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Experimental Investigation on Various Extracted Liquids into Useful Products using Solar Distillation

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Abstract: In order to use solar energy to convert raw ground and surface water into clean potable water, several distillation systems have been investigated so far. However, to be sustainable, the productivity of these systems must be as high as possible. Tubular solar stills (TSS) were investigated as one of the more productive solar distillation systems. The current study aims to improve the productivity of tubular solar stills by exploring different cover materials. The experimental study was carried out on four different TSS setups with cover materials made of polyvinyl chloride (PVC), polycarbonate, acrylic, and glass. In comparison to other materials, it has been observed that the TSS with glass cover gives the maximum productivity (6.23 L/m2) and daily exergy and energy efficiency (7.67%, 71.56%, respectively) for the same water depth of 0.5 cm in each basin. In this study the attempt has been made to design, fabricate and performance analysis of the passive solar still for the cow urine distillation. It is well known fact that the cow urine has huge number of medicinal values, for the purpose of distillation of cow urine the use of solar still and effect of different performance parameter is illustrated.A single slope passive solar still is designed with absorber plate dimension of 0.8 m2with 18.520 of tilt angle. The analysis of effect of different performance parameter such as water depth, wind velocity and solar radiation on the yield is experimented.

Keywords: *Tubular solar still, Productivity enhancement, Reflector*

I.INTRODUCTION:

Water is an essential component of life, covering roughly 71% of the Earth's surface and constituting about 60% of the human body [1].

Its significance cannot be overstated. Water is vital for various biological processes, from digestion to temperature regulation. It sustains ecosystems, supports agriculture, and is crucial for industrial and domestic use. The importance of water conservation is paramount due to growing global water scarcity concerns [2]. Population growth, pollution, and climate change are exacerbating water shortages. Efficient water use in agriculture is critical to ensure food security, and industries must adopt responsible practices to reduce water waste [3]. Individuals can contribute by fixing leaks, using low-flow fixtures, and practicing mindful consumption. Saving water for the future is essential for environmental sustainability and human survival. Preservation of freshwater sources, reducing pollution, and implementing efficient water management strategies are crucial steps [4].

Without proper conservation efforts, the world may face severe water shortages, impacting ecosystems, economies, and the well-being of billions of people.

It is our collective responsibility to safeguard this precious resource for future generations [5]. Several researchers have studied the effects of various designs, operational and climatic parameters. Many designs and modifications of the solar still have been proposed in literature.

This study intends to develop an efficient design and operational approach for a tubular solar still. The goal is to utilize inclined reflectors as heat sources, thereby maximizing productivity while keeping costs at a minimum, in order to achieve an economically feasible model.

II.METHODOLOGY :

A cylindrical-shaped tubular solar still tank was fabricated using PVC material of 1 m 2 diameter with a flat plate basin (0.5-1 cm) made up of GI (Galvanized Ion) with a depth of 1 cm respectively, the tubular solar still is kept on a stand made up of MS (Mild Steel) as shown in fig. 1. The sample of condensed water of 10 liter as taken the condenser during the experiment. The test was conducted between 10 AM to 5 PM and the peak values were recorded around 1 PM.

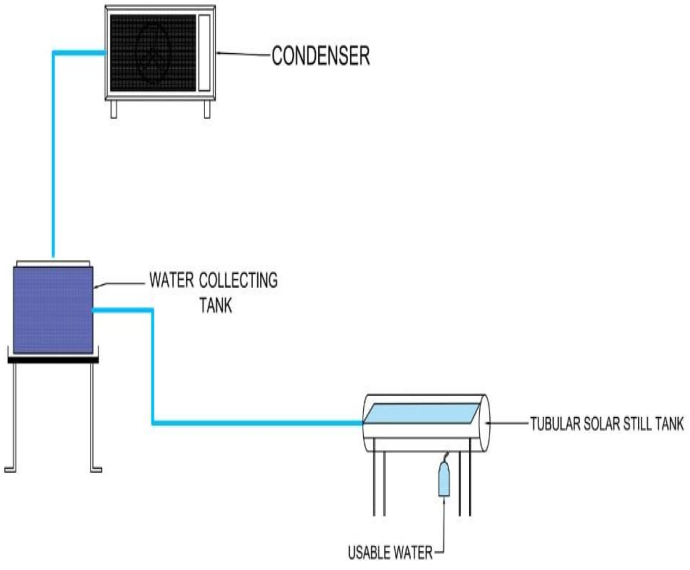

Fig 1:- Experimental Diagram Tubular solar still

Result and Discussion

Ambient Temperature and Solar Intensity

Fig 2 shows the variation between ambient temperature and solar

intensity as can be seen in the graph. The readings were calculated from 10 AM to 5 PM respectively. The maximum ambient temperature at 1 PM and minimum at 5 PM. The maximum ambient temperature and maximum solar intensity is 36ºC and 1050 W/ m^2 at 1 PM. The tests were carried out in October 2023. During the experiments, the solar intensity and ambient temperature increased in the morning and peaked at 1:00 PM. It starts to fall after 10:00 AM. The average solar irradiance in October month was 850W/m^2, respectively, with a peak solar intensity of 1050W/m^2. The maximum ambient temperatures of 36°C were recorded during testing. During the experiments, the daily average ambient temperature was around 29°C in October 2023.

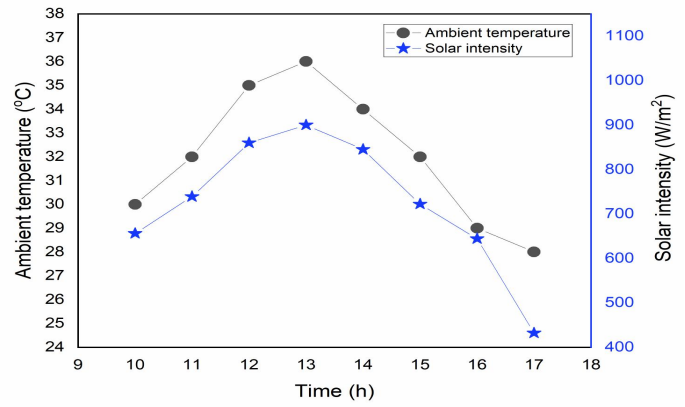

Figure 2: Solar intensity and ambient temperature with Time.

Hourly Freshwater Productivity and Time

Fig 3 shows the variation between hourly freshwater productivity as can be seen in the graph. The readings were calculated from 10 PM to 5 PM respectively.

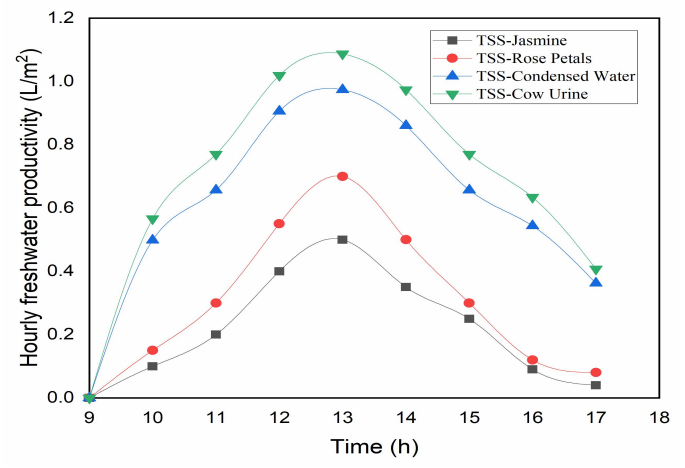

Figure 3: Hourly freshwater productivity

The maximum freshwater productivity at 1 PM and minimum at 5 PM. The maximum freshwater productivity for TSS–Cow Urine, TSS–Condensed Water, TSS–Rose Petals, TSS–Jasmine, (1.1, 0.9, 0.7, 0.5 L/m2) at 1 PM. Also, TSS-Glass increases maximum hourly freshwater productivity higher than due to higher light transmissibility. TSS-Jasime, TSS-Rose, TSS-condensed Water, the accumulated productivity of freshwater for TSS-Jasime, TSS-Rose, TSS-condensed Water, and TSS-Cow Urine are shown in figure 3.

III.CONCLUSION

Solar still is a device used to desalinate impure water like brackish or saline water. It a simple device to get potable/ fresh distilled water from impure water, using solar energy as fuel, for its various applications in domestic, industrial and academic sectors. A solar still consist of shallow triangular basin made up of Fiber Reinforced Plastic (FRP). Bottom of the basin is painted black so as to absorb solar heat effectively. Top of the basin is covered with transparent glass tilt fitted so that maximum solar radiation can be transmitted in to the still, but the major drawback solar still is that it requires more time, thus we used solar distillation for our experimentation process for maximum productivity.

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