The Essential Guide to

MICROFILTRATION AND ULTRAFILTRATION MEMBRANE SYSTEMS

A PUBLICATION OF SAMCO TECHNOLOGIES

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Chapter One

WHAT ARE MICROFILTRATION AND ULTRAFILTRATION SYSTEMS AND HOW DO THEY WORK?

MICROFILTRATION AND ULTRAFILTRATION SYSTEMS

What they are and how they work

Microfiltration (MF) and ultrafiltration (UF) systems solve a variety of process liquid treatment and purification needs, generally with low operational costs and a small footprint. MF and UF are typically incorporated within a larger treatment process, and, when used to pretreat process streams, MF/UF systems are particularly effective at preventing costly fouling of downstream equipment, such as RO units, or removing bacteria and viruses from drinking water.

If you're wondering which pretreatment or contaminant removal systems are right for your facility, you might be asking **"What are microfiltration and ultrafiltration systems and how do they work?"**

The following chapter will simplify MF and UF system technologies, and explain how membrane filtration systems works:

What is membrane filtration?

Membrane filtration is a physical separation process that uses a semipermeable membrane to remove suspended solids from a liquid stream. MF and UF, along with nanofiltration (NF) and reverse osmosis (RO), are all examples of pressure-driven membrane filtration.

MF/UF are flexible filtration methods, and both are used to remove a variety of particles, pathogens, and microorganisms from process liquids. MF/UF is typically incorporated into a larger system, occurring downstream from media filtration units that capture large particles, and upstream from processes that provide further separation, purification, or waste treatment.

MF and UF systems share much in common with one another, with the main difference being that UF can catch finer particles than MF due to the comparatively smaller pore sizes of UF membranes.

What does microfiltration remove?

MF membranes are available in pore sizes ranging from 0.1 to 10 µm. MF porosity is the highest in the membrane filtration family, with the result that MF membranes allow water, ions, dissolved organic material, small colloids, and viruses to pass through, while retaining larger contaminants such as:

- **Algae**
- **Bacteria**
- **Pathogenic protozoa,** including Giardia lamblia and Crypotosporidium
- **Sediment,** including sand, clay, and complex metals/particles

What does ultrafiltration remove?

UF membranes are available in pore sizes ranging from 0.1 to 0.001 µm. Owing to the smaller pore size of its membranes, UF removes a more comprehensive range of contaminants than MF does, while leaving behind ions and organic compounds of low molecular weight. UF is suited for removal of very fine particles, including:

- **Endotoxins**
- **Plastics**
- **Proteins**
- **Silica**
- **Silt**
- **Smog**
- **Viruses**

How does MF/UF work?

MF and UF physically separate solids from liquid streams based on the principle of size-exclusion. As a feed stream is passed through the MF/UF membrane, any solids that are too large to pass through the membrane's pores are retained, while any liquid or small particles are permitted to flow through. In either MF or UF, the portion of the feed stream that has passed through the filter membrane is referred to as the filtrate or permeate, while the remainder is known as the retentate. Depending upon the industrial application at hand, the filtrate and/or retentate may each be directed to other systems, as appropriate, for waste treatment, or purification through RO.

MF/UF units support direct flow and crossflow filtration

In **direct flow filtration**, also known as dead-end filtration, a feed stream is forced through a porous membrane. Particles too large to fit through the membrane pores build up on the filter in a residue known as a filter cake. Dead-end filtration provides more comprehensive filtration of the feed stream, and is typically performed in batch or semi-continuous flows, allowing for the membrane to be replaced or cleaned regularly.

- Typical configuration: Cartridge, Plate and frame filter
- Ideal application: Treatment of feed streams with a low concentration particulate solids, or when a purified filtrate is desired

In **crossflow filtration**, also known as tangential filtration, the feed stream flows along the surface of the membrane, producing a purified filtrate, and a concentrated retentate that stays in liquid form, and can be recirculated through the MF/UF process. Crossflow filtration can operate as a continuous process because the constant flow of the feed stream helps to prevent the buildup of solids that block flow through the membrane.

- Typical configurations: Hollow fiber filter, spiral wound membranes, tubular membranes
- Application: Treatment of feed streams with a high concentration of particulate solids, or when a concentrated retentate solution is desired

Chapter Two

DO YOU NEED A MICROFILTRATION OR ULTRAFILTRATION MEMBRANE SYSTEM FOR YOUR PLANT?

DO YOU NEED AN MF/UF MEMBRANE SYSTEM?

How to know if it's necessary

Determining whether an industrial plant needs a microfiltration (MF) and/or ultrafiltration (UF) membrane system isn't always as straightforward as it seems. While these systems are not essential for every industrial process, when thoughtfully implemented within an intake, process, or waste stream, they can go a long way in improving a facility's efficiency and/or cutting operational costs. Once installed, MF/UF systems are generally inexpensive to run, demanding minimal energy, with maintenance needs mostly confined to the **cleaning and/or replacement of filtration system membranes.**

It other words, MF/UF can be an extremely cost-effective separation strategy, depending on the needs of your facility.

So **"how can you tell if an industrial facility needs an MF/UF membrane system?"** This chapter summarizes the key factors that can help you determine if this type of treatment is necessary for your plant:

Your facility is experiencing downstream fouling

If your plant's process involves reverse osmosis (RO), nanofiltration

(NF), or requires ultrapure process water, then MF/UF may help you cut costs. MF and UF consume less energy and have lower operational costs than other pretreatment technologies, making them a good choice if you're looking to recover and conserve process water or replace separation processes with higher operational costs, such as clarification or sand filtration systems. When added to an existing pretreatment strategy, MF/UF can prevent excess wear on downstream equipment by removing contaminant particles, large molecules, and bacteria. Common applications include:

- **Pretreatment for RO and NF:** MF/UF are used extensively at desalination plants to prevent premature membrane fouling by removing larger contaminant particles prior to passage through RO or NF process trains.

- **Protecting downstream equipment:** MF/UF efficiently removes contaminant particles from process streams, helping to protect specialized equipment from damage and excess maintenance demands, such as **chromatography columns in the biopharmaceutical industry.**

You use harsh chemicals or heat for sterilization and potable water generation

If your facility uses chemical disinfectants to generate potable water, then MF/UF might be a cost-saving alternative. Because **MF/UF uses filtration membranes to physically capture contaminants** from liquid streams, they can reduce your plant's use of heat and/or chemical disinfectants, such as chlorine or sodium hypochlorite. MF/UF filtration membranes are available with pore sizes ranging all the way down to 0.001 µm, allowing them to safely remove dangerous bacteria, viruses, and pathogenic protozoa without harsh sterilization processes. Using MF/UF for disinfection can help to protect equipment from premature wear, protect the quality of edible products, reduce the complexity of waste treatment processes, and avoid contributing to the growing problem of chemical resistance in infectious agents. Common applications include:

- **Sterilization:** MF/UF serves as an alternative to heat sterilization for food, beverage, and **pharmaceutical industries**, removing infectious contaminants while allowing products to retain taste, flavor, and potency.
- **Clarification:** UF is frequently used to remove insoluble solids from fruit juice and other beverages, and to remove bacteria from meat brine for safe reuse.

Your facility needs to remove suspended solids for discharge

If your industrial facility is concerned with the meeting effluent regulations and reducing disposal costs, MF/UF may help. As a relatively simple separation process, MF/UF and other types of membrane filtration essentially split a liquid stream into two parts—a retentate dense with any particles captured by the filter unit, and a liquid filtrate consisting of any substances small enough to pass through the membrane. This means that MF/UF can be an efficient strategy not only for improving water recovery and recycling capabilities, but also for concentrating spent materials to reduce recycling or disposal costs and to facilitate recovery of valuable materials. A common application might include the recycling of process materials, such as the use of MF/UF to recover catalysts, dyes, inks, paints, and surfactants from wash water and other process solutions for reuse and recycling.

Industry-specific separation needs

Because of the flexibility afforded by filter unit design and membrane pore size, MF/UF systems can be adapted to fit a variety of other industrial applications, while delivering low operational costs. Some examples of MF/UF industrial applications include:

Power

In the power industry, high purity water is often needed for key processes such as steam generation. Increasingly, MF/UF membranes are being used for suspended solids removal, replacing less efficient multi-step pretreatment processes, such as clarification followed by media filtration.

Refinery

New drilling technologies in the refinery industry, such as bituminous sand and hydraulic fracturing, produce large amounts of waste water. MF/UF are used to efficiently separate oil and other contaminants from process water, helping to cut costs by promoting reuse of process water and minimizing discharge streams.

Petrochemical and chemical

In the petrochemical and chemical industries, MF/UF are used for a wide variety of applications, including pretreatment for RO, purification of dyes, pigments and optical brighteners, treatment of wastewater and process water, as well as removal and concentration of materials such as minerals, metals, titanium dioxide, and calcium carbonate.

Oil and gas

MF/UF membranes are used to support water reuse in areas where source water is scarce or expensive. **Recent advancements in filtration membrane technology** have also made continuous fermentation a viable alternative to the traditional batched process, further **improving efficiency, especially in the production of ethanol**.

Mining and metals

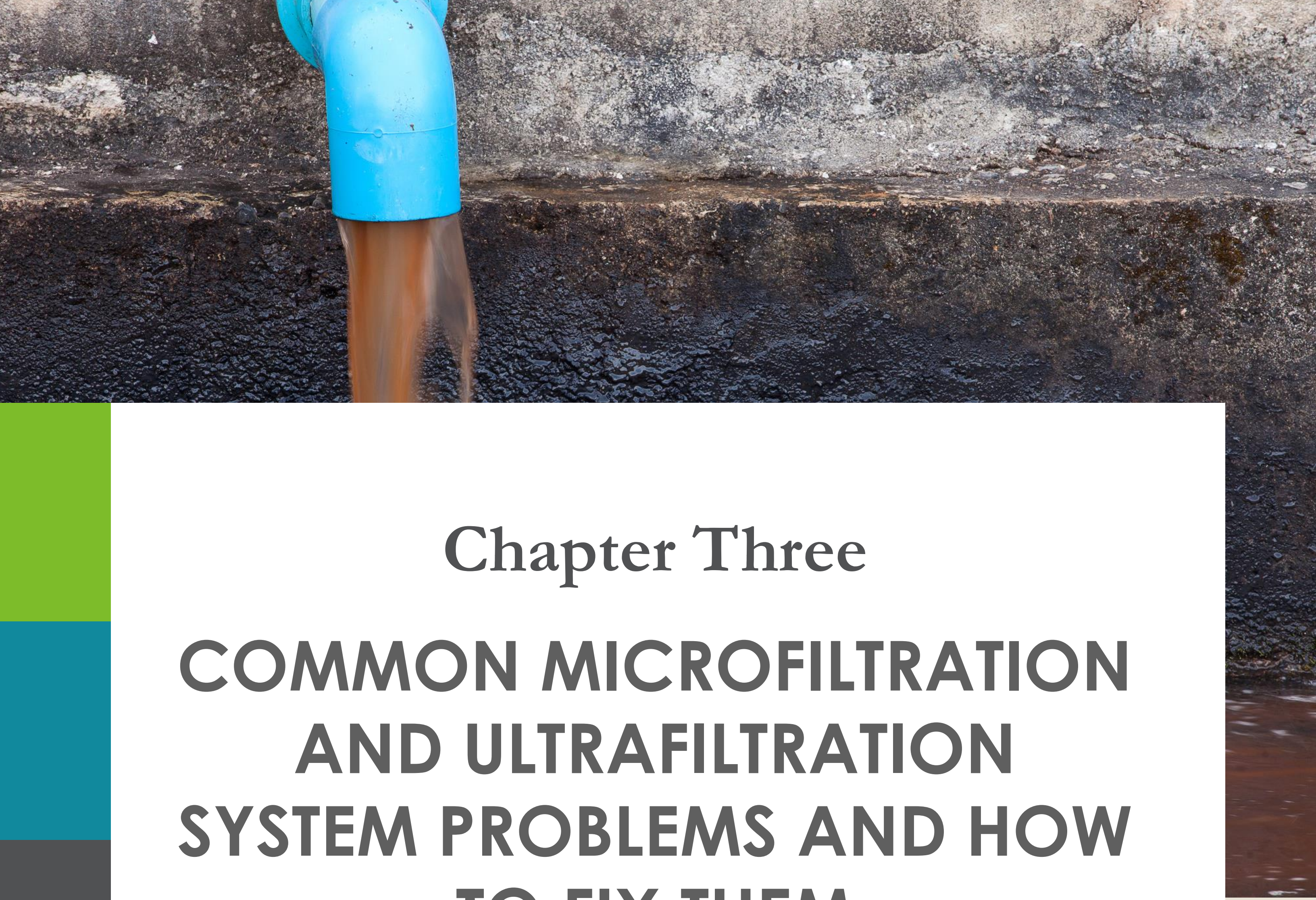
In the mining industry, MF/UF is used to recover of metals from process streams, to pretreat seawater prior to RO, and to treat mining waste water, including acid mine drainage and tailings.

Food and beverage

MF/UF is commonly used in the food industry to concentrate and/or remove specific protein molecules from liquid streams. This can include concentration of proteins in egg whites, separation of whey protein, and concentration of vegetable and plant proteins. In the beverage industry, MF/UF are increasingly used for removal of microbial particles and proteins after fermentation, and improved product recovery. In some cases, MF/UF is also used to remove alcohol content from wine and beer.

Municipal

The municipal water industry depends on MF/UF for efficient removal of contaminants such as bacteria and viruses from drinking water, as well as pretreatment to protect RO equipment from damaging solids present in source water.



Chapter Three

COMMON MICROFILTRATION AND ULTRAFILTRATION SYSTEM PROBLEMS AND HOW TO FIX THEM

COMMON MICROFILTRATION AND ULTRAFILTRATION SYSTEM PROBLEMS

What are they? How do you fix them?

If your facility is considering or using MF/UF technology, you might be wondering, **“What are the most common problems with MF/UF and what are some possible solutions?”**

We simplify and break down what you can expect below:

Membrane fouling

The problem

Nearly all MF/UF membrane filtration systems are subject to fouling, where **deposited materials collect along the membrane surface, reducing its efficiency and increasing energy usage**. It is one of the most common problems we see.

Whether the materials fouling the membrane are organic, biological, colloidal, or scaling in nature will generally determine what solution is best, but keep in mind that there are a variety of other factors that can contribute to how much membranes will foul. These factors can include the pressure and speed at which the liquid is forced through the membrane and other operational conditions.

When biological, organic, or colloidal fouling occurs in your membranes, it is mostly due to an overabundance of **biological, organic, or colloidal material present in the source water along with improper pretreatment**. As we separate the feed solution into two parts, the foulants will concentrate and typically cause the pressure to drop while facilitating a low permeate flow.

Possible solutions

Some possible solutions include:

- **chemical cleaning** with various cleaning solutions or detergents, including caustic/acid treatment, chlorine sanitization or antiscalants/dispersants.
- **ensuring proper pretreatment** via sedimentation or prior filtration methods (such as sand or activated carbon).
- **mechanical actions** such as backwashing, air scour, and vibration to loosen and flush out foulants.
- **scheduled cleaning** regimens should be designed into the system. A robust system will include quick backwash during the day with chemical assist. This may include air scour and chlorine or acid addition. Rigorous chemical cleaning can be applied infrequently.

The cleaning solutions and methods that might be useful in preventing and fixing fouled membranes will, again, vary on the material fouling the membranes and the conditions of the filtration unit. For example, in a project released by the Water Research Foundation (a nonprofit organization that aims to advance water science and protect the environment/human health), a desalination plant's membrane filtration system was being consistently fouled with problematic algal blooms. After trying a few solutions, they found that fouling was greatly reduced when hydrodynamic shear was limited, thereby minimizing algal breakup. Low-shear pumps were included in the system design to be run at lower speeds during algal-bloom peaks. They also found clay was helpful for removing algae in the flocculation phase.

If your facility is experiencing problematic fouling, **be sure to talk to you water treatment specialist about possible solutions**. Oftentimes, what you might think is the issue could be something different entirely, which is why we always recommend treatability studies, membrane autopsy, and pilot testing to get the best diagnosis and treatment suggestion for you specific filtration challenges. In some cases where the fouling is irreversible, your membranes will need to be replaced.

Waste stream disposal

The problem

When treating liquid streams with MF/UF, it is common that roughly 5%–15% of the stream's volume is going to need treatment as a secondary, concentrated waste, and **it is likely this secondary waste will need to be treated for disposal**. Sometimes this includes releasing to the environment under a SPEDES permit or to a POTW (publicly owned treatment works). These disposal permissions need to be negotiated in advance to be sure that the plant will achieve the effluent or discharge requirements and avoid expensive fees if the regulations aren't met.

Possible solutions

There is usually little-to-no chemical treatment in the case of MF/UF, and for that reason, the only contaminants in the secondary waste are solely what contaminants were present in the water source, albeit highly concentrated. Sometimes this waste can be discharged back into the source water or injected into deep wells. Some are diluted and used for irrigation in agriculture. If they cannot be discharged additional treatment may be required such as filter pressing to reduce TSS before discharging. The waste generated by the cleaning process will need to be treated for discharge or trucked to a treatment facility.

Your facility should have a plan in place for this secondary waste to ensure all agreements/regulations are met wherever or however your waste is being disposed of.

Higher-than-normal contamination in permeate

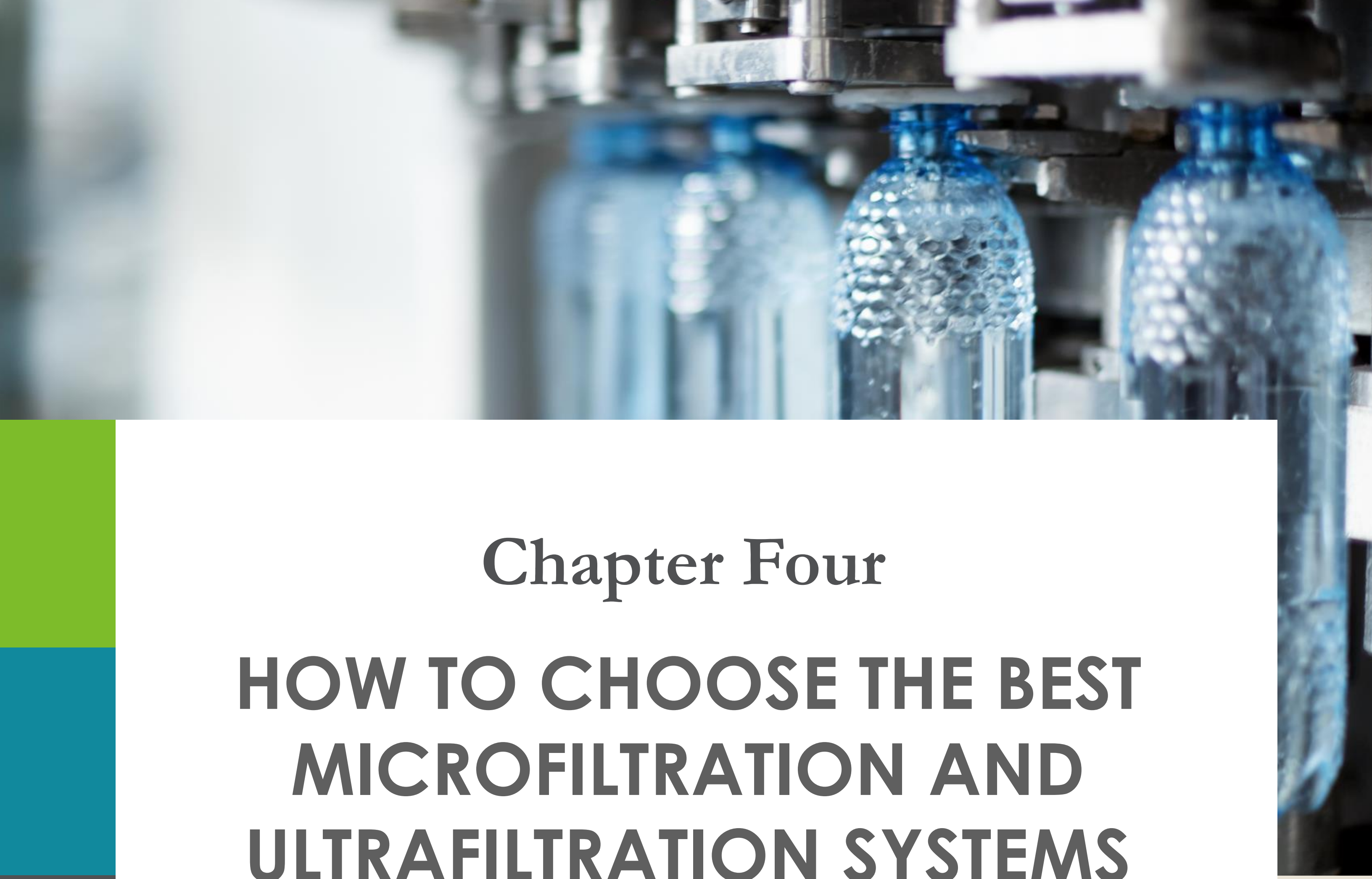
The problem

When particles are getting through MF/UF that should be separated out, there is a good chance the **fibers in the membranes are compromised**. This should not occur in closely monitored membrane filtration systems.

The solution

Integrity testing is often used to test the effectiveness of your MF/UF membranes, and it is essential to ensuring consistent and reliable filtration/separation. Many manufacturers will recommend a bubble test, where you drain the MF/UF module and pressurize it with compressed air. As you raise the air pressure, if you see large, continuous bubbles, it's an indication that there are tears in the fibers somewhere. Some MF/UF modules can also be tested with the pressure decay method, where pressurized air is pumped into the module and held for about 10 minutes. A higher pressure drop indicates an issue with the fibers.

As always, consult with the manufacturer of your MF/UF system to ensure the proper care, maintenance, and testing is implemented.



Chapter Four

HOW TO CHOOSE THE BEST MICROFILTRATION AND ULTRAFILTRATION SYSTEMS FOR YOUR FACILITY

WHICH MF/UF MEMBRANE SYSTEM IS BEST FOR YOUR PLANT?

Here's how to tell

MF and UF systems are used widely across the dairy, food and beverage, biotechnology, pharmaceutical, and automotive industries, and recent advances in filtration membrane technology and module design have made MF/UF increasingly cost-effective and flexible solutions for pretreatment of industrial process streams, removal of biological contaminants from potable water, waste treatment to meet effluent discharge requirements, oil separation, and concentration of macromolecules, such as proteins.

Given the versatility of MF/UF, however, it can sometimes be difficult to untangle all the factors that determine an ideal system to support your process. If you're exploring pretreatment or membrane filtration systems, you might be asking **"How do I choose the best microfiltration and ultrafiltration systems for my facility?"** The following will outline key factors that determine the best MF/UF system to meet your needs.

Know your process stream

MF and UF are physical separation processes used to remove particles, macromolecules, and other solids from a liquid stream. Therefore, knowing the characteristics and contents of your process stream will help you to select the most efficient and cost-effective MF/UF system to meet your production needs.

If you are unsure of which contaminants are present in your feed stream, you may want to consider conducting an optimization study. While optimization studies can be expensive, they can help you design a more efficient treatment system, which could help you save on operational and maintenance costs in the long run.

Here are some key factors to consider when selecting the best MF/UF system to fit your needs:

Particle size and molecular weight

MF & UF both work based on size exclusion, meaning that they use a semipermeable membrane to allow water, ions, and small molecules to flow through, while retaining any particles too large to fit through the membrane's specially-sized pores. Knowing all the substances present in your feed stream will allow engineers to consider particulate shape, size, and/or molecular weight of all substances present in determining optimal membrane pore size and geometry to fit your needs.

MF, with its larger pores, is suited for removal of materials such as algae, bacteria, pathogenic protozoa, and sediment. UF, with its finer pores, is better suited for removal of endotoxins, plastics, proteins, silica, silt, smog, and viruses. If you have a complex process stream, you might also need one or more pretreatment steps to promote optimal efficiency for MF/UF systems and prolong membrane life.

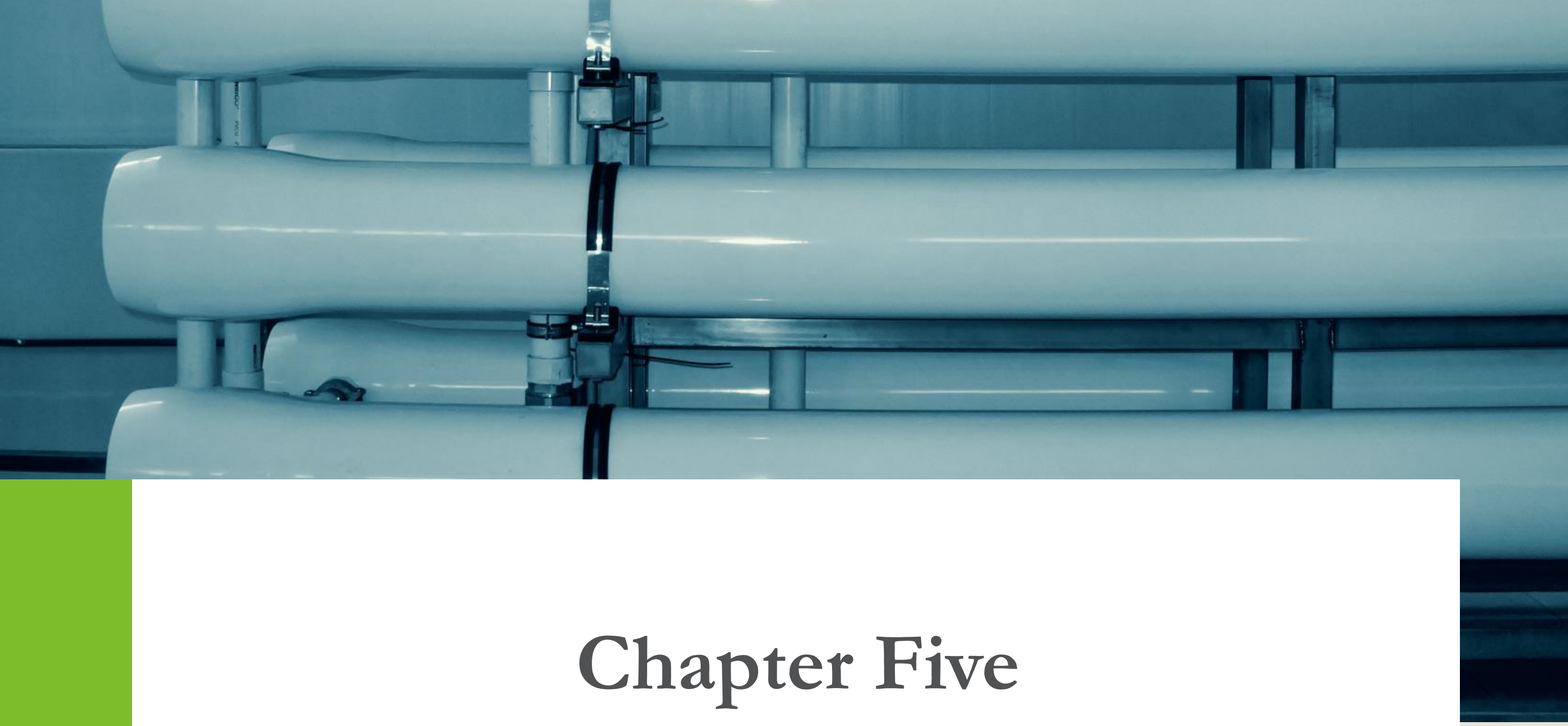
Solution concentration and physical design

The best MF/UF systems for your application should have a physical design based on the types and concentration of materials you wish to recover from your process stream. If your process or waste streams have a low contaminant concentration, your best bet will likely be a direct flow filtration system, such as a plate and frame or cartridge filter design, which tend to require relatively little energy to completely remove solid contaminants from your liquid stream. However, if your stream has a high contaminant concentration or if you are looking to further concentrate materials in your stream while keeping them in a liquid solution, you may be better off with a crossflow filtration system, such as a hollow fiber, spiral wound, or tubular membrane design. Choosing the right physical design to match your goals will ensure that your MF/UF system resists premature membrane fouling, and requires minimal maintenance and operational costs.

Chemical composition, pH, and temperature

Selecting the best membrane material for your MF/UF system also depends on the chemical composition, pH, and temperature of your process stream. Nearly all MF/UF membranes today are made from organic polymers, which tend to be relatively affordable. Common polymer membrane materials include polyvinylidiene flouride, polysulfone, polyether sulfone, and polyacrilonitrile, which are among the strongest and most durable of organic membrane materials, as well as polyethylene, which is one of the most affordable organic membrane materials. Inorganic membrane materials, such as ceramic, alumina, titania, and silicon carbide tend to be more expensive but are more durable and have a high chemical resistance. If your process stream involves high temperatures and/or aggressive chemicals, such as acids or strong solvents, then an inorganic MF/UF membrane material may be a more cost-effective option because it requires less maintenance and replacement in the long run.

As always, be sure to check with your water treatment specialist. They will be able to test your stream for present contaminants and help find a solution specifically for your stream.



Chapter Five

HOW MUCH DO MICROFILTRATION AND ULTRAFILTRATION MEMBRANE SYSTEMS COST?

WHAT MF/UF MEMBRANE SYSTEMS COST

Pricing, factors, etc.

If your facility might require MF/UF membrane system technology, you are likely wondering, **"How much do microfiltration and ultrafiltration membrane systems cost?"**

Since MF/UF membrane systems solve a wide variety of industrial pretreatment, separation, and purification challenges, the solutions and configurations of these systems can be as far-reaching and complex as the problems they are meant to remedy—and the same goes for their cost. Although it can be difficult to pinpoint exactly what you might be spending, it's not impossible to narrow down to a range.

In this chapter, we break down **what your facility might be spending for a reliable MF/UF membrane system** and outline the various factors that often drive that cost up and down:

What's included in a basic MF/UF membrane system?

Most facilities will usually be using an MF membrane system separately from a UF system, either one membrane system or the other depending on the size and weight of the contaminants that need to be removed. The only time MF and UF might be used together would be during a specific process separation where you're trying to separate one molecular weight ion from another, requiring a two-step process. Using them together, however, is pretty rare, so the costs and factors below are focused on the systems individually.

Some of **the most common uses for MF/UF systems include** treating municipal water for viruses and bacteria removal and reduction of silt density index for RO pretreatment. For treating wastewater, MF/UF membrane systems are used for preparing feed for an RO for recycle/reuse or for separating fine colloidal metals from the discharge. Both MF and UF can be used in these applications.

Despite the variety of applications and configurations you might see with these systems, **a typical MF/UF membrane system usually includes some type of:**

- Inlet collection tank
- Feed pump skid and tank
- Membrane/module rack
- Receiving tank
- Backwash pumps off the receiving tank
- Chemical cleaning systems
- Compressed air for scouring the membrane when it's cleaned
- Automation instrumentation (such as PLC controls)

As mentioned above, most MF/UF membrane systems consist of a **module rack** with tanks and **feed pumps before and/or after**, enabling you to collect the feed water and pump it to the MF/UF unit then send the filtered water off to another part of the process. An inlet strainer, or a large strainer to separate out the bigger particles, is usually installed prior to the unit to separate out all the particles that could plug the pores of the MF/UF membranes (usually 500 microns or so).

For the **filtration receiving tank** on the back end, typically there are pumps that forward the water to be used (to an RO system, etc.), and there is also a pump or pair of pumps used for **backwash of the MF/UF system**. This is where you have a chemical feed system so when you're backwashing and cleaning, you can add chlorine to disinfect the fluid stream or add acid to descale (the chemicals added here will depend on the contaminants in your feed stream). This **CIP (clean in place) system**, a cleaning tank with a comb-bottom feature, includes a heater and a pump and filter cartridge housing. The chemicals are mixed in the tank, the water is heated and then fed/circulated either through the RO, MF, or the UF for an extended cleaning. Quick daily cleanings (when a facility backwashes with chlorine and a little acid) helps keep the membranes free of fouling. Every once and a while, we also recommend a thorough cleaning with the CIP tank. Sometimes there are also **compressed-air units** added to these systems for cleaning.

The **monitoring equipment and PLC controls** monitor flows and pressures, which would indicate if an issue arises with the membranes, such as a rip or tear in the fibers of your membrane systems.

The main factors of MF/UF membrane system cost

Water characterization

The main factor that will drive up and down MF/UF membrane system cost is the **characterization of the water**—whether it's surface or well water, and how dirty it is. (Are there algae, organics, or a lot of metals to cause scaling and fouling?)

If you've got heavily contaminated river water, you may have to use pretreatment to get down to reasonable levels.

In wastewater applications, if your water has a lot of suspended solids, you may look at a tubular design versus hollow fiber . . . and this is where you start getting more into the micro filter designs for meeting effluent discharge requirements because you can use your chemistry upfront to drop all your metals and coagulate them all, then you use the MF tubular type to concentrate and filter out the particles instead of clarifiers and sand filters.

MF are used more on the backend wastewater side/metals removal, and the tubular versions are used there, whereas UF hollow fiber and spiral wound are typically used on the front end for polishing pretreated water or being the primary treatment before the water goes to the RO. Again, this is all driven by the characteristics of the water and how dirty it is.

Flow rates

Another factor that causes a difference in cost or size of the system is the flow rate. Typically, an MF/UF membrane system is run at a continuous flow rate based on a certain number of gallons per day. The product water goes into a holding tank and that water is pumped to the use points on demand depending on how fast you want to use it. For example, a food and beverage plant might need about 100K gallons of water per day, but because it is used over the course of two shifts, the average flow rate per day might be 100K gallons, but when the facility uses it in 16 hours, the peak demand is higher.

Once you get past the ancillary systems (the holding tanks, pumps, CIP) the core technology cost is proportional to flow. If you want 10% more flow, you need 10% more modules, which can have a big impact in system cost.

Construction materials

The last factor that will affect the cost of your MF/UF membrane system is the construction materials. In a municipal application where PVC piping is used, its's going to be less expensive than an industrial, medical, or power application where all stainless-steel piping will add substantial amount to the cost.

Other important factors to consider when pricing a MF/UF membrane system

- ***Upfront planning.*** Developing the concepts, designs, and regulatory requirements for your project is the first step to planning your MF/UF membrane system. The cost of engineering

- for this type of project can typically run about 10–15% of the cost of the entire project and is usually phased in over the course of the project, with most of your investment being allocated to the facility's general arrangement and mechanical, electrical, and civil design.
- ***Space requirements.*** When planning for a MF/UF membrane system, the size of your system and your plant location will affect your cost. For example, if your plant is located in a place that is very expensive when it comes to space, you might want to aim for a smaller footprint, if possible.
- ***Installation rates.*** Another thing to keep in mind is the installation rates in your area. These sometimes also fluctuate by location, so be sure you're aware of the cost to install the system and factor this into your budget. In areas where installation costs are high you may want to consider prepackaged modules versus build-in-place facilities.
- ***Level of system automation needed.*** When it comes to the level of automation you need for your MF/UF membrane system, there are two options. The first is a higher level of automation where you won't need an operator present for much of the time. With type of automation, you can eliminate much of the human error associated with running the plant, and although this option is costlier upfront (an initial investment in more sophisticated PLC controls and instrumentation), the ongoing labor costs are less. The second option is a lower level of automation with less capital cost, but with added labor, this can end up costing you more in

- the long run. When deciding whether to invest in more costly controls, you need to consider what works for your company and staffing availabilities.
- ***Turnkey and prepackaged systems*.** If you can order your MF/UF membrane system prepackaged, this will typically save you construction time at about the same cost or less. A benefit to having your system prepackaged is that the production facilities and fabrication shops that assemble your system are, more often than not, highly knowledgeable about the type of system they are manufacturing. This results in a quick and efficient fabrication versus build-in-place facilities. Sometimes when you hire a field crew, there is a bit of a learning curve that can add extra time and/or cost to a project. SAMCO specializes in these types of turnkey, prepackaged systems, and for more information about what we offer, you can visit our website here. Installation costs will vary, but typically range between 15–40% of the project cost, depending on the specifics of prepackaging and amount of site civil work needed.
- ***Shipping the system to your plant*.** When having your MF/UF membrane system shipped to the plant, you usually want to factor in about 5–10% of the cost of the equipment for freight. This can vary widely depending upon the time of year you are purchasing your system in addition to where your plant is located in relation to the manufacturing facility. When you are looking to purchase your system, check with your manufacturer to see if there is a facility where the system can be constructed closer to you if not on-site.

- ***Operation costs.*** Also keep in mind that particular technology packages cost a certain amount to purchase upfront, but you need to also factor in system operating costs over time. For decisions like these, you need to weigh the pros and cons of initial versus long-term cost investment in addition to what works for your company and staff. You will likely want to look into having someone develop an operating cost analysis so your company can plan ahead for the operating cost over your facility’s life cycle. This might help you consider whether or not you want to spend more on your system initially or over time.
- ***Other possible costs and fees.*** When purchasing a MF/UF membrane system, you might also want to keep in mind what other hidden costs and fees might be. For example: Will there be any taxes on the system or additional purchasing fees? What are your possible utility costs to the installation area? Will there be any environmental regulatory fees and/or permits? Any ongoing analytical compliance testing you need to pay for?

Also consider that there will be costs to treating the secondary waste produced by the system. With stringent environmental regulations, you will need to either treat the waste for hauling away or solidify with a filter press/evaporator and transport to third party disposal firm.

Also be sure to ask your system manufacturer about options that might be cheaper to install. They might be able to shed some light on the more installation-friendly systems with suggestions on how to keep your costs to a minimum.

The bottom line

When you have smaller flows, like **10 or 20 GPM**, your costs can be **under $100,000** on a typical front-end system.

A smaller high-end system you might use for a power plant for **100 to 200 GPM, might be $450,000**, whereas a commercial version might be **$250,000 for 150 to 200 GPM.** A less expensive system might be 60 % of that for materials of construction PVC versus stainless steel.

A **500 GPM wastewater MF system** on the wastewater side could cost **$500,000 to $1 million dollars** if you're replacing all the clarifiers, and filters, etc.

Another example is a municipal seawater desalination system for drinking water where UF is being used ahead of RO, at say **3,000 meters cube per hour** (which is a large flow). A system at this rate could be **$10 million for the complete UF system and $15 million for post-seawater RO**, making the entire system about **$25 million**, give or take 25%.

HOW CAN SAMCO HELP?

SAMCO has over 40 years' experience helping design and engineer some of the most effective MF/UF systems in the industry. For more information about what we offer and how we can help your facility, please visit our website or contact us to schedule a consultation with one of our skilled engineers.

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