MEMBRANE TECHNOLOGY HAS EVOLVED

Membranes are a game-changing technology and they've driven water treatment to new heights. As costs to produce membranes come down and the range of available membrane options increases, membranes are appearing in industrial plants and irrigation setups, not just for big-budget municipal systems.

However, membranes are ultimately only as good as the prefiltration systems that protect them. After all, flux and permeate production are heavily dependent upon the quality of influent water that reaches the membrane. As can be expected, long-term membrane performance is compromised by fouling, as well as by damage from repeated cleanings. All of which can have significant economic and environmental repercussions.

ENVIRONMENTAL IMPACT

The environmental footprint (and the economic return) of a membrane system is impacted by a variety of factors. For example, when a RO membrane becomes fouled, more chemicals are required to clean it. This generates more waste material to dispose of in addition to having to store more chemicals at sites that are often sensitive to environmental impacts. When a membrane becomes fouled (plugged), more energy is required to pump across even partially fouled membranes. And a partially fouled membrane also begins to lose efficiency and more water is disposed of due to low permeate (high rejection) production. The net result in this instance is that of an increased "water footprint" for that system or application.

PREFILTRATION IS THE KEY

As a result, prefiltration before membranes is a critical step – or several steps. In fact, membranes are becoming so prevalent that they are sometimes even used to protect other membranes. It is no longer unusual to see RO membranes protected by microfiltration (MF) membranes. While that arrangement does an outstanding job of feeding high-quality influent to the RO vessel, the MF membranes themselves will still need protection.

At the end of the day, membranes may have become less expensive, but they're not cheap enough to go without protection. Ultimately, there's still a need for filtration at the micron level to safeguard systems that do their best work at the sub-micron level.

Specifying the most appropriate technology for membrane protection is an important investment with the potential for extraordinary return. It is our hope that you will consider our unique NanoCeram filtration technology as a valuable part of the prefiltration portion of your RO water treatment system.

Below are some of the advantages which I hope will paint a compelling picture for you and your associates.

In general, our advantages include:

1. **Ultra-Low SDI Values (0.5)** which is crucial in terms of pre-filtration for other ultrapure water systems including reverse osmosis. This metric (a value of 0.5 SDI is considered

extremely low and unobtainable by most other filtration technologies) is used to illustrate the efficiency of ultrasmall particle removal attributed to a particular filter. These same particles can seriously impact the lifetime and performance of today's RO membranes. The advantages of such low SDI values include:

A. Extends the effective lifetime of the typical membrane by:
   i. Reducing the frequency of backflush cycles which can cause wear/tear on the membrane's surface;
   ii. Reducing the pressure drop across a membrane's surface through active filtration of submicron particulate including colloidal materials such as iron oxide, organic carbons and even transparent exopolymer particles (TEP) which is often found in seawater sources. This pressure drop stresses the fabric of a membrane and can ultimately accelerate material fatigue and membrane replacement;
   iii. Reduces the frequency of cleaning cycles. Each cleaning cycle requires the use of chemicals which can generate chemical waste products. Additionally, this also requires the storage of those chemicals which can be a hazard to the environment.

B. Increases permeate throughput:
   i. Actual results by a company which bottles water show a 22% increase of permeate through their RO membranes. This is after replacing the existing 1µ (micron) Absolute prefilter in their system with a NanoCeram filter cartridge.
   ii. Logic suggests a related decrease in the Reject Rate leading to less water waste.

C. Energy Savings:
   i. Reduced pressure drop across a membrane requires less pressurization of feedwaters to the membrane. Pumping systems are less taxed and require shorter power cycles;
   ii. Reduced fouling from colloidal contaminants reduces the quantity of flushing cycles and the resulting energy consumption.

D. Operating Expenses:
   i. Reduced operating pressure can extend the effective life of other system components including piping, pumps, valves and other fittings;
   ii. Fewer and/or shorter backflushing cycles can reduce the quantity of chemicals used for such operations on systems which incorporate such additives during flushing;

2. Very high flow rates with low pressure drop (ΔP);

A. Depending on the treatment system, the NanoCeram filter is rarely the limiting factor in terms of flowrates. The open-pore nature of NanoCeram media enables high flowrates while reducing submicron particulate (including virus, bacteria and cysts);

B. Other system components have greater "pressure drop capacity" to work with. In most systems, the total ΔP cannot be exceeded and the NanoCeram's low ΔP frees up this capacity significantly.

3. **High efficiency reduction of submicron particulate:**
    A. Increases efficacy of many disinfection systems by significantly reducing the organic load which typically exhausts a disinfection mechanism (i.e., chlorine, ozone, UV, biocides);
    B. Reduces the costs of these systems in much the same ways as listed above for RO Membranes.

4. **Extraordinary Dirt Holding Capacity (DHC)**
    A. Such high efficiency at reducing sub-micron particulate is enhanced by the DHC of NanoCeram technology. A typical NanoCeram cartridge can hold a quantity (by weight) of dirt up to 3 times the weight of the filter media contained in that cartridge;
    B. A NanoCeram filter has a DHC many times greater than other well-known technologies including:
        i. Microglass – 22 times greater
        ii. Meltblown – 286 times greater
        iii. Membrane – 380 times greater

5. **Very high efficiency;**
    A. NanoCeram is considered a 0.2 micron Absolute filter
        i. Retains 99.9% of 0.2µ particulate;
        ii. Average poresize of 2.0µ.

6. **Currently available in eight (8) standard filter cartridge sizes**
    A. These filter cartridge sizes have been selected specifically to fit within industry-standard cartridge housings;
    B. Custom filter cartridge sizes are available.