

# SOLAR WATER DISTILLATION WITH PARABOLIC REFLECTOR USING MYLAR REFLECTIVE PAPER

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*Abstract:* Freshwater makes up a very small fraction of all water on the planet. While nearly 70 percent of the world is covered by water, only 2.5 percent of it is fresh. The rest is saline and ocean-based. Even then, just 1 percent of our freshwater is easily accessible, with much of it trapped in glaciers and snowfields. But then there is the question of whether or not that water should be consumed. A lot of it is contaminated with various chemicals such as bleach and fluoride. Sea having the largest amount of water but it contains salt at very higher percentage, so to make it Drinkable it should be desalinized and distilled. In this communication an attempt has been made to review, in brief, work on solar distillation, its present status in the world today and its future perspective. The basic heat and mass transfer relation responsible for developing, testing procedure for various designs of with use of Parabolic Disc reflector have also been discussed

*Index Terms* - Parabolic Disc reflector, Mylar Reflective Paper, Renewable Sources

## I. INTRODUCTION

The purification of saline/sea water has been done by many methods. One of the methods is solar distillation. A solar distillation unit is very simple in design and easy to operate. The solar distillation systems are mainly classified as passive solar still and active solar still. The numerous parameters are affecting the performance of the still such as water depth in the basin, material of the basin, wind velocity, solar radiation, ambient temperature and inclination angle. The productivity of any type of solar still will be determined by the temperature difference between the water in the basin and inner surface glass cover. In a passive solar still, the solar radiation is received directly by the basin water and is the only source of energy for raising the water temperature and consequently, the evaporation leading to a lower productivity. This is the main drawback of a passive solar still. The active solar distillation is mainly classified as follows

High temperature distillation—Hot water will be fed into the basin from a solar collector panel.

Pre-heated water application—Hot water will be fed into the basin at a constant flow rate.

Nocturnal production—Hot water will be fed into the basin once in a day.

The performance of a solar still can be affected by depth of water, glass cover angle, fabrication materials, and temperature of water in the basin and insulation thickness, which affects the performance of the solar still that could be modified for improving the performance. The performance can be improved by reducing the water depth and thereby increasing the evaporation rate. The temperature difference between water in the basin and condensing glass cover also has a direct effect in the performance of the still. The increased temperature of the water in basin can increase the temperature difference between the evaporating and condensing surfaces. To achieve better evaporation and condensation rate, the temperature of water in the basin could be raised by feeding thermal energy from some external sources. The experiments are carried out in the western Maharashtra climatic conditions during the summer. The project work also extends to cost effective solar distillation systems, scope for further research and recommendation.

## II METHODOLOGY

The schematic diagram of the solar still coupled with parabolic concentrator is shown in Fig.1 The parabolic shaped concentrator or solar collector concentrates the incident solar radiation on large surface and it focuses on to a small absorber or receiver area. The performance of concentrators is much affected by the sun tracking mechanism. The tracking mechanism should move the collectors throughout the day to keep them focused on the sun rays to achieve the higher efficiency. These types of solar collectors reach higher temperature compared to flat plate collectors owing to reduced heat loss area. The various types of concentrators were used over the years based on the applications. To achieve higher yield, the contractor is coupled with solar still by means of increasing water temperature in the basin. The water or oil will be supplied to trough receiver pipe by natural circulation mode or forced circulation mode

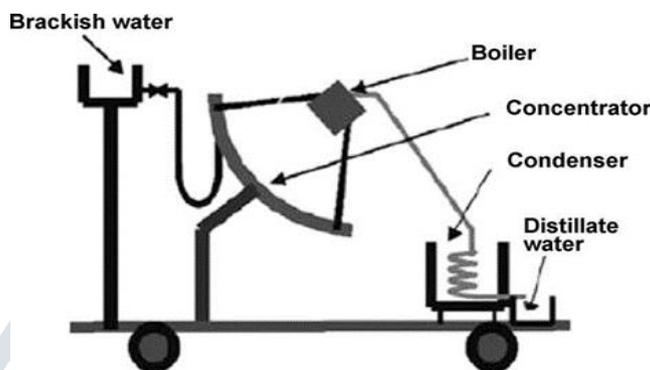


Fig 1 schematic diagram of parabolic solar concentrator

## III DESIGNING OF PARABOLIC REFLECTOR USING MYLAR PAPER



Fig.2 parabolic dish collector

A parabolic dish collector is a concentrating solar collector that is similar in appearance to a large satellite dish, but has mirror-like reflectors and an absorber at the focal point. A parabolic dish system uses a computer and dual-axis tracking to follow the Sun across the sky and concentrate the Sun's rays onto the receiver located at the focal point in front of the dish. To select the materials, the most relevant aspects were evaluated so they would permit good performance, bearing in mind optical, physical, and thermal factors.

Requirement of the material	Mechanical Property	Desired Range	Materials
Must be shiny and reflect	Reflectivity	0.51-0.87] [51-87%]	White PVC, high- reflectivity aluminum, hard plate pre-painted white, galvanized plate, painted plate, stainless steel.
Corrosion resistance from rain water	Corrosion resistance	Excellent corrosion resistance.	-AISI 304, AISI 316
Resistance to high temperatures		[400- 659°C]	Steel 304,304L,310,314,316,

## MYLAR PAPER:

- Colour: silver
- Feature: used in indoor garden to reflect the light back on the plants increase 90% reflectance and the plant's growth easy to install, directly place in the flat surface portable and lightweight, can be folded packa
- Thickness: 12 microns,50mic, 100mic,150mic, 188mic
- Characteristics: Low heat shrinkage, well tensile strength, aluminium coating is well-proportioned has very high lustre degree, light reflectivity reach 98%, suitable for yarn, cling packaging, cosmetic packaging and tobacco and liquor packaging.



**Fig.3 Parabolic dish collector with attached mylar paper .**

## STEAM GENERATOR / EVAPORATOR



**Fig.4 Evaporator**

An evaporator is a device in a process used to turn the liquid form of a chemical substance such as water into its gaseous-form/vapor. The liquid is evaporated, or vaporized, into a gas form of the targeted substance in that process Steam generator is constructed using copper sheet of thickness 1mm. Copper have highly Heat conductive properties so we used copper to make the vessel. The vessel is heated using solar reflective parabolic reflector disc. The vessel is painted as black so as to increase its heat conduction rate. The thickness is kept minimum and surface is kept larger so as the water will get more surface area and it will start boiling at very minimum time. The water is supplied from water tank through the Polypropylene plastic pipe at lower end. As the water enters into the vessel due to solar radiations heat water get converted to steam. After the generation of steam, it is passed from the top of the vessel through the standard steam hose. The steam generated is having 2 bar pressure and temperature about 200°C. EPDM pipe is used to transfer steam from vessel to accumulator.

## STEAM ACCUMULATOR



**Fig.5 Steam accumulator**

Steam accumulator used to store the steam for some time during the working of our project. As evaporation rate is higher than condensation rate so the steam is allowed to store for some time, then it is passed to condenser coil for condensation. It having three connections on its surface those are provided for mounting and passing of steam. Pressure gauge is mounted on this to measure the pressure of steam inside the container. Steam valves are used to control the flow rates of steam to condenser input having capacity 1.5 liter

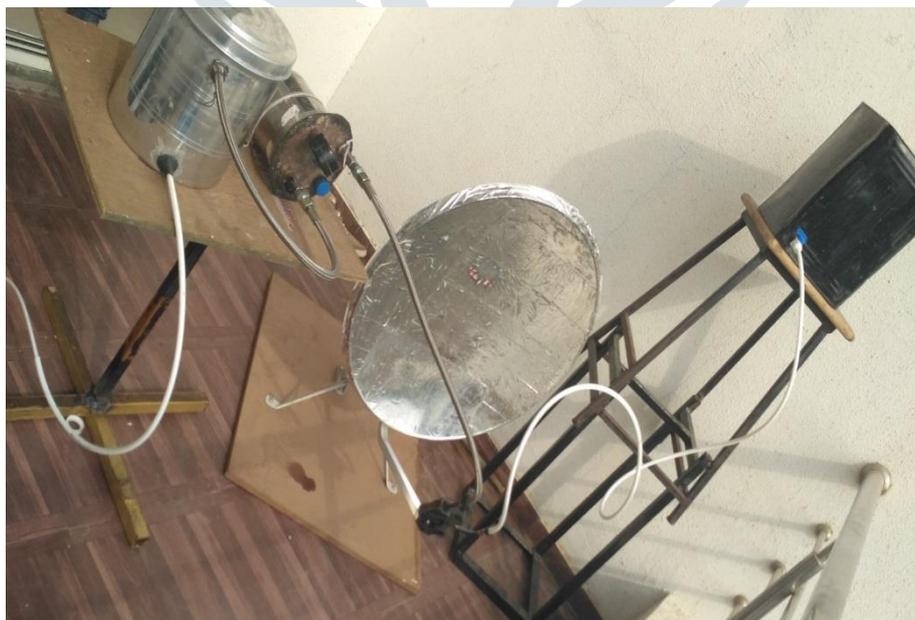
## CONDENSER



**Fig.6 Condenser**

In systems involving heat transfer, a condenser is a device or unit used to condense a substance from its gaseous to its liquid state, by cooling it. In so doing, the latent heat is given up by the substance and transferred to the surrounding environment.

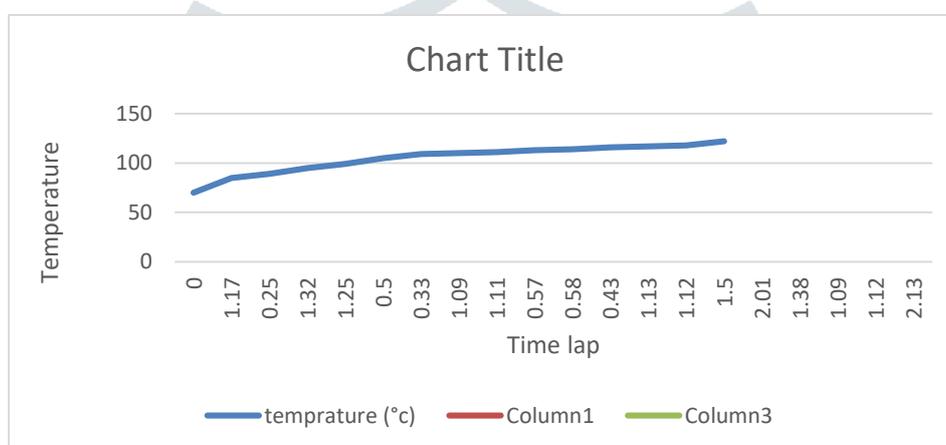
## IV. WORKING OF SOLAR WATER DISTILLER:



**Fig.7 working model Solar water distiller**

## V READINGS AND DISCUSSIONS

Sr. No.	Time (Hrs)	Time lap	Temperature (°C)	Sr. No.	Time (Hrs)	Time lap	Temperature (°C)
1	1:36	-	70	11	1:44	0.58	114
2	1:37	1.17	85	12	1:44	0.43	116
3	1:37	0.25	89	13	1:45	1.13	117
4	1:38	1.32	95	14	1:46	1.12	118
5	1:39	1.25	99	15	1:48	1.50	122
6	1:39	0.50	105	16	1:49	2.01	124
7	1:40	0.33	109	17	1:51	1.38	125
8	1:41	1.09	110	18	1:52	1.09	127
9	1:42	1.11	111	19	1:53	1.12	128
10	1:43	0.57	113	20	1:55	2.13	130



## VI CONCLUSION

- A parabolic evaporator has been designed and developed which can be used to generate heat in temp range of 100-130 °C
- By using parabolic solar reflector, we can convert saline sea water into drinking water in shortest possible duration and minimum cost in most efficient way
- Solar distillery's advantage over conventional distillation had utilised to supply drinking water in coastal and rural area where the energy supply is not available

## VII FUTURE SCOPE

. The following factors are to be considered for the selection of solar still: the availability of solar radiation, total water requirement, salt/saline water available, cost of the still, operating easiness, maintenance cost, better utilization of available waste hot water and life of solar still. The further research of active solar still may be focussed on the following factors:

- The composite material may be used instead of FRP, GRP, GI sheet, aluminium sheet, etc., as a basin liner to increase the thermal conductivity and in turn the yield.
- The effect of energy storing materials in high temperature distillation may be taken to find productivity enhancement.
- The automated sun tracking mechanism can be achieved by using photoelectric sensors and actuators
- The evaporated water can be further be condensed in multiple condensers if the rate of evaporation is more
- The condensed water can be further filtered for purification with reversed osmosis or UV rays

The evaporative cooling can be employed for further cooling of condensed water

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