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# "FABRICATION AND ANALYSIS OF SOLAR DISTILLATION SYSTEM BY USING HONEYCOMB: A REVIEW"

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## ABSTRACT

Water is the main source for sustaining living being on earth. Water is life in all its forms. Solar energy has been used to get potable water from saline water or kitchen water. Water shortage has become one of the major global challenges, which is linked to population growth. Ground water and reservoirs are the available sources of fresh water to fulfil the need for human beings. But these sources are not always useful due to dissolved Impurities. Solar distillation is an effective technology in which purification of water is done with the help of solar radiation. The solar radiation comes to the glass cover and this is transmitted to the honeycomb structure in which the honeycomb structure is fitted to the basin of the water of the solar distillation system and this honeycomb is filled with water the honeycomb is heated and water evaporates and then condensate within the system of the solar distillation system. The main goal of this review paper is to address the improvement in the water Quality by building a single slope basin type solar water distillation system with the use of honeycomb and also to enhance the productivity of distilled water with the use of honeycomb structure which is made up of black plastic pipe. The efficiency of the solar distillation system with the use of honeycomb structure is high as compare to the simple solar distillation system. The simple solar distillation system gives the efficiency is about 19.11% whereas honeycomb structure gives efficiency of about 24.37 %.

***Keywords:*** *Solar still; Honey-comb; & Thermal efficiency.*

## I. INTRODUCTION

Water is essential to life. Next to oxygen accessibility of water is considered to be a basic substance of human beings. About 1.2 billion people in the world have lack accessibility of potable water, over 2.6 billion without accessibility of adequate sanitation and 1.8 million children killed each year by preventable water-borne diseases. Another common problem of water resources is of having fluoride contamination due to wastewater derived from industries like glass, fertilizers, semiconductors and metal processing. To remove excessive amount of fluoride from water. A reverse osmosis filtration system is most common best solution to remove fluoride from water. This can remove 85-92% fluoride from water. In this technique the water passes through the semi permeable membrane, as well as additional filters such as sealiment of carbon filters.

Reverse osmosis is most commonly used because of it is safe, cost effective and easy to maintain. Many of these people live within the poorest countries of the world. The honey-comb has been applied for water heating air heating and building application. In Israel, panels fitted with honeycombs are available commercially. In countries like India the full potential of honeycomb has not been fully utilized. Honeycomb can make the solar cooker more effective by efficiently absorbing the solar energy during the day and retaining the heat till late afternoon and evening. There are many methods developed e.g. precipitation, adsorption and reverse osmosis are most common.

The purification of water with these techniques are very effective but are expensive also not affordable to the common people. In remote and arid areas with low infrastructure and without having any dependency on conventional fuel sources, the free and abundant solar radiation intensity along the year and the available brackish water resources are two favourable conditions for using the solar powered desalination technology to produce the fresh water, even for domestic use. The application of solar distillation is very simple and do not require any

conventional energy source. The basic a principle on which solar still works is simply the miniature of the earth's hydrologic cycle.

Water is one of the basic needs of living beings. The water reserves cover 71% of earth surface, out of which 97.5 % is salt water and 2.5% fresh water. Use of water from all these resources is not always possible, because of their brackish in nature as well as they may contain harmful bacteria also.

Renewable energy is that source of energy which is used again and again in future. The solar energy is the main source of renewable energy which is easily available on the earth surface. Solar distillation process is based on the thermal energy process in which impurities are removed from the water. Solar distillation is one of the methods of getting potable water by using solar energy. Solar distillation is cost saving in comparison to other types of distillation such as reverse osmosis, due to easily available solar energy. Solar distillation is highly effective technique with the use of this is to provide impure water to portable water.

Solar still is one of the cost effective method of producing pure water using solar distillation techniques. Solar still uses heat as input which is obtained from solar radiations. The proposed honey-comb solar still has higher efficiency as compare to the simple solar still. The solar radiation comes from the sun which is directly come from the glass cover the glass cover absorb this radiation and convert this radiation into heat and this heat is used to evaporation of water , the water evaporates and condensed inside the glass cover. This distilled water is collected to the distilled jar. Due to the temperature difference between water and glass cover the water condensing at glass cover leaving all contaminants in the basin.

There is a strong need to improve the performance of solar still and productivity of distilled water. The performance of solar still can be improved by decreasing the reflection losses from the water surfaces by providing honeycomb structural basin. The thermal efficiency of solar still in comparison to solar still without honeycomb structure is 19.11%.

## II. SOLAR DISTILLATION

Solar distillation is the process in which solar energy is used to evaporate water and collects its condensed within the same closed system. This is the simplest treatment of brackish water. This is one of the best techniques that can be used to purification of water. This is used to produce drinking water or to produce pure water for lead acid batteries, laboratories, hospitals and producing commercial products.

There are basically two types of solar distillation system one is active and other is passive solar distillation system. In passive solar distillation system the solar energy are directly used to the evaporation of water. But the efficiency of this type of system is low. In active solar distillation system an additional source of the thermal energy is required to the evaporation of water in same passive solar distillation system.

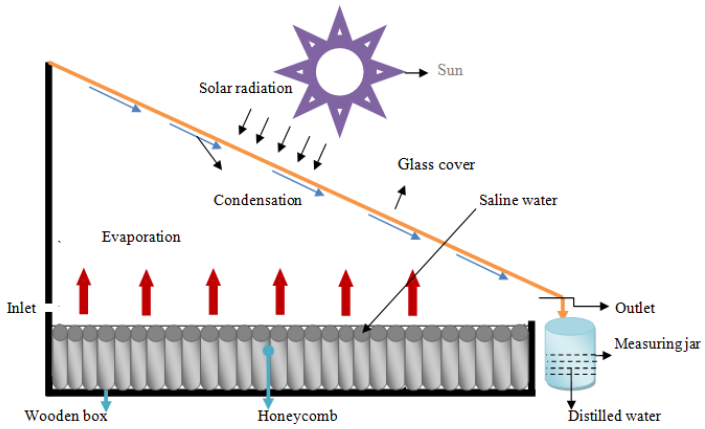


Figure1: Single slope solar distillation system by using Honeycomb

## III. WORKING

The solar distillation system is use of purify brackish water or saline water to potable water. In this the solar radiation comes from the sun and focused to the glass cover of the solar still. The glass cover transmitted this solar radiation to the honeycomb structure of the solar distillation system which is fitted to the basin of water to the single slope solar distillation system.

The honeycomb structure is made up black plastic pipe length of same diameter and the pipe is filed with the water. The solar radiation comes from this honeycomb structure then the honeycomb structure is heated and water is also heated which is filled in the honeycomb structure and then the water evaporates and this water is condensed to the inner portion of the glass cover and this condensed water is collected to the measuring jar. The black pipe is used because of absorptivity of black pipe is high. A major portion of this solar radiation is absorbed by black painted surface called basin liner. However a small amount of reflection losses takes place at the glass cover, water and basin liner.

## IV. LITERATURE REVIEW

Various arrangement of absorbing component can widely affect the overall performance of solar still. Studied shows that the performance of solar still depends upon the reflection losses from the water surface. It was observed that the reflection losses of the solar radiation from the water surface were greatly reduced with increasing the water temperature of the solar still. Hence performance of the solar still is good with decreasing the reflection losses with the use of honeycomb structure of the basin water. According to this efficiency of solar water distillation system with the use of honeycomb is 24.37% as compare to simple solar still having the efficiency of 19.11% [1]. The use of phase change material in solar distillation system increase the productivity of distilled water is of 35-45% as compare to simple conventional solar distillation system [2]. The use of Nano-particles mixed with black paint increased the thermal efficiency of the solar distillation system. Because of area of heat absorbing surface of the solar distillation system is increased. The increment of productivity of distilled water is 38.09% and increment of thermal efficiency is 12.18 % of the solar distillation system [3].

The amount of distilled water is directly related with the performance of the solar still. The distilled water productivity depends upon the water temperature and heat transfer coefficients. The higher temperature of water gives the higher productivity of the distilled water [4].The circulation of water between the two towers were maintained by the forced convection. There were various studies are done on the different theoretical and experimental at different environmental conditions and it was observed that the productivity of distilled water is

decreased in winter and increased in summer conditions. The productivity of water of the humidification and de-humidification distillation solar still in winter condition is 2 to 3.5 kg/m$^2$ and in summer is 6 to 8 kg/m$^2$. It was found that the highest productivity of distilled water is 7.26 to 11 kg/m$^2$ in July and August [5]. The productivity of distilled water to the active solar distillation system is increased with increasing the solar collector area [6].

The solar still is made up of plywood and the glass plate of thickness 4 mm is used as the glass cover surface is fixed at the angle 11 degree. Solar-still based desalination technique is applied for converting saline water into potable one. In this work a single slope single basin solar still integrator with honeycomb encapsulated collector has been developed to enhance the efficiency of the system. Thermal model of expressions for natural circulation of water between the collector and the still, in summer and winter, hourly variation of temperature of glass cover, water mass, and basin liner has been derived. A numerical calculation has been made for one of the typical days at Chennai in Tamil Nadu, India which is highly energy absorbing weather condition produced in the still. The summer and winter production rate of the still coupled with the honeycomb encapsulated solar collector is higher than the still without collector for all typical working days in the year [7].

The different angles of inclination of condensing cover (15°, 30°, 45°) have been chosen for winter and summer conditions both. It has been observed that the passive solar still with inclination of 45° gives better performance both in winter and summer respectively. Different water depths (0.04, 0.08, 0.12, and 0.16 m) have also been taken for solar still with 30° inclination angle for summer weather condition. Comparisons of instantaneous gain and loss efficiencies at 0.01 and 0.04 m water depths for a 15° inclination angle have also been made to show the effect of water depth on the performance of solar stills. It was found that depth of water basin is low gives better efficiency, which is in agreement with many investigators [8].

A honeycomb double slope solar still has been designed to increase the productivity. The experiments have been carried out to predict the performance of the proposed still in October 2009, Karpagam University, Coimbatore, India. This concept is given for the transparent honeycomb structure with thin glass tube of ratio (H/D=7) in the basin. In this studied the effect of the transparent honeycomb structure in the basin is to increase the productivity of the solar distillation system. So that this type of solar still receive large amount of solar radiation and daily output of the solar radiation is increased by 25% of the simple double slope solar still. Hence the productivity of solar distillation is increased [9].

## V. CONCLUSION

The performance of the solar still is depends upon the reflection losses from the water surface, slope of the solar distillation system and the productivity of solar distillation system is increased in summer is 6-8 kg/m$^2$ and decreased in winter 2-3 kg/m$^2$ this is effected by solar radiation is available in summer and winter condition. The productivity of the solar distillation system is increased with the use of phase change material, use of Nano-particle with black paint and use of honeycomb structure to the basin of the solar distillation system. Hence increase the efficiency of solar distillation system with the use of honeycomb structure is 24.37% high as compare to simple solar distillation system having efficiency is about 19.11%.

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