

# *Duraflow's tubular membranes: Making it easier to recycle industrial wastewater*

**It's an encouraging trend: The owners, managers and supervisors at a growing number of industrial facilities are more often recycling the wastewater these plants generate.**



The goal for these plant officials? They want to use that reclaimed wastewater within their buildings, for everything from cooling their key equipment to reuse right back in their process lines. It's a smart financial move, one that can help these users reduce their yearly utility bills and operational costs. They also want to be in a position to react when the inevitable edict comes down to recycle.

The benefits don't end there. Recycling wastewater also helps industrial users deal with the often complex regulations surrounding how they discharge their wastewater. Meeting these environmental regulations can require plenty of time and cost. If manufacturers instead re-use large portions of their wastewater, they'll have less of it to discharge reducing the stress and fees involved in meeting increasingly tough discharge regulations. The ultimate goal could be to completely eliminate the industrial liquid discharge entirely referred to as "ZLD" (zero liquid discharge)

Deciding to recycle more wastewater is one thing, of course. Actually doing it requires some serious planning. One of the most common techniques that industrial users turn to today when recycling wastewater is the proven combination of using low-pressure cross-flow membrane microfiltration (MF) to pre-treat wastewater before it goes through the reverse osmosis (RO) process for salt removal. This double form of treatment – microfilters and reverse osmosis (MF/RO) — is an efficient and effective way to turn wastewater into useable water.





Low pressure Microfiltration has been around for decades as treatment for sewer discharge. Improvements in the membrane technology over the past decade have made MF/RO truly reliable for **recycling water with membrane life beyond 5 years.** These improvements also allow an industry to improve discharge reliability now while setting up for water recycle in the future and ultimately ZLD in the distant future as economics and the regulatory climate changes moving forward.

### **A common problem**

But this combination, for all of its benefits, isn't free of challenges. And the biggest involves the solids and other contaminants that microfilters catch before they get the chance to move further along to the reverse osmosis process. In the process of removing contaminants MF membranes do become fouled by some of these contaminants. This is good for the downstream ROs in a recycle operation because it protects the RO from fouling. This is bad for overall performance unless it can be controlled.

Microfilters, because of the work they do, will eventually be fouled by suspended solids, bacteria, organics or mineral scaling. But Duraflow, which builds specialty crossflow tubular membrane filters, offers an alternative that dramatically reduces fouling and, when fouling occurs, is tough enough to survive cleaning by the harshest of chemicals. Duraflow's tubular membrane filters can be a key part of the industrial sector's efforts to reclaim a greater amount of its wastewater because these membranes are the perfect size to greatly reducing fouling. It simply takes Duraflow membrane filters far longer to foul.

### **The right-size solution**

Duraflow's filters are made with 1-inch tubes with a membrane coating on the inside. What makes them special? Industrial users can create the maximum amount of turbulence through these tubes because of their large tube diameter. Turbulence keeps the solids moving without accumulation on the membranes.

Permeate flow through a tubular membrane treating wastewater is a function of pressure, surface area, pore size and turbulence of the feed flow. Duraflow tubular membranes offer the optimum combined amount of these factors.



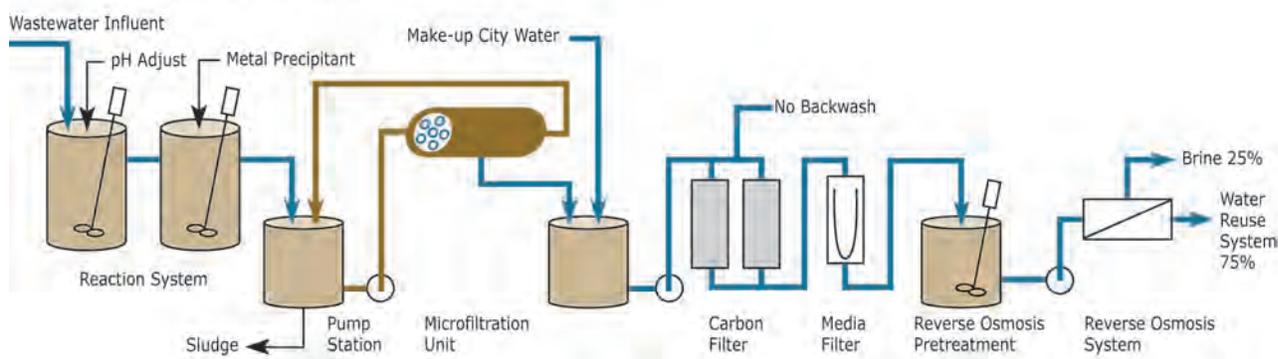
## Energy Efficiency

Another important system factor is the number of modules that can be put in series for a given pump output and pressure. Larger tubes create less pressure drop allowing more modules in series and thus less energy consumed per gallon treated. At some point in the operation the number of modules in series and the flux (permeate flow per unit squared of membrane surface) are more important than simply square feet of membrane. Thus more square feet of surface area is not the determining factor for system efficiency.

## High Solids Applications

An additional benefit of the large 1 inch tubes is the tolerance of extremely high concentration of suspended solids. It is not unusual for solids to concentrate as high as 3-5% in these systems. This is critical to avoid plugging tubes with solids. This is especially true in high solids applications such as brine treatment or lime softening.

Duraflow Microfiltration Recycle Process



## Chemical Pretreatment

Another important factor in mitigating membrane fouling is the proper application of chemical pretreatment. Particles can be coagulated into a larger more filterable particle size with coagulants. Precipitants can be added to improve metal removal. Adsorbents can be used to control organics. Back-pulse can also be used to clear pores of particles. In applications where specific contaminants such as Silica, Selenium, Mercury or Lead are to be removed pretreatment is critical.

In applications such as RO Brine treatment or cooling tower blowdown where calcium hardness and silica must be removed both large diameter tubes and good pretreatment are a must.

## Membrane Cleaning

At the same time, Duraflow builds its tubular membranes out of materials that are far more tolerant of aggressive cleaners. This is important, too. Many other



membranes will break down when exposed to harsher chemicals. This makes cleaning these membranes a challenge for industrial users. Forced to use milder chemicals, users often can never truly clean their membranes, exacerbating the problem of fouling.

***Duraflow's tubular membranes, though, can handle any cleaners that users throw at them.***

Fouling isn't a dirty word for Duraflow membranes. They are expected to foul because that means that they are doing their job of protecting the more sensitive downstream ROs from these foulants. That's why Duraflow tubes are made out of materials that can be cleaned even with stronger chemicals. If they're going to catch more contaminants, they need to be able to withstand harsher cleaning methods.

The combination of microfilters and reverse osmosis is a powerful one for industrial users who are recycling their wastewater. That's because microfilters are designed to catch the solids and other pollutants that, if left unchecked, would foul the reverse osmosis process. In the simplest terms, a membrane acts as a type of shield, catching potentially harmful pollutants as water is pushed through it.

Many membranes, especially in heavy-duty industrial applications, can become fouled fairly quickly. And then, because these membranes are fairly fragile, industrial users can't clean them aggressively.

That's not the case with Duraflow's tubular membranes. Industrial users can clean Duraflow membranes even with industrial bleach. That would destroy other membranes. If you put an oxidizer like bleach or strong acids on other membranes it will destroy them.

It's little surprise, then, that Duraflow's membranes are becoming an increasingly popular choice among industrial users. Duraflow has found its niche in this space, making it easier for manufacturers to reclaim wastewater that they would normally have to discharge. About 500 of Duraflow's tubular membrane systems are operating across the globe, with 300 of them in China.



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[www.duraflow.biz](http://www.duraflow.biz) ~ [info@duraflow.biz](mailto:info@duraflow.biz) ~ tel: 978.851.0447

That is the trend today among a growing number of users, turning toward this extra level of protection when reclaiming wastewater. Industrial users want a membrane that can deal effectively with foulants. But they also want one that can be cleaned easily. This kind of product solves that issue of fouled membranes that plagues so many users in this niche. Duraflow systems tend to run really well for a long period of time.

### **A form of protection that is on the rise**

The economic conditions are changing for industrial users, making reclaiming wastewater a sounder financial decision. Demand for products like Duraflow's tubular membrane filters is surely expected to increase.

Duraflow does a lot of business in China, because recycling wastewater is mandated there. There is expected to be more wastewater recycling here in the rest of the world too, because it is becoming more economically sound for industrial users to re-use their water than it is to buy it from the city. Dumping their wastewater can also be expensive.

Then there's one last benefit of recycling water: When industrial users rely on their own re-claimed water, they also gain a better understanding of the quality of that resource. It might not only be cheaper to recycle water, it might be more reassuring, too. You know what is in it when you use your own recycled water. That's not always the case with city water especially in areas where city water is of questionable or unreliable quality.

To sum it all up...When it comes to industrial water recycle systems the **pretreatment** to the Reverse Osmosis is more critical than Reverse Osmosis itself. The proper chemical pretreatment in a filtration system designed for the solids and the foulants that can be easily cleaned once fouled assures many years of successful, reliable and economical service with minimal upsets. Duraflow technology is available world-wide through a network of trained professional OEM Distributors.

### **About Us**

Duraflow, which is headquartered in Tewksbury, Mass., manufactures Tubular Microfiltration Membrane products specifically designed for the harsh industrial environment. They are used for many industrial filtration applications because they can tolerate high levels of suspended solids, are easy to clean, have amazing chemical resistance and last a very long time. Our global infrastructure and uncompromising commitment to product quality and development has earned Duraflow its reputation for supplying world-class membrane technology around the world. Duraflow is an ISO 9001-2015 Certified Company.

Founded by Joseph Lander and William Matheson in 2003, the filters were created to satisfy the fast-growing global wastewater recycle demand. Duraflow works closely with its customers to provide consultation and support in analyzing project objectives and presenting the most practical, cost-effective solution to meet short- and long-term requirements.

**Find out more.**

