

Productivity of Solar Still an Experimental Approach

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ABSTRACT: The primary aim of this study is to raise the productivity of single basin single slope, solar still by using various solid, storage materials such as pebbles, metal, granite in the still. Various liquid sensible heat storage materials such as oil, water, charcoal powder were poured in small containers and introduced into the still. Various evaporative surfaces such as clothes, blue sponges were tested to improve productivity in the still. To improve the condensation rate outer glass cover temperature was cooled at regular intervals of 10 minutes using sprinkler manually. The performances of modified still were compared with conventional still of the same size running under the same meteorological conditions. The solid, sensible heat storage materials produces 52% more than conventional still. Liquid sensible heat storage material produces 22% more than conventional still.

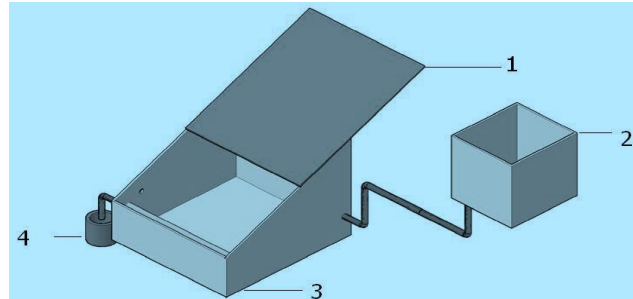
KEYWORDS : Water cooling; heat storage; Sensible Heat storage; Single basin

I.INTRODUCTION

To enhance the yield of the single basic solar still, many research works are being carried out. Nabil Hussain A Rahim [1] adopted a fresh technique to improve the efficiency of horizontal solar still. In this study the efficiency of evaporative and condensing zones are improved by copper condenser tubes inside the still. Asphalt basin liner and sprinkler are used in the still to increase the productivity by O. O. Badran [2]. Kalidasamurugavel and et al., [3] done the experiment with different types of liner materials to improve absorption rate the answers evidenced that the rubber was the best absorbing material. Rajasenivasan and et.al, [4] used dye in the watershed to increase productivity. A.Senthilrajan et.al,[5] analyses Multibasin still with biomass heat sources and done analytical validation using response surface methodology. Senthilrajan et.al [6] integrated a pyramid still with single basin still using common biomass heat source with various sensible materials the results shows that the productivity of combined still was maximum in biomass mode than conventional and solar modes.

II.EXPERIMENTAL SETUP AND PROCEDURE

Single basin single slope, solar still was fabricated with 1.2mm thick mild steel. The size of the basin was 1x 1 x 0.75m. The catchment area is painted black to absorb maximum solar radiation. The position and bottom positions of the stills were insulated with 3mm thick thermocouple insulation layer to reduce heat losses in the still. The condensing surface of the still is made of plain glass with 3 mm thickness is set at 30⁰ inclination to the horizontal axis. A silicone rubber sealant is applied to keep the glass intact with the steel to prevent the vapor leakage from the still. Collection troughs were provided below the lower border of the cover, to collect the condensate. Distillate outlets were provided to drain the water through hoses and to store in jars. Provisions were made to supply raw water, run out the basin water and insert thermocouples. Fig.1 shows the sentiment to be fabricated experimental single basin solar still. A formal style of same area was constructed and run parallel with the modified still for comparison. Experiments were conducted at Mohamed Sathak polytechnic college, Kilakarai, Ramanathapuram, Tamil Nadu, India during the months of September - December, 2019. The interpretations were read from morning 9AM to Evening 5 PM for every one hour



Parts; Glass 2. Input tank 3. Solar still 4. Collection tank:

III. MODIFICATIONS IN THE STILL

Solid sensible heat storage materials such as metal parts, pebbles, granite, metals, are brought out in the still with 2cm water depth. The area of water, $m_b c_{p_b}$, values for various materials are shown in Table.1. Various liquid sensible heat storage materials such as oil, mi water, charcoal powder were introduced in the G.I billets. All the liquid materials were filled half of the intensity in the berth. The Area of water and $m_b c_{p_b}$ values for theoretical analysis were Tabulated in Table.1 clothes, sponges and with materials were examined in the still with 2cm water depth. The Area of water and $m_b c_{p_b}$ values are presented in Table. 1

Table 1

Sl. No	Materials	A_w (m)	$m_b c_{p_b}$ J/k	(m_w) Kg
1	clothes	0.8	600	13.72
2	Sponges	0.8	515	13.415
3	Wick	0.7	475	13.36

IV. RESULTS AND DISCUSSION

Effect of solid, sensible heat storage materials on productivity

Some materials can store more amount of heat energy and increases the heat capacity of the still area in addition to increasing the basin absorption. These materials soak up energy during heating periods and released energy slowly during cooling. The fig.2 shows the productivity of various solid, sensible heat storing materials with time various materials such as metal, pebbles, granite are placed inside the still with 2 cm water depth and proven. The productivity of metal will be more compared to other materials.

Effect of liquid sensible heat storage materials on productivity

Various liquid sensible heat storage materials are presented inside the lines and placed inside the still and tested. Fig.3 shows the output of various liquid sensible storage materials. The productivity is higher for water than others.

Effect of evaporative surfaces on productivity

Due to capillary action clothes, sponge, absorb more water. Thus, exposure area is increased. This contributes to increasing the evaporation rate in the steel. As demonstrated in fig. 4. Productivity for sponges are 62% higher than conventional still and 23% than clothes..

The impression of glass cooling on productivity

The fig. 5 shows the temperature of the glass and productivity during various hours. Glass cooling increases 27% of productivity in the still This growth in the still yield is due to the divergence between the glass cover temperature and water temperature, which will increase the condensation process on the inside stratum of the screen.

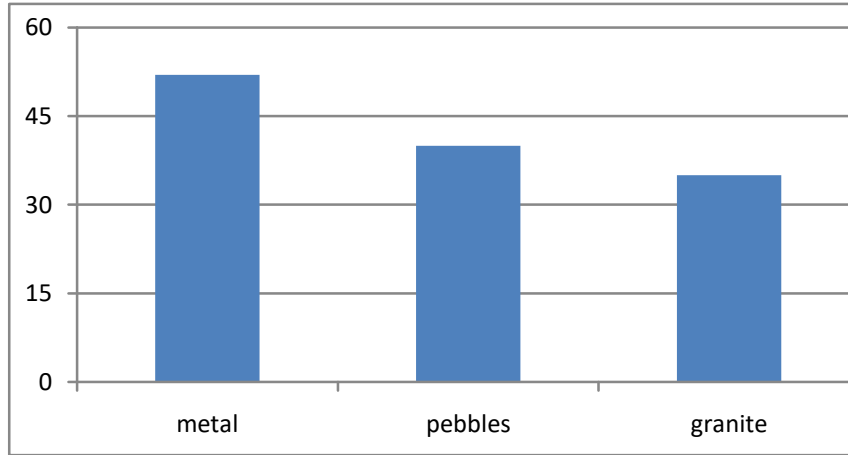


Fig. 2 Effect of solid, sensible heat storage materials on productivity

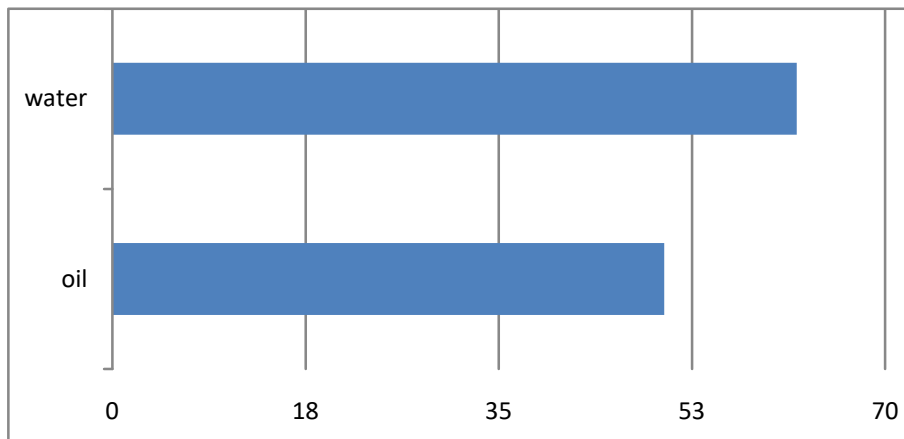


Fig.3 Effect of liquid sensible heat storage materials on productivity

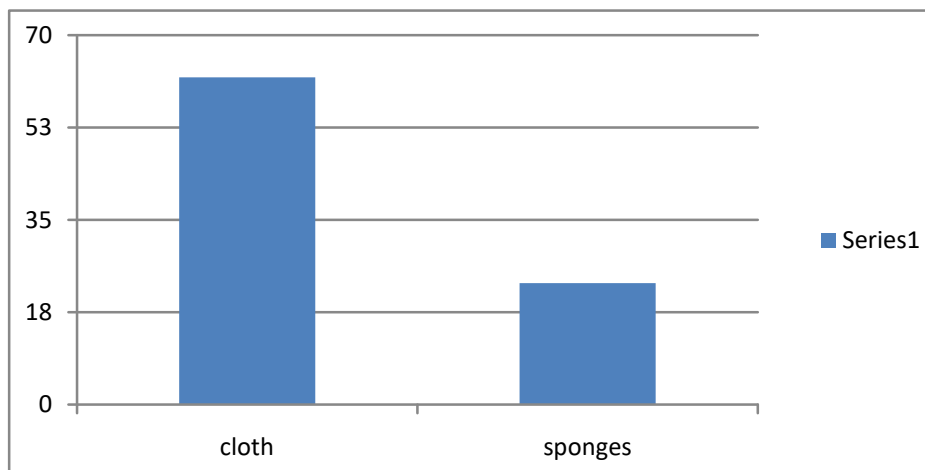


Fig.4 Effect of evaporative surfaces on productivity

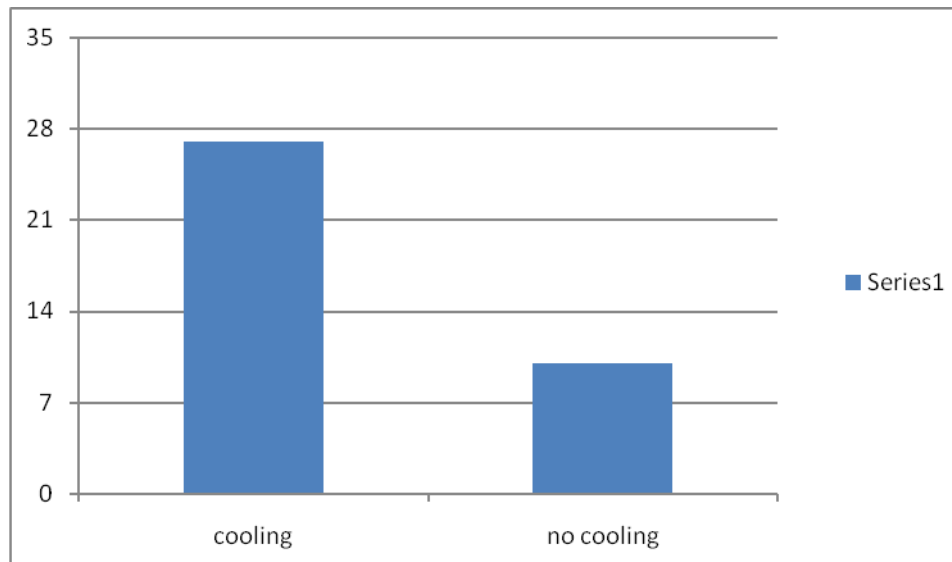


Fig.5 The impression of glass cooling on productivity

V.CONCLUSION

An experimental study has been carried on to predict the productivity of a single slope, solar still using different solid, liquid sensible heat storage mediums and various explorative materials.

- Established on the experimental results the following determinations are reached
- An increase in the still productivity was observed with the increase in the solar intensity
- The role of solid, sensible heat storage materials in the still improves productivity by 52% than conventional blade.
- The liquid sensible heat storage materials in the form of billets increase the productivity by 50% than conventional blade.
- The used of evaporative surfaces to increase the area of exposure and still productivity by 22%
- Lower water depth in the still increases the productivity in the still.
- Manual glass cover cooling in the still increases the productivity by 20% more than without glass cooling.

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