INTEGRATED WATER SERVICES

TURNING WASTEWATER INTO VALUE FOR YOUR BUSINESS

Environmental regulations across the globe are growing more strict by the year. At the same time, for industrial businesses, sustainability has become a non-negotiable value. Given this landscape, the question is how a business will adapt.

TURNING WASTEWATER INTO VALUE FOR YOUR BUSINESS

Membrane bioreactor (MBR) technology is your key to staying ahead with efficient wastewater treatment. MBRs offer a sophisticated solution that optimizes the treatment process and ensures compliance. Even better: Your high-quality effluent can be used in any number of ways as a resource for your business.

MBR systems streamline the removal of organic pollutants and enhance effluent quality to meet even the most rigorous regulatory demands. That's important for your business.

This technology equips businesses to tackle high organic loads and fluctuating wastewater characteristics—common hurdles in many industrial processes like those encountered by food and beverage manufacturers. By integrating a bioreactor that promotes extensive microbial breakdown with a precise membrane filtration stage, MBR systems deliver an effluent that's ready for reuse. Imagine using your wastewater for everything from industrial washdowns to safe agricultural irrigation. That's real value for your business.

Perfect for food and beverage businesses looking to future-proof their operations, this white paper will guide you through implementing MBR technology to turn wastewater liabilities into valuable assets.

TABLE OF CONTENTS

Consider the following example:

A soft drink manufacturing plant is grappling with increasing scrutiny over its wastewater management. This is a common enough story across the food and beverage industry, and in this case the scrutiny focuses on high organic loads and variable effluent quality. The plant generates significant volumes of wastewater laden with sugar syrups, flavor concentrates, and cleaning chemicals.

As environmental regulations tighten, the facility needs a solution to ensure compliance and reduce wastewater disposal costs. Given the competitive marketplace, the solution also needs to maximize opportunities for water reuse in processes like facility washing and cooling systems.

The current challenge stems from the plant's outdated wastewater treatment system, which is based on traditional biological treatment methods struggling to meet the more stringent effluent standards. This system frequently faces issues like elevated Biochemical Oxygen Demand (BOD), inconsistent pH levels, and high suspended solids.

Bottom line: The plant's objective is to reduce its environmental footprint and implement a more efficient treatment process that would facilitate water recycling.

To tackle the challenges effectively, the plant partners with an MBR design specialist like **Integrated Water Services** to develop a customized system tailored to handle the specific organic load of the beverage manufacturing process. This innovative system utilizes aerobic bacteria to efficiently break down dissolved organics. The design partner carefully adjusts the system's Hydraulic Retention Time (HRT) to optimize the degradation of sugars and chemicals.

The team chooses flat sheet membranes for their durability and ease of cleaning, making them particularly suitable for handling the high levels of suspended solids and potential membrane fouling agents found in beverage production. These membranes provide efficient filtration and ensure consistent effluent clarity, which is critical for meeting regulatory standards and supporting reuse initiatives.

Ultimately, the investment in MBR technology transforms the soft drink plant's wastewater treatment from a regulatory compliance challenge into a strategic business asset. The operations team decides to use the recycled water for cleaning equipment and workspaces, significantly reducing the facility's demand for potable water.

Turning wastewater into an asset with real value on the balance sheets has proven the substantial benefits of adopting cutting-edge wastewater treatment solutions in the food and beverage industry. Sounds promising?

Understanding Your Pretreatment Needs

First, your team must take stock of current operations, much like the soft drink company in our example.

To get the most out of an MBR investment, set a baseline to begin your planning: Recognize and address the unique pretreatment needs of your facility.

What are you trying to treat? Accurate profiling of organic and nutrient loads, solids content, and the presence of any inhibitory substances will inform the custom configuration of the MBR.

By tailoring your MBR system to the pretreatment requirements of your facility, you can reduce fouling tendencies, maintain membrane integrity, and achieve a higher quality effluent suitable for reuse and recycling.

Thoughtful evaluation and adaptation of key parameters like HRT, Solids Retention Time (SRT), and aeration rates are vital to optimizing performance.

This section will guide you through understanding your unique wastewater profile and the technical considerations necessary for implementing an MBR system that meets your pretreatment needs.

Characterization of Influent Wastewater

What is the nature of your influent right now?

Take a detailed look at the physical and chemical profile of your wastewater. Measure key parameters like pH, temperature, TSS, Chemical Oxygen Demand (COD), BOD, Alkalinity, Nitrogen and Phosphorus. These metrics define the wastewater's organic and inorganic load, and they'll help your design partner set you up with the right MBR system for your needs.

When considering a new MBR system, accurate measurement of COD and BOD will dictate the microbial population control within the bioreactor. Assessing TSS levels will then inform the need for dissolved air flotation (DAF) or grit removal, in addition to fine screening, before wastewater enters the membrane filtration phase. These are important design factors.

When it comes to the biological process, microbial identification can reveal the presence of nitrifying bacteria, filamentous organisms, and other species that may affect system performance. Pathogen detection is equally important, as a high pathogen load may necessitate supplementary disinfection stages.

Profiling the influent in this manner helps tailor the bioreactor's microbial community composition and optimize its metabolic pathways. This ensures the degradation process operates efficiently and effectively.

Determining the Organic and Nutrient Load

Once you've **measured important parameters** like pH, temperature, TSS, COD, and BOD, you now have a basis for an MBR design plan. That design will include specifications for HRT and SRT.

Higher BOD and COD values indicate a greater organic load (think breweries and their ethanol- and sugar-rich wastewater, for example). A greater organic load demands a higher biomass concentration and extended SRT to ensure complete degradation.

Nitrification and denitrification require an accurate assessment of total nitrogen levels, including ammonium and nitrate concentrations. This enables precise control of anoxic and aerobic zones in the bioreactor.

Phosphorus removal will require an assessment of total phosphorus levels and a clear distinction between orthophosphate (the most readily available form in wastewater), polyphosphate, and organic phosphorus. These distinctions guide the incorporation of biological phosphorus removal processes, such as luxury uptake, and/or chemical precipitation.
This is a salient example, because the regulatory requirements around phosphorus are growing increasingly stringent over time–more so than many other chemicals.

Biological Phosphorus Removal

In MBRs, enhanced biological phosphorus removal (EBPR) processes exploit the metabolic processes of **phosphate-accumulating organisms (PAOs)**. Those PAOs uptake phosphorus in excess of their immediate growth requirements during non-aerobic periods and store it as polyphosphate. During subsequent aerobic conditions, these polyphosphates are utilized for growth, releasing phosphorus into the biomass, which can then be physically removed from the system.

Process Design Considerations:

- Anaerobic, Anoxic and Aerobic Zone Configuration: The MBR must be configured with dedicated anaerobic, anoxic and aerobic zones. Anaerobic and anoxic zones encourage the release of phosphorus from PAOs, while aerobic zones promote its uptake.
- SRT Adjustments: The system's SRT must be long enough to allow PAOs to proliferate over other bacteria that do not contribute to phosphorus removal. Typically, SRTs longer than 10 days are favorable for EBPR.

- Organic Loading: Adequate volatile fatty acids (VFAs) must be available in the influent to the anaerobic and anoxic zones as these are vital for the PAOs to perform luxury phosphorus uptake.

Chemical Phosphorus Precipitation

In instances where biological phosphorus removal may not be sufficient or reliable, chemical precipitation can be used as an additional or alternative treatment. Chemical precipitation involves the addition of metal salts (usually iron or aluminum) to the wastewater, which react with dissolved phosphorus to form insoluble precipitates that can be separated from the water.

Precipitation Chemistry:

- Iron Salts: Ferric chloride and ferric sulfate can be added to form ferric phosphate, a precipitate that is removed via sedimentation or filtration.
- Aluminum Salts: Aluminum sulfate (alum) can be used to form aluminum phosphate, which is also insoluble and can be physically removed.
- Dosage and Control: The precise dosing of these chemicals is critical and must be dynamically adjusted based on real-time phosphorus measurements to avoid under or over-treatment, which could lead to inefficiencies or additional operational costs.

Balancing these processes requires diligent monitoring of the influent load and effluent quality to maintain optimal nutrient removal efficiency. Your measurements are never truly done.

Solids Content and Settling Characteristics

TSS levels will influence membrane fouling tendencies and sludge dewatering. Don't overlook this connection.

Wastewater with high TSS content often necessitates DAF or grit removal in addition to fine screening to reduce the solid load entering the bioreactor, and that will be an important facet of your design plan.

Without proper pre-screening, excessive solids could exacerbate the fine screen performance and ultimately the membrane performance. This will lead to increased transmembrane pressure (TMP) (a buildup of pressure between the influent and effluent sides of the membrane configuration) and reduced flux rates. System capacity degrades when membranes foul; the bottom line is that less water passes through the membrane over time.

Sludge settling velocity is another example in evaluating sludge recirculation and wastage rates. Poor settling characteristics, often indicated by a high Sludge Volume Index (SVI), can lead to sludge bulking and inefficient dewatering.

Sludge bulking will be clear when a substantial cloud-like mass of sludge floats and even overtakes the volume of well-settled sludge in the tank. Bulking is often caused by excessive growth of filamentous bacteria, which form long, thread-like structures that trap air and other particles, preventing the sludge from settling. Inefficient dewatering may stem from excessive organic content or even certain microbial populations that resist compaction. This inefficiency can make it difficult to achieve a compact, concentrated sludge cake, however since gravity settling is not required in membrane systems, sludge bulking is not an issue for membrane filtration process.

Strategies like incorporating flocculants or bio-augmentation may be necessary to improve settling.

Furthermore, **optimizing aeration and mixing intensity** can positively impact sludge compaction, improving the overall efficiency of solid separation. This will be a nuanced conversation with your MBR design partner.

Inhibitory and Toxic Substances

Heavy metals–including lead, cadmium, and mercury–are common inhibitory substances that can disrupt microbial communities. These substances tend to bioaccumulate in the biomass, affecting enzyme activity and leading to reduced bioreactor efficiency.

Monitoring influent concentrations, as you've been doing, and removing these metals through chemical precipitation or ion exchange before biological treatment is essential to protecting the system's microbial population.

Industrial solvents, CIP chemicals, antifoams, and other surfactants may directly damage membrane materials or alter microbial activity. Some solvents can create foaming issues or inhibit nitrification processes, requiring

additional treatment steps like activated carbon adsorption or advanced oxidation.

Operational Variability

Flow fluctuations and organic load variability significantly impact membrane fouling rates and microbial efficiency. Daily and seasonal variations must be carefully accounted for to prevent hydraulic overloading or underloading of the bioreactor. Buffer or equalization tanks can help regulate these fluctuations by providing a consistent feed rate to the MBR system.

Load variability, such as sudden increases in organic concentration, requires adaptive control systems that can modify aeration, mixing, and sludge recirculation rates in real-time.

Real-time monitoring of COD, ammonium, and nitrate concentrations, along with dissolved oxygen levels, helps maintain optimal conditions for nitrification and denitrification while ensuring the bioreactor maintains high metabolic rates.

Effluent Quality Requirements

Let’s turn to the regulations surrounding the effluent that will come out of this treatment.

Effluent quality requirements often dictate the selection and configuration of MBR systems. Compliance is key!

Regulatory standards define permissible limits for BOD, TSS, pathogens, and nutrient concentrations, influencing the bioreactor design and membrane selection. The adoption of additional polishing stages, such as UV disinfection, reverse osmosis, or activated carbon adsorption, may be necessary to meet specific reuse standards for irrigation, industrial use, or potable water.

When targeting water reuse applications, specific requirements, such as residual chlorine concentration or turbidity, will demand ongoing effluent quality monitoring and secondary treatment. Implementing a multi-barrier treatment approach ensures that effluent achieves the desired quality and can safely fulfill its intended application.

How MBR Technology Improves Pretreatment

So, what now?

MBR technology can address both short- and long-term needs for businesses facing wastewater treatment challenges. The high degradation capacity of a bioreactor pairs well with advanced membrane filtration, allowing MBR systems to deliver consistently high-quality effluent that can be recycled and reused.

This section will explain the intricacies of how MBR technology enhances pretreatment, giving businesses a chance to transform their wastewater management practices into sustainable operations with effluent as an asset.

Enhanced Organic and Nutrient Removal

In an MBR system, enhanced organic and nutrient removal begins with the bioreactor stage. This is where microorganisms metabolize a wide range of organic compounds.

Here's a brief overview of this prerequisite stage.

A well-designed bioreactor provides sufficient retention time and controlled aeration. The bioreactor operates with an extended SRT, ranging from 12+ days to 30+ days for enhanced nutrient removal. This leads to a high concentration of active biomass capable of efficiently processing biodegradable organics, including BOD and COD.

This extended SRT fosters a diverse microbial community with specialized niches. With the right microbials, the bioreactor will comprehensively degrade organic matter and nitrification. The aerobic conditions maintained in the bioreactor promote the spread of nitrifying bacteria that are responsible for converting ammonium to nitrate. This ensures compliance with nitrogen effluent standards.

Here's where the MBR design really excels.

The subsequent membrane filtration stage removes any remaining suspended solids, allowing for the retention of nitrifying and denitrifying bacteria within the bioreactor.

In cases where biological phosphorus removal is required, as we've noted, the MBR system can incorporate anaerobic zones for phosphorus release and subsequent luxury phosphorus uptake by PAOs. For industries with varying nitrogen loads, such as food processing, these zones enable effective nitrogen reduction through the establishment of simultaneous nitrification-denitrification.

Solids Content and Settling Characteristics

MBRs excel in handling high TSS loads, which many food and beverage manufacturers will encounter. (Imagine a potato processing plant. These facilities often handle large volumes of raw potatoes that need to be washed, peeled, and cut before being processed into various products such as french fries, chips, or mashed potatoes. This contributes to a heavy TSS load.)

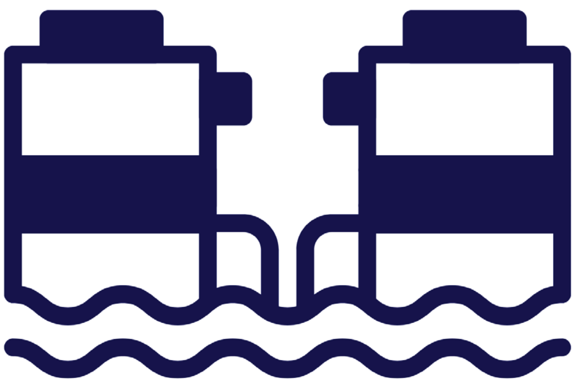
By combining mechanical pretreatment with sophisticated membrane filtration, MBRs can deliver much more efficient treatment than traditional methods. Initial stages like fine screening and grit removal are crucial, as they effectively intercept and remove larger particulate matter before it enters the bioreactor. This pretreatment protects the membrane surfaces from clogging and enhances the overall efficiency of the system compared to traditional methods that rely on gravity settling.

In the heart of the MBR system, the bioreactor operates with a controlled environment optimized for microbial health, fostering the growth of floc-forming bacteria. These bacteria help to aggregate fine particles, thus improving both the biodegradation of organic matter and the physical properties of the sludge.

Unlike traditional activated sludge processes, MBR systems decouple HRT and SRT, allowing for longer SRTs without the risk of washout. This leads to enhanced biomass retention and stability, significantly improving the system's ability to manage organic loads and sludge volume.

To ensure the longevity and efficiency of the membrane components, MBR systems incorporate routine maintenance practices such as air scouring and backwashing (if required). These processes actively remove any solids that accumulate on the membrane surfaces, a key advantage over traditional systems where membrane fouling can lead to costly downtimes and extensive cleaning requirements. Automated, real-time monitoring of parameters such as TMP and filterability allows for immediate adjustments to operational settings, ensuring the system continuously operates at peak efficiency.

Moreover, MBR technology advances sludge handling by integrating sophisticated membrane thickening, dewatering and conditioning techniques. Prior to dewatering, a membrane thickener can be used, which takes waste activated sludge (WAS) from the MBR and thickens it to up to 3%. After that, flocculants can be dosed to enhance particle aggregation and bio-augmentation to adjust microbial community dynamics for optimal sludge compaction. Mechanical dewatering methods like centrifuges or belt presses are more effective due to the improved sludge quality, offering a stark contrast to traditional methods where dewatering may be hampered by inconsistent sludge properties.



Inhibitory and Toxic Substances Removal

Toxic substances in your wastewater demand the advanced membrane technologies and precise operational controls you get from MBR systems. Anything less just won't cut it.

Constructed from materials like polyvinylidene fluoride or polyethersulfone, the membranes are specifically chosen for their resistance to chemical wear and granular filtration. These materials prevent toxic compounds from disrupting the critical biological processes within the bioreactor.

Within the MBR's bioreactor, properly managed conditions will cultivate a microbial community resilient to toxins. By fine-tuning sludge age and HRT, the system supports the growth of specialized microbes adept at handling complex pollutants. In scenarios where wastewater toxicity is particularly high (imagine a spice processor), the bioreactor can be seeded with specific microbial strains renowned for their pollutant-degrading capabilities. This strategic microbial management enhances the system's ability to maintain treatment performance even under challenging conditions.

In certain cases, your design partner can augment your MBR system with activated carbon adsorption, advanced oxidation processes, or nanofiltration. These additional stages are designed to intercept and remove specific toxins before they enter the bioreactor, thereby protecting the biological treatment process and ensuring that effluent quality remains consistently high–and ideal for recycling and reuse.

Operational Variability

In food and beverage manufacturing, production rates and wastewater attributes can change markedly from one

cycle to the next. MBR systems are designed with modularity at their core, allowing treatment capacities to be scaled up or down easily.

By simply adjusting the number of membrane modules, facilities can respond flexibly to production demands, ensuring efficient operation across varying production cycles. This capability prevents the system from becoming overtaxed during peak periods and underutilized during downtimes.

MBR systems are outfitted with sophisticated automated controls that fine-tune operational parameters in response to real-time changes in the wastewater's flow rates and organic content. These smart systems adjust aeration and filtration rates dynamically, enhancing microbial processing when needed or conserving energy when possible. For instance, during high production periods, increasing aeration can help microorganisms more effectively break down a surge in organic materials, while reducing aeration during low production periods lowers energy consumption without compromising treatment effectiveness.

The bioreactor ensures consistent effluent quality, regardless of variations in incoming wastewater.

Extended SRTs allow a diverse and resilient microbial community that can adapt to fluctuating organic loads and compositions. This adaptability is crucial for decomposing diverse organic compounds consistently, keeping effluent quality stable even when influent characteristics vary.

Superior Effluent Quality

This is where the real value will appear on your balance sheets, so to speak. MBR systems are distinguished by their ability to produce consistently high-quality effluent, meeting regulatory standards for various reuse applications. and can translate into significant cost savings and operational efficiencies.

For example, industries that adopt MBR technology can drastically reduce their consumption of potable water by reusing treated wastewater for non-potable applications such as cooling processes, irrigation, or even process water in manufacturing. This not only diminishes the environmental footprint by conserving water resources but also offers a hedge against fluctuating water supply costs.

Furthermore, facilities located in regions with strict water usage regulations or those facing periodic water scarcity can maintain uninterrupted operations by integrating MBR systems. This sustainable approach to water management can enhance a company's reputation for environmental stewardship, potentially leading to favorable marketing opportunities and compliance with emerging corporate sustainability goals.

The key to this high-quality effluent is in the membrane filtration stage in the MBR. The membrane filtration stage retains suspended solids, bacteria, and viruses, delivering effluent that is more often clearer and safer than conventional secondary treatment.

Membranes are **available in various pore sizes,** with microfiltration and ultrafiltration ranges capable of rejecting particulates down to 0.01 microns. This high level of filtration ensures effluent clarity, essential for applications like industrial cooling, boiler feed water, or landscape irrigation.

That's what your team needs.

MBR Benefits for Food & Beverage Manufacturers

From membrane selection to pretreatment stages, this section provides a comprehensive overview of how MBR systems can be customized to deliver consistent, high-quality effluent suitable for reuse and recycling.

The wastewater generated in the food and beverage industry typically includes high levels of organic matter, fats, oils, greases (FOG), and varying pH levels due to different manufacturing processes.

Membrane filtration can accomplish a lot, given that landscape. In an MBR's bioreactor stage, microorganisms decompose the soluble BOD and COD through aerobic metabolism. The biomass concentration is maintained at high levels through an extended SRT, which fosters a rich microbial community capable of degrading organic contaminants like sugars, proteins, and starches.

Given the propensity of FOG to clog membranes and interfere with biological treatment, the aeration system needs precise optimization to prevent grease buildup.

Fine-bubble diffusers, jet aerators, or slot-injector aerators ensure consistent aeration, promoting microbial activity and preventing FOG accumulation on the membranes. A DAF unit can further enhance pretreatment by separating floating FOG before it enters the bioreactor, reducing the organic load and extending membrane life.

Regular backwashing or chemical cleaning protocols using mild acids or caustic solutions dissolve grease films and ensure consistent transmembrane pressure.

Biological nutrient removal should also be considered to remove nitrogen and phosphorus through nitrification-denitrification cycles or simultaneous nitrification-denitrification, preventing eutrophication in reused water.

Membrane Filtration Efficiency

MBR systems commonly use hollow fiber or flat sheet membranes, and both provide specific advantages based on influent characteristics and treatment goals.

Hollow fiber membranes, with a high surface area-to-volume ratio, are ideal for large-scale operations with consistent flow and load patterns.

Flat sheet membranes offer superior resistance to fouling due to their wider channels, making them suitable for highly variable influent compositions.

Maintaining TMP is vital for membrane efficiency.

Automated air scouring systems periodically release compressed air near the membrane surface, creating turbulence that minimizes biofilm buildup. Backwashing protocols reverse the flow through the membrane, dislodging particulates and restoring permeability.

Fouling Control and Maintenance

If there are any notable challenges in the implementation of MBR systems, you can find them in membrane fouling.

In MBR systems, fouling can come from high biomass concentrations and varying water quality. Biofouling is common due to the rapid growth of bacterial colonies on membrane surfaces.

To mitigate this, the bioreactor's air scouring systems deliver compressed air beneath the membrane modules. This constant air flow creates shear forces that inhibit biofilm growth and improve mixing.

In addition, organic fouling from soluble microbial products (SMPs) or extracellular polymeric substances (EPS) can reduce membrane permeability. Monitoring TMP is important in detecting early fouling symptoms. When TMP exceeds predefined thresholds, backwashing is initiated to remove organic deposits.

For stubborn fouling, chemical cleaning-in-place (CIP) cycles are performed using alkaline or acidic solutions that dissolve deposits and restore membrane permeability. A well-calibrated maintenance protocol will significantly extend membrane lifespan and reduce operational downtime.

Adaptability to Variable Loads and Waste Streams

Many industrial/manufacturing businesses will deal with variable influent compositions and fluctuating flow rates. The high SRT maintained in the bioreactor allows for the establishment of diverse microbial populations capable of processing a wide range of organic compounds and nutrient levels. This flexibility is critical in industries with highly variable wastewater streams.

Automated control systems can adjust aeration rates and recirculation flows to accommodate changes in organic load or flow rate. This ensures that the bioreactor maintains aerobic conditions for nitrification or anaerobic conditions for denitrification as required.

Membrane filtration also plays a role in adaptability, providing consistent effluent quality regardless of variations in the influent load. This stability allows the system to handle peak flows without compromising effluent clarity or contaminant removal efficiency.

By combining effective fouling control, scalability, and process adaptability, MBR technology presents a comprehensive solution for diverse pretreatment challenges, ensuring that wastewater is efficiently processed and primed for reuse or further treatment.

Reduced Footprint and Flexibility

Going back to our soft drink company example (and other examples coming up), your business may be operating in a small physical space. That's not a problem. MBR technology's compact footprint makes it suitable for space-constrained facilities, urban areas, and retrofits of existing wastewater treatment plants.

By eliminating the need for secondary clarifiers, MBR systems reduce the total land area required for treatment. High biomass concentrations within the bioreactor and precise aeration control allow the system to handle higher organic loads per unit volume compared to conventional activated sludge processes.

Membrane modules can be added or removed to scale treatment capacity based on demand. This scalability means an MBR system can be designed to accommodate future expansions without significant infrastructure modifications.

Recycling and Reuse Opportunities

Because MBRs treat wastewater to standards that often surpass regulatory requirements for non-potable applications, your company can reap compounding benefits through reuse.

This diminishes reliance on fresh water, of course, and also cuts costs associated with water procurement and waste disposal. For example, your high-quality effluent can be reused for other production-related processes, such as wine barrel washing, reducing the environmental footprint of your operations.

In manufacturing processes that involve MBR-treated water works efficiently in cooling towers where maintaining water quality is essential to avoid issues like fouling. When further treated to eliminate any remaining hardness, this water becomes suitable for use as boiler feed, helping preserve precious freshwater resources and reducing the need to treat fresh water for such high-demand applications.

The reuse benefits extend to agricultural activities, too. Treated water from MBR systems, safe for crop irrigation due to its controlled nutrient levels, supports sustainable agriculture by providing a dependable water source during dry spells. This not only helps manage the water cycle within the community but also promotes responsible water use in agriculture.

The food and beverage industry's stringent hygiene requirements make MBR technology particularly beneficial as the treated water is also suitable for cleaning and sanitizing facilities. This includes washing floors and equipment, and feeding clean-in-place systems to maintain industry-standard cleanliness.

Conclusion

Bottom line: By combining biological degradation with advanced membrane filtration, MBR systems consistently deliver high-quality effluent that meets rigorous regulatory standards and is ideal for reuse and recycling. For manufacturers in food and beverage, now is the time to invest in the future, because the future is here.

The unique demands of this industry arise from varying wastewater composition and operational requirements, but the modular design of MBR systems ensures both scalability and flexibility. Influent characteristics are optimized through the integration of buffer tanks, Dissolved Air Flotation, oil-water separators, and chemical precipitation units.

At the same time, precise aeration control, consistent monitoring of TMP, and comprehensive chemical cleaning protocols help maintain membrane integrity and extend the system's operational lifespan.

Additionally, the modular design allows for easy expansion to meet changing capacity needs.

With continued advances in membrane materials, aeration systems, and monitoring, MBR technology is poised to handle fluctuating loads and increasingly stringent regulatory demands.

By turning wastewater liabilities into valuable resources, MBR systems provide a strategic pathway toward sustainable water management practices aligned with both economic and environmental goals. Every business can benefit from this cutting-edge technology, fostering a circular economy and contributing to a healthier planet.

IWS

INTEGRATED WATER SERVICES

IWS Website

www.integratedwaterservices.com

info@integratedwaterservices.com

(833) 758-3338