

## **Ftir Analysis Of Membrane Used In Treating Different Ground Water Sample**

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### **Abstract**

*Water is most precious substance in the world and providing a clean and safe drinking water is important for human health. Water are easily get polluted directly from industrial and domestic pollutants. Membrane technology has become a noble separation technology over the past years in water treatment process. Membrane technology works with low energy use and easy process conditions. This work is focussed on treating the ground water from different part of Chennai by the RO –UV-UF System. The membrane plays keys role in the disbursement of the water treatment process. Our main objective to explore the knowledge about the fall off RO membrane performance and find the better solution from fouling. FTIR analysis gives the complete detail report about the organic matters present on the RO Membrane and identify the functional group. The report suggest that presence of aliphatic and aromatic compounds present in the fouled membrane.*

**Keywords:** *Membrane Technology, Reverse Osmosis, Fourier Transform Infrared Spectroscopy, aliphatic and aromatic compound.*

### **1. Introduction**

Water is the biggest gift of nature provide to human. Today scenario is totally different, COVID 19 yet another issue in today situation brings an alarming about the health and hygiene. To prevent COVID 19 Wash our hand with clean water, providing the water and that water should be pure to prevent all disease. The survey report says that by 2050 going to be greater shortage of fresh water and one in four people going to have an impact on this water scarcity. Water borne diseases are easily spreadable to community and affect the human health. Water is being treated in various methods like sedimentation, filtration, etc and quality of water is being improved. On other hand surface water needs more treatment rather than the ground water because it can easily be polluted. Reverse osmosis is a straining procedure which helps in removing the salts from the seawater as well the brackish water. It was discovered in the year 1950. It is done for filtration of water. Reverse osmosis helps in improving the quality and safety of water for domestic as well as for industrial use. It is widely used to desalinate the sea water. Reverse osmosis helps in removing many types of suspended and dissolved species from water. Membranes are the most important part in the water treatment process and it became the necessary role in desalination process. Membrane generally acts as barrier shield and prevents the undesirable substances and passes only the desirable one. Membrane are effective in removing suspended solids from water and helps in water treatment process. Membrane are mainly made up of thin polyamide material. In recent research nano materials are being used for preparation of membrane. The pore size of membrane varies from 0.1 to 5000 nm depending on the filter type. Thus depending on the pore size filtration process can be classified as reverse osmosis, ultra filtration, nano filtration, microfiltration. All membranes lose their performance with time. One of the major causes for the loss of performance with time. One of the major causes for the loss of performance is due to substances that deposit on the membrane surface. The performance of the membrane

depends on the deposition of substances on the surface. As time varies performance of the membrane get lose their stability. Deterotartion in stability will make membrane to fail in their performance. Fouling on membrane is caused by the precipitation and deposition of molecules. Fouling is biggest hindrance to the membrane technology .Once the fouling is getting affected in membrane the quality of water decrease and flux increase. Thus to overcome this issue intense chemical cleaning is required to get free from fouling. If there is more fouling present there will be in case where the replacement of membrane can be done. This will lead to increase in operating cost . Fouling can be classified on two types based on how stable the particles are attached to the membrane surface and strength of the membrane. Reversible fouling can be removed by physical cleaning methods and continuous backwashing. Once the strong attachment of particle are formed and fixed in the membrane which could not be removed by the physical methods i.e said to be irreversible fouling. Fouling can be measured when there is sudden decrease in membrane rejection and the permeate quality get decline. This will indicate the fouling nature in the membrane mostly seen in membrane distillation process. Fouling can be controlled by chemical method their by foul ants and other impurities are being removed. Selecting the appropriate membrane for the specific operation there by the fouling can be minimized .The detail study of feed water and compatibility of membrane is to be analyzed first before usage of the membrane. If it is common aqueous filtration process then hydrophilic membrane is recommended and if the process is membrane distillation then hydrophobic membrane is best to prevent from fouling. Fouling can be detected by FTIR analysis and their functional groups are being detected\.

## **2. MATERIALS AND METHODS.**

### **FTIR ON MEMBRANE**

Fourier Transform Infrared (FTIR) spectroscopy is a widespread, relatively cheap technique for studying the structure of compounds through chemical bond vibrations. this technique uses un polarized radiation that is most often emitted using an interferometer. Since each chemical bond vibrates at a specific frequency absorption occurs when radiation at the same frequency is encountered. An interferometer is often the source of radiation due to its ability to scan through radiation frequencies continuously. The output of the instrument is an interferogram which is Fourier transformed into an output of percent transmittance versus wave number ( $\text{cm}^{-1}$ ). Most IR spectrometers emit wave numbers in the range of  $400\text{cm}^{-1}$  to  $4000\text{cm}^{-1}$ . FTIR instrument are used to identify the unknown compound by frequency of light. Basically the spectrometer comprise of a source, beam splitter, mirror and detector. FTIR can be analyzed by absorption, emission, reflection. FTIR is an effective instrument for finding the functional groups present in the unknown compounds. The transmitted light reaches the detector thereby the detector response yields an interferogram.

### **EXPERIMENTAL METHOD**

The Experiment were conducted in RO-UV-UF System involves following stages. The water source from the North, South, East and West part of Chennai were collected and Classified based on TDS of water sample .The first stage has the water sample passing through a sediment filter, it removes all the particulate matter and suspended solids.[5] Then sample water is passed through the activated carbon filter which removes chlorine and organic compounds and alsorids the water of bad odor. Then this half treated sample is sent to main chamber which involves RO purification that passes the water through a semi permeable filter at a pressure of 30-40 psi. While it is done, the suspended impurities including lead, pesticides, sulfates, and nitrates. Then treated water samples end to UF membrane chamber where the removal of macromolecules of the given treated water sample with a very small pore size of 0.01 micron. The final chamber stage puts the water to UV filtration using a UV lamp pf 11 watt. It removes all microorganisms making the

water safer and free of germs. The ultraviolet rays, absolutely lethal for bacteria and viruses, attack them so that they can't reproduce. Without the addition of any chemicals, 99.99% of all microorganisms are killed. Finally the treated water is collected in pure water tank .[6]

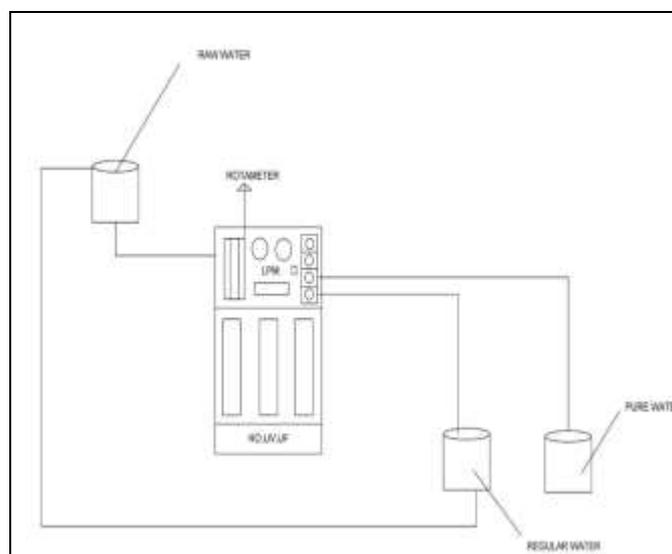


Figure 1: Experimental model (RO-UV-UF SET UP)

After the water treatment process is completed the membrane is removed from the experimental set up. The same experimental procedure is being run for four different water sample with two different temperature (30 °C and 35 °C). The membrane is tested once all the feed water had done the enough operation with various parameter. Fourier Transform Infrared spectroscopy (FTIR) on the fouled membranes were taken to identify the organic matter present on the membrane surface.

### 3. RESULTS & DISCUSSIONS

#### Fourier Transform Infrared Spectroscopy (FTIR) Analyses

FTIR analysis is being done for the used RO membrane. The FTIR absorption peaks are shown in fig 2 and the peaks shows the functional group present in the membrane. There is high peak in between 3100 and 3000  $\text{cm}^{-1}$  , and similarly between 840 and 800  $\text{cm}^{-1}$  this confirms the presence of aromatic hydrocarbon . The peaks also indicate the presence of aliphatic alcohols the fig 2 indicates the peaks between 3600 and 3200 $\text{cm}^{-1}$  and between 1150 and 1100 $\text{cm}^{-1}$ . The FTIR report also indicate the presence of inorganic carbonate and the small amount of olefins present in the fouled membrane. Thus those deposition also indicated in the FTIR analysis between 2990 and 2850  $\text{cm}^{-1}$  and between 1460 and 1350  $\text{cm}^{-1}$

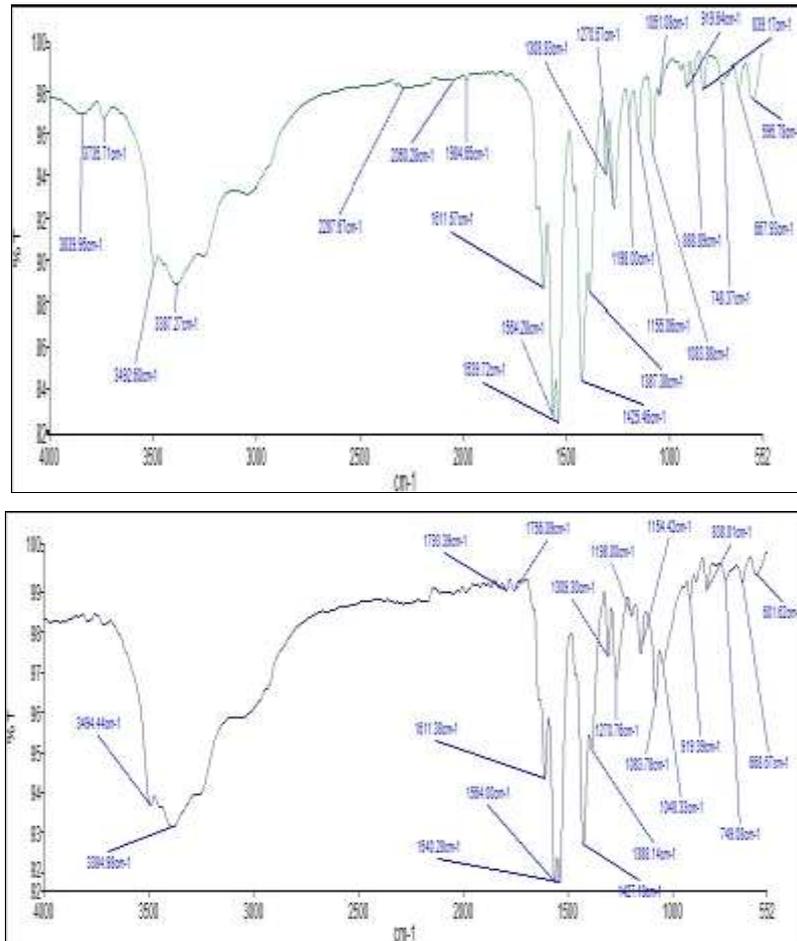


Figure 2. FTIR spectra for the RO membranes fouled by the feed water

Thus the presence of aliphatic and aromatic functional group in the fouled membrane is confirmed. Thus due to it the permeate quality got decreased and it can be rectified by proper chemical cleaning method

#### 4. CONCLUSION

The various ground water is tested using the RO-UV-UF experimental set up with two different temperature and the permeate level found to be the same. FTIR analysis is done for the fouled membrane thus the fouling characterizes that presence of aliphatic and aromatic compounds. Thus it can be treated with chemical methods. Further to control the fouling the slit density index method that will predict the fouling and hence the membrane can be prevented from the fouling. Fouling and scaling are the part of the membrane the proper maintenance is only solution for the prevention.

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