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FILMTEC Membranes
Water Chemistry and Pretreatment: Introduction

Introduction

To increase the efficiency and life of reverse osmosis and nanofiltration (RO/NF) systems, effective pretreatment of the feed water is required. Selection of the proper pretreatment will maximize efficiency and membrane life by minimizing:
- Fouling
- Scaling
- Membrane degradation

Optimizing:
- Product flow
- Product quality (salt rejection)
- Product recovery
- Operating & maintenance costs

Fouling is the accumulation of foreign materials from feed water on the active membrane surface and/or on the feed spacer to the point of causing operational problems. The term fouling includes the accumulation of all kinds of layers on the membrane and feed spacer surface, including scaling. More specifically, colloidal fouling refers to the entrapment of particulate or colloidal matter such as iron flocs or silt, biological fouling (biofouling) is the growth of a biofilm, and organic fouling is the adsorption of specific organic compounds such as humic substances and oil on to the membrane surface. Scaling refers to the precipitation and deposition within the system of sparingly soluble salts including calcium carbonate, barium sulfate, calcium sulfate, strontium sulfate and calcium fluoride.

Pretreatment of feed water must involve a total system approach for continuous and reliable operation. For example, an improperly designed and/or operated clarifier will result in loading the sand or multimedia filter beyond its operating limits. Such inadequate pretreatment often necessitates frequent cleaning of the membrane elements to restore productivity and salt rejection. The cost of cleaning, downtime and lost system performance can be significant.

The proper treatment scheme for feed water depends on:
- Feed water source
- Feed water composition
- Application

The type of pretreatment system depends to a large extent on feed water source (i.e., well water, surface water, and municipal wastewater). In general, well water is a consistent feed source that has a low fouling potential. Well water typically requires a very simple pretreatment scheme such as acidification and/or antiscalant dosing and a 5-µm cartridge filter.

Surface water, on the other hand, is a variable feed water source that is affected by seasonal factors. It has a high fouling potential, both microbiological and colloidal. Pretreatment for surface water is more elaborate than pretreatment for well water. Additional pretreatment steps often include chlorination, coagulation/flocculation, clarification, multimedia filtration, dechlorination, acidification and/or antiscalant dosing.

Introduction (cont.)

Industrial and municipal wastewaters have a wide variety of organic and inorganic constituents. Some types of organic components may adversely affect RO/NF membranes, inducing severe flow loss and/or membrane degradation (organic fouling), making a well-designed pretreatment scheme imperative.

Once the feed water source has been determined, a complete and accurate analysis of the feed water should be made. The importance of a feed water analysis cannot be overemphasized. It is critical in determining the proper pretreatment and RO/NF system design.

Finally, the application often determines the type or extent of RO/NF pretreatment required. For example, pretreatment in an electronics application might be much more sophisticated than for a municipal system due to the different product water quality requirements. Pretreatment is a continuous water treatment process upstream of a continuous membrane process. Water treatment chemicals may be dosed continuously or intermittently during operation of the RO/NF system.

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