RESEARCH PAPER ON DESIGN AND IMPLEMENTATION OF PORTABLE SOLAR POWERED DESALINATOR BASED ON ANTISCALANT AND REVERSE OSMOSIS

Prof. K.S.Kamble*1, Shivam Pawar*2, Siddhant Narkar*3, Shubham Sawant*4, Prathamesh Rane*5

[*1,2,3,4,5]Department Of Mechanical Egineering, S.S.P.M College Of Engineering, Kankavali, India

ABSTRACT

Desalination plants are giving exceptionally compelling arrangement to meet the required demand of drinking water from saline water. It centers on plan and displaying of versatile sun powered based Switch Osmosis (RO) desalination plant. The proposed plant is run by a stand-alone Sun oriented framework with battery capacity. The full vitality prerequisite of the plant is assessed to anticipate the capacity of sun based board, measuring the charge controller, control supply, and capacity framework. Decontamination of saline water utilizing sun based fueled desalination strategies is an productive arrangement to the water shortage at ships, which speaks to a promising economical arrangement of desalination plant.

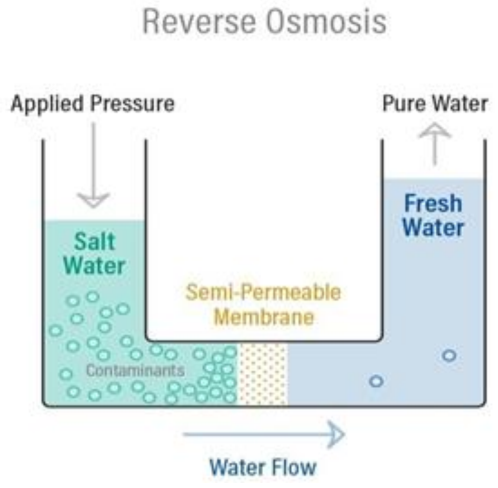
Keywords: Solar, Renewable energy, Desalination, Seawater, Reverse Osmosis, Water Filter.

I. INTRODUCTION

The current invention is a portable and transportable solar cell desalination system that uses antiscale agents and reverse osmosis processes. This enables for the successful filtration of sea/brackish water into drinking water. It is true that a scarcity of freshwater is linked to a big amount of solar energy. Linking these two criteria also looks natural and appealing in nations where grid power is not ubiquitous and access to sea and brackish water is simple. The concept of solar desalination is not new. Ancient mariners desalinated water with modest, little sun distillers for generations. Although solar energy is sometimes described to as "free energy," determining the feasibility and economics of solar energy desalination is not so straightforward.

II. METHODOLOGY

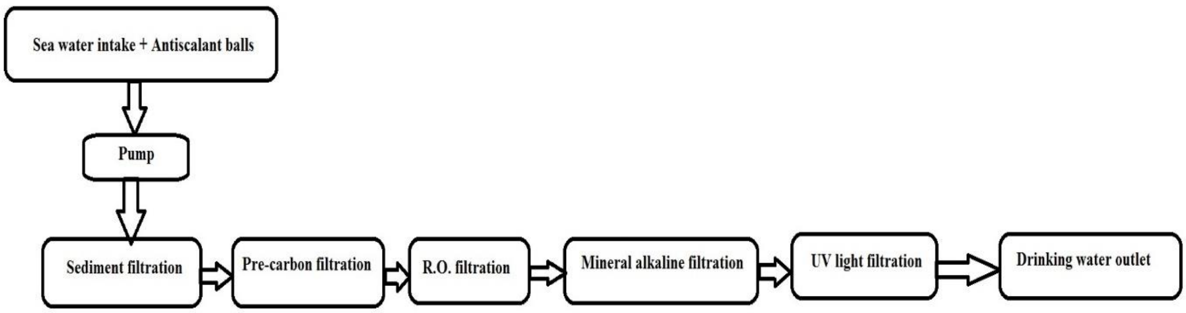
To convert salty saltwater to pure drinkable water, the system uses a three-stage procedure. The device allows the user to stream salty water via a mesh-based intake, which separates large trash such as plastic granules or stones, vegetation, and other debris. This water is then pushed into a big purification chamber with three levels of purifiers for filtering weed, sand, and large salt particles, including sand and gravel.



The end result is still salty water, but it's free of particles. The water is then carried on to the second stage of filtration, where salt is removed using reverse osmosis. Three filtration membranes are used to separate fresh water from saline water, with the salt particles trapped in membrane filters.

The water is now kept in a tank above the system. When the system tap is opened, water flows from the tank to the tap, where we detect the flow and activate the UV lamp for stage 3 filtering to kill any leftover bacteria and viruses. This water is now drinkable thanks to a three-stage process that eliminates the usage of chlorine.

Currently, the system's pumps are powered by a big battery. Due of the abundance of solar power in coastal areas, this battery is charged by two 50Watt solar panels. This makes it incredibly portable, allowing it to be used on any beach or on lengthy sea trips for simple and quick sea water filtration.



SOLAR

Solar energy technologies are classified into two types: solar heat and solar power. The capture of solar energy as heat is referred to as solar heat. A flat plate collector with a high number of tubes in a clear plastic enclosure houses the low and medium temperature system. The contained heat is transmitted to a working medium with a high heat capacity thanks to the greenhouse effect created by clear plastic.

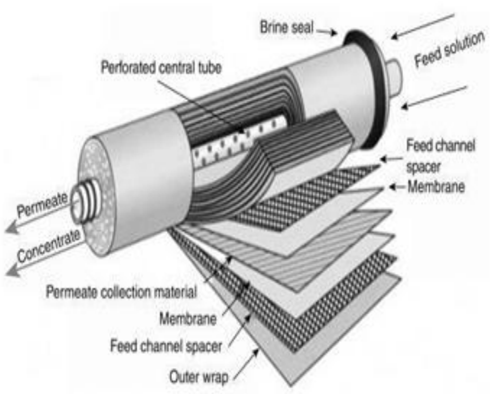
Reflectors focus solar energy to generate water vapours that power a steam turbine in high-temperature systems. Despite the high efficiency of these systems, the use of concentrated solar power for electricity generation is limited to large-scale installations. For distillation processes, these systems can be used as a direct source of thermal energy. Large volumes of concrete, ceramics, or other similar medium can be used to store thermal energy (Eltawil et al., 2009).

SIMPLE WATER FILTER

Most of the water we consume every day comes from completely pure ground. Some of the pollutants are microscopic, but many are large enough to be removed by a coarse filtration system that you can make yourself from sand and rock. It's important to remember that this filter does not render the water potable. Enjoy the experiment, noting how much clearer the water appears after passing through it, but don't drink any of the filtered water, because it may still contain pathogens.

RO MEMBRANE

RO membranes can often remove 90 percent to 99 percent of pollutants in the water supply, such as total dissolved solids (TDSs). The membranes are commonly made up of a flat sheet of thin composite membranes with an active polyamide layer (high permeability but impermeable to dissolved salts and particulate matter) and a porous polysulphone layer looped around a central collection tube. A semipermeable polymer thin film bonded to a thick support layer is used as the RO membrane. The most common membrane materials are cellulose acetate, polyamide, polyimide, and polysulfone.



III. MODELING AND ANALYSIS

The entire model has been designed with the help of designing software solid works. With the help of colour feature the colours are given to the entire model.

Figure 3: 3D view of Model.

Figure 4: Actual Model

Table 1: Raw Material and their Cost

SR NO	PART NAME	MATERIAL	QTY	COST
1	SOLAR PLATE	STD	2	7000
2	UV CHAMBER	STD	1	300
3	SMPS SUVI	STD	1	550
4	SEDIMENT FILTER	STD	1	250
5	CARBON FILTER	STD	1	250
6	MLT FILTER	STD	1	250
7	SLC S.V.	STD	1	230
8	LRD	STD	1	180
9	PRE-FILTER ECO	STD	1	300
10	BOOSTER PUMP	STD	1	1400
11	TILLU PUMP	STD	1	1200
12	HOUSING	STD	1	1180
13	HOUSING ELBO	PVC	3	30
14	PUMP ELBO	PVC	2	24
15	T JOINT	PVC	1	20
16	STEM T JOINT	PVC	1	12
17	TWO SIDE PUSH	PVC	06	60
14	SLX S.V. CONNECTOR	PVC	2	40
15	THIRED ELBO	PVC	8	96
16	TILU PUMP SMALL	STD	1	450
17	BLUE SHELL MINRAL	STD	1	300
18	TDS CONTROLLER (SCREW)	STD	1	300
19	PIPE ¼ BLUE	PVC	2.5M	60
20	PIPE ¼ WHITE	PVC	10M	180
21	TEFLON TEP	STD	2	30
22	‘C’ CLAMP	PVC	10	160
23	PLYWOOD (12mm Thickness)	WOODEN	1	1720
24	TABLE (Material and Fabrication)	G.I.	1	1500
25	HIGH PRESSURE SWITCH	STD	1	300
26	CLUSTER	G.I.	4	500
27	SCERW (For Fitting of Plywood)	STD		120
28	Fltr. Net AND NUTS	STD		331
29	COLOUR (PRIMER & OIL PAINT)	STD		617
30	TANK	STD		380
TOTAL				20320/-

IV. RESULTS AND DISCUSSION

SR. NO.	PARAMETER	ARABIAN SEAWATER ANALYSIS (BEFORE PURIFICATION)	PERMITTED VALUE FOR DRINKABLE WATER BY IS10500	ANALYSED VALUES BY PROTOTYPE (AFTER PURIFICATION)
1	SALINITY	32 - 37 ppt	<1	0.4
2	pH	7.9 - 8.1	<6.0 - 9.5	7.3
3	TDS	34482	<600	412 mg/L
4	Ca	416 mg/L	<75	33 mg/L
5	Mg	1295 mg/L	<100	58
6	Na	10752 ppt	<50 ppm	36
7	Fe	54 mg/L	<0.3	0.06
8	Cl	19.34 mg/L	<5	2.8
9	Total Alkaline	168 mg/L	200-600	168

Table 2. Analysis done by DISTRICT WATER QUALITY TESTING LABORATORY, SINDHUDURG

V. CONCLUSION

According to claim made for patent, wherein this portable design of desalinator results as reduces,

a. Salinity from Arabian Sea water 37 ppt to drinkable water as 0.4 ppt,
b. pH value from Arabian Sea water 8.1 to drinkable water as 7.3,

TDS value from Arabian Sea water 34482 mg/L to drinkable water as 412 mg/L .

ACKNOWLEDGEMENTS

We would like to place a record of our deep sense of gratitude to. Department of Mechanical Engineering, SSPM's COE Kankavli, for his generous guidance, help and useful suggestions.

We express our sincere gratitude to **Prof. Sachin V. Vanjari (Head of Mechanical Engineering Department)** for his simulating guidance and continuous encouragement throughout the course of present work.

We also wish to extend our thanks to faculty members of **Department of Mechanical Engineering SSPM's COE Kankavli** for providing us infrastructure facilities to work in, without which this work would have not been possible. We are also grateful to our family members for their constant encouragement, extended cooperation and help.

VI. REFERENCES

[1] Seawater desalination using renewable energy sources - Kalogirou - Progr Energy Combustion Science, 31 (2005) 242 – 281.

[2] Precise way to select desalination technologies - Khalid Al Subaie – Desalination 206 (2007) 29-35 – Elsevier.

[3] Overview of the cost of desalinated water and costing methodologies - K.V.Reddy, N.Ghaffour-Desalination 205 (2007) 340 - 353 – Elsevier.

[4] A photovoltaic-powered seawater reverse-osmosis system without batteries – M. Thomson, D. Infield -Desalination 153 (2002) 1–8.

[5] Technical and economic comparison between PV- RO system and RO-Solar Rankine system - D.Manolakos et al - Desalination 221 (2008) 37–46.

[6] Solar-driven desalination with reverse osmosis: the state of the art – A. Ghermandi, R. Messalem - Desalination and Water Treatment - 7 (2009) 285– 296.

[7] Performance of a self-regulating solar multistage flash desalination system- S.M.A. Mustafa, D.I. Jarrar and H.I. Mansy - Solar Energy, 35 (1985) 333.

[8] Solar Desalination of Water - D.L. Block -FSECRR- 14-89, Florida Solar Energy Center, Cape Canaveral, February 1989.

[9] Techno-economic evaluation of a solar powered water desalination plant - G. Fiorenza, - V.K. Sharma - Energy Conversion and Management, 44, (2003) Pages 2217–2240.

[10] The solar desalination plant in Abu Dhabi: 13 years performance and operation history - A. El- Nashar and M. Samad -Renewable Energy, 14 (1998) 263–274.

[11] Proving test for a solar-powered desalination system in Gaza-Palestine -S. Abu-Jabal Moh'd, I. Kamiya and Y. Narasaki - Desalination, 137 (2001) 1–6.

[12] First experimental results of a new hybrid solar/gas multi-effect distillation system: the AQUASOL project – D.C Alarcón-Padillaa, J. BlancoGálveza, et al - Desalination 220 (2008) 619– 625.