Protecting Membranes Boosts Benefits

By Jim Lauria, Vice President, Marketing & Business Development, Amiad Filtration Systems

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

But membranes are 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. Long-term membrane performance is compromised by fouling, as well as by damage from repeated cleanings. And the environmental footprint – and the economic return – of a membrane system are impacted when more chemicals are required to clean it, more energy is required to pump across partially fouled membranes, and more water is disposed of due to low permeate production.

Prefiltration systems can deliver significant economic return with minimal physical and environmental footprint.

As a result, prefiltration before membranes is a critical step – or several steps. Increasingly, membranes are becoming so prevalent that they are being used to protect other membranes – for instance, it is no longer unusual to see reverse osmosis (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 still need protection themselves. Membranes 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.

The performance of membranes is limited by the quality of water that goes into them. Effective, efficient prefiltration gives membranes a boost.

Choose Carefully

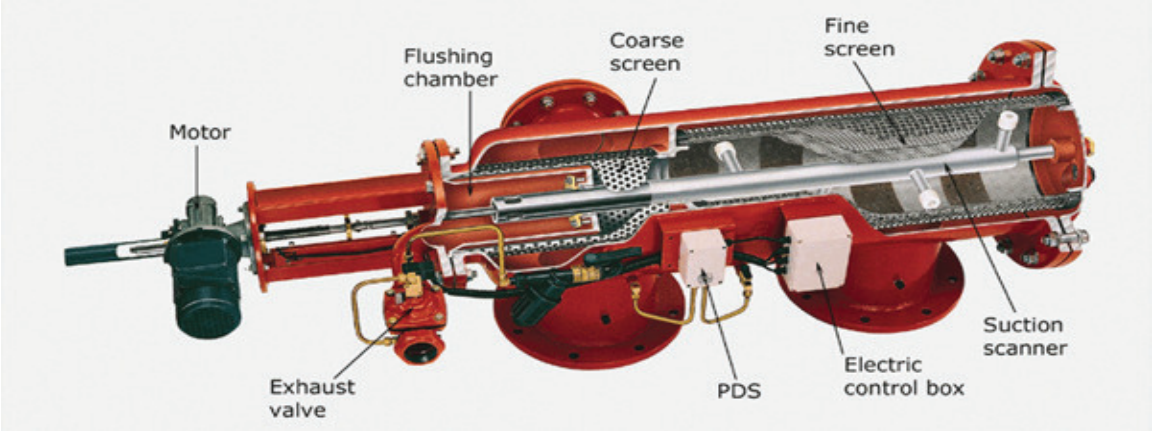
Choosing the optimum prefiltration system depends on several variables, including the anticipated flow through the system, the degree of filtration required (which in turn is based on the size of the solids that must be removed and what else lies downstream of the prefiltration unit), and the nature of the contaminants in the water.

Non-deformable solids such as sand or silt are common in a wide variety of water and wastewater treatment applications. Such solids can interfere with membranes or pre-membrane fine filtration systems such as cartridges or sock filters.

Tallying up operating expenses such as maintenance, consumables and energy illustrates the economic return delivered by good prefiltration technology.

Non-deformable solids are dealt with worldwide with automatic self-cleaning screen filters, which engage a set of suction nozzles to draw trapped solids off the screen when a target pressure differential is reached across the filter. In Amiad's automatic self-cleaning system, an exhaust valve is opened to the atmosphere, allowing pressure inside the filter housing to draw water and filter cake through suction nozzles that focus the back flush on one square inch of screen at a time.

The process is extremely efficient, using 75 percent less back flush water than sand media systems, and does not interrupt the operation of the filter. The technology is used in drinking water, wastewater, industrial and agricultural applications across a vast spectrum of flow rates and filtration degrees from 3500 microns to 10 microns.



Automatic self cleaning screen filters focus back flush on a small area of screen at a time for highly efficient cleaning without interrupting filtration

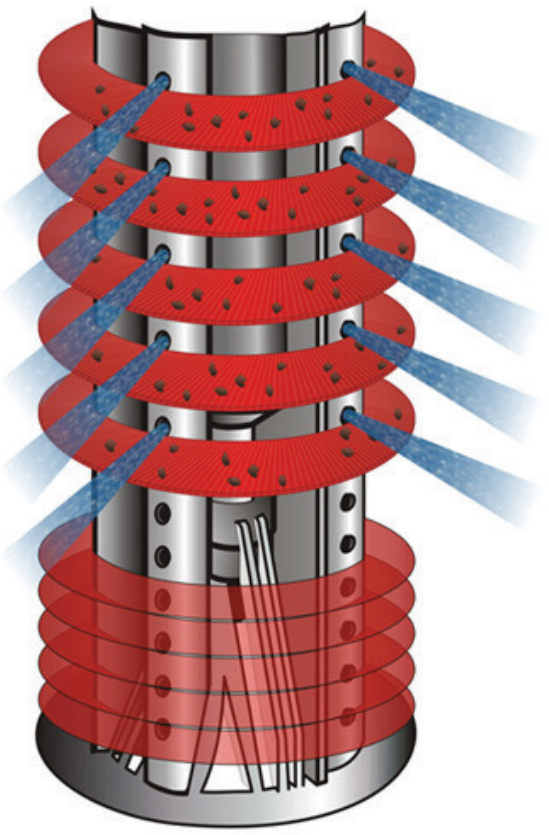
Where volumes are high and pressure is low, automatic self-cleaning brush filters (ABF) systems can be preferable. For instance, Amiad ABFs are in use in the Singapore Public Utilities Board's NEWater wastewater treatment plant system, where they screen more than 200 million gallons of influent water per day. There, they protect microfiltration (MF) and reverse osmosis (RO) membranes followed by UV and hydrogen peroxide disinfection in the world's most ambitious water recycling system.

Disc Systems

Deformable particles such as algae can be a challenge for screens. Depth filtration – for instance, from sand media systems and stacks of grooved discs – can be more effective against such soft solids.

In disc filters, particles travel from the outside to the inside of a tightly compressed stack of discs. Each disc is etched with fine channels that allow influent and solids to travel; however, as the channels intersect between discs, solids are trapped. The diameter of the discs provides ample opportunity for the system to capture particles, even those flexible enough to squeeze through smaller openings than the solids' nominal size.

When a target pressure differential is reached between the clean and dirty sides of the system, the inlet closes, the core telescopes to separate the discs, and powerful streams of water blast particles from between the discs.



Self-cleaning disc filters are outstanding for trapping deformable solids. Tightly-compressed stacks of grooved discs are loosened for cleaning.

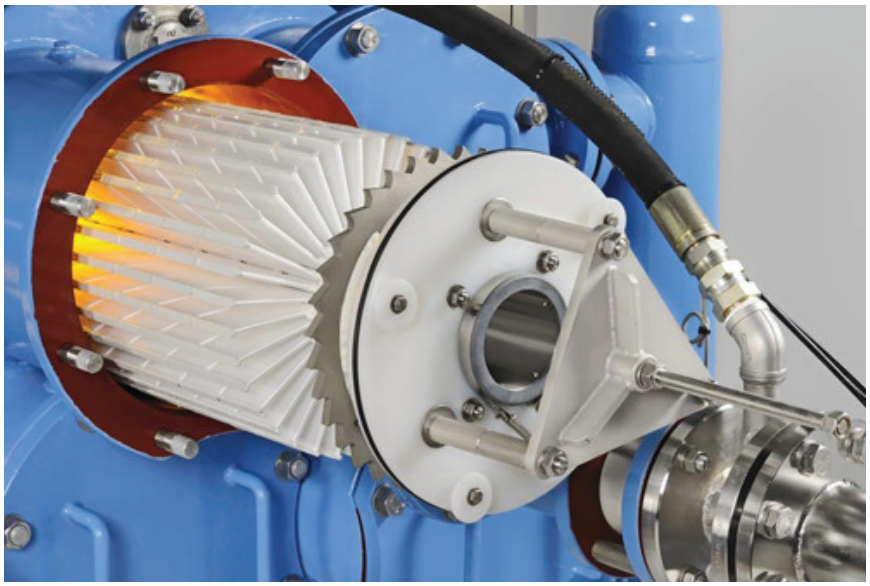
Amiad has seen significant adoption of its Arkal line of disc filters in seawater reverse osmosis (SWRO), brackish water and certain corrosive wastewater treatment systems. Where rust or corrosion is a concern, the all-plastic construction of the disc systems is viewed as a significant benefit.

Microfiber Protection

Deformable particles like algae and transparent exopolymer particles (TEP) – as well as small non-deformable solids and cysts of *Giardia*, *Cryptosporidium* and *Legionella* – may also be trapped by automatic microfiber (AMF) systems, which use extremely fine polyester thread densely wound around plastic cores to trap solids. As with Amiad's other automatic self-cleaning technologies, pressure differential between the influent and effluent sides of the system is the most commonly used trigger for automatic self-cleaning.

When the target pressure differential is reached, a high-pressure jet of water is directed through the fibers and deflected by grooves in the plastic core of each AMF filter element. The water sprays back through the fibers and releases trapped particles for disposal.

Providing filtration down to the 2-micron level, AMF filters are widely used to protect microfiltration or RO membrane systems, often replacing cartridge filters and eliminating the need to buy, replace and dispose of consumables.



Amiad's automatic microfiber (AMF) filtration system uses tightly wound polyester fibers to capture solids in an automatic self-cleaning system capable of filtration down to the two-micron level.

Multi-Stage Approach

The wisest approach to protecting membranes is to develop a multi-stage system, in which upstream filters remove contaminants that would render downstream technologies less useful and efficient. For instance, it is costly and impractical to employ a 1-micron cartridge filter to capture 200-micron sand particles.

In fact, screen filters are often extremely useful additions to prefiltration systems that already employ sand media filters, which can be prone to media carryover, sending grit downstream during operation or cleaning. One electrical generating plant in the western U.S. had taken its sand media filter offline several years ago because media carryover was plugging the 1-micron cartridge filters upstream of its RO demineralizer unit, requiring cartridge changes twice a month. Adding an automatic self-cleaning screen filter between the sand media system and the cartridge filter reduced total suspended solids (TSS) from 10.5 ppm to 0.0001 ppm upstream of the cartridge system and dramatically extended cartridge life.

Just as it makes no sense to use a membrane for gross filtration, there is no point in forcing a fine filter to remove larger solids than necessary. The return on investment from adding a prefiltration system can be surprisingly fast, especially when operating expenses such as labor, cleaning and consumables are tallied. And of course, improving permeate production is the name of the game.

For instance, one Southwestern city increased recovery to 85 percent from 70 percent on a brackish well RO desalination system by adding automatic self-cleaning screen filters as well as a sulfuric acid/sodium hydroxide system to its drinking water treatment facility. The result was more volume of treated drinking water as well as better performance of their system – a double victory.

In all, membranes are making it possible for municipal and industrial water treatment professionals to turn poor-quality water into an outstanding-quality resource, and expanding the global water supply by enabling wastewater reuse in unprecedented ways. In a vital supporting role, prefiltration makes it possible for membranes to perform to their potential – and contributes significantly to improvements in economy, ecological footprint and performance that will continue reducing the cost of membrane treatment and expand its adoption.

Jim Lauria is Vice President of Marketing and Business Development for Amiad Filtration Systems, a manufacturer of clean technology water filtration systems for municipal, industrial, agricultural and commercial applications. He holds a Bachelor of Chemical Engineering degree from Manhattan College and has over twenty years of global experience as a senior executive in the water treatment industry. You can read his blog on water issues on the Huffington Post: http://www.huffingtonpost.com/jim-lauria. He can be contacted at jim@amiadusa.com.