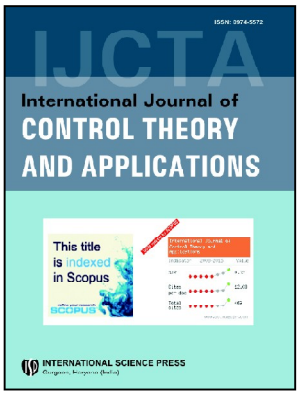

International Journal of Control Theory and Applications

ISSN : 0974-5572

Volume 10 • Number 22 • 2017

Water Purification System Using Nano Filters

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Abstract: The problem of water scarcity is growing everyday. Clean and safe drinking water getting depleted every second. World bank estimates that 21% of communicable disease in India are related to unsafe water. Current water purification methods such as Reverse Osmosis and Vaccum distillation are energy consuming and cost intensive. High pressure (800 to 1180 psi) is much needed in water purification by these methods. Membranes of Microporous filtrations have large pore size and so they rejects only certain amount of solutes. The proposed work is to prove the utility of Nano materials in water purification. There are three basic categories of water purification technologies that are used for desalination: membrane technologies, distillation processes (thermal technologies), and chemical approaches. The Ultra clean water that is safe to drink is produced from treated water which is further purified using advanced membrane technology and ultra violet disinfection.

Keywords: Nano filters, Water purification, Salinity, Graphene membrane, CNT,

1. INTRODUCTION

Nanomaterials such as Carbon Nanotubes(CNT), Zeolites and Graphene are used as membrane in purification method.The precise and small diameter size of CNT is proved to reject most of the ions due to the energy barrier existing at the entry of the channels.Thus the finding of membrane technologies has given efficient facilities to purify water even at the ionic levels[1]. Here pores allow only the water molecules to enter through the pores of the nanotubes as shown in figure 1.These nano materials allows friction less passes of water through the pores and rejects most off the salts, ions and pollutants as they have Cytotoxic property too [2].

In case of a Bucky-paper, the CNTs are arranged randomly into a non-woven paper-like structure. This Bucky structure have a highly porous with large specific surface area.Bucky-papers are typically formed by purifying the CNTs and then dispersing them in a suitable solvent[3]. These Ultra thin materials materials as shown in figure 2 canbe used along with the pressure assisted filtration method for removing natural organic matters. These Nano materials seems to be "Photo bomb"as it gives the solution to numerous environmental problems such as storing electricity,removing air pollution, advanced photovoltaics,high strength materials .Energy and the pressure required to filter salt is approximately 100 times less than normal methods [4].Sensors suchas pH sensor, salinity sensors and turbidity sensor are used to monitor the purification level in the desalinated water.

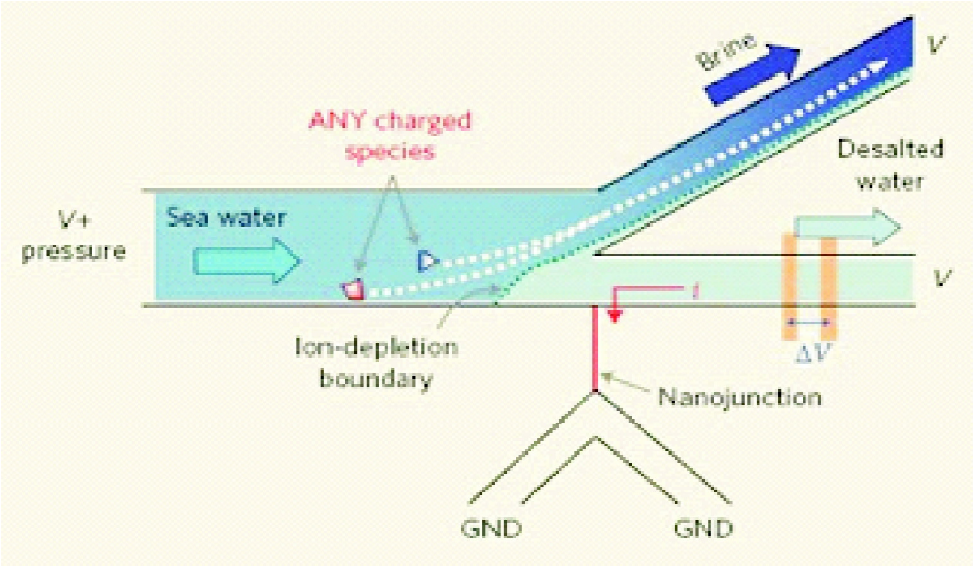

Figure 1

1. Nano Material

Nanofiltration (NF), a lower pressure membrane for high rejection of divalent ions, had been identified as a key component to reduce the costs of both pressure and fouling in the desalination process due to it's unique separation ability, NF technology has been developed for removing the scaling ions and low-molecular-weight organics as well as the NaCl from seawater [5]

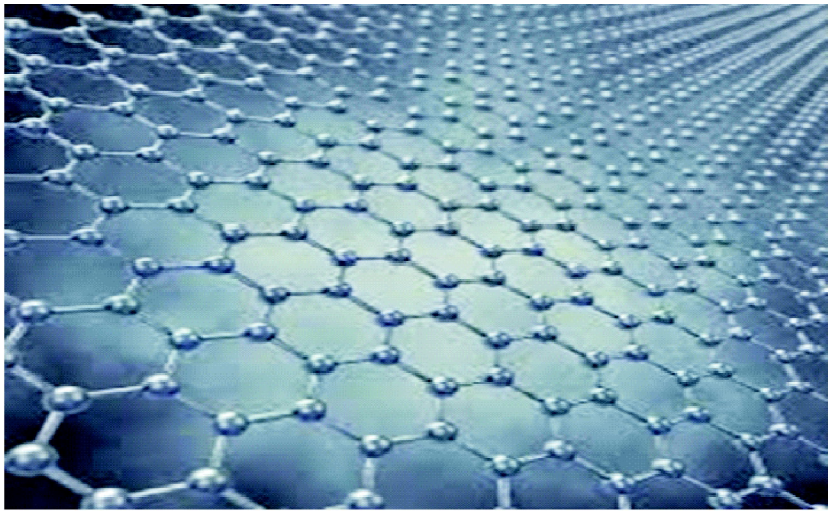

Figure 2

Graphene Oxide (GO) is graphite that was oxidized to intersperse the carbon layer with oxygen molecules and then again reduced to separate the carbon layer completely into individual or few layer graphene. Completely oxidized compound can then be dispersed in the base solution such as water and graphene oxide is then produced GO which is electrical insulator due to the disruption of its sp^2 bonding. The common method of synthesis of GO is by HUMMER'S MEHOD. This can be varied by varying the oxidizing agents used to exfoliate graphite flakes[7].

1. Block Diagram

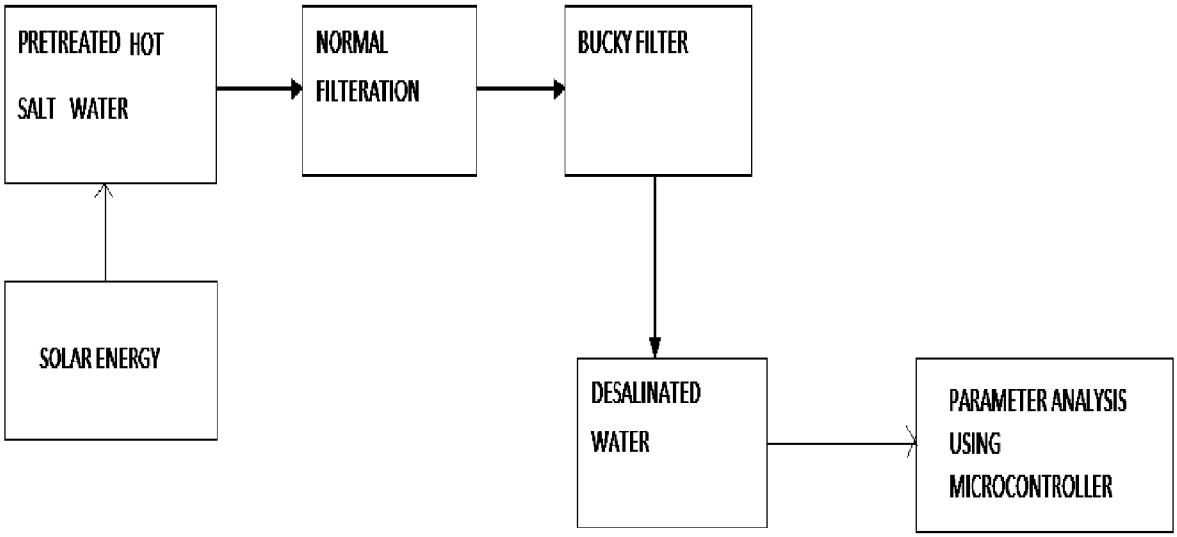

Figure 3

I. Method of Synthesis

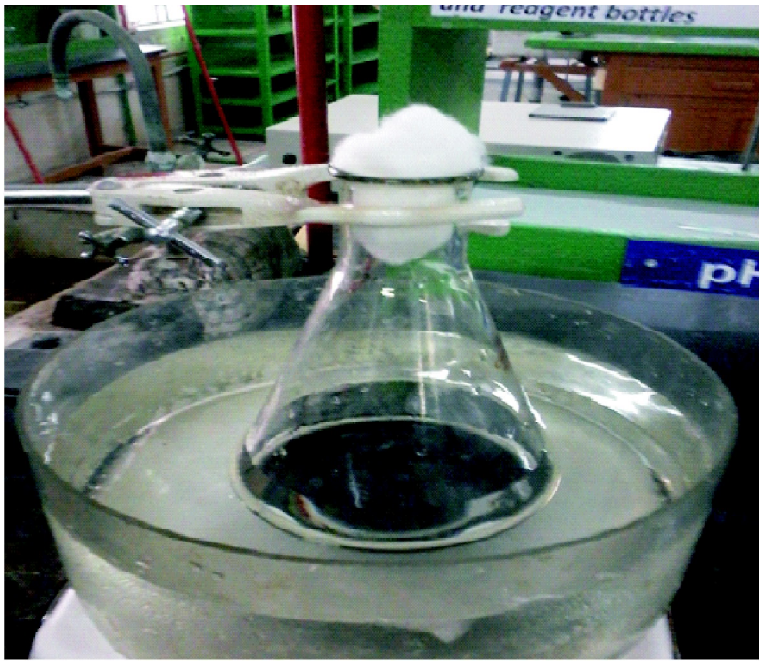

Figure 4

This involves both oxidation and exfoliation of graphite sheets due to thermal treatments of the solution. Graphite flakes (acid treated 99% , Sodium Nitrate(98%nice chemicals),Potassium Permanganate (99%RFCL), Hydrogen Peroxide(40% Emplura), Sulphuric acid (98% A(s), Hydro chloric acid (35% RANKEM Graphite flakes and Sodium Nitrate each 2 gram dissolved in 90 ml of sulphuric acid (98%) at ice bath in a 1000ml

volumentric flask. After stirring for few hours potassium permanganate (12 g) is added to the mixture at about 15 p c and 184 ml of water is added to the mixture and then stirred. Ice bath is removed and the reaction is continued in a reflux system for at about 98p c. Then the solution get changed to brown color then it is maintained at 25 p C. After this the solution is treated with 40ml of H_2O_2 to get a bright yellow solution.Then taking water in two separate beaker equal amount of prepared solution is added and then stirred. After this,solution is kept without stirring so that the particales settles at the bottom. After filtering the resulting mixture is washed and at 60p C gel substrate obtained is tried 6 hours to get a reduced GO powder.

II. PREPARATION OF FILTERATION MEMBRANE

The Polyvinylpyrrolidone (PVP)was dissolved using an acetic acid solution (1% wt) for blending the RGO.RGO / PVP was spin coated on glass for about and then dried in a vaccum oven at 50p C. Before making of the thin flim RGO was kept in Muffler till 500p C.

Figure 5

There is the space between the hollow fiber substrate and GO membrane which allows stress-free shrinkage.Defect-free GO hollow fiber membrane was determined and the membrane was found to be stable in

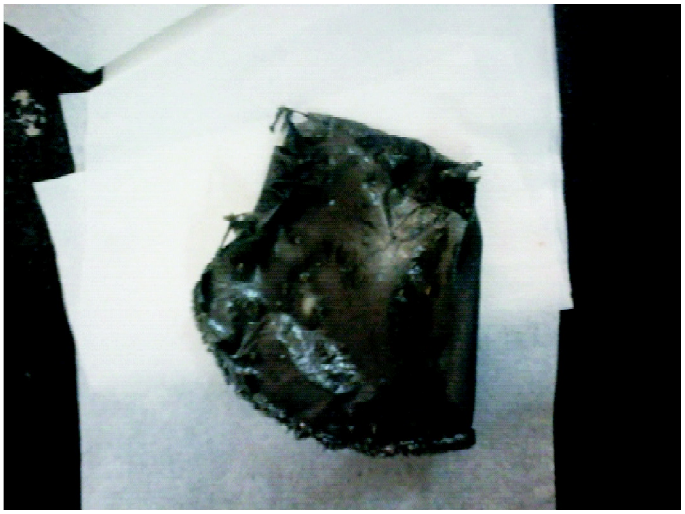

Figure 6

a long term gas-tight stability test. Posultrathin GO membranes needto be supported on a substrate for large scale applications for withstanding high pressure application across themembrane. So far either the planar polymeric or ceramic supports have been used for NF material.The structure of the membrane that has been obtained using the above methods can be viewed through the figure 7

III. CERTAIN TEST ANALYSIS DONE ON THE RGO TO FIND ITS CHARACTERISTICS

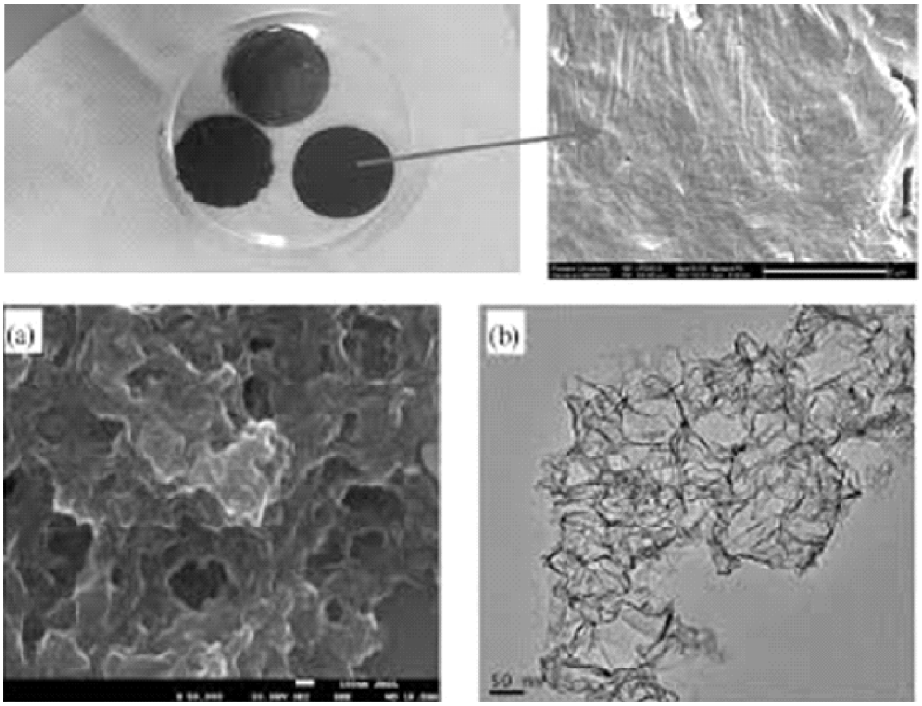

Figure 7

Scanning Electron Microscope (SEM) is that produces the images of the samples by scanning it with focused beam of electrons.From the SEM analysis the internal structure of the membrane is obtained and diameter of the nano pores were found to be about 50 nm.It was obtained from the calculation using Scherrer Equation. This membrane is fitted to the pipe of ¾ inch diameter in two stages for making it to be useful of filtration purpose. The first stage membrane is of bucky structured membrane which is of microporous structure.Which blocks the passage of some of the organic solutes and waste particles.The membrane of the second stage is the nano porous membrane which is to reject most of the salt particles from entering its pores since the pore diameter being smaller than the particle size of salt molecules.The results of SEM analysis can be viewed by the figure 7

From IR analysis it is found that there are number of carboxyl groups that react with NaCl and other organic compounds that are present in water to improve its purity.This membrane obtained is fitted to an 1 inch pipe and checked for filtration. Here bore water is used as sample. Repeated filteration is donewith the membrane using the same sample. It was found that the salinity content of the sample gets reduces after each filteration process.Thus the results obtained are tabulated in the below table.

Purification test was done using Soap water with this nano porous graphene membrane obtained .portable water is obtained with less salinity after filtration done with the graphenemembrane.The results obtained are tabulated below. And the image below show the reading obtained during fileration of the Soap water.

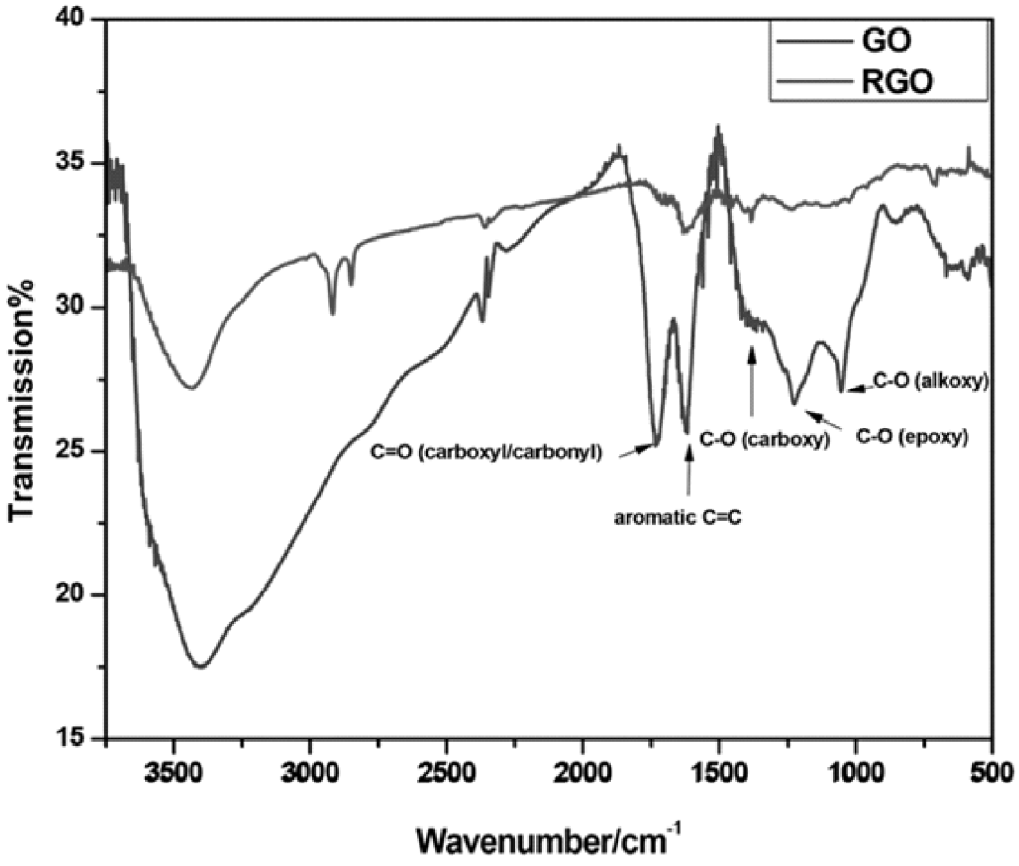

Figure 8

Figure 9

Figure 10

Figure 11

Table III

Sample Solution	*pH value*	*Salinity value*
Soap water	6.90	8
Filtered soap water	8.17	2
Soap+shampoo+detergent water	7.14	15
Filtered Soap + shampoo + detergent water	8.16	9

IV. OVERALL SETUP

Figure 12

Hardware to measure water level and temperature. Here Before sending the sample water for purification it can be passed through Bio Sand filters and Ceramic filters or Ion exchange resins filter.. Bio Sand filters are which is actually a layer of sand and gravel which removes pathogens and suspended solids. The ceramic filters are clay mixed with saw dust , rice husks or coffee husks, this removes chlorine and E.Coli bacteria the Ion exchange resins filter are for softening the water by absorbing the minerals present.

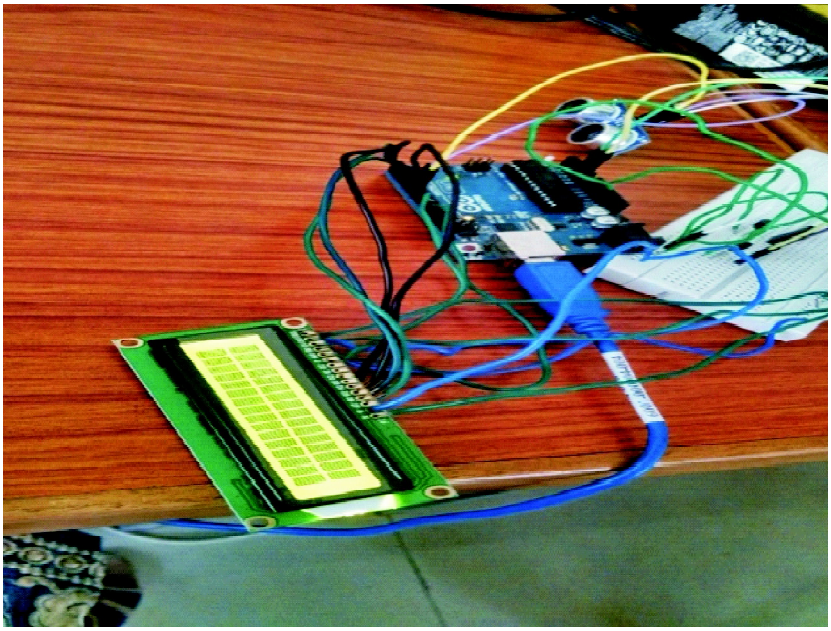

Figure 13

V. CONCLUSION

All the above experimental analysis of the sample were done to find the efficiency of the Nano porous graphene membrane in water purification system with very less energy consumption to get portable drinking water. Also this approach of water purification is very cost effective that can be afforded by normal people .Which may reduce the demand the for drinking water in the future.

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