Molecular Filtration, Inc.®

SEAWATER OUR LAST RESOURCE FOR SURVIVAL

PRETREATMENT OF SEAWATER AT THE MOLECULAR LEVEL

DESALINATION USING REVERSE OSMOSIS

Desalination using reverse osmosis membranes has become very popular for producing fresh water from brackish water and seawater. Membrane life time and permeate flux, however, are primarily affected by the phenomena of concentration polarization and fouling at the membrane surface.

Reverse Osmosis Bi-fouling:

One of the most serious forms of membrane fouling is bacterial adhesion and growth. Once they form, biofilms can be very difficult to remove, either through disinfection or chemical cleaning. This wastes energy, degrades salt rejection, and leads to shortened membrane life.

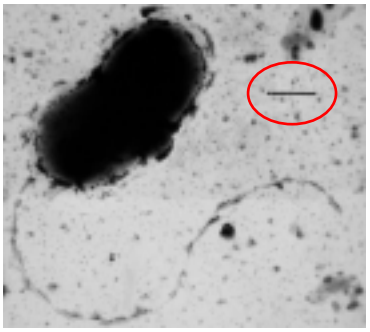
Microbiological Fouling

Bacterial fouling of a surface (i.e. formation of a biofilm) can be divided into three phases:

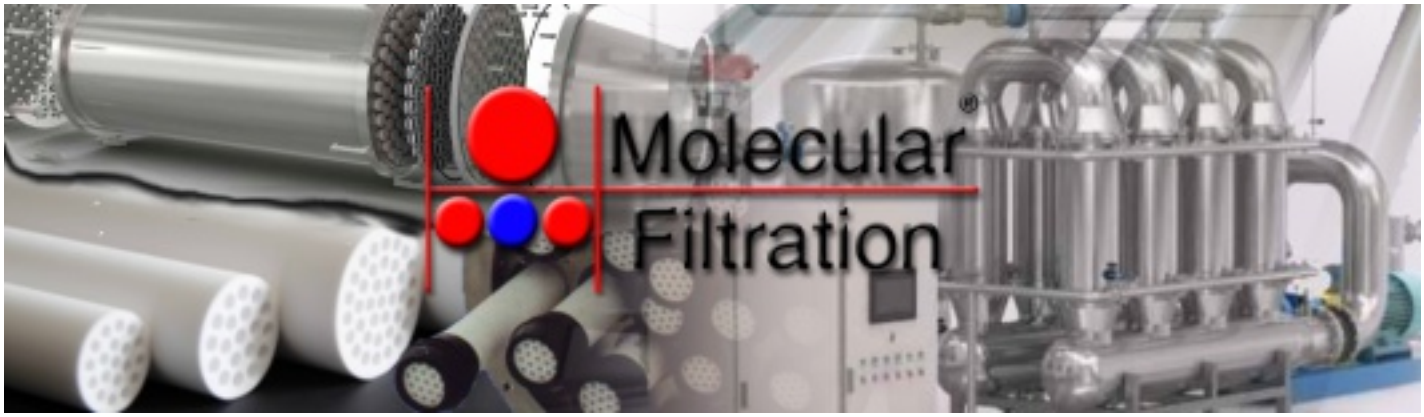
- Transport of the organisms to the surface
- Attachment to the substratum
- Growth at the surface.

Studies have shown that it takes about three days to completely cover a reverse osmosis membrane with a biofilm. It was found that bacteria would sometimes aggregate upon adhering. While minimal bacterial attachment occurred in a very low ionic strength solution, significantly higher numbers of attached microbes occurred when using salt concentrations corresponding to waste water.

Sulfate-reducing bacteria



Desulfovibrio vulgaris is the best-studied sulfate-reducing bacteria species; the bar inside the red circle in the upper right is 0.5 micrometer long.



Sulfate-reducing bacteria are those bacteria that can obtain energy by oxidizing organic compounds or molecular hydrogen (H_2) while reducing sulfate (SO^{2-}) to hydrogen sulfide (H_2S). In a sense, these organisms *"breathe"* sulfate rather than oxygen, in a form of anaerobic respiration.

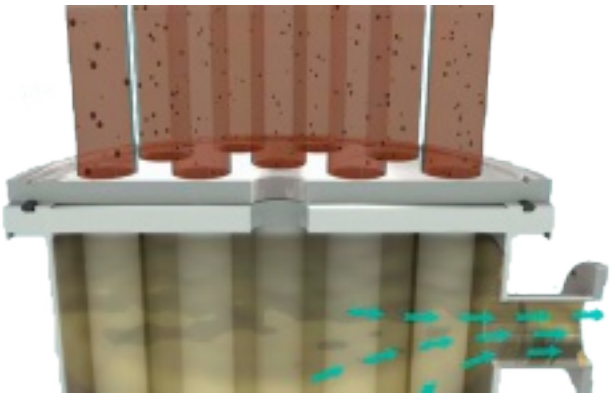
Sulfate-reducing bacteria can be traced back to 3.5 billion years ago and are considered to be among the oldest forms of microorganisms, having contributed to the sulfur cycle soon after life emerged on Earth. (There are a few genera of Archaea which can also reduce sulfate).

Many bacteria reduce small amounts of sulfates in order to synthesize sulfur-containing cell components; this is known as assimilatory sulfate reduction. By contrast, the sulfate-reducing bacteria considered here reduce sulfate in large amounts to obtain energy and expel the resulting sulfide as waste; this is known as dissimilatory sulfate reduction. They use sulfate as the terminal electron acceptor of their electron transport chain. Most of them are anaerobes.

Most sulfate-reducing bacteria can also reduce other oxidized inorganic sulfur compounds, such as sulfite, thiosulfate, or elemental sulfur (which is reduced to sulfide as hydrogen sulfide).

In addition, there are sulfate-reducing bacteria that can reduce fumarate, nitrate and nitrite, iron (Fe(III)) and some other metals, dimethyl sulfoxide and even oxygen.

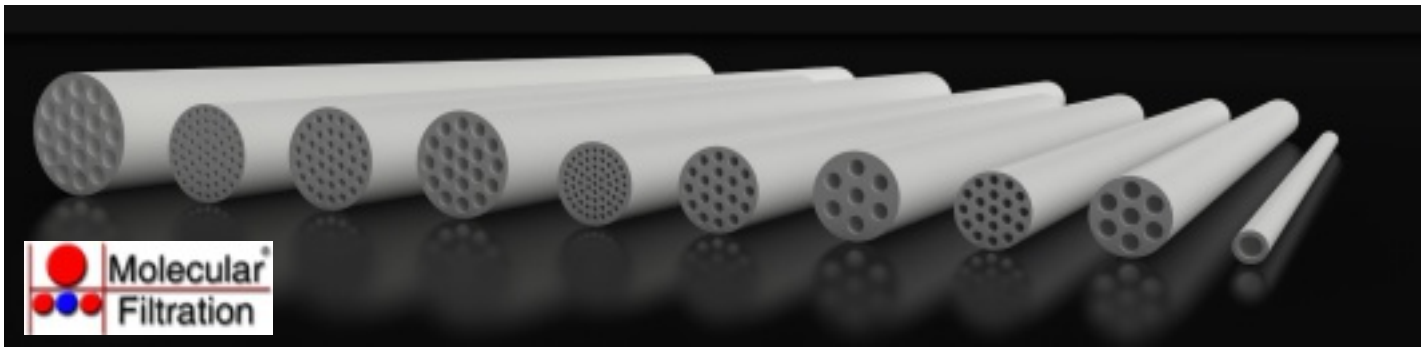
Organophobic Ceramic Membranes



With its unique capabilities to reject organics and bacteria, Molecular Filtration, Inc. organophobic ceramic membranes is setting a new a new standard for the pretreatment of seawater.

Vibrio Vulnificus - A Killer Bacteria!!

Vibrio vulnificus is a species of Gram-negative, motile, curved, rod-shaped bacteria of the genus Vibrio.



Vibrio vulnificus causes an infection often incurred after eating seafood, especially raw or undercooked oysters. Vibro vulnificus does not alter the appearance, taste, or odor of oysters. The bacteria can also enter the body through open wounds when swimming or wading in infected waters, or via puncture wounds from the spines of fish such as tilapia or stingrays.

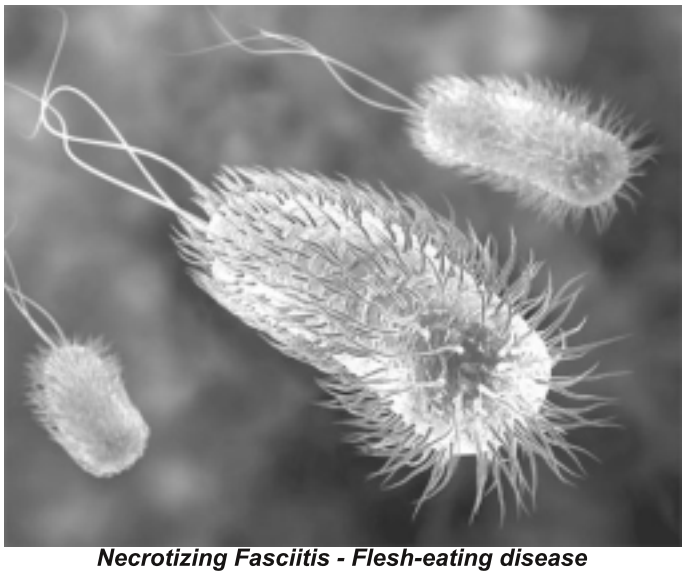
Symptoms include vomiting, diarrhea, abdominal pain, and a blistering dermatitis that is sometimes mistaken for pemphigus or pemphigoid.

Vibro vulnificus is eighty times more likely to spread into the bloodstream in people with compromised immune systems, especially those with chronic liver disease. When this happens, severe symptoms including blistering skin lesions, septic shock, and even death can occur. This severe infection may occur regardless of whether the infection began via contaminated food or via an open wound.

Necrotizing Fasciitis: Flesh-eating disease

Necrotizing fasciitis, commonly known as flesh-eating disease or flesh-eating bacteria syndrome, is a rare infection of the deeper layers of skin and subcutaneous tissues, easily spreading across the fascial plane within the subcutaneous tissue. The most consistent feature of Necrotizing Fasciitis was first described in 1952 by Wilson, as necrosis of the subcutaneous tissue and fascia with relative sparing of the underlying muscle.

Necrotizing fasciitis progresses rapidly, having greater risk of developing in the immunocompromised due to conditions such as diabetes or cancer. It is a severe disease of sudden onset and is usually treated immediately with surgical debridement and high doses of intravenous antibiotics, with delay in surgical treatment being associated with higher mortality.



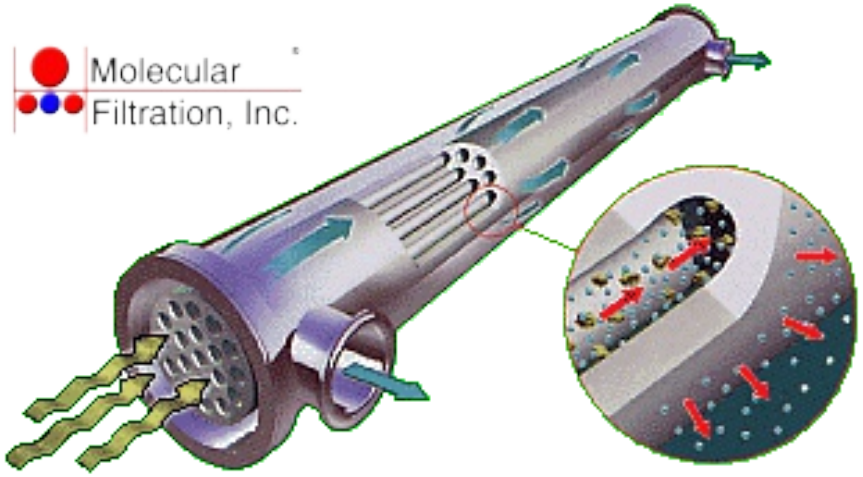
Necrotizing Fasciitis - Flesh-eating disease

Many types of bacteria can cause necrotizing fasciitis:

- Streptococcus pyogenes
- Staphylococcus aureus
- Clostridium perfringens
- Bacteroides fragilis
- Aeromonas hydrophila

MOLECULAR FILTRATION SYSTEMS PROVIDE BACTERIA-FREE WATER OUTPUT

Extend the live of your reverse osmosis membrane, protect your investment MOLECULAR FILTER seawater previous to desalination



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