

An Overview on Desalination of Seawater by Ro Principle

Mr. Sushant N. Pawar¹, Mr. Roshan S. Thorat², Mr. Digvijay M. Mane³

¹UG Student, Mechanical Engineering Department, JSPM NTC, Pune

²UG Student, Mechanical Engineering Department, Siddhant College of Engineering, Chakan, Dist.-Pune 412109

³UG Student, Mechanical Engineering Department, AGTI's Dr. Daulatrao Aher College of Engineering, Karad, Tal- Karad, Dist. Satara. 415539.

Abstract- Desalination is the process that allows the use of non-conventional water sources such as saltwater or seawater for the production of drinkable water and water for many more purposes.

For desalination, Reverse osmosis (RO) is one of the technologies that are used which is popular nowadays in the water industry or water processing industry. In the Reverse osmosis (RO) process, practical considerations, and plant configurations related to the water Conservations. Cellulose acetate membrane is widespread because of the chlorine and fouling confrontation. Feed water must be pretreated using membrane filtration technologies in order to minimize membrane fouling. This is a case study of recent developments in order to enhance the understanding of the process. So In the case study, we studied about agriculture field.

In Future river water is used only for drinking purposes because of the growth of the population. At that time we use seawater by using the RO principle for agriculture purposes. So it performs multi operations.

After that process, the wastewater (Brine Solution) is remaining. This Brine Solution is used to generate electric power with the help of osmotic power.

We focus on renewable energy which converts seawater into drinking water, uses in the agriculture field, and generation of electricity.

Index terms- Desalination, fouling, membrane, Osmosis, filtration reverse osmosis.

I.INTRODUCTION

The obtainability of good quality water is on the decline and water request is on the escalation. Availability of fresh water for industrial requirements and human consumption is insufficient worldwide. In world percentage of drinking water is 3% while sea

water is 97%. There are areas like Kutch and Saurashtra, the coastal regions of Western Rajasthan and Tamil Nadu etc. which face persistent water shortage.

To overcome this problem of supplementing drinking water supplies the solution is to apply future technologies to the desalination seawater to produce freshwater.

Reverse osmosis is the backbone of the osmotic plant. During this process, other minerals and dissolved salt are parted from the water, making suitable for drinking. Carlsbad reverse osmotic plant holds more than 2,000 pressure vessels housing more than 16,000 reverse osmosis membranes.

Reverse osmosis, and to some level Nano filtration methods, are considered effective in salt deletion.

Membrane technologies are used for desalination of sea water. A membrane technology is the most communal technology used for desalination in the world, while thermal technologies are not widely used.

A membrane is a thin film of permeable material that permits water molecules to pass through it, but simultaneously precludes the passage of larger and unwanted molecules such as bacteria, viruses, salts, and Metals. Membranes are made from a wide variety of materials such as polymeric materials that include acetate, cellulose, nylon, and non-polymeric Materials such as, composites, ceramics and metals.

A type of renewable and gas emission-free energy that has just newly been given integrity is salinity-gradient energy, which is based on the release of free energy upon mixing of waters with different salt concentrations.

Recently, reverse osmosis energy has been introduced as a source of Renewable and sustainable energy, and it shows potential for Power production.

II. REVERSE OSMOSIS

Much of man's technological inventions today have been borrowed from nature. One of them is the most important process termed "reverse osmosis". It is the opposite of the natural process called osmosis

As the man makes progress, water and the other natural resources of the world have become polluted and unsafe for use. Reverse osmosis is one of today's substantial procedures for processing water to make it suitable for use.

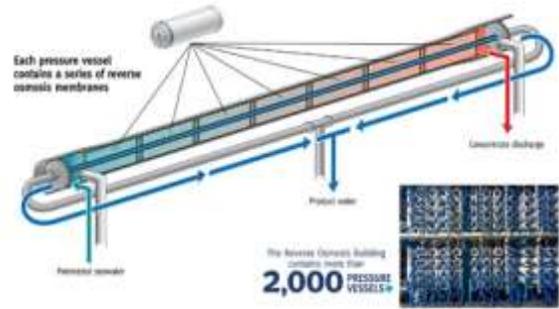
Reverse Osmosis is a technology that is used to remove a large majority of contaminants from water by pushing the water under pressure through a semi-permeable membrane. The principle of RO is Applying pressure on water from the more concentrated solution is forced out through the semi-permeable membrane into another ampule, in effect straining it from contaminations. This is the process usually used today to purify water.

The basis of the whole system is the semi-permeable membrane that acts as a colander. This membrane is penetrable only to water molecules. As the concentrated water (water with thawed and solid particles of minerals, salts, etc.) is forced through the membrane, only water molecules can pass through the pores.

These impurities cannot pass through the membrane which is composed of various heavy metals, mineral salts, other matter particulates, organic molecules, some bacteria, and even some viruses. These are forbidden by the membrane based on their molecular or atomic weights.

The membrane confiscates these salts and other dissolved mineral elements, as well as other impurities like sugar, proteins, dyes, nitrates, and pesticides. All things considered, this improves the color, taste, and other natural properties of water.

Hence we use water for intake purposes which is more important in the future. It is very important to apply renewable energy for a wide diversity of applications and deliver energy solutions by adjusting the energy proportion, improving energy stability.



Structure of the Membrane Vessel

India ranks sixth in the world in terms of energy production and consumption energy. As concerned, but still much more energy is needed to keep pace with our economic development objectives. Most of our energy necessities are met through fossil fuel that leads to dependency on imports and energy uncertainty increasing energy sustainability, conversion reduction, and hence enriches the system efficiency.

Apart from this, the Government of India has launched various arrangements and projects for creating job opportunities through rural employment guarantee schemes, poverty assuagement programs, Bharat Nirman, Rajeev Yuva Shakti programs, Make in India, etc. These schemes have been successfully implemented at the village level by government agencies, and also by small enterprises, NGOs SHGs, etc. This will also put an affirmative impact on reverse osmosis power energy.

The present work intended to study the reverse osmosis power concept.

III. LITERATURE SURVEY

The Carlsbad Seawater Desalination Project was regarded well before the current drought gripped California. In fact, the historic plant the largest in the nation, is part of a strategic vision by the San Diego County Water Authority that has its roots in the drought of 1987-92.

Avinash Mishra: The necessity for renewable energy resources has never been higher than today. A comparative unknown, Renewable energy resource is osmosis. It's based on the materials determined after equality. Osmotic energy is not something we can use in the next-door future. The disadvantages, the hurdles, are too big to be overcome at the moment. The cleaning of the membranes and the cost are good

examples of such hindrances. However in the future if the technology is further advanced and the costs will decrease, osmotic energy might be a substitute to the energy sources we use today.

GOVERNMENT OF INDIA BHABHA ATOMIC RESEARCH CENTRE TECHNOLOGY TRANSFER AND COLLABORATION DIVISION
 –The world’s water consumption rate is doubling every 20 years, outdoing by two times the rate of population growth. The accessibility of good quality water is on the decline and water demand is on the increase. Worldwide accessibility of fresh water for industrial needs and human consumption is limited. Various industrial and progressive activities in recent times have caused in increasing the pollution level and deteriorating the water quality. Water shortages and undependable water quality are considered major obstacles to achieve sustainable development and progress in the quality of life.

Syed Waqar Hasan, Syed Faraz Hasan: In this informative paper, there is detailed breakdown of an in-depth look into the technical details of the osmotic power generation. They recognized some of the geographical locations alongside the country’s coast that can be ideal for installing an osmotic power station. They evaluated the osmotic potential in the sea water on the coast of Karachi with the help of laboratory tests and mathematical approximation. According to assessment, the osmotic potential in Karachi’s sea water is comparable to that available in the first commercial osmotic power plant. It has been discussed that the best location of set up an osmotic plant is where the river meets to an ocean or a sea.

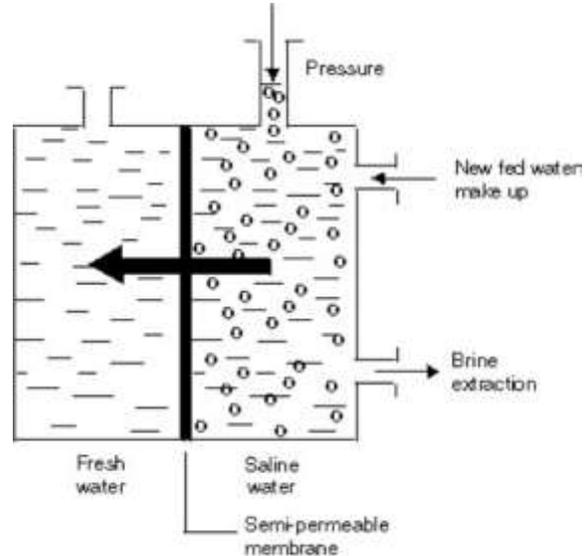
IV. REVERSE OSMOSIS WORKING

The principle of RO is Applying pressure, water from the more concentrated solution is forced out through the membrane into another container, in effect straining it from impurities. This is the process usually used today to purify water.

Reverse osmosis works by using a high-pressure pump to upsurge the pressure on the salt side of the RO and force. The water transversely the semi-permeable RO membrane parting almost all (around 95% to 99%) of dissolved salts behind in the reject

stream. The amount of pressure required depends on the salt concentration of inlet water.

The more concentrated the feed water, the more pressure is essential to overcome the osmotic pressure.



Osmosis Process

Reverse Osmosis is able of removing up to 99%+ of the dissolved salts (ions), pyrogens, particles, organics, colloids, and bacteria from the feed water (although an RO system should not depend on upon to remove 100% of bacteria and viruses). An RO membrane rejects impurities based on their size and charge. Any contaminant that has a molecular weight greater than 200 is likely excluded by a properly Running RO system.

ADVANTAGES

- To overcome the shortage of water, the solution is future technologies applied to the desalination seawater to produce fresh water for supplementing drinking water supplies.
- It is a very clean process.
- It is renewable.
- This water is also used for agriculture purposes.

DISADVANTAGES

- Reverse Osmosis energy is expensive than diesel power plants but less expensive than hydropower plants.

But our focus point is that ‘Can we use the seawater in other main energies or resources?’

The answer is yes.

- For Agriculture Purpose
- For Power Generation

1. Agriculture Purpose

India is a country that is reliant on Farming as a main source of income for many families.

In sometimes the water is sufficient for only drinking purposes. At that time there is a lack of water for agricultural use. This problem is unravelled by desalination by reverse osmosis.

To overcome water shortage, the Ministry of Agriculture installed newly a desalination unit on low water quality farming.

The cropping pattern in the study region is mainly vegetables and some date, palm, and field crops. Prosperous farmers had shifted from growing vegetables to other soil and water salinity resistance crops such as date or palm trees.

2. Power Generation

The energy derived from the variance in salinity between seawater and freshwater converted into electricity by means of a turbine. There are numerous different types of power plants based on osmosis (the osmotic process); both land-based plants and plants fixed to the seafloor.

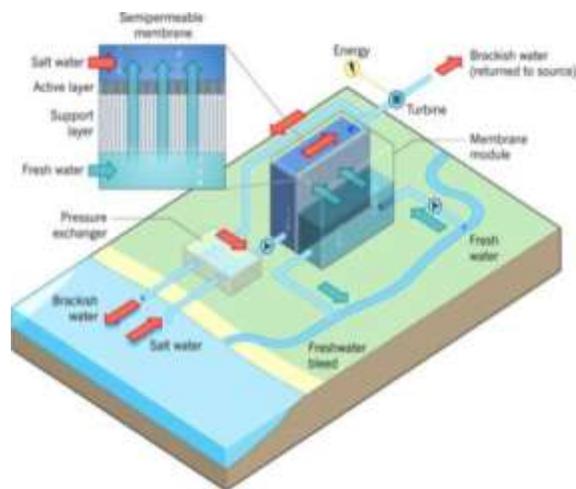
The thing the plants we have studied have in mutual is that osmosis is not directly used to generate power. What the osmosis does is that it creates a flow through the plant and it is that flow that forces the turbine to rotate and generates power.

Required aspects for Establishing Osmotic Power Plant:

- Abundant source of saltwater.
- Abundant source of freshwater.
- Location which is suitable for establishing a power plant.
- Plenty of Manpower.
- Necessary equipment's for power generation.

Freshwater is provided into the plant and filtered before entering the membrane modules containing spiral wound or hollow fiber Membranes. In the membrane module, 80 – 90% of the freshwater is conveyed by osmosis across the membrane into the pressurized seawater. The osmotic process surges the

volumetric flow of high-pressure water and is the key energy transfer in the plant. This Pressure is vital for the rotation of the turbine.



Osmotic Power Plant Layout

V. CONCLUSION

In this paper, we have observed osmotic energy. Moreover, the research also assessed the various strategies and methods, which should be practiced by the firms in India to reduce their electricity bills by encouraging the use of osmotic power. However, the introduction of modern technology is essential if the rate at which energy is consumed by industries in India is to be reduced.

The groundwater treatment is crucial for the drinking Purpose, which was found by the scenario of Indian groundwater quality.

Desalination technologies produce new sources of freshwater from saltwater or brackish water. This paper summarizes a review of the fundamental aspects of the RO process for desalination. The field of RO membrane Desalination has hastily developed over the past 40 years to become the primary choice for innovative plant installation. Ro Principle achieves multi-uses in a one-time investment.

REFERENCES

- [1] American Water Works Association. 1999. Manual of Water Supply Practices: Reverse Osmosis and Nano filtration.
- [2] Brunner, R. E. Electro dialysis. 1990. Saline Water Processing.

- [3] Hans-Gunter Heitmann: VCH Verlagsgesellschaft, Federal M'nif, S. Bouguecha, B. Hamrouni, and M. Dhahbi, "Coupling of membrane processes for brackish water desalination," *Desalination*, vol. 203, no. 1-3, pp. 331-336, 2007.
- [4] Avinash Mishra Osmotic Power Huge Source of Renewable Energy *International Journal of Scientific & Engineering Research* Volume 4, Issue3, March-2013 ISSN 2229-5518
- [5] Ministry of Water Resources, "Integrated water resources development a plan for action," Report for the National Commission for Integrated Water Resource Development, 1999.
- [6] Dykes, G. M. and W. J. Conlon. 1989. Use of Membrane Technology in Florida. *Journal of the American Water Works Association*, 81:43-46.
- [7] Stein Erik Skilhagen. OSMOTIC POWER – a new, renewable energy source. Head of Osmotic Power, Statkraft AS, Lilleakerveien 60216 OSLO, NORWAY.
- [8] Bhausaheb L. Pangarkar, Mukund G. Sane, and Mahendra Guddad. Reverse Osmosis and Membrane Distillation for Desalination of Groundwater: A Review *International Scholarly Research Notices / 2011 / Review Article* Volume 2011 |ID 523124 | 9 pages | <https://doi.org/10.5402/2011/523124>
- [9] Tamim Younos, Kimberly E. Tulou Virginia Polytechnic Institute and State University Overview of Desalination Techniques *UNIVERSITIES COUNCIL ON WATER RESOURCES JOURNAL OF CONTEMPORARY WATER RESEARCH & EDUCATION* ISSUE 132, PAGES 3-10, DECEMBER 2005.
- [10] Fernanda Helfer, Charles Lemckert, Yuri G. Anissimov. Osmotic power with Pressure Retarded Osmosis: Theory, performance and trends – A review. *Journal of membrane science* Volume 453, 1 march 2014, pages 337-358
- [11] Digvijay M. Mane, Hrishikesh S. Gadve, Shailesh S. Jankar. AN OVERVIEW ON OSMOTIC POWER AND IT'S SCOPE IN INDIA. *International Journal of Advance Research in Science and Engineering* (ISSN: 2319-8354) Volume No.07, Special Issue No. (03), February 2018, ICRISEM-18