Reverse Osmosis Pretreatment

White Paper

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WHAT IS THE PROBLEM?

As reverse osmosis (RO) membranes approach the minimum energy required for separation, the importance of reducing maintenance costs increases. RO membrane replacement accounts for approximately 13% of plant costs and can be closely tied to improper pre-treatment. RO pre-treatment is often poorly implemented as it can be easily undervalued, and its complexity underestimated. RO pre-treatment manages the various contaminants that can compromise the RO membrane and product water quality. Its complexity comes from the number of different contaminants and how much they can vary from source to source. Often, several pre-treatments are required and need to be custom tailored to the feedwater.

WHAT IS THE SOLUTION?

Due to the complexity of pre-treatment, only some pre-treatments will be discussed here. Other common pre-treatments are briefly mentioned at the beginning of the next page. Dissolved air filtration (DAF) bubbles air through the water to separate hydrophobic suspended particles and oils. DAF has a reduced plant footprint and an increased ability to remove algae when compared to sedimentation. However, the process is not as effective when there are rapid changes in feed water quality, such as periods of heavy rainfall as the air to solids ratio is critical to its operation.

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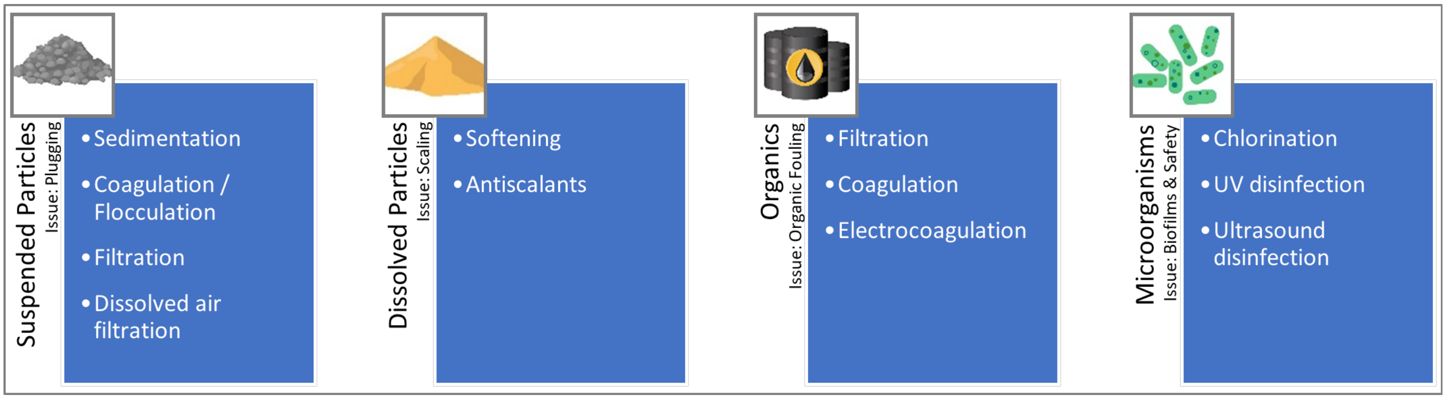
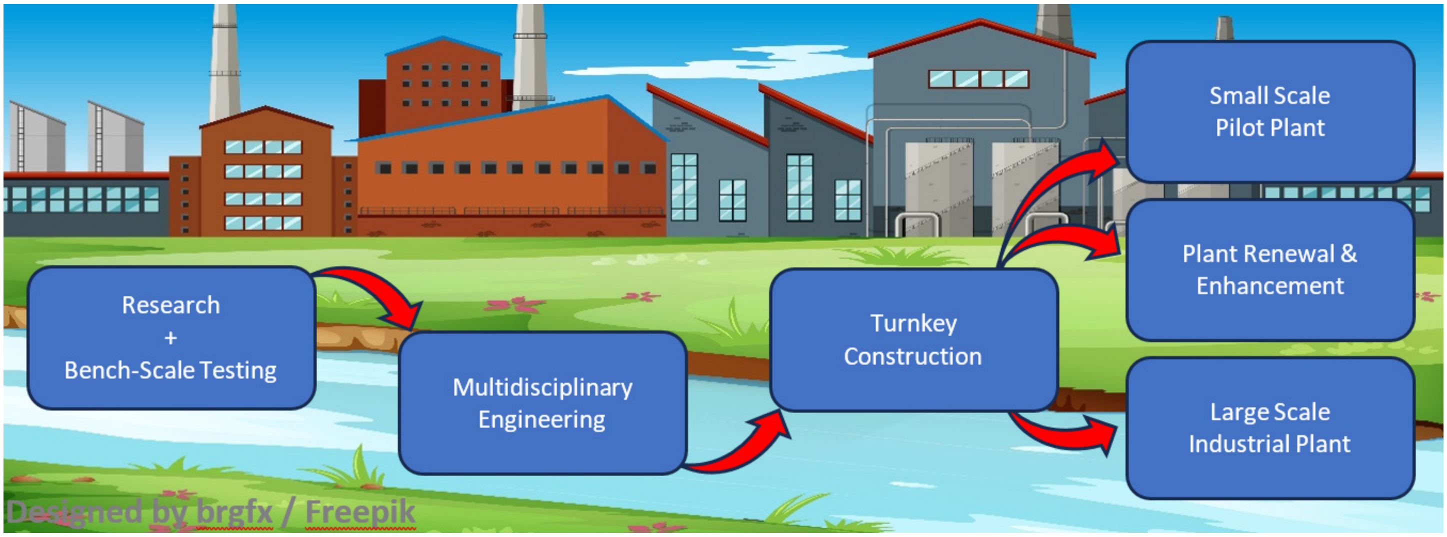
Chlorination is one of the most prevalent methods for managing the level of microorganisms which can cause health risks and biofilms. A chlorine compound such as hypochlorite is added to oxidize and kill the microorganisms. Any unreacted chlorine then remains in the system and continues to supress microorganism growth. However, this unreacted chlorine can harm the RO membrane and must be removed before RO. Additionally, as this is a chemical process, large changes in feed water quality can hamper its effectiveness.



More advanced membrane technologies have risen in popularity which serve as an alternative to conventional pretreatments. Membrane filtration falls into three categories and like conventional pretreatment the configuration needs to be tailored to the feedwater. Microfiltration effectively handles solids and bacteria greater than 0.1 µm but can clog if exposed to fine silts smaller than the pore size. Ultrafiltration is the most common pretreatment for desalination plants and rejects viruses, suspended organics, silt, and bacteria. Lastly, nanofiltration can be implemented to reduce the dissolved mineral salts. Their ability to manage several different contaminants simplifies the process and reduces the total number of units required for the plant. They provide higher operational flexibility which makes it easier to manage changes to feedwater quality. Membrane technologies increase the energy requirements and capital costs of the plant compared to conventional pretreatments but overall reduce the total costs by improving the lifecycle of the RO membrane and improving the flexibility of the plant. Additionally, with ongoing research in advanced membrane materials such as self-cleaning ceramic membranes and electrically conductive carbon nanotube and graphene membranes, the cost required to effectively pretreat RO feed water is only expected to decrease.

WHAT VALUE DOES CLEARBAKK BRING?

ClearBakk takes your complex water treatment problem and presents you with a simple custom-engineered solution optimized to your needs. Partnered with several membrane experts within the Alsys group such as CeraMem and Orelis we are uniquely positioned to provide modern membrane solutions. We have a presence in Europe, North America, China, and India and bring knowledge from the water, oil & gas, chemical, food, and animal sectors to ensure that cost of the plant is a little as possible, but as much as necessary.



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IMAGES

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