative or visit us online at

LENNTECH
info@lenntech.com Tel. +31-152-610-900
www.lenntech.com Fax. +31-152-616-289