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Solar Distillation System

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Abstract: ***Solar energy is widely available renewable source of energy. Its can naturally available so there is no pay to obtain solar energy. This energy is used in solar distillation system for extraction of distillate water source. A device which convert the dirty/ saline water in to pure/ potable water using the renewable source of energy is called solar still. Solar still method of distillation is simple, cost effective and economically friendly. Solar stills are very simple to construct and easy to operate but their efficiency and productivity are fairly low. To increase the yield from stills different methods were adopted. In this paper, an experimental investigation on single and double effect desalination systems are reported and the effects of some parameters such as water depth, input radiation intensity and salinity on the productivity of the system is discussed. Increase in water depth in the basins, decrease in the radiation intensity and increase in the salinity reduces the system production rate. On using a passive double effect desalination system will increases the yield of the system considerably.***

Keywords: Double Effect Type, Solar Still, Desalination, Radiation

I. INTRODUCTION

Potable water is a human birth right – as much a birth right as clean air. However, much of the world's population does not have access to safe drinking water .Out of 6 billion people on earth, more than one billion, i.e. one in six, lack access to safe drinking water. Moreover, about 2.5 billion (more than one in three) do not have access to even adequate sanitation services. Collectively, these shortcomings generate water-borne diseases that kill on an average more than 6 million children each year, or about 20,000 children daily. Of the total earth's surface, 70% is covered by water, but most of it is in the sea as saltwater. Fresh water covers only 3% of the earth's surface and much of it lies frozen in the Antarctic and Greenland polar ice. Humans consume fresh water available from rivers, lakes, underground sources and aquifers. Jointly, these sources account only for 1% of all the water available on earth. Six billion people depend on this supply and a significant portion of the world's population now faces water storage. Fresh water is one of Earth's most valuable renewable resources. It is the essence of life and is a basic human requirement for domestic, industrial and agricultural purposes. Sufficient drinking water resources are necessary for the development of any country. Water is not only indispensable to industrial development to economic growth, to social wellbeing, but it is also indispensable for the preservation of natural resources. For a country, a region, a civilization, securing an adequate water supply has always been one of the essential prerequisites, not only to its development, but frankly, to its survival. Nature, a very large –scale process of solar distillation, provides most of the required fresh water, through hydrological cycle. The important of supplying potable water can hardly be overstressed. More than two-third of earth's surface is covered with water. Most of the available water is either present as seawater or icebergs in the Polar Regions. More than 97% of the earth's water is salty; rest around 2% is frozen in glaciers and polar ice caps. Less than 1% fresh water is within human reach. Even this small fraction is believed to be adequate to support life and vegetation on earth.

II. LITRATURE REVIEW

A. *Sebaii et al. (2000)*

Designed and fabricated a single slope single basin solar still with baffle suspended absorber using locally available materials. A mathematical model for the still was presented. Also it was proved that the optimum collector inclination for a flat-plate collector was 28.56º for a condensing glass cover inclination of 15.18º for NewDelhi's climatic conditions.

B. *Omar Badran (2011)*

Has done the performance of active single slope solar still using different operational parameters is studied theoretically and compared with the experimental data for validation purposes, to find out best factors enhancing still productivity. The thermal performance of a single slope solar still coupled with collector is evaluated through implementing the following effective parameters; a) different insulation thicknesses of 1, 2.5 and 5 cm, b) solar intensity, c) overall heat loss coefficient d) effective absorptive and transmissivity, and e) temperature differences between the still cover and water and f) wind speed. It can be concluded from this study that active solar stills can be one of the options for enhancing the productivity of stills, while wind speed and insulation thickness can contribute to the enhancement of the overall yield.

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C. Zurigat et al. (2004)

Presented a model for a regenerative solar desalination unit and evaluated its performance. Their experimental set up consists of two effects, with provision for cooling water to flow in and out of the second effect. This set up has the advantages of increasing the temperature difference between water and glass cover in the first effect and utilizes the latent heat of water vapor condensing on the glass

III. CONSTRUCTION

A double basin solar still 75 cm * 75 cm is designed with length 60cm and breadth of 60m. It consists of a glass cover of 60 cm * 30 cm. There is basin with same measurement. The angle of inclination is taken as 9º55'. A stand is placed at bottom so as to withstand the weight of the basin.

The glass is tightened with airtight cover with proper insulation.

The basin surface is coated with blackened surface and collection trough is placed near to the basin at bottom of the glass. The volume of salt water is calculated by multiplying length breadth and height. And mass of the salt water is calculated by multiplying density of salt water and volume of the salt water. The basin has inlet for the saline water and has a outlet pipe where the left out water in the still is being extracted. There is a collection tank where the pure water is being collected. The mass flow rate of distillate water / day calculated is around 2.3 liter.

A. Working

The double effect solar still obtain maximum temperature attained during day inside the basin water is 67°c.Its can storing large amount of heat. It increases the heat transfer rate in water which is in the basin. Double effect solar still carry on temperature in long period of time such as multi effect still one side glass can carry temperature on morning time and afternoon time double still carry temperature and evening time carry temperature in other side still glass.

Energy obtained is possible for Long period of time and concave design can improve the intensity of solar ray. Due to this storage of heat in the basin the water temperature increases in the system , intensity of temperature increased at afternoon time as it increase the water evaporate level also increases in the basin.

When the temperature gradually decreases after the sun set such as night time process will stop, in the still system can based to work on the evaporation and condensation, initially evaporated and finally condensed to collect the distilled water. And this continues for the next day also. Thus by introducing double effect solar still the distillate water output is increased when compared with normal solar still.

B. Line Diagram

Process diagram of solar still

Necessity for Distillation Of Water

1) For the use of drinking purposes.
2) For the use of cooking purposes.
3) For the use of various industries, chemical and biological laboratories.
4) For the use of agricultural lands.
5) For the use of aquariums to give the aquarium fish a longer life.

IV. CONCLUSION

Solar still is designed and fabricated with necessary parts and experimental results of various parameters are listed in tables and graphs with varying temperatures and distillate output. Literature survey have been studied and stated for solar still and double side solar still to enhance the heat transfer rate .The comparative study is done and with the help of distilled output the efficiency is calculated for single still and double still. Efficiency of normal single solar still is found to be 40% and for double solar still assisted the efficiency is 44%.

It is found that the efficiency of double assisted solar still is more when compared to single normal still. Thus by this comparative study and by incorporating double side glass in the still the efficiency of stills have been increased. In future different types of phase change materials can be used in different types of stills by considering important parameters like temperature, radiation, latent.

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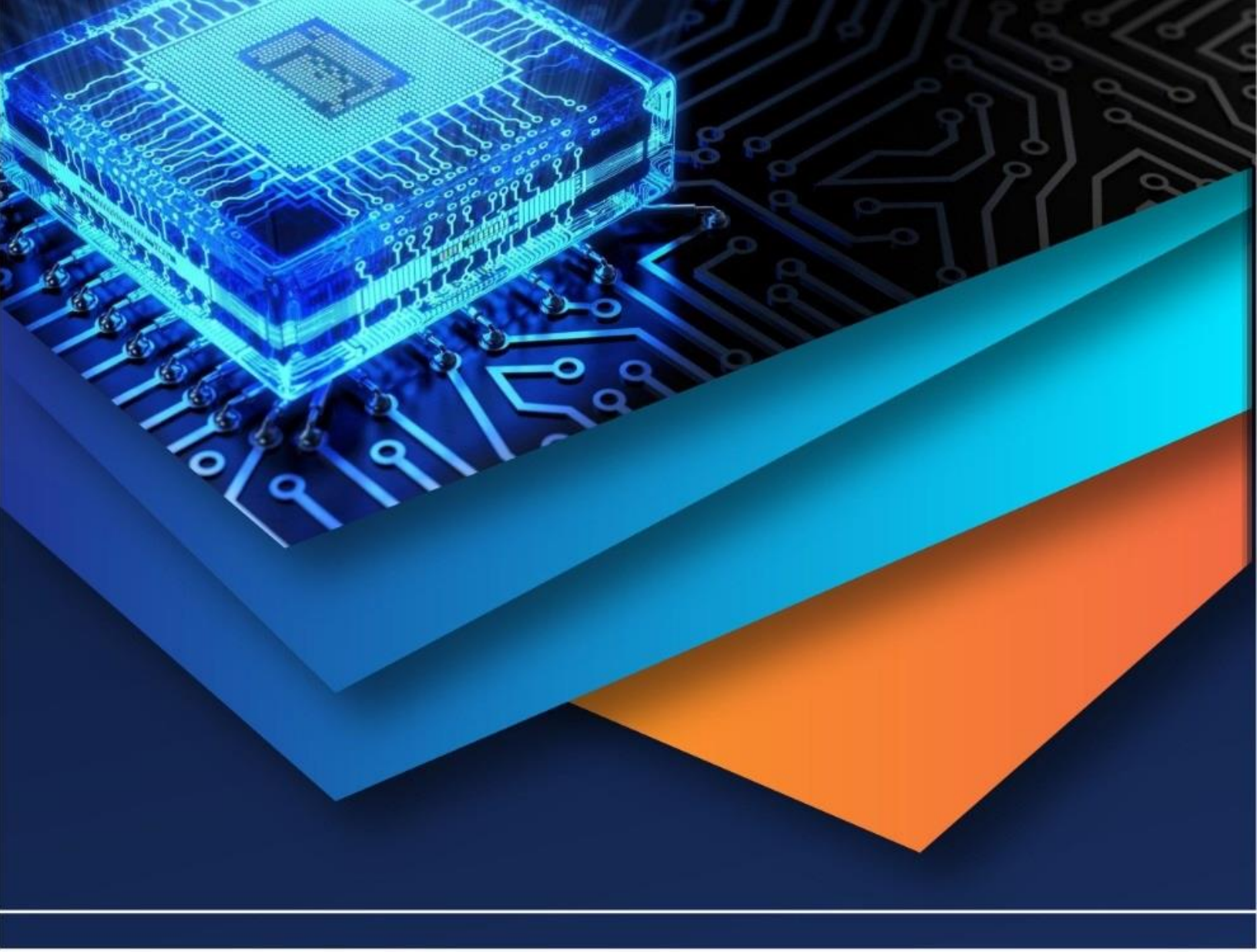

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