

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Visit: www.ijirset.com

Vol. 6, Issue 4, April 2017

Performance Assessment of Solar Water Distillation Plant

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ABSTRACT: For human life, pure water is important. But in most parts of the world it's not available and rare. Pure water is important not only for drinking but also for other matters, such as making boilers or feeding water, purified water for medical purposes, etc. The time demand is therefore purifying water. Water purification is a method that absorbs energy, but our typical energy supplies are minimal. Alternative renewables will provide us with a better option in this situation. Solar power is a resource available for this scientific purpose and provides the optimal solutions. The plant has two pieces equipped for solar water distillation. The top portion consists of glass and a cotton plate for heat absorption. This structure is connected to the correct insulator. A small bottle, which is condensed pure water in this bottle, is connected underneath it. Cellulite is the lower component. Wick is included in the cellulite box. The wick reaches from the floor to the copper plate 's back. In the presence of solar fuel, the wick collects the ground water and translates it into a glass box. The whole machine is air tight. It works very well, but its output depends more on the wick. The outcome can be improved from a composite wick material.

KEYWORDS: Solar energy, Pure water, Filters

I.INTRODUCTION

For modern society, energy is the most essential reality. Developments in human beings are speeding up as energy is correctly used and transformed. Energy is used in many forms from the very creation of the earth. Therefore, it is important not only to improve the usage process but also to properly develop the conversion process. Enough energy can be saved by reducing energy loss through conversion.

One of life's core components is water, which increases the possibility of surviving. About 35% of the planet is submerged with water, but the big concern is: "How many can be used?" Some special techniques that can purify water in a usable format are needed in order to use water properly. Energy resources are the fundamental prerequisite for these special strategies, but the traditional energy resources are small due to a major problem. A generic approach is thus time-consuming, reducing reliance on conventional oil. Solar energy can be the best option as a source of clean energy. Solar energy can be translated into different clever energy sources, but is directly used as an energy supply for this experimental purpose.

A special structure of two sections has been created for evaluating purposes. The top portion of the board is made of glass comprising a copper plate and composite wick material. For the condensing of water to the desired location, a narrow passage is usable. The lower portion is composed of a cubic box of cellulite with wicks. This bottom segment is connected to the top and stretched to the ground. This arrangement ensures an air-tight climate.

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The wick which acts as a raw water absorber is the most important part of this arrangement. Wick material collects and heightens water from a certain depth. The most significant properties during the selection of a wick substance are capillary and surface tension. The composition of the wick material, without which the absorption properties of the wick material will evolve, is also significant. Special composition of the wicks is used for this study in order to achieve improved results.

Solar Water Plant is an underwater cleaning device that filters the water, without using toxic materials, electricity, avoiding waterborne pathogens, climate effects and deforestation as well as CO₂ emissions. The closed glass wick content is heated by solar heating and water is also evaporated from the wick. The vaporized water then condensed in a cold spot. The capillary movement of the wick tends to lift the water below. Two phenomena include capillarity, capillarity or wicking: firstly, liquid migration in thin tubes and secondly, fluid flux through porous medium such as water flows through the soil. The adhesion and surface stress result in capillary action. The tension of the surface is used to keep the surface stable and the entire liquid surface is drawn up instead of only moving the edges up. The unified forces between liquid molecules are the source of the so-called surface tension. The surface pressure derives from the water molecule's polar nature. The attraction of water moles to soil particles is defined by capillary activity in hydrology. Capillary activity transfers drainage from soil wetlands to dry fields. Soil potential variations (talk m) induce soil capillary activity. The choosing a wick substance is very critical and important. Therefore, it is important to concentrate on the composition of material that has good absorption characteristics relative to other normal wicks. Locally available wick has strong absorption properties such as: natural fiber, such as black fiberglass, fibrous polyurethane thread, nylon clothesline, polyester cord[1][3][4][5][6][7].

II. EXPERIMENTAL WORK

The apparatus is under the beam of the sun. The sunshine thereby penetrates the device and water is evaporated. Evaporation is the process of a substance in liquid form transitioning into the gas phase. Oppositely, condensation is when a gas returns to liquid form. For evaporation to occur, the liquid must gain enough energy to excite the molecules to move farther apart. Often, the energy comes from heat. Figure 1 displays the basic model of solar water farm. Basic principal of working of solar still is Solar energy heats water, evaporates it (salts and microbes left behind), and condenses as clouds to return to earth as rainwater.

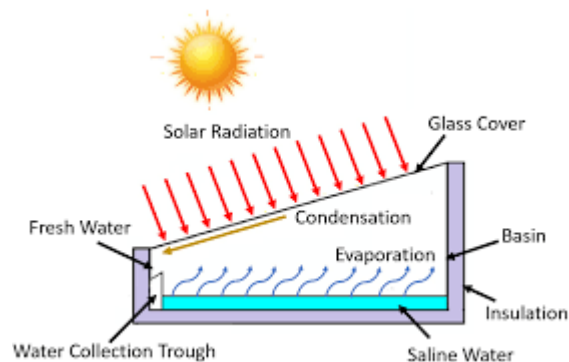


Figure 1: Model diagram of a solar distillation plant

Two key sections are most important in this experimental design. The upper portion is made of glass to allow the greenhouse effect to be realized in this regard. The roof or glass box looks like the top of Figure 1. A copper plate is placed

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beneath this glass case. Since copper is a very strong thermal medium, heat can be transmitted evenly. The wicks are fixed beneath a copper board. Cellulite is the lower component. The wick extends from the top glass box to the ground water supply through the cellulite box. The sun rays inside the glass housing, and so on. The copper plate is heated at this time. The hot copper board has heated the wick beneath the copper board. Water is then vaporized within the wick and vapour exits the wick. When water evaporates, the vapour of water increases, condensing for collection in the glass surface in figure 1 and figure 2. This method prevents impurity as well as destroys microbiological species. In the end, water is cleaner than rainwater [2]. Water to be cleaned is poured into the still to partially fill the basin. The glass cover allows the solar radiation to pass into the still, which is mostly absorbed by the blackened base. This interior surface uses a blackened material to improve absorption of the sunrays. The water begins to heat up and the moisture content of the air trapped between the water surface and the glass cover increases. The heated water vapor evaporates from the basin and condenses on the inside of the glass cover. In this process, the salts and microbes that were in the original water are left behind. Condensed water trickles down the inclined glass cover to an interior collection trough and out to a storage bottle.



Figure 2: Solar distillation plant

III. RESULTS AND DISCUSSION

Solar water distillation plant efficiency can be determined by the sun shine. the measurement usually carried out on the basis of solar day. The solar energy can be utilized for 8 hours/day in table 1 and 2. The thermal efficiency of distillation system is influenced by the water level in the collector. The water temperature, the internal air, the glass (internal and external) and the temperature differences between these variables have directly proportional influence to the thermal efficiency of the solar distiller. The temperature and efficiency curve shown in figure 3

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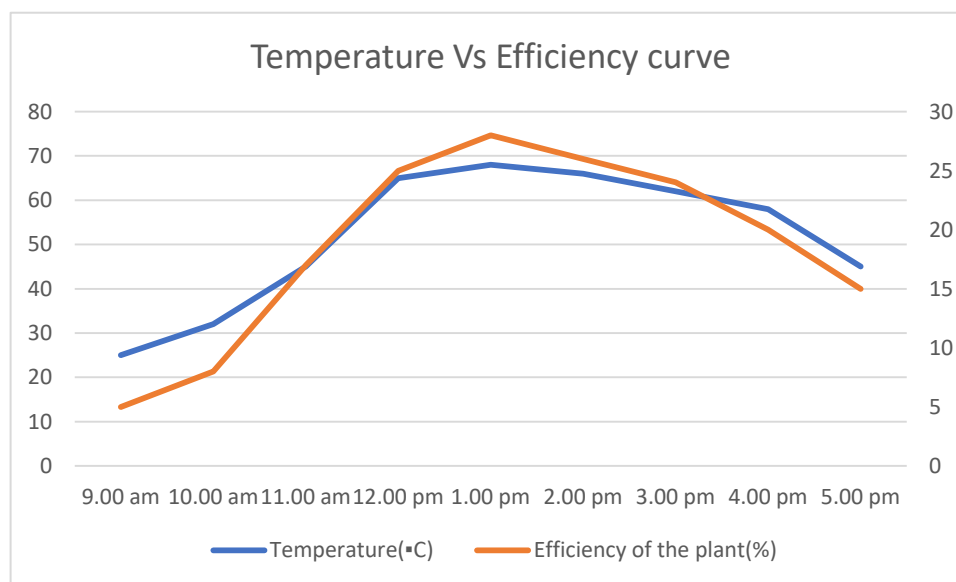
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Time (hour)	Collected Water (Lts)	Area (m ²)	Mass flow rate (Lts/m ² /4 hour)
4	0.125	0.15	1.25
4	0.145	0.15	1.11
4	0.156	0.15	1.20
4	0.138	0.15	1.15
4	0.116	0.15	1.35

Table 1 Mass flow rate in lt/m²

Solar intensity (W/m ²)	Solar power(W)	Efficiency (%)
990	111.625	17.90
1200	134.584	14.62
1250	142.56	18.24
1100	125.23	16.98
1000	121.525	19.16

Table 2 Efficiency (%)



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IV.CONCLUSION

It is an efficient method of water softening, it is cheap method to tap the water using solar energy, it can be reused. The performance of the solar distillation plant was performed well throughout the experimentation process. From the graph, it can be concluded that the increase in temperature, the evaporation is maximum in the period of 11 am to 1:30 pm. The maximum temperature achieved is 70.°C which is at 2.00 pm. then the temperature decreases. The aim of the experiment was to get pure water from the brackish water available. The brackish water supplied was 20 liters and at the end of the experiment we got 2 liters. The TDS level of purified water obtained is 75 PPM with potable. The efficiency of the system is 10-30% depends on the sun shine of the day.

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