
A REPORT ON

**RECYCLING OF INDUSTRIAL EFFLUENT FROM
BEVERAGE INDUSTRY THROUGH ULTRA
FILTRATION AND REVERSE OSMOSIS**

SUBMITTED TO

**AQUA ENGINEERS AND CONSULTANTS INDIA PVT.LTD
SEWAGE TREATMENT PLANT, VANAGARAM, CHENNAI.**



SUBMITTED BY

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Aqua Engineers and Consultants India Pvt Ltd
(An ISO 9001 : 2015 Certified Company)
Innovative Technologies For Sustainable Solutions...

09-02-2022

CERTIFICATE

This is to certify that **Mr.V.V.ABHINAV KOUSHIK (39030001)**, a student of B.Sc., Chemistry, Department of Chemistry, Sathyabhama Institute of Science and Technology, Chennai has carried out his work entitled **“Recycling of Industrial Effluent from Beverage Industry through Ultra filtration & Reverse Osmosis”** as a part of summer internship Project for the Degree of **B.Sc. Chemistry**. The work was done at **Aqua Engineers and Consultants India Private Ltd** under my supervision from **24th January 2022 to 4th February 2022**.

For Aqua Engineers and Consultants India Pvt Ltd

K.JAYARAM

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I want to thank my advisers and everyone at the company for their patience and assistance during my on-site training. Thanks to their guidance, I was able to develop my industrial skills and learn about plastic moulding techniques. These skills will help me to expand my resume and advance my career.

ABOUT COMPANY

Aqua Engineers and Consultants India Pvt Ltd (AECIPL), an Engineering Procurement & Construction (EPC) company catering to water, wastewater treatment & Air Pollution control, headquartered in Chennai, India. Aqua Engineers are committed to the environment, keeps its product innovations in the forefront for water& waste water treatment and recycling technologies.



ULTRA FILTRATION

Ultrafiltration (UF) is a variety of membrane filtration in which forces like pressure or concentration gradients lead to a separation through a semipermeable membrane. Suspended solids and solutes of high molecular weight are retained in the so-called retentate, while water and low molecular weight solutes pass through the membrane in the permeate.

Applications of ultrafiltration

UF can be used for removal of particulates and macromolecules from raw water, to produce potable water. It has been used to either replace existing secondary (coagulation, flocculation, sedimentation) and tertiary filtration (sand filtration and chlorination) systems employed in water-treatment plants or as standalone systems in isolated regions with growing populations. When treating water with high suspended solids, UF is often integrated into the process, using primary (screening, flotation and filtration) and some secondary treatments as pre-treatment stages. Ultrafiltration processes are preferred over traditional treatment methods for the following reasons:

1. No chemicals required (aside from cleaning)
2. Constant product quality regardless of feed quality
3. Compact plant size
4. Capable of exceeding regulatory standards of water quality, achieving 90-100% pathogen removal.

When water recycling is simple, it often needs very little processing. However, when more intensive processing is required, the industry standard procedures include using UF, which is meant to remove physical solids from water by passing it through a semi-permeable membrane. Using ultrafiltration, solids are primarily captured by the filter and discarded.

Recycled water can also be used for a number of industrial purposes, including boiler or cooling tower feed water supplementation, pH adjustment, washing equipment, hardstands and vehicles, fire protection, process rinse water or processing water for production lines in manufacturing industries, toilet flushing, dust control, construction activities, and concrete mixing.

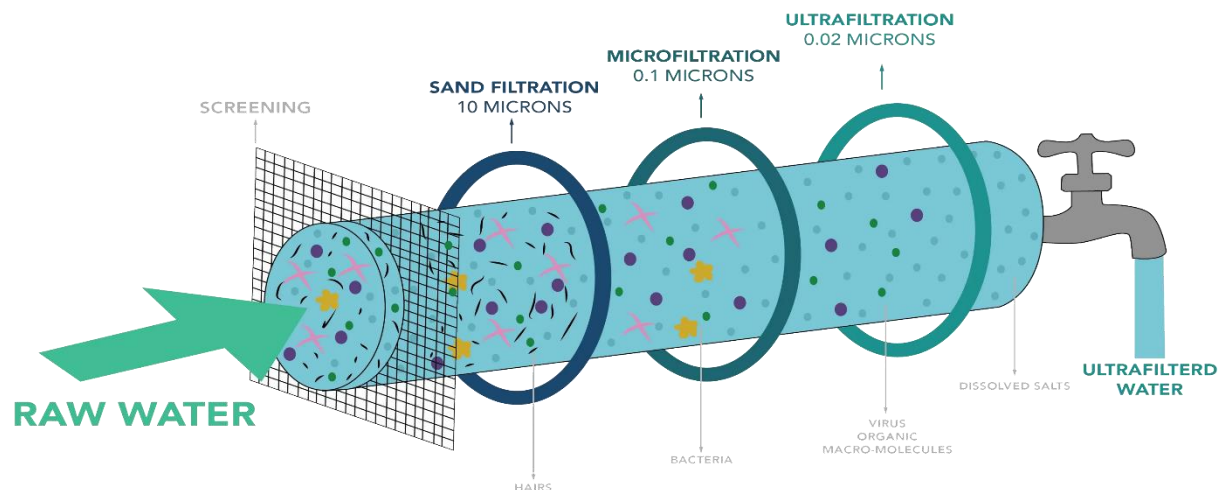
Industries using ultrafiltration

Industries that consume large volumes of water or discharge highly toxic effluent are candidates to employ ultrafiltration for water reuse.

These include the chemicals, steel, plastics & resins, paper & pulp, pharmaceutical and the food & beverage industries, including soft drinks & canned foods, as well as power, water & wastewater treatment plants and others.

Ultrafiltration is used to recycle flow or add value to later products and more. In many cases ultrafiltration (UF) is used for prefiltration in reverse-osmosis plants to protect the reverse-osmosis process. Ultrafiltration is an effective means of reducing the silt density index of water and removing particulates that can foul reverse osmosis membranes.

Ultrafiltration is frequently used to pretreat surface water, seawater and biologically treated municipal water upstream of the reverse osmosis unit.



REVERSE OSMOSIS

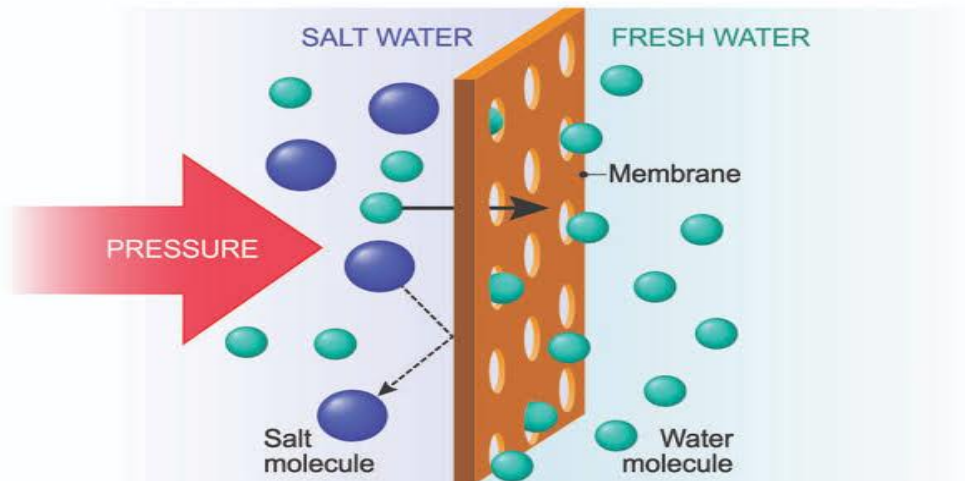
Reverse osmosis (RO) is a water purification process that uses a partially permeable membrane to separate ions, unwanted molecules and larger particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property that is driven by chemical potential differences of the solvent, a thermodynamic parameter. Reverse osmosis can remove many types of dissolved and suspended chemical species as well as biological ones (principally bacteria) from water, and is used in both industrial processes and the production of potable water. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be "selective", this membrane should not allow large molecules or ions through the pores (holes), but should allow smaller components of the solution (such as solvent molecules, e.g., water, H₂O) to pass freely. [1]

In the normal osmosis process, the solvent naturally moves from an area of low solute concentration (high water potential), through a membrane, to an area of high solute concentration (low water potential). The driving force for the movement of the solvent is the reduction in the Gibbs free energy of the system when the difference in solvent concentration on either side of a membrane is reduced, generating osmotic pressure due to the solvent moving into the more concentrated solution. Applying an external pressure to reverse the natural flow of pure solvent, thus, is reverse osmosis. The process is similar to other membrane technology applications.

Reverse osmosis differs from filtration in that the mechanism of fluid flow is by osmosis across a membrane. The predominant removal mechanism in membrane filtration is straining, or size exclusion, where the pores are 0.01 micrometers or larger, so the process can theoretically achieve perfect efficiency regardless of parameters such as the solution's pressure and concentration. Reverse osmosis instead involves solvent diffusion across a membrane that is either nonporous or uses nanofiltration with pores 0.001 micrometers in size. The predominant removal mechanism is from differences in solubility or diffusivity, and the process is dependent on pressure, solute concentration, and other conditions. [2]

Reverse osmosis is most commonly known for its use in drinking water purification from seawater, removing the salt and other effluent materials from the water molecules. [3]

REVERSE OSMOSIS



CONCLUSION

Ultrafiltration, when coupled with an appropriate chemical pretreatment can provide a cost-effective, high-performance method for pretreatment of industrial wastewater RO systems. Compared to conventional wastewater treatment operations, UF systems have smaller footprints and lower operating costs. In addition, high quality and consistent filtrate produced by modern UF systems leads to improved overall performance of the RO system. As has been proven true in the field, a well-protected RO membrane can be operated effectively for several years before replacement is required.

Against the backdrop of today's global water supply issues, companies across all industry segments are realize that it makes good business sense to become more self-sufficient through the recycling of the water resources they use to support their production processes. Whatever the industry or the specific requirement, Process and Water is ready to help customers meet their production water challenges with UF-RO systems that are among the most innovative in the industry.

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