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CONVERSION OF SALINE WATER INTO POTABLE DRINKING WATER

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Abstract: *Water demand is increased rapidly all over the world in recent years. The sustainable and affordable supply of clean, safe, and adequate water is one of the emerging issues facing the world. Nanographene is the water desalination technology emerging in recent days. Among the several methods for desalination of saline water into potable drinking water, Reverse osmosis is an important method. In this, we discuss the replacement of the membrane in the RO as nanographene. Also, performance Analysis of nanographene instead of RO membrane in water desalination is presented.*

Key Word*: Water desalination, Nanographene, Reverse Osmosis, Drinking water, Desalination Technology, Graphene Oxides, water supply*

I. INTRODUCTION

A survey which has been done in 2010 resulted in 780 million people worldwide lacking proper and pure water supply. People live in rural areas where poverty and the cost and challenge of delivering safe water are greatest. Effective treatment at the household level – often using the same basic approaches of filtration, disinfection and assisted sedimentation can remove, kill or -inactivate most microbial pathogens. Moreover, by focusing on the point of use rather than the point of delivery, treating water at the household level minimizes the risk of recontamination that even improved water supplies can present.

Two-dimensional graphene oxide (GO) is a material with a single layer of carbon lattice decorated with oxygenated functional groups both in the basal plane and along its edges. It has many numerous applications due to its mechanical, electrical, optical properties and it is highly flexible. Graphene oxide membranes are capable of forming a perfect barrier when dealing with liquids and gasses. They can effectively separate the organic solvent from water and remove water from a gas mixture to an exceptional level.

In this project, we are replacing the process of reverse osmosis with nano-graphene membranes. The atomic thickness of graphene ensures its high fluid permeability (several folds higher than those of most commercial nanofiltration membranes), lowering the energy and cost costs of water separation. It is also possible to size-selectively transport molecular materials through nanopores in the graphene layer or through 2D channels between adjacent graphene sheets. Desalination membranes can also be fabricated from graphene-based materials.

This section shows the various analyses and the research to proceed, which have already been considered or yet to be processed. The section gives the researchers an idea as to how one should carry out the upcoming work and ways to process it.

II. LITERATURE REVIEW

The basic study about the project comes under the advanced methods of water desalination technologies that have been emerged in recent years or that have been in the investigation to implement water desalination because in recent years water scarcity is a major issue in the world. A literature survey was done, to analyze the various possibilities and probabilities to enhance the work and push it to an extent where it can be applied in real-time for further proceedings.

According to the study, in the year 2013, the work done by Rubina Bahar and Mohamed Nurul Alam Hawlader at National University at Singapore has been studied the different desalination methods for conversion of saline water into potable

water and explained the different methods of water desalination and provides an overview on this method with their processes and appropriate applications. From this study, we collected the basic data on water desalination.

The work done by Darun S K in the year 2013 explains the new idea on removing the salt in saline water to make freshwater production easier using nanographene pores and this paper explains the nature of nanographene and it provides the solution to water scarcity in the current world and also for the upcoming years.

Citations of U.S Technology assessment John Andelin in the year march 1988 cited on using desalination technologies for water treatment to treat the saline water and wastewater had been done to reduce the water scarcity in the world. In this, we have analyzed the different methods and their performance, applications, properties, and efficiencies on the water treatment and also provide an enormous description of the various treatment technologies.

A review of Shahin Homaeigohar on Graphene membranes for water desalination reveals that the properties and performances and provides the solution for water purification. In this, they analyzed the environmental impacts, cost analysis, energy efficiency on water purification.

The article review done by Albert Boretti on graphene-based desalination membrane has high permeability for next-generation industrial development for water purification and also coupling with high selectivity in industrial activity.

III. NANOGRAPHENE

Nanographene & its functions:

Graphene has been hailed by many as the "wonder material" of the 21st century. The carbon-based material is nearly 200 times stronger than steel, flexible, nearly transparent, and highly conducive to heat and electricity. Since graphene is just a single layer of carbon atoms connected in a hexagonal pattern, it is also extremely thin and lightweight, and therefore an attractive material for nanotechnology applications.

Graphene is a two-dimensional mesh of carbon atoms arranged in the form of a honeycomb lattice. It is also called “miracle material. The simplest graphene-based desalination membrane can be produced by making nanoscale pores in a layer of graphene. since a typical carbon atom has a diameter of about 0.33 nanometres, there are about 3 million layers of graphene in 1 mm of graphite).

Role of nanographene in water desalination:

Graphene has shown significant promise for water filtration applications and a team of scientists from the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia recently developed an extremely efficient water purification system that appears to be simpler and faster to use than conventional filtration systems.

The simplest graphene-based desalination membrane can be produced by making nanoscale pores in a layer of graphene. This results in a flexible, chemically, and mechanically stable separation membrane, based on a single-atomic layer thick material with target use in desalination. If the hole size is larger than one nanometre, the salts go through that hole. You have to make a membrane with a very uniform less-than-one-nanometre hole size to make it useful for desalination.

Graphene oxide membranes have already proven their worth in sieving out small nanoparticles, organic molecules, and even large salts. But until now, they couldn't be used to filter out common salts, which require even smaller sieves.

Previous work had shown that graphene oxide membranes became slightly swollen when immersed in water, allowing smaller salts to flow through the pores along with water molecules.

Graphene is the name for an atom-thick honeycomb sheet of carbon atoms. It is the building block for other graphitic materials (Units of graphene are known as nanographene; these are tailored to specific functions and as such their fabrication process is more complicated than that of generic graphene. Nanographene is made by selectively removing hydrogen atoms from organic molecules of carbon and hydrogen, a process called desalination.

Replacing the nanographene membrane instead of RO membrane:

Water desalination is a major issue that plays a major role in the world. Nowadays new technology is emerging day by day. Among those one of the new methods is emerged is nano-graphene technology. And one of the best methods that are working successfully is Reverse Osmosis. In this project, we used to replace the nanographene membrane instead of the Reverse osmosis membrane. In this reverse osmosis, there are three sections in it. They are the Pretreatment section, membrane section and the final one is the post-treatment section. From this in the membrane section have the reverse osmosis membrane. In this, we can remove the RO membrane and replace it with a nanographene membrane to study its performance in water desalination technology. This method is mainly done to analyze the salinity removal efficiency of

nanographene membrane. because salinity is the important factor to be considered in saline water. The salinity level is reduced in the nanographene treatment.

Scope of this project:

This project mainly deals with water desalination to remove salinity in seawater. Here we use a nanographene water filter membrane which is placed in the reverse osmosis water filter. In nowadays nanographene water filters are also available. But we plan to analyze the performance of the nano-graphene membrane. In which the Nano graphene filter membrane has a nanographene membrane with a pore size of fewer than 3 nanometers. Because the diameter of the pore is increasing the capacity of water filtration is decreased. So, we need to take care of fixing the diameter of the pores. After placing the filter membrane in the reverse osmosis water filter the water filtration increases. And analyses the various water quality parameters and shows great results and its efficiency is comparatively much better than other methods.

Performance of nanographene:

In order to study the performance of nanographene on saline water desalination, we have collected saline water from the Bay of Bengal at Rameswaram and tested this saline water for various parameters listed in the following table 6.1. In the following table, we have mentioned the BIS standard for drinking water and also the value of sample water, and performance of reverse osmosis and nanographene water, and the efficiency of nanographene. We analyze the various water quality parameters to check whether the treated water is perfect for drinking or not. After the analysis, the nanographene filtered water is acceptable for drinking.

IV.RESULT

This paper explains the experiment on water desalination that has been carried out to analyze the performance of nanographene membrane in reverse osmosis water desalination. In this project, the various water quality parameters were tested on the sample water before and after treatment. By comparing the result of the water sample and we found out the efficiency of water purification and compared it with the BIS standards of each parameter. After comparison of each property of water quality shows that the performance of nanographene is acceptable as per BIS standards. In this project, we majorly concentrate on the removal of salinity. The salinity is the important factor of seawater if we remove the salinity in that water. Seawater is relatively portable for drinking. In this, the salinity is effectively removed by the nanographene. Hence the performance and the results are studied and finally, we conclude that the performance of nanographene membrane in reverse osmosis is providing greater efficiency, and also the treated water is edible for drinking. It is represented in the following table and graph.

Table no 1 Shows the various water quality parameters and results of treatment on various methods and its efficiencies of patients of the three groups before treatment.

Table no 1: *Shows the parameters of water samples before and after treatment and their efficiencies.*

S.NO	PARAMETERS	UNIT	FRESHWATER	SALINE WATER	RO PROCESS	NANOGRAPENE	EFFICIENCY OF NANOGRAPHENE	EFFICIENCY OF RO PROCESS
1	COLOUR	HAZEN UNIT	5	6	3	3	50	50
2	TURBIDITY	NTU	5	27	1.23	5	81.5	95.4
3	ODOUR	NO UNIT	UN OBJECTIONABLE	PUNGENT SULPHUR ODOUR	UNOBJECTIONABLE	UNOBJECTIONABLE		
4	BOD	mg/l	15	18	4	2	88.9	77.8
5	COD	mg/l	200	330	90	185	43.9	72.7
6	DO	mg/l	8	9.03	5	6	33.6	44.6
7	pH		8.5	8.3	7.6	7.8	6	0.08
8	SALINITY	mg/l	600	1000	680	430	57	32
9	IRON	mg/l	1	1.3	0.3	0.3	76.9	76.9
10	COPPER	mg/l	1.5	2.3	0.9	1	56.5	61
11	MANGANESE	mg/l	0.5	2.1	1.2	0.09	95.7	43

12	ZINC	mg/l	15	18	14	7	61.1	22
13	HARDNESS	mg/l	500	6630	272	60	99.1	96
14	ALKALINITY	mg/l	450	155	105	85	45.2	32
15	NITRATES	mg/l	45	17	14.8	10	41.2	13
16	CALCIUM	mg/l	200	490	400	77	84.3	18
17	CHLORIDES	mg/l	750	1970	288	258	86.9	85
18	FLUORIDES	mg/l	1.5	3.4	2.63	1.42	58.2	22.6
19	TEMPERATURE	◦C	15	17	13	12	29.4	23.5
20	TOTAL SOLIDS	mg/l	1500	5000	1100	500	90	78

GRAPHICAL REPRESENTATION OF EFFICIENCY OF RO AND NANOGRAPHENE:

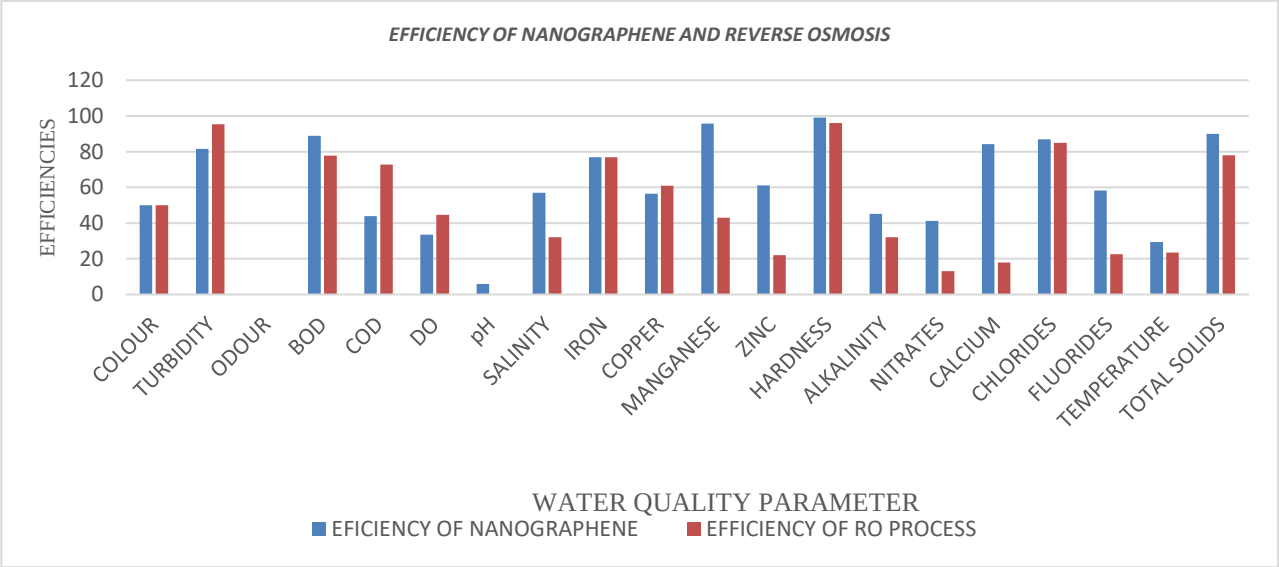

Figure 1 Graphical representation of efficiency of nanographene and RO

V. CONCLUSION

This paper explains the experiment on water desalination that has been carried out to analyze the performance of nanographene membrane in reverse osmosis water desalination. In this project, the various water quality parameters were tested on the sample water before and after treatment. By comparing the result of the water sample and we found out the efficiency of water purification and compared it with the BIS standards of each parameter. After comparison of each property of water quality shows that the performance of nanographene is acceptable as per BIS standards. In this project, we majorly concentrate on the removal of salinity. The salinity is the important factor of seawater if we remove the salinity in that water. Seawater is relatively portable for drinking. In this, the salinity is effectively removed by the nanographene. Hence the performance and the results are studied and finally, we conclude that the performance of nanographene membrane in reverse osmosis is providing greater efficiency, and also the treated water is edible for drinking.

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