



FILMTEC Membranes

Water Chemistry and Pretreatment: Biological Fouling Prevention

Introduction

All raw waters contain microorganisms such as bacteria, algae, fungi, viruses, and higher organisms. The typical size of bacteria is about 1 μm . Microorganisms can be regarded as colloidal matter and removed during pretreatment as discussed in *Colloidal and Particulate Fouling Prevention (Section 2.5)*. The difference between microorganisms and non-living particles, however, is the ability of microorganisms to reproduce and form a biofilm under favorable conditions.

Microorganisms entering a RO/NF system find a large membrane surface where dissolved nutrients from the water are enriched due to concentration polarization, thus creating an ideal environment for the formation of a biofilm. Biological fouling of the membranes may seriously affect the performance of the RO system. The symptoms are an increase in the differential pressure from feed to concentrate, finally leading to telescoping and mechanical damage of the membrane elements (see [High Differential Pressure, Section 8.5.3](#)), and a decline in membrane flux. Sometimes, biofouling develops even on the permeate side, thus contaminating the product water.

A biofilm is difficult to remove because it protects its microorganisms against the action of shear forces and biocidal chemicals. In addition, if not completely removed, remaining parts of a biofilm lead to a rapid regrowth. Biological fouling prevention is therefore a major objective of the pretreatment process. The control of microbiological activity is also part of system design (see [System Design Considerations to Control Microbiological Activity, Section 3.15](#)), in the system operation (see *System Operation, Section 5*), in the sanitization of systems (see *Section 6.8, Sanitizing Membrane Systems*) and in the preservation of systems - see [Preservation of RO and NF Systems \(Section 7.4\)](#).

The various methods to prevent and control biological fouling are described in [Chlorination/Dechlorination \(Sections 2.6.3\)](#) to [Use of Fouling Resistant Membranes \(Section 2.6.11\)](#). Each method has specific advantages, but the optimum strategy is a combination of the different concepts.

The most successful approach is the limitation or removal of nutrients for microorganisms from the water in order to limit biological growth. This can be achieved with [biofiltration \(Section 2.6.8\)](#). The continuous addition of oxidation chemicals such as chlorine may increase the nutrient level because organic substances may be broken down to smaller biodegradable fragments. Dosing chemicals such as antiscalants or acids must be carefully selected because they may also serve as nutrients.

Other methods are based on chemicals that have a biocidal effect on microorganisms. These sanitization chemicals are applied during the normal operation of the plant either as a continuous dosage to the feed water stream or preferably as a discontinuous (intermittent) dosage in certain intervals. Preventive treatments are much more effective than corrective treatments because single attached bacteria are easier to kill and remove than a thick, aged biofilm. Typical treatment intervals are one to four per month, but they can be as short as one per day, depending on the feed water quality (e.g., waste water) or the permeate quality required (e.g., pharmaceutical-grade water). A third application mode is the off-line application using separate cleaning equipment. This mode is dealt with in *Sanitizing Membrane Systems (Section 6.8)*.

Introduction (cont.)

The attachment of bacteria to a membrane surface and their growth can be minimized by a surface modification of the membrane. This concept is available with the FR (Fouling Resistant) series of FILMTEC membrane elements – see [Use of Fouling Resistant Membranes \(Section 2.6.11\)](#).

Other physical methods are targeted to remove microorganisms in the feed water with [microfiltration or ultrafiltration \(Section 2.6.9\)](#) or to kill them with [UV radiation \(Section 2.6.10\)](#).

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>

Notice: The use of this product in and of itself does not necessarily guarantee the removal of cysts and pathogens from water. Effective cyst and pathogen reduction is dependent on the complete system design and on the operation and maintenance of the system.

Notice: No freedom from any patent owned by Seller or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other governmental enactments. Seller assumes no obligation or liability for the information in this document. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

