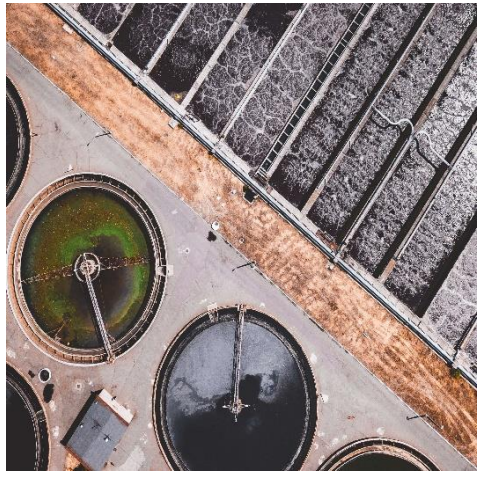
Abstract for Modern Water Treatment Facilities



The following abstract considers the main aspects of water treatment with a focus on reverse osmosis membrane elements production and modern sludge treatment facilities

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INTRODUCTION

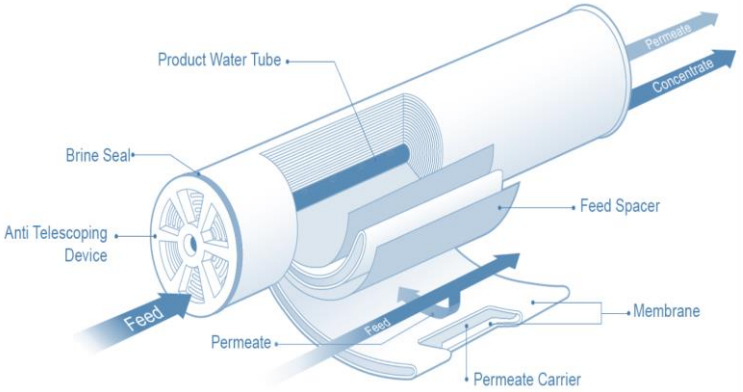
Water treatment is the process of removing contaminants and impurities from water in order to make it safe for consumption, industrial use, and other purposes. With increasing concerns about pollution, environmental degradation, and water scarcity, water treatment has become an essential part of modern society. Two key processes in wastewater treatment are reverse osmosis and sludge treatment.

Reverse osmosis is a water purification process that uses a semi-permeable membrane to remove contaminants from water. The process involves applying pressure to the contaminated water, forcing it through the membrane, and producing clean water on the other side. Reverse osmosis is commonly used in industrial wastewater treatment, as well as in the treatment of brackish and seawater. Sludge treatment is the process of treating the solids that are removed from wastewater during the treatment process. These solids, also known as sludge, can contain a high concentration of organic and inorganic materials, pathogens, and other contaminants. Sludge treatment typically involves several processes, one of these processes is a thermal treatment. This thermal treatment sterilizes sludge and releases small biomolecules, increasing biogas production in anaerobic digestion. This process generates high amounts of biogas for electricity and produces a fertilizer for agriculture also known as biosolids, class A.

REVERSE OSMOSIS MEMBRANE ELEMENTS PRODUCTION PROCESS

The production process for the reverse osmosis membrane elements is composed of five main steps. The first step in the RO process is the tricot welding, in which the tricot is unwound from the raw material roll and is cut to the desired length, the sides are welded, and the single sheets are stacked to be put into a folded membrane. The second step is cutting and folding of the membrane flat sheet and the feed channel spacer. Subsequently the third step is rolling of the elements. The prefabricated sheets from the previous steps are loaded into the machine. The main tricot is attached to the perforated central core tube by taping and the tube is fixed in position using clamp pins.

The sub tricots welded to the main tricot are tilted back in a position, ready to be loaded with the membrane leaves, and are moved into the pre-align area. The membrane leaves are glued to the tricot sheets and the process is repeated until the desired number of membrane leaves is reached. The products that have completed the leaf loading and gluing are moved to the rolling position, wound around the central core tube, are fixed with tape and the winding diameter is controlled as a first quality control of the product. The fourth step is trimming, the surplus material is trimmed to the desired length. The end caps are attached to the cut ends of the membrane after a leak test. Finally, the membrane elements are wrapped and rolled in fiberglass coated with FRP resin solution. The elements are then welded in plastic in the packaging station.



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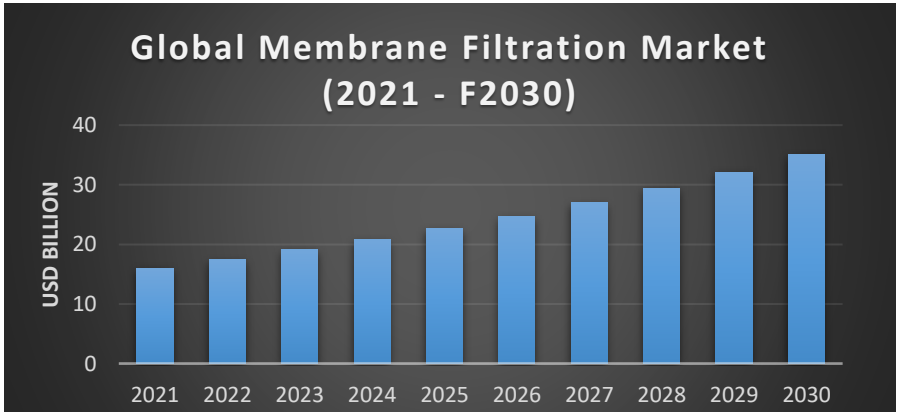
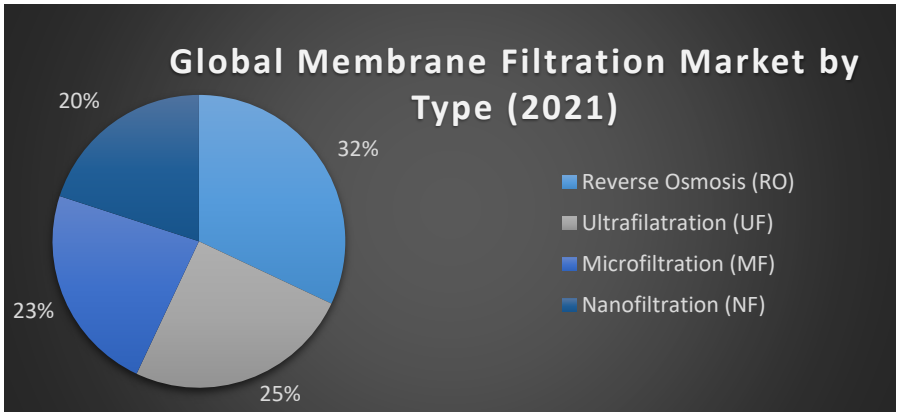
MEMBRANE FILTRATION MARKET

Global (RO) filtration membrane market is anticipated to grow in the forecast period up until 2030. Due to the rising population worldwide and the scaricity of drinkable water, the reverse osmosis membrane market will rise worldwide. The increasing global demand for water will further increase the global Membrane Filtration Market size as a whole. The global membrane filtration market size was valued at 16 billion in 2021 and it is expected to reach USD 35 billion by 2030 and growing at a compound annual growth rate (CAGR) of 9.09% during the forecast period 2022 to 2030. The global membrane filtration market does not only consist of RO membrane, but also ultrafiltration membranes as well as microfiltration and nanofiltration in differing market sizes. The reverse osmosis segment accounted the largest market share with 32% in 2021.





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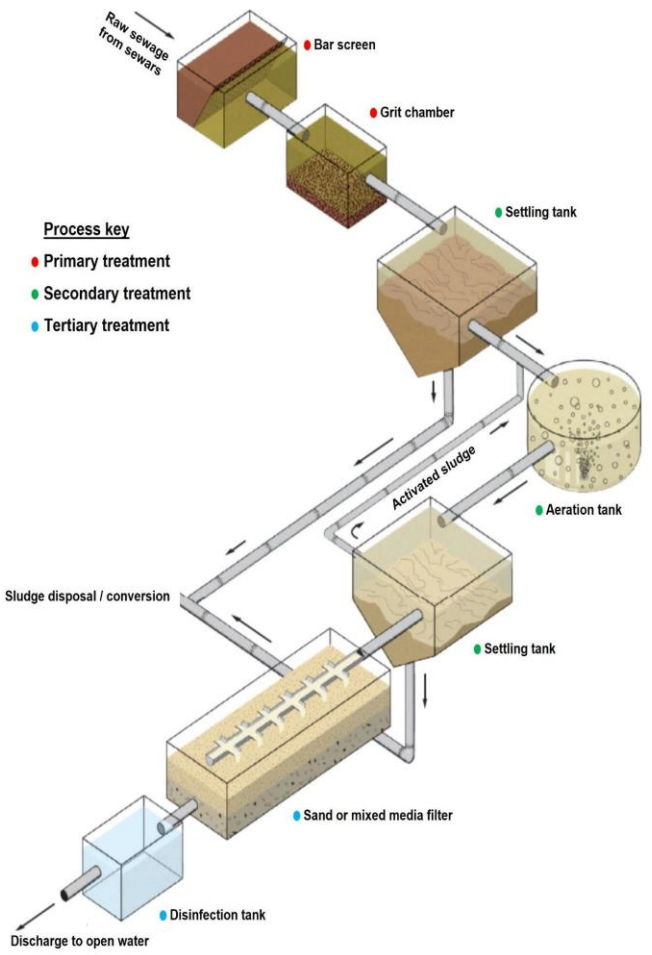
MODERN ENVIRONMENTLY FRIENDLY SLUDGE TREATMENT PROCESS

One important step in the sewage sludge treatment process is the thermal treatment. The thermal treatment exposes sewage sludge or other types of wet organic waste to high temperature and pressure, a process that is similar to preparing meals using steam. From the wastewater treatment plant's treatment units, raw sewage sludge is collected and dewatered to 16 – 18 % dry solids. This thickened sludge is continuously fed into the pulper which homogenizes and pre-heats the sludge to a temperature close to 100°C, using steam recovered from the flash tank. From the pulper, the warm sludge is fed continuously to the reactors. Once a reactor fills up, sludge flows to the next available one. When the reactor is full and sealed, steam is pumped to raise the temperature and pressure.

The now sterilized and hydrolyzed sludge is passed to the flash tank. The sudden pressure-drop leads to substantial cell destruction for the organic matter in the sewage sludge. Leaving the flash tank, the sludge is cooled to the typical temperature for anaerobic digestion, in heat exchangers. Then it is fed to the anaerobic digesters.

The process minimizes the size of new digestion plants and maximizes the use of existing facilities. Treating the sewage sludge with thermal heat results in a strong increased biogas production which can be converted into electricity and also results in ready-to-use fertilizer for the agriculture and home gardening sector.



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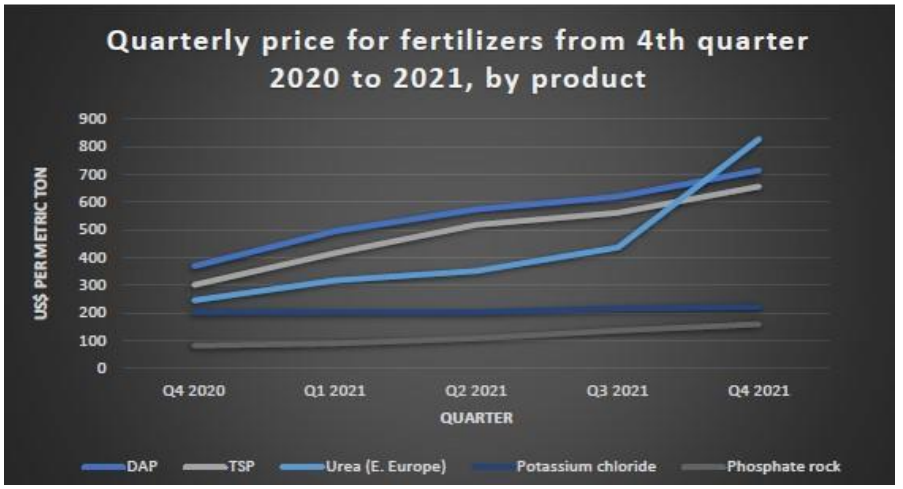
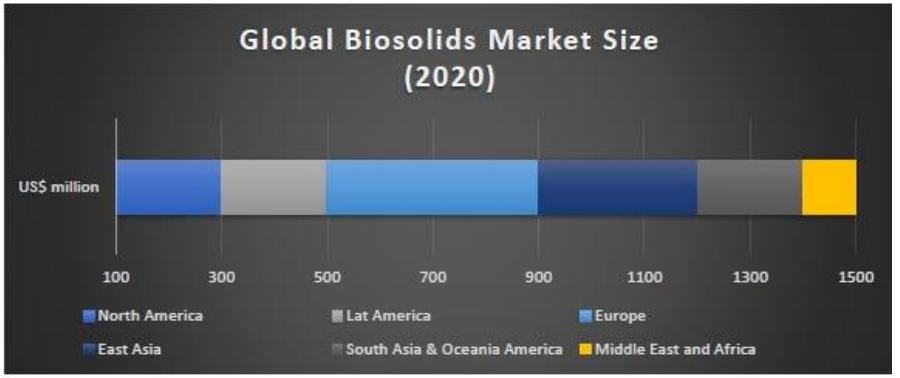
BIOSOLIDS FERTILIZER MARKET

Sewage sludge is a valued byproduct of post urbanization and industrialization. Biosolids are the useful product of sewage sludge treatment used for safe land application as fertilizers and soil conditioners. Biosolids can be categorized after thermal hydrolysis process into two classes: Class A and Class B. Class A biosolids are suitable to use as bio-fertilizers. Both Class A and Class B biosolids are strictly regulated by the EPA. We can see the current data of the quarterly prizes of the most popular classes of fertilizers from the end of 2020 until the end of 2021, globally. In the past five years, the market for biosolids has been driven by the agriculture industry. While historically the demand has grown at a lower rate, recent years have seen growth from other industries such as power generation and construction. This is expected to continue, leading to higher growth during the forecast period of 2021-2031.





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