Acta Ciencia Indica, Vol. XLI P, No. 1, 65 (2015)

A BRIEF REVIEW OF RO SYSTEM BY SOLAR PV

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RECEIVED : 10 December, 2014

REVISED : 14 April, 2015

Safe drinking water shortage in the world has necessitated research and development in the sea and brackish water desalination based on renewable energies. As a consequence the lack of drinking water increases. Currently, approx 1.2 billion people globally (1/6th of world's population) do not have access to adequate clean water. An innovative stand-alone solar desalination system can be used to produce drinking water from sea- water or any brackish water sources. The energy consumption of RO plant is strong function of clean water (permeate) flow rate and system pressure and they needs to be turned to match the maximum power provided by the PV arrays.

KEYWORDS : Reverse Osmosis, Desalination, and Renewable Energy.

INTRODUCTION

Access to clean water is quickly becoming a significant worldwide problem. With current rates of population growth and the effects of global warming, the problem of access to clean water is expected to grow. In the recent years, the interest in the use of Reverse osmosis membrane desalination has increased due to energy efficiency and versatility of this process relative to other water desalination technologies. PV –powered reverse osmosis is considered one of the most promising forms of renewable energy powered desalination, especially when it is used in remote areas. PV-RO initially is most cost- competitive for small- scale systems where other technologies are less competitive. Several research groups in the world have shown interest and working to integrate the RO process to the PV panels to minimize the environmental effects, improve the effectiveness and efficiency and to reduce specific energy consumption by different design considerations.

Osmosis is an natural process. When two liquids of different concentration are separated by a semipermeable, the fluid has a tendency to move from low to high concentrations for chemical potential equilibrium. Reverse Osmosis is just reverse process of osmosis. When high pressure is applied, liquid moves from high concentration to lower concentration. With this process water passes through membrane of Reverse Osmosis system and rejects salt and other ions.

SYSTEM DESCRIPTION

PV RO consists of power generation unit and desalination unit. PV power unit consists of PV panels and DC power is produced when the solar radiations are incident upon it. RO desalination process consists of high pressure pump, membrane unit and pressure control

valve at the brine side. The solution is pressed by pump against the membrane, water molecules passes through the membrane reducing the concentration of the solute known as permeate and the rest of the water with high salt concentration is rejected as a waste known as brine. Figure 1depicts out the illustration of PV RO system.

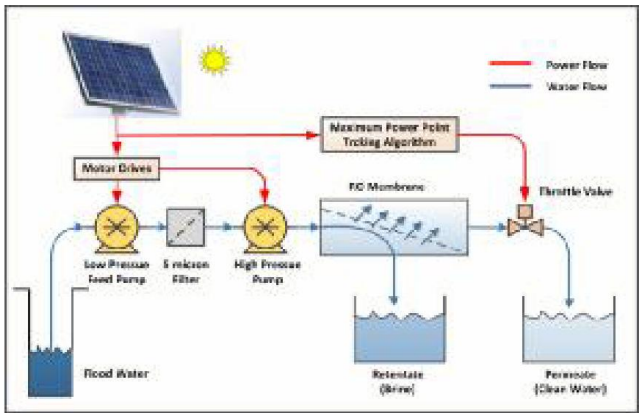

Fig. 1. Components of PV RO System.

THE COMPONENTS OF PV-RO SYSTEMS

The PV RO system consists of many parts: Reverse Osmosis Stack, High pressure pump, DC motor, Storage Batteries, PV modules, in which RO stack and PV modules are important. Osmotic pressure can be seen in Fig 2 as the pressure created by the difference in water levels) will counter the diffusion process exactly, and equilibrium will be formed.

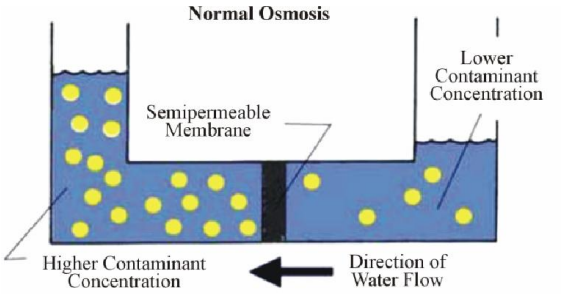

Fig. 2

The process of reverse osmosis forces water with a greater concentration of contaminants (the source water) to go into a tank containing water with an extremely low concentration of contaminants (the processed water). High water pressure on the source side is used to 'reverse'the natural osmotic process. Fig 3 with the semi-permeable membrane still permitting the water to pass while rejecting the most of the other contaminants. The specific process through which this occurs is called ion exclusion in which a concentration of ions at the membrane surface from a barrier that allows other water molecules to pass through while excluding other substances.

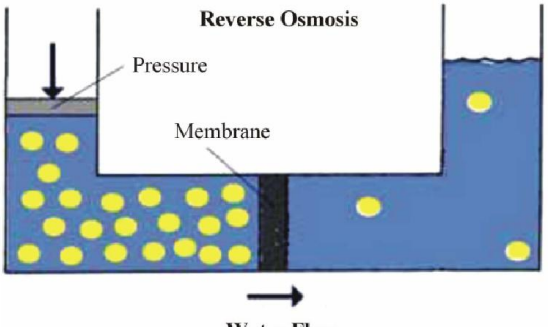

Fig 3

PV–RO MODEL

Design and sizing of the PV-powered RO desalination systems depend mainly on the daily fresh water requirement. The main goal of system sizing is to achieve the right balance between daily needs of electrical energy consumed by the loads and daily produced electrical energy by the PV generator. To achieve this we should start with the loads. The daily consumed electrical energy by the loads has to be identified at the beginning of the system sizing so as to calculate the daily needed PV electrical energy and the total peak power of the PV generator.

CONCLUSION

The photovoltaic powered RO system has a favourable application. For the RO system, it can be calculated that a gain of 25 and 15% of electrical power and desalinated water flow, respectively, could be achieved using the east-west one axis tracking system compared with fixed flat plate. More experimental work needs to be carried out to study the continuous performance of the system, and more investigation should be directed to the membrane fouling and recovery ratio of the system.

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