ISSN 2395-1621

Structural Analysis of Pre RO Carbon Filter

#1Sumit A.Mali,#2Mahendra U.Gaikwad, #3Jagdish L.Shinde

#1xyzsumiet@gmail.com

#123Mechanical Engg. Department, Savitribai Phule Pune University
Dattakala Group of Institutions Faculty of Engineering (ME), Swami Chincholi,India

ABSTRACT

The container used in Water Purification system previously is of material Polypropylene, in this work the same is replaced by Acrylonitrile Butadiene Styrene (ABS) so as to withstand higher water pressure & then analyzed to for safe design.Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from contaminated water. The goal is to produce water fit for a specific purpose. Most water is disinfected for human consumption (Drinking water)Water purifiers are mostly employed for the same. container is the essential part of the water purification system.it needs to design carefully to withstand certain amount of pressure created by water entering in the container. Firstly the material selected is Acrylonitrile butadiene styrene (ABS).3D modeling by using Pro-e or Unigraphics & structural Analysis by using Ansys Pro are the further steps involved in this work.so, ultimately we can have the design parameters for the safe designing of the container

ARTICLE INFO

Article History

Received :18th November 2015

Received in revised form :

19th November 2015

Accepted : 21st November , 2015

Published online :

22nd November 2015

Keywords— Mechanical engineering,Design Engineering.

I. INTRODUCTION

Reverse osmosis (RO) is a water purification technology that uses a semi permeable membrane to remove larger particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, acolligative property, that is driven by chemical potential, a thermodynamic parameter. Reverse osmosis can remove many types of molecules and ions from solutions, including bacteria, 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 the solvent) to pass freely.

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 movement of a pure solvent is driven to reduce the free energy of the system by equalizing solute concentrations on each side of a membrane, generating osmotic pressure. 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. However, key differences are found between reverse osmosis and filtration. The predominant removal mechanism in membrane filtration is straining, or size exclusion, so the process can theoretically achieve perfect exclusion of

particles regardless of operational parameters such as influent pressure and concentration. Moreover, reverse osmosis involves a diffusive mechanism, so that separation efficiency is dependent on solute concentration, pressure, and water flux rate.[1] 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.

1) Drinking water purification

Around the world, household drinking water purification systems, including a reverse osmosis step, are commonly used for improving water for drinking and cooking.

Such systems typically include a number of steps:

- A sediment filter to trap particles, including rust and calcium carbonate
- Optionally, a second sediment filter with smaller pores
- An activated carbon filter to trap organic chemicals and chlorine, which will attack and degrade thin film composite membrane reverse osmosis membranes
- A reverse osmosis filter, which is a thin film composite membrane
- Optionally, a second carbon filter to capture those chemicals not removed by the reverse osmosis membrane
- Optionally an ultraviolet lamp for sterilizing any microbes that may escape filtering by the reverse osmosis membrane
- Latest developments in the sphere include nano materials and membranes

II. PROBLEM STATEMENT

Pre RO carbon filter or activated carbon filter which is used to remove chlorine and organic impurities like harmful pesticides. which is placed after Pre sediment filter. When water enters in the Pre RO carbon filter after passing through the Pre sediment filter. The water entering in this filter is having permissible value of 30 PSI. but, in some cases, like in multistory building the pressure of water increases 5 PSI per floor, as it is coming down from the water tank located at the top. So,the water pressure entering the pre RO carbon filter exceeds the permissible value of 30 PSI. there may be leakages are found in this filter due to the excess water pressure. which is going to affect the whole purification system

Fig 1.1 Cut sectional view of RO system

III.OBJECTIVES

I) The initial objective of the present work is to select the suitable material for pre RO carbon filter. As Polypropylene is used for the same. but, we are replacing Polypropylene with Acrylonitrile Butadiene Styrene (ABS) material.

II) The next Objective is to analyze the pre RO carbon filter of Acrylonitrile Butadiene Styrene (ABS) using ANSYS software, i.e. to calucate the yield stress values.so that we can decide, how much water pressure it can sustain as compared with the filter made of material Polypropylene.

1.4.2 Water flow Diagram

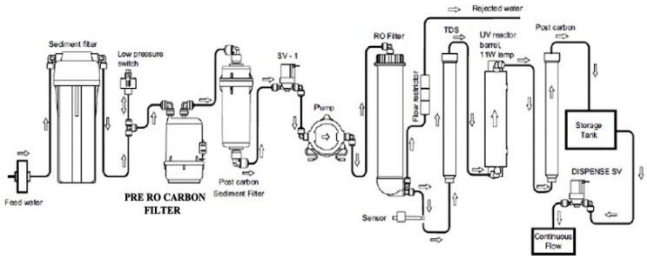

Fig.1.2 Water flow diagram

1.4.5 Properties of the Materials

Table 1.1 Properties of the Materials

Properties	Metric Value	
	Polypropylene(PP)	ABS
Density (g/cm^3)	1.03 to 1.38	0.91 to 1.23
Elongation (%)	3 to 75	2.5 to 10
Flexural Modulus (GPa)	2.1 to 7.6	1.5 to 7.0
Specific Heat (J/kg-K)	1080 to 1400	1230 to 1900
Strength To Weight Ratio (kN-m/kg)	31 to 80	40 to 81
Ultimate Tensile Strength (MPa)	33 to 110	36 to 100

IV.EXPERIMENTAL VALIDATION

In the experimental work, we can test the pre RO carbon filter on electrically operated set upn the set up contains two solenoid valves, one solenoid valve operates on pressure of 5 PSI while the other solenoid valve operates on pressure of 40 PSI.As the water enters through the inlet to the pre RO carbon filter ,the water entered is held for about 30 seconds

with the help of sensors. in this way one cycle is completed. For validation about 10000 cycles are carried out.

REFERENCES

[1] Tien Vinh Nguyen, Sanghyun Jeong, Thi Thu Nga Pham, Jaya Kandasamy Saravanamuthu Vigneswaran ,Effect of granular activated carbon filter on the subsequent flocculation in seawater treatment, Desalination 354 (2014) 9–16

[2] Seema S. Shenvi , Arun M. Isloor , A.F. Ismail ,A review on RO membrane technology Developments and challenges ,Desalination 368 (2015) 10–2

[3] Shihong Lin , Menachem Elimelech, Staged reverse osmos operation: Configurations, energy efficiency,and application potential ,Desalination 366 (2015) 9– S.M.Javaid. Zaidi , F. Fadhillah, Z. Khan, A.F. Ismail Salt and water transport in reverse osmosis thin film composit seawater desalination membranes Desalination 368 (2015) 202–213

[4] Adhiyamaan Arivazhagan, S.H. Masood , Dynamic Mechanical Properties of ABS Material Processed by Fused Deposition Modelling, Vol. 2, Issue 3, May-Jun 2012, pp.2009-2014

[5] Garud R. M., Kore S. V., Kore V. S., Kulkarni G. S. A Short Review on Process and Applications of Reverse Osmosis,Volume 1, Issue 3: 233-238

[6] Lauren F. Greenlee, Desmond F. Lawler, Benny D. Freeman, Benoit Marrot,

[7] Philippe Moulin Reverse osmosis desalination: Water sources, technology,