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Enhancing the Productivity of the Solar Still with Reflector and Boiler

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Abstract - A single slope solar still with 0.82 mx 0.8m x 0.7m has been fabricated with G.I sheet and tested with different water depths of 1,2,3cm. The reflector and boiler fitted at input side raises the water temperature. Various solid and liquid sensible heat storage materials, Evaporative surface materials are used in the still. To reduce glass cover temperature the outer glass was cooled by using sprinkler manually at regular interval of time. Theoretical analysis was performed and compared with experimental values. The performances of modified still were compared with conventional still of same size running under the same meteorological conditions. The solid sensible heat storage materials produces68% more productivity than conventional still. Liquid sensible heat storage material produces 24% more than conventional in still. The payback period of the still was 352 days.
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***Key Words*:** : reflector, boiler ,solid sensible heat storage materials, liquid sensible heat storage materials, Glass cooling, Evaporative surfaces, water depths.

I.LITERATURE SURVEY

Fresh water is one of nature's most important gifts to life as a person's survival depends on drinking water. Solar desalination is the best method for purifying the impure water in a low cost. The solar stills have many advantages than other methods of desalination. Rai et al. [1990] predict the productivity decreases with the salt concentration. Badran & Tahaneih [2005] coupling a flat plate solar collector with the still to increase the productivity by 38% Bassam & Hamzeh [2003] have done the experimental study with different sponge cubes in basin and improves the productivity by 28% to 37.3%. Voropolulos et al. [2004] investigated the hybrid still coupled with heaters; the results showed that the productivity is doubled by coupling. Benon Bena & Fuller [2002] coupled a natural convection solar dryer with a biomass back up heater and increases four times better than the solar dryer. Nakatake [2009] increase the productivity by using external reflector in the solar still. Muafag Suleiman & Tarawneh [2007] uses sprinkler for glass cooling to reduce glass cover temperature and improves productivity of 14% more than conventional still. The model which has been proposed is using a converged plate reflector instead of a flat one. The reason the flat plate reflectors result in a decreased efficiency over time is due to the fact that when the sun's rays strike them, they scatter the heat energy, resulting in an excessive amount of energy loss.

2.WORKING

A solar still was created using 1.4mm thick mild steel, with the basin measuring 0.82x 0.8 x 0.7m and painted black to absorb maximum solar radiation. In order to minimize heat loss in the still, the side and bottom were insulated with 4mm of thermocol insulation with a thermal conductivity of 015w/mk. The condensing surface of the still was produced from plain material.. Collectiontroughs have been supplied under the lower edge of the glass cover to collect the condensate. Distillate shops were furnished to empty the water through hoses and to store in jars. Provisions were made to supply raw water, drain the basin water and insert thermocouples. Fig.1 suggests the photographic view of be fabricated experimental single basin solar nevertheless. A conventional nevertheless of identical area became fabricated and run parallel with the modified still for evaluation. Experiments have been carried out at Mohamed sathak polytechnic university, Kilakarai, Ramanathapuram, Tamil Nadu, India all through

the months of may also -june , 2016. The readings had been taken from morning 9.AM To evening five.PM for every one hour interval. Pv sun meter, virtual anemometer and mercury thermometers had been used to measure global radiation, wind pace and ambient temperatures respectively. k-type thermocouples with multichannel virtual display unit have been used to measure basin, water, glass cover temperatures.Fig.1 experimental setupsensible warmth garage several types of realistic warmth storage materials inclusive of rocks, metals, pebbles have been trying to growth the water inlet temperature. Metals pieces having 0.eight x 0.4 x 0.04 m region changed into ordered at regular intervals within the stack. the whole hundreds of metal pieces are zero.5 Kg. leather pieces having region 0.five x zero.5x zero.01 m become positioned at ordinary c language inside the nevertheless. pebbles having dimensions zero.02m diameter changed into identified within the still. The extent of pebbles are 1.five Kg. The precise warmness ability of rocks, metals, pebbles are 0.75, 0.54, 0.64, KJ/Kg- Latent warmth garage materials that allows you to boom the water temperature various materials which encompass wax, water are used inside the shape of billets. The spots are having diameter zero.02 m and length zero.04 Pellets are made of GI sheet steel. all of the fabric are saved 1/2 of the amount in the billet. The latent warmness of wax, water, liquid paraffin is 647,334, KJ/Kg. Evaporative location To boom exposure vicinity wick cloths, smallpots are added within the shape of. all of the exposure materials are of place 0.5x0.5m placed 20p.cin the water surface. these materials lifts water via capillary action and facilitates to boom the publicity vicinity in the still . Water intensity numerous characters of water depths along with 1cm, 2cm, and 3cm have been introduced into the nonetheless to suss out the operation. The flock of water for 2cm water depth is12.5kg system

2.1 Procedure

First feed salinized water into the feeder tank and notice down the preliminary• temperature(T1). note down the volume(V1) of the water with the assist of flask and also measure• the mass (m1) of the same amount of water used all through the method. Calculate the initial density (D1) by means of the usage of the method.• Then allow the water to pass via copper tube by opening the gate valve• slowly. The gate valve shall be opened slowly so that water flows at a decrease price and may get excess quantity of warmth at the same time as passing over the parabolic reflector. The water is allowed to drop into the collector tank and take the studying of the• very last temperature(T2). The risen temperature of the recent water ends in evaporation of water droplets• inside the glass surface. allow the temperature to fall in order that condensation takes vicinity, the water droplets• formed on the glass floor is the natural form of water. The water droplets slowly slide down the glass surface and is accrued. measure the quantity(V2) of the natural water with the assist of flask and additionally•degree the mass of fresh water(m2). Calculate the very last density(D2) by way of using the components.• Now calculate the proportion (%) of fresh water to salinized water. Repeat the• equal technique for any other four readings. Plot the graph final Temperature(T2) Vs very last Density(D2).•

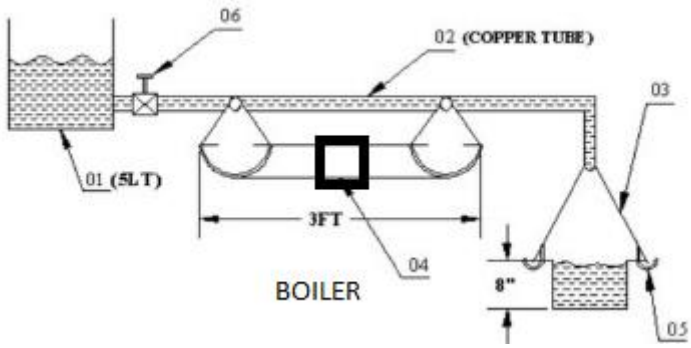

Fig.1 Experimental setup

3.Results and discussions

3.1. Effect of reflector and boiler on temperature

The result of water temperature in the basin and the productivity is proven in fig.2. It's miles apparent that as the water temperature accelerated,. That is because of be increase of the heat content of the water in the basin, results, in lower water temperature in the basin main to decrease

evaporation charge. Nevertheless withreflector produces a maximum of 55oc,nonetheless with boiler produces a temperature of68^{o}C

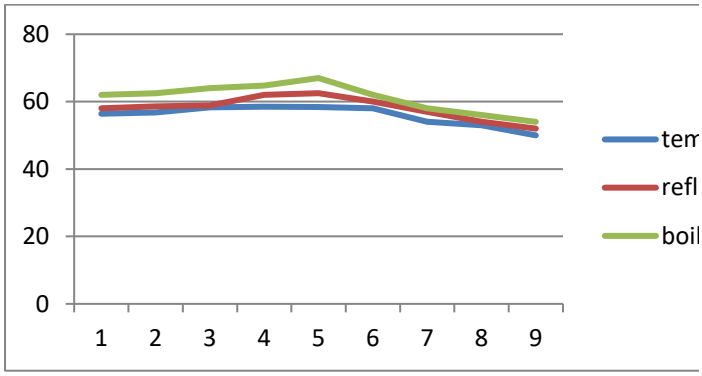

Fig.2 Effect of reflector and boiler on temperature

3.2 Effect of solid, sensible heat storage materials on productivity

some materials can save greater amount of heat strength and will increase the heat capability of the drain vicinity, further to increasing the basin absorption. These materials soak up electricity during heating durations and released power slowly all through cooling. The fig. 3 suggests the productiveness of various solid.Pebbles and rocks produces greater out of 68% and 42%.

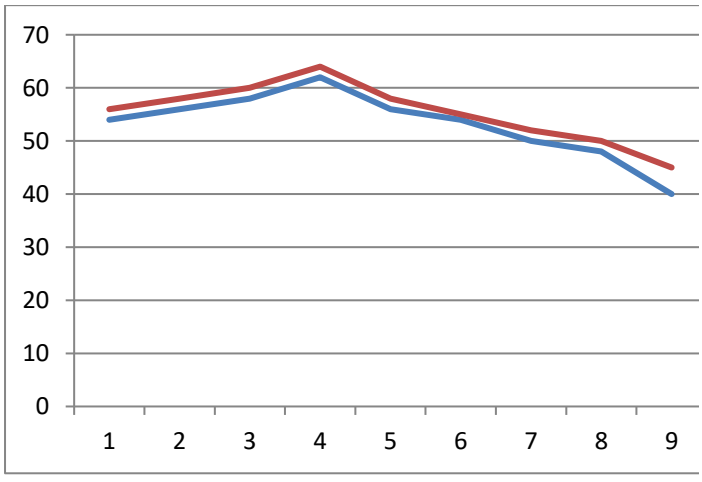

Fig.3 Effect of solid, sensible heat storage materials on productivity

Various sensible heat storage materials are presented inside the lines and placed inside the still and tested. Fig.4 shows the output of various liquid sensibilities The latent heat materials undergo phase change from liquid to vapor and again from vapors to liquid. During the phase changing it absorbs heat energy and transmits it to the water and increases water temperature in the still Storage materials. More output was observed in wax (45%) than other materials

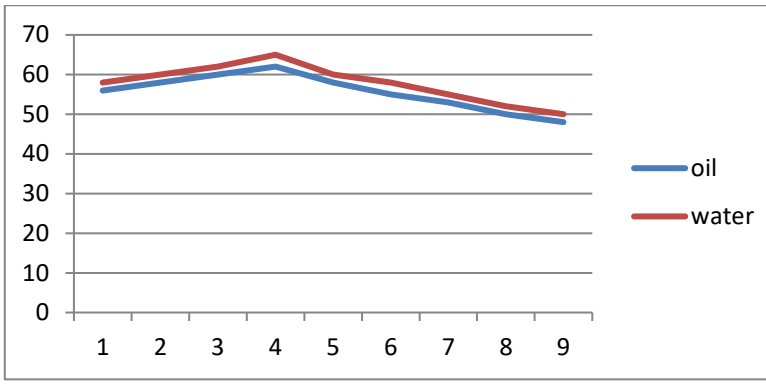

Fig.4 Effect of liquid sensible heat storage materials on productivity

3.3 Effect of evaporative surfaces on productivity

Diverse sensible warmth storage materials are offered inside the strains and positioned in the nonetheless and tested. Fig.Four suggests the output of diverse liquid sensibilities The latent warmness materials go through phase exchange from liquid to vapor and once more from vapors to liquid. During the segment converting it absorbs warmness power and transmits it to the water and increases water temperature within the still storage materials. More output become found in wax (forty five%) than different substances

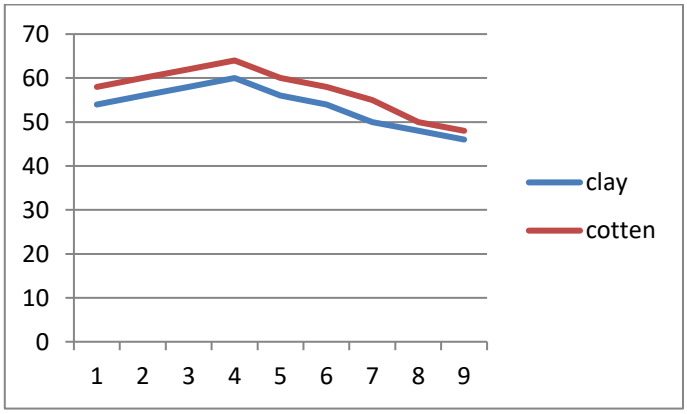

Fig.5 Effect of evaporative surfaces on productivity

4.CONCLUSION

An experimental study has been carried on to predict the productivity of a single slope, solar still using reflector and boiler with different solid, liquid sensible heat storage mediums and various evoporative materials. Established on the experimental results the following determinations are reached Changes in solar radiation do not bear on yield.

Solar still behaves as condensing unit

.• Cost of water production is low.

• The yield can be increased in proportion to increase in inlet water temperature.

Use of solid, sensible heat storage materials in the still improves productivity by 58% than conventional still. The liquid sensible heat storage materials in the form of billets increase the productivity by 45% than

• conventional still. The used of evaporative surfaces increase the area of exposure and still productivity• by 25% Lower water depth in the still increases the productivity in the still.

•Effect of reflector improves water temperature

Effect of boiler raises the output

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