

POREX® Tubular Membrane Filter Modules for Fluoride Reduction

Choosing Tubular Membrane Filter Modules (TMF) for Fluoride Reduction

High fluoride levels in wastewater can be problematic for industries using hydrofluoric acid as a cleaning agent or etchant, such as the semiconductor, solar cell or metals manufacturing industries, or as a reactant or catalyst in the plastics, pharmaceutical, petroleum refining and refrigeration industries. Fluoride concentrations from these industries may range from 100 to more than 10,000 ppm in rinse waters, but discharge limits are often below 20 ppm. Today, recycle and reuse is needed for any viable water source. To reuse or recycle fluoride waters, levels of less than 5 ppm or lower are required.

Onsite treatment is essential to economically support manufacturing facilities. For industrial applications, a

Calcium Hydroxide solution (Lime) is frequently used to force the precipitation of fluorides as Calcium Fluoride. This process is good for treatment to about 20 ppm fluoride. To achieve levels of 5 ppm or less, a secondary precipitation step using aluminum sulfate or alum is needed.

To consistently achieve treatment levels below 5 ppm after precipitation, membrane filtration is required. The Porex tubular membrane filtration modules are specifically designed for this type of high solids treatment systems. Our exclusive patented materials and processes provide extremely durable and consistent membrane modules that have been in use for more than twenty years. Our modules will assure consistent, low maintenance performance. Porex Filtration group will provide system design and operation assistance to OEM partners assuring a reliable, cost effective, efficient treatment system.

Designing a TMF System for Fluoride Removal

TMF system design is a cross flow membrane system that uses the filtrate flow inside the membrane module tubes to scour the membrane surface. This action cleans the membrane surface, greatly increasing flux rates when compared to conventional hollow fiber membranes.

The pretreated water with solids flows thru a series of membrane modules placed end to end. Solids concentration in the recirculated influent stream typically is kept around 3%. Solids are drawn off the concentration or recirculation tank to maintain a consistent solids level. Solids are often settled in a small settling tank before other processing such as filter press before leaving the system.

Filtrate that passes thru the membrane typically has an SDI of less than 1 and can usually be used directly for other processes or into an RO for further treatment without any significant additional processing. The TMF system eliminates multiple other treatment steps often used to treat waste water such as clarifier, large settling tanks, multi media filters, carbon filters and cartridge filtration. The Porex TMF can usually eliminate all of these treatment steps saving equipment cost, footprint, maintenance and operating costs.

The Porex TMF system can be designed in a number of different ways according to the requirements of the end user. Clean in Place (CIP) processes as well as complete system automation are common designs. Multiple pore size options and multiple module configurations allow extremely diverse treatment options dependent upon requirements.

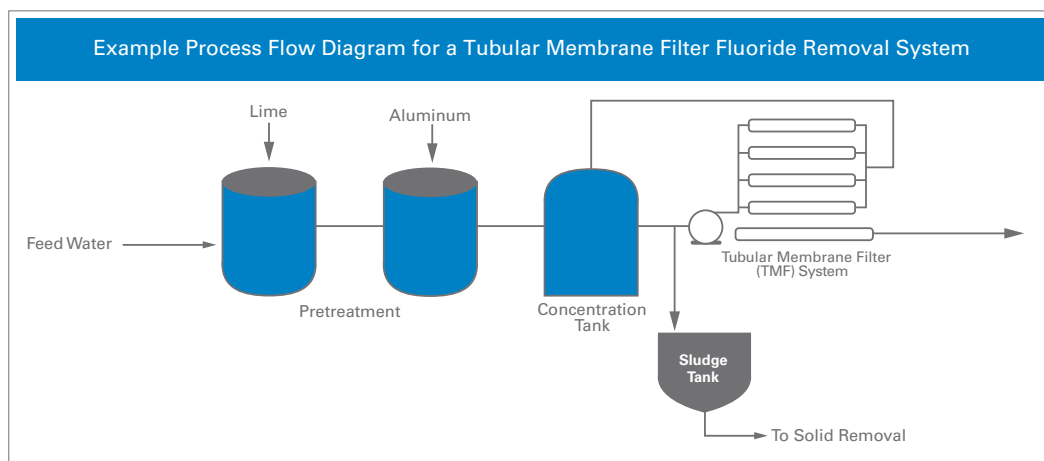


Figure 1 – Process Flow Diagram for a TMF Fluoride Reduction System

▼ POREX® Tubular Membrane Filter Modules for Fluoride Reduction

How long will TMF modules last?

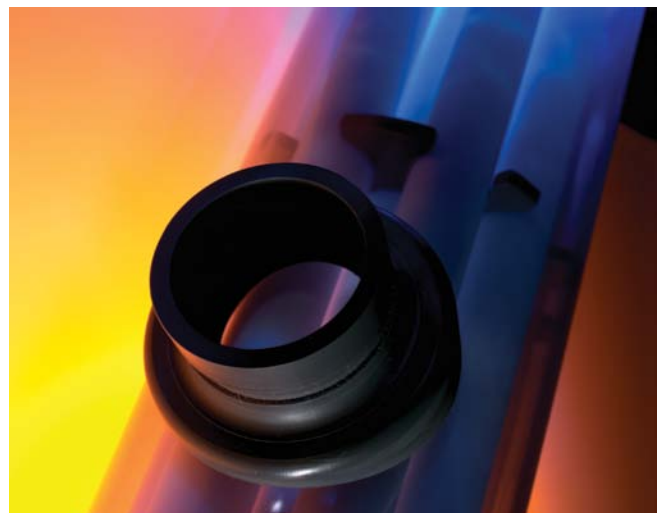
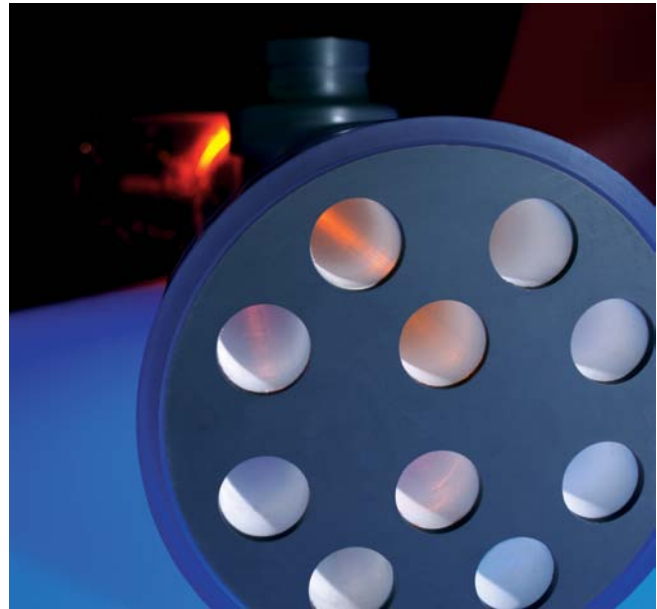
The typical lifespan of a Tubular Membrane Filter Module is 3 to 5 years or longer with the total TMF system designed for approximately 20 years of operation. The PVDF membranes and the PE or PVDF substrates used in the Tubular Membrane Filter Modules are extremely robust. They are designed to withstand harsh environments and will resist abrasion, high temperature, and pH environments from 0-14 without a decrease in retention efficiency.

Summary

Tubular Microfiltration or Ultrafiltration systems using POREX Tubular Membrane Filter Modules offer:

- Easy operation, maintenance and control
- Continuous operation and performance
- Resistance to abrasion and temperature fluctuations
- High flux rates

When used to reduce Fluoride for reuse or to an RO, operating a Tubular Membrane Filter Module system will yield a significant process improvement, typically resulting in efficient recycle reuse or much longer RO module life and reduced cleaning frequency. Tubular Membrane Filter Modules provide a cost effective alternative to changing filter bags or cartridge filters on a daily basis. For solids removals, TMF systems offer a compact alternative to bulky clarifiers which are greatly affected by temperature changes and require significant floor space. TMF is a filtration technology that can handle process streams with a high solids concentration that presents a challenge to other membrane based technologies.



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