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Solar Still (Pyramid Type)

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ABSTRACT

The purpose of this paper is to design a water distillation system that can purify water from nearly any source, a system that is relatively cheap, portable, and depends only on renewable solar energy. The motivation for this paper is the limited availability of clean water resources and the abundance of impure water available for potential conversion into potable water, In addition, there are many coastal locations where seawater is abundant but potable water is not available. Our main goal is to efficiently produce clean drinkable water from solar energy conversion. Distillation is one of many processes that can be used for water purification. This requires an energy input as heat, electricity and solar radiation can be the source of energy When Solar energy is used for this purpose, it is known as Solar water Distillation. Solar Distillation is an attractive process to produce portable water using free of cost solar energy. This energy is used directly for evaporating water inside a device usually termed a “Solar Still”. Solar stills are used in cases where rain, piped, or well water is impractical, such as in remote homes or during power outages. Different versions of a still are used to desalinate seawater, in desert survival kits and for home water Purification. Solar Distillation is an attractive alternative because of its simple technology, non-requirement of highly skilled labour for maintenance work and low energy consumption.

Keywords:- Solar, Pyramid Type

I. INTRIODUCTION

Due to environmental issues and limited fossil fuel resources, more and more attention is being given to renewable energy sources. In the recent years solar energy has been strongly promoted as a viable energy source. One of the simplest and most direct applications of this energy is the convergence of solar radiation into heat. Solar radiation can be widely used for water heating in hot water systems, swimming pools as well as a supporting energy sources for central heating installations. The energy of the solar radiation is in this case converted to heat with the use of solar panel. Using the sun’s energy to heat water is not a new idea. More than one hundred years ago, black painted water tanks. Water is a basic necessity of man along with food and air. Fresh water resources usually available are rivers, lakes and underground water reservoirs. About 71% of the planet is covered in water, yet of all of that *96.5%* of the planet's water is found in oceans, *1.7%* in groundwater, *1.7%* in glaciers and the ice caps and *0.001%* in the air as vapor and clouds, Only *2.5%* of the Earth's water is freshwater and *98.8%* of that water is in ice and groundwater. Less than *1%* of all freshwater is in rivers, lakes and the atmosphere.

II. LITERATURE SURVEY

Tiwari[1] et al. (2003) reviewed briefly the different work on solar distillation, its present status in the world today and its future perspective. The authors reviewed the various water sources, water demand, and availability of potable water and purification methods.

Sebaii[2] 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 28.580 for a condensing glass cover inclination of 15.18 ^{0} for new Delhi's climat

Khalifa et al.[3] (1999)conduct d an experimental study on new designs of basin type solar stills. Also several single and double slope stills were constructed and conducted tests to show the effect of some modifications on the performance, such as productivity and efficiency.

Y.P.Yadav[4] (1998) presented a transient analytical solution for a solar still integrated with a tubular solar energy collector. The authors derived explicit expressions for the temperature of various components of the system as a function of time and space coordinates and in terms of geometrical, operational and meteorological parameters.

Hanson[5] et al. (1995) reported the performance of single-basin solar stills for the removal of a selected group of inorganic, bacteriological and organic contaminates from impure water. The stills were also successfully removing bacteria. Also it was prove d that the stills ability to remove contaminants from the water did not vary significantly between the units tested in the laboratory and in the field.

Orfi[6] et al. (1993) presented the characteristics of a solar desalination system based on the humidification- dehumidification principle. The experimental set up consists of two solar collectors, an evaporator and a condenser. Also the authors developed a general mathematical model including the mechanism of heat and mass transfer in the various components of the present desalination system.

III. COMPONENTS OF SOLAR

Solar still is a simple device which can convert available water or brackish water into portable water by using solar energy. Main components of solar still are:

1.Basin: It is the part of the system in which the water to be distilled is kept. It is therefore essential that it must absorb solar energy. Hence, it is necessary that the material has high absorbtivity or very less reflectivity and very less transmitivity. These are the criteria for selecting the basin materials.

2.Condensate channel: It is the part of the system in which condensed water is collected. Sheet of required dimension is first cut out, and then it is folded by using the folding machine.

3.Black liner: Solar radiation transmitted through transparent cover is absorbed in the black lining. Black bodies are good absorbers. Black paint is used as liner.

A blackened tray is placed at the base of the solar still which acts as a black body to absorb the incident heat. The condensed water from the glass is collected in a pipe placed at an inclination which enables the collected water to flow downwards to the final collection tank.

4.Transparent cover: Glazing glasses used and thickness of5 mm is selected. The use of glass is because of its inherent property of producing greenhouse effect inside the still. Glass transmits over 90% of incident radiation in the visible range

5.Insulation: Thermocol used as insulator to provide thermal resistance to the heat transfer that takes place from the system to the surrounding.

6.Sealant: M seal and putty is used as sealant to make the distiller leak proof and airtight. UV Glue is used to join Metal to Glass. Silicon Glue is used to join Glass to Glass.

7.Supply and deliver system: Three holes are made in the basin, one for supply and two for delivery.

8.Table: Pinewood table is used to support whole setup. Pine wood has good surface finish. Base of Ply wood is used because of its good strength

9. Square box: Iron Square Box is used to hold side *(*threaded*)* stand.

FIG 1: Solar still (Pyramid type)

3) Dimensions of the Solar still :

Area of basin = 0.75x0.75m²

Height of basin = 0.15m

Area of glass = 0.375x0.6m²

Thickness of glass cover = 0.003m

Angle of glass = 25°

Thickness of insulation = 0.08m

4) Materials Used :

1) Acrylic sheet

2) GI Sheet

3) Glass wool

4) Thermocol

5) Iron pipes

6) Silicon

7) Chloroform

5) Advantages :

(1) low maintenance cost

(2) portable

(3) Does not require any external energy sources

(4) Wastage of water will be minimum

(5) High quality of water can be obtained

(6) Any type of water can be purified

6) Disadvantages :

(1) Less productivity

(2) It should be leak proof

(3) Efficiency can be reduced drastically in winter

IV. CONCLUSION

Distillation is a method where water is removed from the contaminations rather than to remove contaminants from the water. Solar energy is a promising source to achieve this. This is due to various advantages involved in solar distillation. The Solar distillation involves zero maintenance cost and no energy costs as it involves only solar energy which is free of cost.

It was observed that when the water depth increases from 0.01m to 0.03m the productivity decreased by 5%.These results show that the water mass (water depth) has an intense effect on the distillate output of the solar still system.

S. NO	SOLAR DISTILLATION	PH VALUE	SALINITY (PPT)	ALK (PPM)	HCO3(PPM)
1	BEFORE	7.8	3	540	540
2	AFTER	5.7	0	20	20

S. NO	SOLAR DISTILLATION	TOTAL HARDNESS	CALCIUM HARDNESS	Ca^{2+}	Mg^{2+}
1	BEFORE	830	260	104	139
2	AFTER	50	20	8	7.29

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