Advancing Water Treatment with SiC Membrane Technology

Current paradigm & challenges in conventional water treatment:
Gravity sand filtration has traditionally been used for water treatment due to its ease of operation and design. However, they also have a number of limitations that make them less suitable for contemporary water treatment needs. One significant drawback is the large amount of land area required for these systems, especially considering that they typically are located in or near urban areas where space is often limited. Additionally, to effectively filter water, a pre-treatment process involving extensive chlorination, coagulation/flocculation, and sedimentation with a retention time of up to 2 hours is necessary. Since a minor upset in inlet water can cause problems in outlet capacity and water quality. Furthermore, regular backwashes of approximately 10% of the filtered capacity are required, leading to the production of large volumes of sludge concentrated with chemicals that may pollute the surrounding environment.
Despite its historical reliability, gravity sand filtration falls short in meeting the current standards for drinking water quality, particularly in the removal of emerging contaminants such as PFAS and pesticides.

Figure 1 Gravity Sand filter treating river water

New advancement in water treatment:
Cembrane's Silicon Carbide (SiC) membrane modules offer a cost-effective and efficient solution for upgrading traditional sand filtration systems resulting in higher output and improved water quality at a lower cost. The unique properties of SiC, which ironically is derived from sand, enable it to act as a psychical barrier for particles, microorganisms, bacteria, and even emerging contaminants such as PFAS and pesticides. This leads to a reduction in the usage of coagulants, flocculants, and disinfectants, and a significant improvement to the filtered water quality.

A key benefit of using SiC membrane modules is the ability to easily and quickly upgrade existing sand filter basins or settling tanks. The submersible nature of the SiC modules allows for easy installation, utilizing existing basins hence increasing capacity without the need for extensive modifications and civil works. Operation can even be in **gravity mode**, without the use of pumps to drive filtration, continuing the simple operation of the Sand filters. This leads to a cost-effective and efficient upgrade that can provide a substantial enhancement in capacity, efficiency, and water quality all within the same footprint.

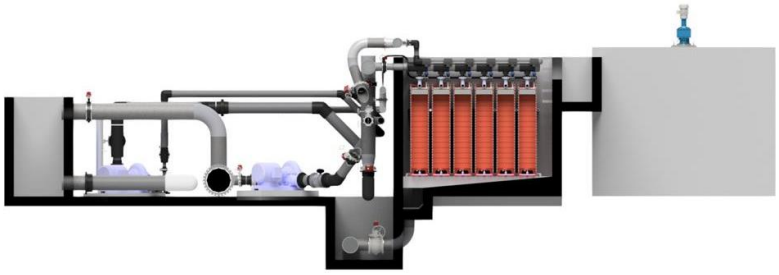

Figure 2 Side view of Rehabilitation of Sand filter basin with SiCBlox FX modules

Below table presents an overview of the key differences between Cembrane's SiC membrane modules and traditional sand filtration.

Parameter	Unit	Cembrane	Gravity Sandfilter
Footprint	%	30	100
Influent TSS limit	mg/l	10.000	20
Bacteria removal	%	100	20-90
Turbidity	NTU	0,02-0,1	0,2-1
Coagulant	mg/l	1-8	20-50
Reject water	%	0,5-5	10-30

Figure 3 Technical overview SiC vs. Sand filtration

Previous experiences:

Cembrane has a proven track record of successfully upgrading sand filters with SiC membrane technology. We have completed projects globally, in Europe, the Middle East, Africa and Asia. Our technology has been implemented in a wide range of water treatment applications, including drinking water treatment & municipal- & industrial wastewater treatment.

One of the more notable projects was the upgrade of a municipal drinking water treatment plant in Sweden in 2017. The plant was experiencing difficulties meeting Manganese removal target and was in need of expansion to meet the growing demand for clean drinking water in the area. By replacing the plant's sand filters, we were able to remove Manganese to well below quality requirements, and increase the plant's capacity by more than 3x within the same building.

Figure 4 Manganese & Iron blocked by the SiC flat sheet membrane

Another project we completed was the upgrade of a brackish water treatment plant in Middle East. The plant was not able to meet the feed water requirements of the Reverse Osmosis unit exceeding an SDI of 5. Our SiC membrane technology was able to effectively remove these contaminants, providing the RO with an SDI below 1, enabling the plant to achieve design flow rate. The SiC membranes were installed directly into the settling tank, allowing the end-user to free up space by taking sand filters out of use and meeting design parameters.

Figure 5 Submerged SiC membranes into existing settling tank

We are currently in the process of upgrading several sand filter systems all around the world, and we are always keen to take on new projects. If you would like to learn more about the specific details of these projects or discuss the potential benefits of SiC membrane technology for your water treatment project, please reach out to our sales team at sales@cembrane.com