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Enhancement of Solar Still Using Sensible and Latent Heat Storing Materials

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ABSTRACT: Energy and water the two major issues faced by human beings nowadays. Owing to increase in the energy costs and the adverse effect on the environment caused by the burning of fossil fuels, renewable energy sources are being used worldwide to contribute in meeting the energy demand. Harnessing the abundance of solar power has been one among the foremost attractive energy alternatives. The development of an efficient and economical solar power storage system is of major concern. Energy storage plays an important role in conserving available energy and improving its utilization. Electrical energy consumption varies during day time and night time. Solar energy is available only during the day. Hence its applications require efficient thermal energy storage in order that the surplus heat collected during sunshine hours could also be stored for later use during the already dark. Thermal energy storage (TES) will improve the efficiency and output of solar energy. A thermal energy storage system mainly consists of three parts, the data-storage medium, heat transfer mechanism and containment system. Thermal energy storage (TES) applications have significantly increased due to the rise within the energy prices and environmental regulations. Latent heat storage (LHS) is one among the efficient ways of storing thermal energy. Unlike the sensible heat storage (SHS) method, the heat of transformation storage method provides much higher storage density with a smaller temperature difference between storing and releasing heat. For the solar desalination process, they are used as a bridge to cross the gap between the energy source, the sun and the desalination

I. INTRODUCTION

Energy is an essential factor for the social and economic development of the societies. Renewable energy is accepted as a key source for the longer term on this earth. The combined effects of the deflection of fossil fuels and the gradually emerging consciousness about environmental degradation have given the first priority to the use of renewable alternative energy resources in the 21st century. All of renewable, solar thermal energy is considered to be practically unlimited in the long term and is a very abundant resource in the world. Many conventional and non-unconventional techniques have been developed for purification of saline water. Among these water purification systems, solar distillation proves to be economical and eco-friendly technique. Among the non-conventional methods to disinfect the polluted water, the foremost prominent method is solar distillation. The solar distillation method is more attractive than other methods. This method require simple technology as no skilled workers needed, low maintenance and it can be used anywhere without problems. There are two differing types of solar systems; those are active type and passive type. In active type system extra thermal energy is supplied to the basin through an external mode to extend the evaporation rate and productivity of pure water. Passive solar systems give lower yield when comparing with active solar systems. In the present days, most of the solar stills are passive solar stills. Because, they need only sunshine to operate it, and there are no moving parts to wear and power consuming. In a passive solar still, the radiation is received directly by the basin or solar still water and is merely source of energy for raising the water temperature, so the evaporation resulting in a lower productivity of pure water. The passive solar still of a conventional design is basically a sealed enclosure

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containing a shallow body of uniform temperature brine solution. This brine solution is heated by absorption of radiation admitted through the top transparent condensing glass cover. The convective circulation of humid air induces the temperature difference between the brine solution and the top condensing glass cover. This causes the transport of water vapour from the brine surface to the top transparent glass cover and from it condenses into the distillate chamber. The parameters which are affecting the solar still are; water depth within the basin, material of the basin, wind velocity, solar radiation, inclination angle of glass cover and ambient temperature. The yield of water from the solar still is depend upon the temperature difference between the water within the solar still or basin and glass cover inner side temperature. The yield from solar still is directly proportional to the temperature difference of water in solar still and in side of the glass cover. Thermal processes for the distillation of sea water are known to be among the first technologies adapted to solar energy. The idea of saline water evaporation by using solar thermal energy for getting pure water is the best technique. It is very fortunate that in times of high water demand, solar radiation is also intense. It is beneficial to exploit solar energy directly by installing solar stills because they are clean and friendly to the environment. Numerous studies on solar stills of various designs to increase the productivity of potable water and efficiency of solar still have been carried out theoretically and experimentally.

II. OBJECTIVES

The main objective of our project is to enhance the distillate productivity of the only slope solar still with the assistance of solar thermal energy storing systems. solar power is an abundant and safe source of vitality and thus is distinguished together of the foremost promising energy choices. Nevertheless, solar power is intermittent in nature as there's not sun in the dark. Its total availability value is seasonal and is hooked on the environmental condition of locations. Hence, solar power presents an unsteady energy resource. So, thermal energy storage are going to be necessary to save lots of the available solar power at a period of no load or when excessive solar power is out there and to form up for the shortage of energy when the load is in need of energy. The distillate output of a solar still is low i.e., 2-3litres/day, hence it's not utilized in the economic and domestic applications and it's used during the sunshine hours. Hence, for the effective use of solar still, the distillate output must be increased. Hence, thermal energy storage materials are wont to store the energy during the sunshine hours and release during off-sunshine hours for increment in distillate output. By using the thermal energy storing system, the productivity are going to be resulted in an improved form at great extent. The another objective of the project is to match the sensible and heat of transformation storage system, by which ready to "> we will able to seek out the difference between the sensible and heat of transformation storing system and to find which is very efficient for the solar desalination process.

III. EXPERIMENTAL SETUP

The experimental setup is shown below in Fig. 1 during which solar still is formed from low-carbon steel sheet of required size. the highest of the basin is roofed with transparent 3 mm pane for condensation purpose inclined by nearly 23°-30° angles which is adequate to the latitude of the situation .the size of the setup is shown on the Fig. 1. the entire setup is insulated by using thermocol of thermal conductivity 0.047 W/m K to attenuate heat losses. The setup is painted with black color so it'll be better to soak up the utmost amount of radiation falling on them and convert it in to the warmth. radiation intensity and ambient temperature are measured with radiation monitor and digital thermometer. the whole assembly is placed on a stand structure made from forged iron . A pipe with storage container is fixed for outlet. to vary the water in stills provisions are made. During the experiment the external temperature, glass temperature, temperature inside the still, water surface temperature, low-carbon steel wall temperature and portable water generated were also measured at a interval of 60 min from 9 AM to eight PM. A cross section pipe is employed to hold down the pure condensed water from the solar stills to the collecting container which is provided outside the solar still.

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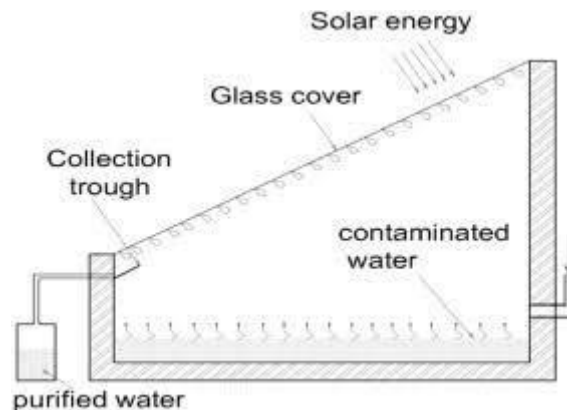


Fig. 1

IV. MATERIALS USED FOR THERMAL STORAGE

For sensible heat storing materials :-

- Sand stones
- Coconut oil
- Aluminium pieces

For latent heat storing materials :-

- Wax
- Molten salt
- Stearic acid

V. WORKING PRINCIPLE

A basin of solar still has a thin layer of water, a transparent glass cover over the water is covered the basin and channel for collecting the distillate water from solar still. The glass transmits the sun rays through it and saline water in the basin or solar still is heated by solar radiation which passes through the glass cover and absorbed by the bottom of the solar still. In a solar still, the temperature difference between the water and glass cover is the driving force of the pure water yield. It influences the rate of evaporation from the surface of the water within the basin flowing towards condensing cover. Vapour flows upwards from the hot water and condensate. This condensate water is collected through a channel.

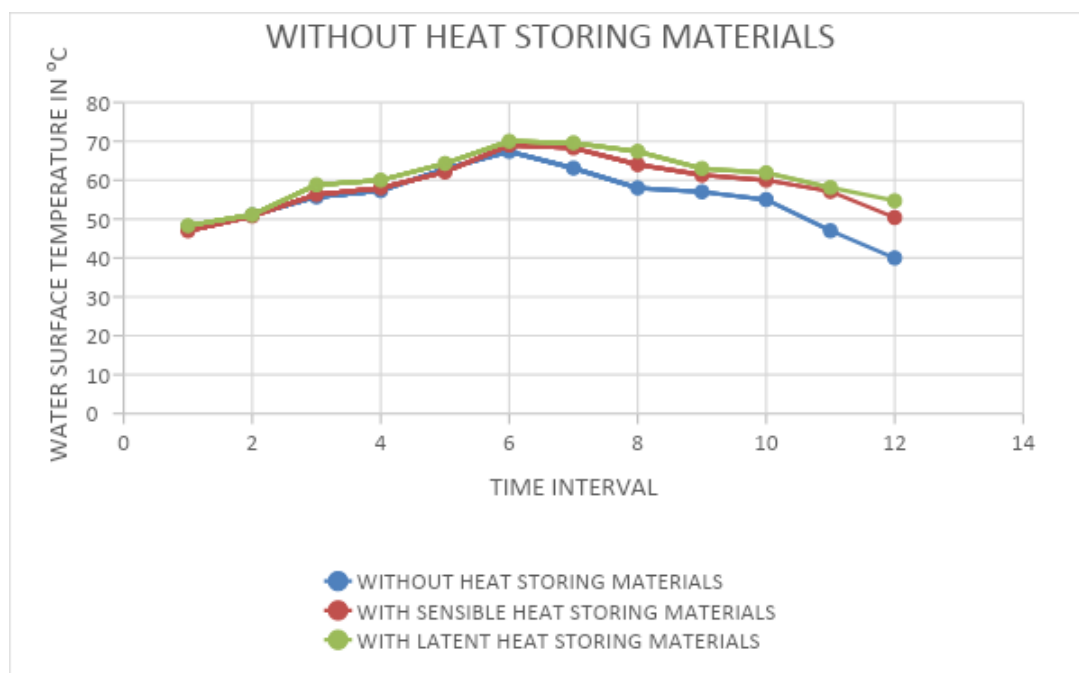
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VI. VARIATION IN WATER SURFACE TEMPERATURE



VIII. APPLICATION

- It gives high yield.
- It can provide high productivity.
- It can be used in any places providing high range of heat.
- It can be worked in home, office and institutions.

IX. CONCLUSION

In this study, the aim of the present investigation is to develop a single slope single basin solar still that would assist in increasing the availability of clean water in remote areas. To achieve this the solar still is checked with the absence of heat storing materials and presence of sensible and latent heat storing materials and derived the readings with productivity at Francis Xavier Engineering College, Tirunelveli. The experiments were carried out in actual solar still condition to get the productivity. The experiments conducted in the period of March 2020. From this experimentation, the normal experimentation regarding the single slope solar still gave the productivity of about 2.6 litres / day and the solar still with the presence of sensible heat storing materials gave the productivity of 3.2 litres / day and with latent heat storing materials gave the productivity of 3.4 litres / day.

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