Performance Analysis of inclined solar still Equipped with Evacuated Tube

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***Abstract* - The purpose of this project 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 project is the limited availability of clean water resources and the abundance of impure water available for potential conversation into portable water is not available. Our project goal is to efficiently produce clean drinkable water from solar energy conversation. Solar Distillation is a technique to produce water with a low salt concentration from seawater or brine using solar energy.**

I.INTRODUCTION

Deficiency of PURE WATER in India is an ongoing water crisis that affects nearly 1 million people each year. In addition to affecting the huge rural and urban population, the water scarcity in India also extensively affects the ecosystem and agriculture. Adequate quality drinkable water is the fundamental need of all living beings. Most of the human diseases are due to consumption of polluted water. The distillation processes such as Multi-stage flash, Multi-effect desalination, Vapour compression; Membrane processes are not convenient to use everywhere since they consume a large amount of energy. To rise above this difficulty, solar still is a promising way of converting brackish water into potable water. For solving this problem of crisis in India. We had put a step forward for this major issue, in this project we will solve the problem of water scarcity by solar water distillation. We will try to solve the problem of water scarcity by preparing this project.

II. LITERATURE SURVEY

For making of Solar Water Distillation Machine with Evacuated Tubes the existing technologies for Distillation and its Types should be studied.

2.1 "DESALINATION" In this machine a single slope solar still has been integrated with an evacuated tube collector and operates in force mode. Thermal model of integrated system has been developed to predict performance of solar still under New Delhi climatic conditions the average annual yield per unit of solar collector area has been estimated higher than the natural mode.

2.2 "SOLAR STILL AUGUMENTED WITH AN EVACUATED TUBE COLLECTOR IN FORCED TUBE" Firstly, in this modified design of solar still integrated with an evacuated tube Collector in first mode is proposed. Secondly thermal analysis of the system has been carried out. Thirdly system has been optimized for mass flow rate.

2.3 "SOLAR STILL WITH CALCIUM STONES AND EVACUATED TUBES TO ENHANCE THE YIELD" In this present research study shows the evacuated tubes coupled with solar Steel to enhance the yield. Basin area of One meter square taken for the experiment and five evacuated tubes have been used at lower side of the Steel calcium stones as sensible heat storage material have also been utilized to enhance the yield in present work. It is concluded that the calcium stones are good sensible heat storage material to reduce water quantity and accumulated heat during the daytime.

2.4 "WATER PRODUCTIVITY OF A NANOFLUID BASED SOLAR STILL EQUIPPED WITH THERMOELECTRIC MODULES" The water productivity of a new Nano fluid based solar still is

modelled in terms of the solar radiation, MBD temperature, glass temperature, water temperature, basin temperature, and nanoparticle concentration. The Solar still is equipped with thermoelectric cooler in which four thermoelectric cooling module and compass the condensing channel.

2.5 "ENHANCEMENT OF UPPER BASIN DISTILLATE OUTPUT BY ATTACHMENT OF VACUUM TUBES WITH DOUBLEBASIN SOLAR STILL" Generally the distillate output of a solar still isslow handsit is not practice able for the solution of drinkable water in the universe today here a new concept is utilized to increase the distillate output of a solar still in use. A double basin solar still integrated with evacuated tubes and vacuum tubes. The distillate output of basin material with calcium stones found were more when compared with black granite gravel and pebbles.

III. FABRICATION OF BODY

Outer Body is a rigid component which holds all the other components basically it is made up of Plywood size 12mm thickness (3*4). The Inner Body is made up of Aluminum with 1mm thickness (10*6) . After that we had made a water Inlet Chamber of Fiber with thickness of 10*4 cm. The stand of angles of 22 degree is cut out in such a way that it will from frame for holding the tank. The Main frame is composed of Aluminum owing its Corrosion Resistance, Low Weight, Long Life and Easy Clean ability. The inside of Distiller is coated with carbon black to increase absorption of Radiation. The cover on the top is made of tempered glass so that the birds cannot see their reflection and hence avoid Nuisance.

IV. METHODOLOGY

3.1.1 Problem:-Impure water is the problem which affects many human lives around the world this is a major issue and it is a question for question of death or life for those person for those authority formats dangerous operations.

3.1.2 Collecting research paper:-Collecting research paper from the internet on the prefabricated machines or system for carry solar water distillation. Collecting research paper on solar distillation with evacuated tube.

3.1.3 Project proposal:-Making a project proposal for the selection of project and experiencing our ideas with project incharge and getting suggestions and implementing that suggestion and submitting the project proposal to the project incharge

3.1.4 Selecting area of work:-After project finalization we have to decide and area of work for fabrication of distillation machine with respect to the residence of group members as the suitable area of work is our group member house college workshop and other workshop for fabricating some complex components.

3.1.5 Making CAD model and animation of machine:-Making and CAD model of machine for clearing all the concepts related to the machine. Making the animation of machine for explaining the working of machine.

3.1.6 Finding resources:-Resources should be fined for fabrication of machine it requires some pre-fabricated parts which are readily available in market also the complex parts such as telescopic rod and Archimedes screw should be fabricated from various workshops finding the materials and work piece for fabricating those parts.

3.1.7 Collecting different components:-After fabrication and purchase of all the components all the components should be collected from various locations at the workplace.

3.1.8 Assembly:-Assemble all the components of machine as according to CAD model and animation and make sure that is relative motion between parts is efficient and the mechanism used in machine is properly working. 3.1.9 Trial on project:-Take a trial on project and find out some parameters such as
1. High Efficiency
2.Time required for distillation
3. Comparison of solar machines with other machines
Components The Solar Water Distillation Machine consist of following parts
1 Evacuated Tubes
2 Solar Still
3 Glass Cover

4 Temperature Indicator

Components in Detailed:-

EVACUATED TUBES:- The evacuated tube comprises of a smaller glass tube suspended within a larger glasstube. The air is then pumped out of the space between the small inner tube and the larger outer tube creating a vacuum thermal insulation layer.
This vacuum layer is absolutely key since it reduces heat loss from the solar collector.

SOLAR STILL:- The solar still can be effectively used to obtain sufficient quantities of good water from salt water in regions where the insulation of solar energy is high. A solar still distills water with substances dissolved in it by using the heat of the Sun to evaporate water so that it may be cooled and collected, thereby purifying it. In a solar still, impure water is contained outside the collector, where it is evaporated by sunlight shining through clear plastic or glass. The pure water vapour condenses on the cool inside surface and drips down, where it is collected and removed.

GLASSCOVER:- . Glass covers, used to protect the absorber and to reduce convective thermal losses. Also it require an AR coating to minimize reflection losses and to increase solar transmittance. It presents high thermal and environmental durability and it consist of layers on top of the infrared reflector.

TEMPERATURE INDICATOR:-
Temperature indicators are installation instruments which can process signals from temperature sensors and show them on the display. Temperature indicators enable easy and economic valuation of resistance sensors, such as Pt100 or different thermo element types

WORKING
Solar water distillation is the process of using energy from the sunlight to separate freshwater from salts or other contaminants.
The untreated water absorbs heat, slowly reaching high temperatures. The heat causes the water to evaporate, cool, and condense into vapour, leaving the contaminants behind. Solar distillers work by mimicking the natural water cycle: The sun provides energy to warm the water, the water evaporates (forms clouds) and condenses (makes rain) when it meets a cooler surface. Unlike electric distillation, boiling is not required for solar distillation.

V.REPORT & ANALYSIS

ENERGY ANALYSIS		
PARTICULARS	SIMPLE	EVACUATED TUBES
Average solar irradiation	878.02875	878.02875
Mean Water Temp.	316.4474286	316.98575
Mean Glass Temp.	323.32625	323.025
Mean Temp.(Ti)	319.8868393	320.005375
Area of Evacuated Tube in m2	0.2704	0.4056
Latent Heat	1379.448139	1378.757388
Productivity(me) in kg/s	0.032370102	0.323636725
Efficiency (%)	12.42448992	34.80458555

Table 2.3 Time and Temperature Variations

DATE: - 01/03/2021								
Time	**10:00**	**11:00**	**12:00**	**01:00**	**02:00**	**03:00**	**04:00**	**05:00**
Solar radiation	970.47	1007	1018	1007	970.4	893.3	731.58	334.1
Water temperature (Tw)	35.4	44.3	45.6	50.5	50.6	49.6	45.7	42.8
Glass temperature (Tg)	34.5	43.3	40.1	42.8	42.2	42	40.7	37.1
Evacuated Tube temperature (Ep)	40.2	48.6	49.7	49.9	50.1	49.9	46.5	43.7

Table 2.2 Trial Report

Sr.No.	**TIME**	**Parameters/ Solar (W/m2)**	**Water**	**Water**	**Evacuated Tubes**	**Evacuated Tubes**
			Min Temp	**Max Temp**	**Min Temp**	**Max Temp**
1.	**10.00** am	950	64.537	488.22	38.593	40.996
2.	**11.00** am	990	65.739	507.26	38.703	41.206
3.	**12.00** am	1003	66.129	513.45	38.738	38.738
4.	**01.00** pm	991	65.769	507.74	38.705	41.211
5.	**02.00** pm	952	64.597	489.17	38.702	41.206
6.	**03.00** pm	868	62.074	449.19	38.369	40.564
7.	**04.00** pm	690	56.727	364.46	37.883	39.628
8.	**05.00** pm	240	43.209	150.25	36.655	37.262

VI.CONCLUSION

- Produces pure water
- No prime movers required
- No conventional energy required
- No skilled operator required
- Local manufacturing/repairing & Low investment
- Can purity highly saline water (even sea water)

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