

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 3, March 2019

Enhancing the Performance of Solar Still With Internal Modification Flat Plate Collector

S.Joe Patric Gnanagaraj¹ Paulpandi², Sajey Raja², Sivarama Krishnan², Sathesh Kumar²,

Associate Professor, Department of Mechanical Engineering, Francis Xavier Engineering College, Vanarpettai,
Tirunelveli, Tamil Nadu, India¹

U.G. Student, Department of Mechanical Engineering, Francis Xavier Engineering College, Vanarpettai, Tirunelveli,
Tamil Nadu, India²

ABSTRACT: A Single basin solar still with basin Area (0.9mx0.7m) was design & fabricated with integration of flat plate collector (0.9mx0.9mx0.3m) to increase the heat transfer rate. Experiments were done with different modifications of solar still and the readings were taken .First reading is taken from still without modification of flat plate collector .The second setup consists of still with flat plate collector modified by heat absorbing materials (pebbles, chips, red stone) . The final experimental setup consist of still integrated with flat plate collector and glass wool. The results indicated that the productivity of the still without modification of flat plate collector, still with flat plate collector modified by heat absorbing materials, still integrated with flat plate collector and glass wool was 36.92 %, 42.68 % and 46.60 %. Also it was found that the productivity of the still was highest with the minimum depth of water.

KEYWORDS: Flat Plate Collector, Heat Absorbing Materials, Solar Still,

I. INTRODUCTION

General

More than two-thirds of the earth's surface is covered with water. Most of the available water is either present as seawater or icebergs in the Polar Regions. More than 97% of the earth's water is salty; the remaining 2.6% is fresh water. Less than 1% fresh water is within human reach. This small amount is adequate to support life and vegetation on earth. Nature itself provides most of the required fresh water, through the horological cycle. A very large-scale process of solar distillation naturally produces fresh water. The essential features of this process are thus summarized as the production of vapors above the surface of the liquids, the transport of vapors by winds, the cooling of air-vapor mixture, condensation and precipitation. This natural process is copied on solar desalination. As the available fresh water is fixed on earth and its demand is increasing day by day due to increasing population and rapidly increasing of industry, hence there is an essential need to get fresh water from the saline brackish water present on or inside the earth. This process of getting fresh water from saline brackish water can be done easily and economically by desalination.

II. PROBLEM DEFINITION

In many countries that suffer a chronic shortage of water, such as those of the Middle East and North Africa, over 80% of all fresh water consumed is used by agriculture. As fresh water resources are finite, there is a pressure to reduce agricultural use of water to meet the growing demand for domestic and industrial use. The number of desalination plants in India is 230 plants in 2000 with an overall capacity of 220000 (m³/day). The average

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 3, March 2019

quota of water resources in India is expected to reach 645 (m³/person) in 2025. So there is a need for desalination to meet the requirements of industry, tourism, petroleum, electricity, health, and reconstruction. The desalination plants spread on the Red Sea coast, South Sinai, and the northern coast.

III. AIM OF THE EXPERIMENT

The objectives of the present work are preparation and development of single Solar still with two flat plate collector

IV. EXPERIMENTAL SETUP



Fig -1 Schematic diagram of Experimental setup

- 1) Single Basin Still + Without Modification
- 2) Single Basin Still + Flat Plate collector
- 3) Single Basin Still + Baked Plate Collector
- 4) Single Basin Still + Parallel Collector
- 5) Single Basin Still + Series Collector

V. EXPERIMENTAL PROCEDURE

A double slope solar still was fabricated with an area of 1m X 0.6m X 0.4m the box of solar still was fabricated using wood of thickness 1.5 cm . the basin was fabricated steel with an area of 80cm X 60cm X 30cm. Inside of the still is painted black to increase the heat absorption capacity of the material. The slope of the still consists of transparent glass of thickness 4mm.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 3, March 2019

The slope of glass is maintained at 30° . The double slope allows more radiation into the still. The collection channel is fabricated at both end of still using PVC pipe for the collection of condensate. Further modifications of the still is done by insulating the basin with materials like glasswool, sponge, thermocol in the space between hotbox and basin. The amount of incident solar rays can be increased with addition of a reflecting mirror at the side. The reflecting mirror is adjusted at various angles for experimentation. The output productivity of still is observed during high radiation condition and low radiation condition with and without modifications to still.

MATERIAL USED



Fig mild steel with two flate plate collector

The mild still angle are L-shaped structural steel represented by dimension of sides & thickness. For e.g. 50cmx50cmx6cm means, both the sides of angles are 50mm & thickness is of 6mm. This is welded by filler rod into dimensions of (0.9m x 0.9m x 0.3m) in a rectangular shape. It is connected by stand like material. The stainless still are used cover material which can stand heavy load such as pebbles, red stone with any error. The welding process is used to join the material into respective shape. Carbon steel is steel in which the main interstitial alloying constituent is carbon in the range of 0.12-2.0%. The American Iron and Steel Institute (AISI).

The purpose of heat treating carbon steel is to change the mechanical properties of steel usually ductility, hardness, yield strength or impact resistance. Weldability is a term used to describe the relative ease or difficulty with which a metal or alloy can be welded. The better the weldability, the easier it is to weld. However, weldability is a compatibility of the metal or alloy with a specific welding process. Its ability to be welded with mechanical soundness.

VI. RESULT ANALYSIS

THERMOCOUPLE

The temperatures of the basin, glass, ambient, and water were recorded with the help of K-type thermocouples. The accuracy of the K-type thermocouples is $\pm 0.1^\circ\text{C}$. Least experimental value 20°C . Paramount possible error $= 0.1/20 = 0.005\%$. Error for K-type thermocouples used in the experiment = 0.5%.

International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

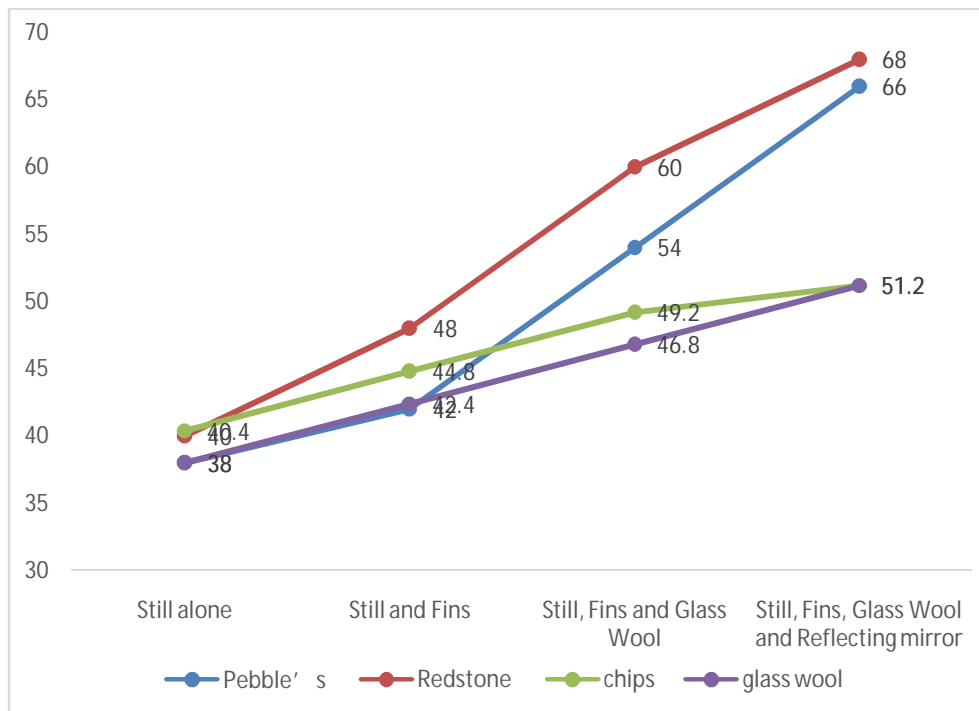
Visit: www.ijirset.com

Vol. 8, Issue 3, March 2019

2 READINGS AND GRAPH

Table5.2.1 Internal Modification of single basin Solar still with high radiation

Sl.no.	Description	During High Radiation (600–720W/m ²)			
		Date	Input water 5 liters	Output 8 H/ D	Daily efficiency %
1	Single Basin Still + Without Modification	02.03.19	5	1.8	36
2	Single Basin Still + Flat Plate collector	03.03.19	5	2.2	44
3	Single Basin Still + Baked Plate Collector	05.03.19	5	2.8	56
4	Single Basin Still + Parallel Collector	07.03.19	5	3.2	64
5	Single Basin Still + Series Collector	15.03.19	5	3.8	70



International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Visit: www.ijirset.com

Vol. 8, Issue 3, March 2019

VII. CONCLUSION

- Four DBSS solar stills have been fabricated and their performances were compared to various length of external reflecting mirror
- Providing bricks, red stone, glass wool, chips and pebbles were used to in the basin for the improvement of the productivity
- The productivity of the still with reflectors and flat plate collector 29.92 %, 38.68 % and 41.60 % respectively more than the conventional still.
- Maximum productivity occur in internal and external modification were, glass wool, chips, redstone, pebbles
- Daily cleaning of the Basin , glass cover, and the reflecting mirror is required.

REFERENCES

- [1] U.S. Energy information Administration, world supply and consumption of petroleum products, Wikipedia, <http://en.wikipedia.org/wiki/Petroleum>
- [2] Y. Uemichi, Development of a catalytic cracking process for converting waste plastics to petrochemicals, J. Mat. Cycles Waste Manage.,5(2), 89-93, 2003.
- [3] A. Marcilla, A. Gómez-Siurana and F. Valdés, Catalytic cracking of low-density polyethylene over H-Beta and HZSM-5 zeolites: Influence of the external surface. Kinetic model, Polym. Degrad. and Stability, 92(2), 197-204, 2007.
- [4] G. Manos, "Catalytic Degradation of Plastic Waste to Fuel Over Microporous Materials" Chapter 7 in Recycling of Waste Plastics: Pyrolysis and Related *Feedstock Recycling Techniques*, (Eds: J. Scheirs, W. Kaminsky), J. Wiley, 193-208, 2006.
- [5] Convert Agricultural Waste into Sustainable Profitable Green Energy, Available online at www.pmcbiotec.com/downloads/agricultural.pdf.
- [6] Marcilla A, Beltran MI, Navarro R (2008). Evolution with the Temperature of the Compounds Obtained in the Catalytic Pyrolysis of Polyethylene over HUSY. Ind. Eng. Chem. Res., 47: 6896-6903.