Experimental Analysis of Solar Still with External Condenser

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Abstract-A conventional solar still is widely exploited but it has low efficiency. Thus, numerous modeling and design attempts have been made to improve its performance. This research work focused on the effect of condenser unit attached to the passive solar still on the daily productivity. Comparative study has been carried out for passive solar still and condenser attached to the solar still. From this research study it has been observed that condenser attachment gives the higher productivity as compared to the passive solar still.

Keywords - *Conventional, Passive, Solar Still, Productivity, Temperature.*

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I. INTRODUCTION

Today fresh water demand is increasing continuously, because of the industrial development, intensified agriculture, improvement of standard of life and increase of the world population. Only about 3 % of the world water is potable and this amount is not evenly distributed on the earth. On deserts and islands where underground water is not readily obtainable and the cost of shipping the places is high it is worthwhile to take into consideration of producing potable water from saline water, using solar energy that is in abundance in deserts.[3][4]

This research work has been focused on the distribution of solar radiation and make solar still more effective with increasing the productive output of it. The condenser attached to passive solar still and its result data can compared to the passive solar still. For batter comparison both solar still fabricated separately and measured the data for the same day.

For this research work following research work has been studied:

T.Arunkumar et Al. worked on "Experimental study on various design of solar still", they fabricate seven solar still (spherical, pyramidal, hemispherical, double basin, concentrator-coupled CPC tubular, CPC coupled with pyramid solar still). From this experiment the maximum productivity has been observed in tubular solar still coupled with pyramid type solar still. It shows the maximum amount of productivity due to the concentrator effect. The productivity of the solar still entirely depends on the climatic parameters as well as increasing the water temperature. This will leads to raise the evaporative and convective heat transfer coefficients in the solar still. The concentrator effect plays a vital role to increase the water temperature up to 95◦C as compared to the other types of solar still. So evaporative heat transfer rate is higher for tubular solar still, and it is showing the maximum amount of yield.[1]

M.Koliraj Gnanadason et al. worked with **"Enhanced Performance of Design of a Single Basin Solar still".** They replaced conventional S.S. basin with copper material and perform an experiment from morning to evening. They measured hourly distilled output and they conclude that copper still the productivity is improved significantly. [2]

II. Experimental Setup

In this research single slope basin type solar stills were designed and constructed from 1.4 mm galvanized steel with a net basin area of 0.6 m². A 5 mm thick glass cover was fixed at an angle of 23^o to the horizontal. In order to maximize the absorption of solar radiation and the inner sides of the galvanized basins were painted by black paint. To prevent or minimize heat lose from the base and the sides of the galvanized basins, each galvanized basin was covered with thermwool (0.045 (W/m² °C) but of a slightly larger size. The conventional was used for the comparative study. Cylindrical condensers were designed and constructed from 2 mm PVC pipe of diameter 6 inches. Each condenser had a diameter of 15 cm and a height of 50 cm. The condensers were fixed to the back of the other two solar stills by 10 cm diameter. This is called as advanced solar still which has been attached with condenser.

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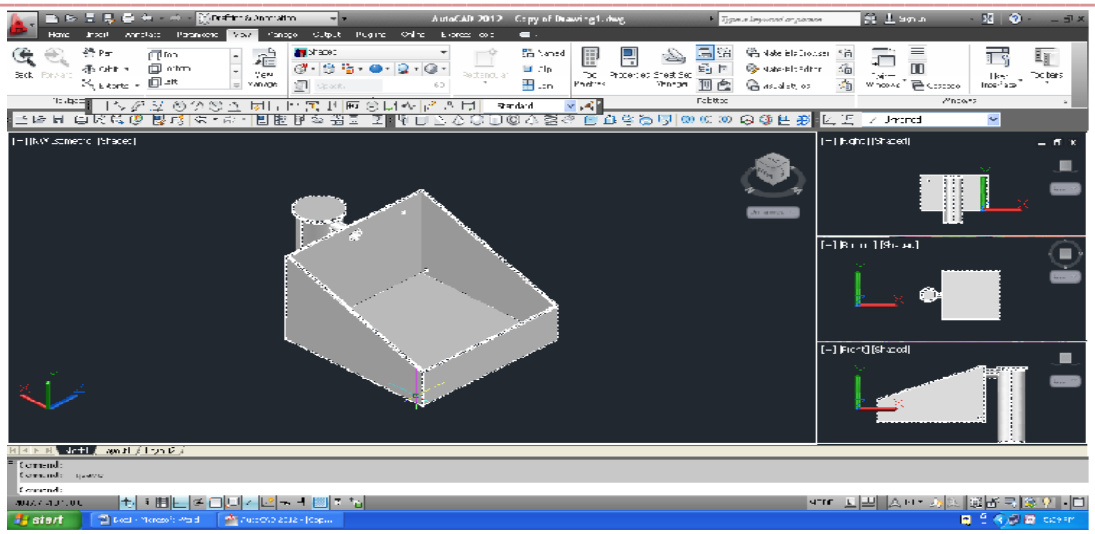

Figure 1 CAD geometry of solar still with condenser

A suitable frame was built and still were mounted adjacent to each other. A feed water tank was attached to the stills for water inlet. As an extra precaution, to ensure that the water level inside the stills is exactly horizontal, marking of each centimeter in the basin has been marked by white paint. The water level was checked before and throughout the tests. A collecting channel of suitable shape and size was fitted at the lower edge of each glass cover and was used to collect the condensate fresh water at the lower side of the solar still.

Figure 2 photographs of experimental set up with and without condenser solar still

III. Result and discussion

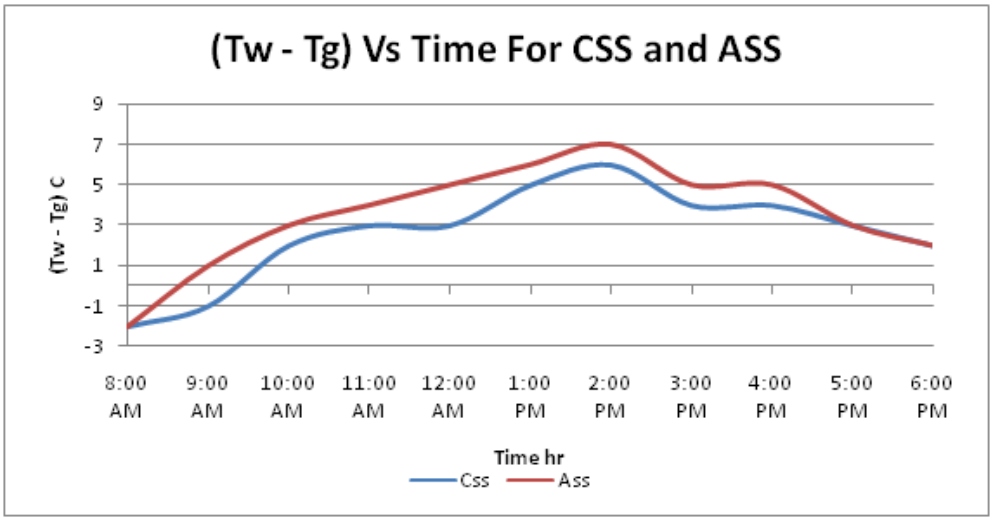

Figure 3 variations in (Tw-Tg) vs. Time for CSS and ASS

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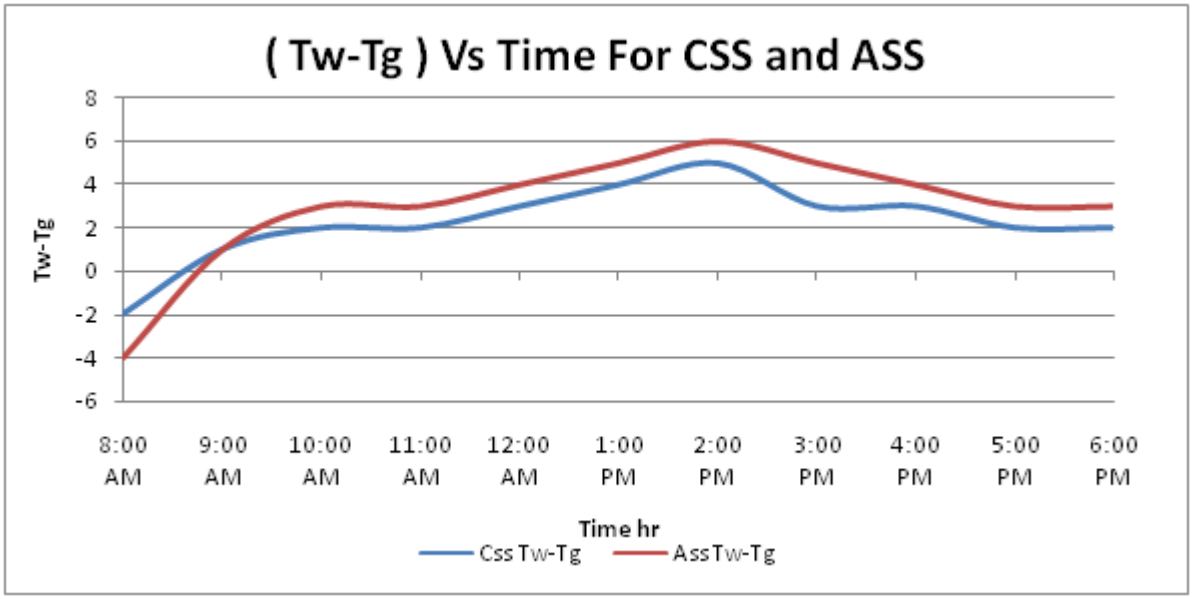

Figure 4 variations in (Tw-Tg) vs. Time for CSS and ASS

Figure 3 and figure 4 shows that the variation in temperature difference between water surface and inner surface of condensing glass cover. From this chart it has been observed that the temperature difference between water surface and inner surface of glass cover has been increasing gradually from the start of sunlight. This difference has been maximum at the 1:00pm to 2:00pm and after that it decreases gradually. For 1cm water depth maximum temperature difference has been observed.

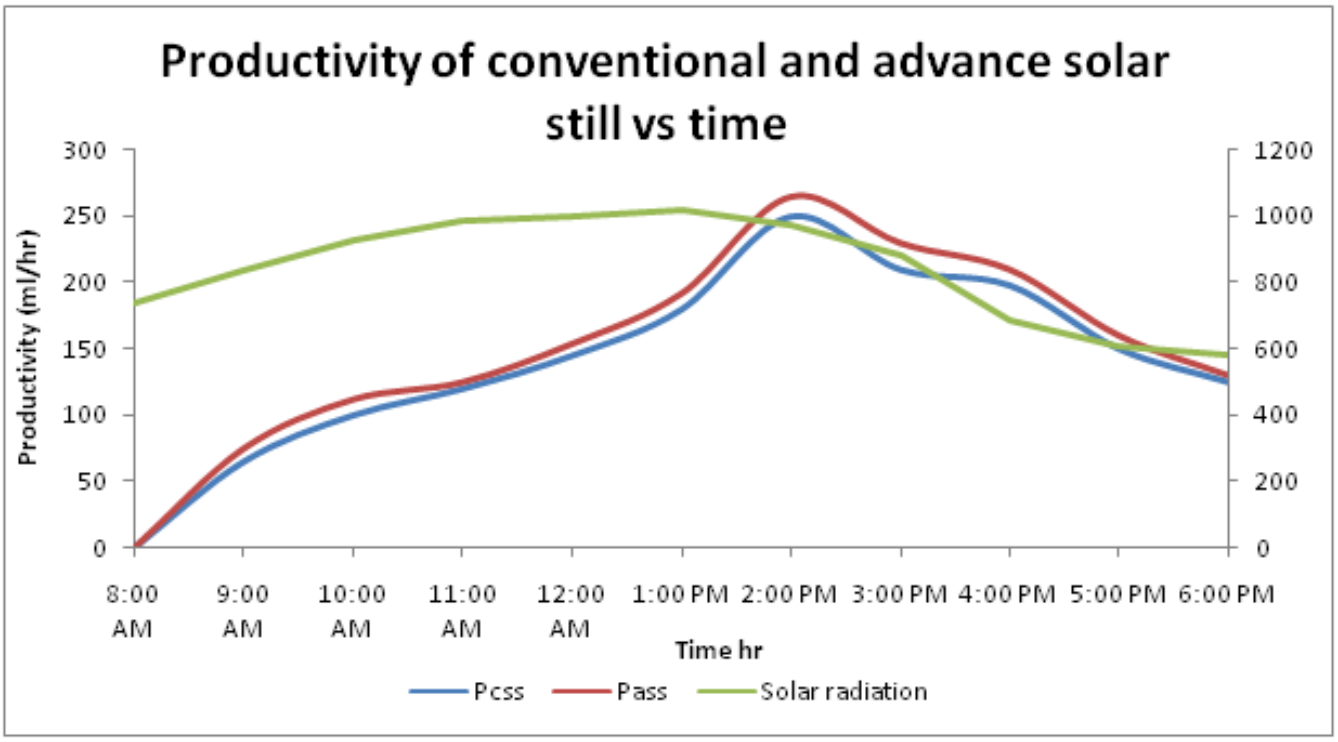

Figure 5 variations in productivity vs. time vs. solar radiation for 1cm water depth

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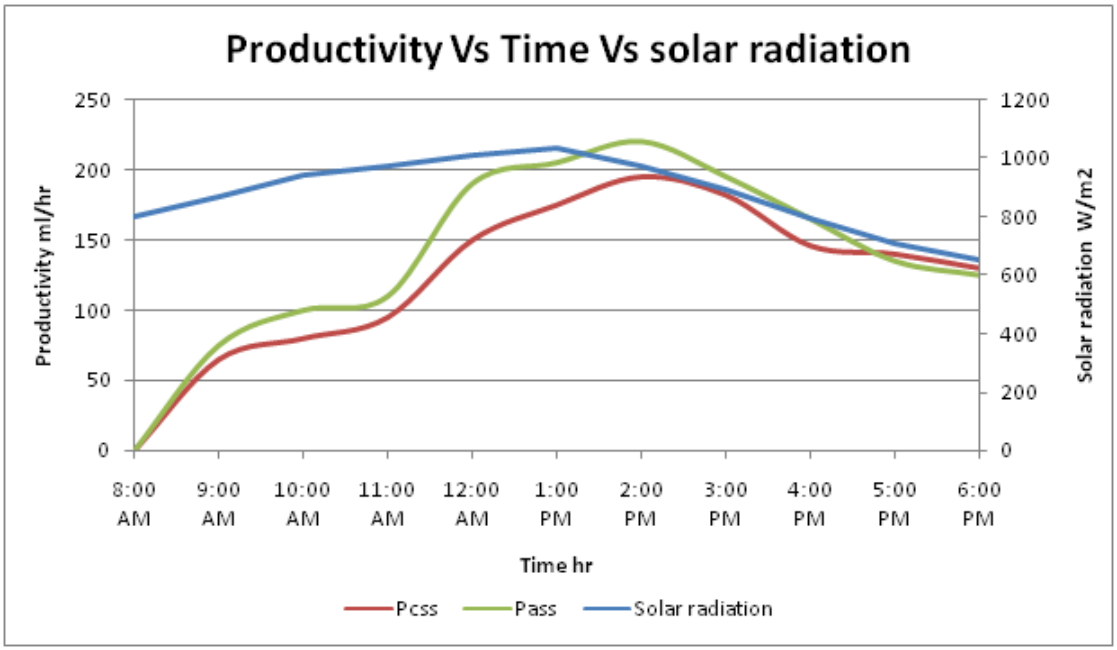

Figure 6 variations in productivity vs. time vs. solar radiation for 1.5cm water depth

Figure 5 and Figure 6 shows the variations in productivity of the conventional and advanced solar still with respected to solar radiation during the day period for 1cm and 1.5cm water depth. From this chart it has been observed that the productivity of solar still has been increasing with increasing solar radiation. The productivity has been gradually increasing from 8:00am to 2:00pm and than it has been gradually decreasing. The maximum productivity of solar still has been observed at 2:00pm for both solar still. The maximum productivity has been observed in advanced solar still as compared to the conventional type of solar still. The maximum productivity has been observed with 1cm as compared to the 1.5cm water depth.

IV. Conclusion

From the above results it has been observed that the productivity and temperature difference has been increased with increasing solar radiation. Highest values of these have been observed in between 1:00pm to 2:00pm. Maximum productivity has been observed at the maximum temperature difference between water surface and inner surface of condensing glass cover. Advanced solar still has been more effective as compared to conventional solar still and it gives the higher productivity as compared to conventional solar still. The productivity of solar still has been increasing with decreasing the water depth in the basin.

V. References

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