International Journal of Interdisciplinary Innovative Research &Development (IJIIRD)
ISSN: 2456-236X
Vol. **06** Issue **01** | **2021**

Advance Solar Water Distillation System

Payal Kapse[1], Sanchit Bire[2]
[1,2] B-Tech 4th yr., Department of chemical engineering, Priyadarshini Institute of Engineering and Technology Nagpur, Maharashtra, India

ABSTRACT

Solar Water Distillation System is the most basic and older water distillation system . In this system water is get evaporated and this evaporated vapour is then condensate and get collected thus we receive the distilled water. "Solar Water Distillation is the process of using the energy From Sunlight to separated freshwater from salts or other contaminants". Different types of solar water distillation have been tried by the several researchers. Such as Single effect, Multi Effect, Basins in the passive distillation. Whereas High temperature active and natural circulation in active mode. Still the effectiveness is not able to reach its height. Here we had tried a mixture of both active and passive system with the complete use of sunlight energy by all the different ways which we can consider. Trying to make it sustainable and also cost efficient within some days. We had designed the solar water distillator in such a way that it can work as a multifunction element for us. We had used all the ways or most of the ways of using the energy sources. Such as evacuated tubes , natural heating bed , heating from the bottom, and also storing energy and recycling it to increase the temperature of the water so that the process of evaporation fastens up.

Keywords-: ***Advance System, Self-Developed, Evacuated Tubes, Distillator, multifunction***

1. INTRODUCTION

Solar Water Distillation has not been practiced on a large scale , Due to its in efficiency and slow speed. Still, we all know that solar power is the abundantly free power which we can use a lot. Initially other Distillation Process is pretty cheaper at the initial state. But the maintenance led it to be higher and the most difficult one. The important aspects of any process is the energy. If you can reduce the costation of energy then half the job done. Still, you have to look after its efficiency. If you can increase its efficiency then its like adding glitters to gold. Here while designing we specifically focused on the efficiency. Which can be achieved by the good rate of output. Good output rate can be achieved by using the ample energy source and some basic design changes. Here we are starting with the traditional distillation system then moving towards the types of solar distillation system. Then next is what changes or addition can bring the high rate of the output. We are also going to compare that it's really process such a faster comparing to the older systems. Then the conclusions results are placed in front of you. This is the study which is conducted on self-basis. Thus, results and conclusions are on the same results. Before preparing all this reports no of literature survey has been taken by the authors.

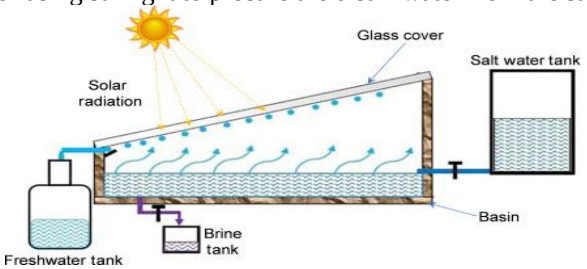
2. WATER SCARCITY

Water is life, we all know that without water no life's can survive on this planet earth. Scientists are trying find out the way to pure the sea water for the drinking purpose. As sea and the oceans are the major source of the water. But we can't use this water for drinking cooking or any of the purpose. We can conclude that the water is a free source that too sea water. But still there is no cheaper way to get the usable water from the sea.

Water is the major problem in many regions of India . Many peoples have to travel thousands of Km in search of the water. They have to roam long long way and still get a sluggish water. Due to the water scarcity people have to drink that sluggish water too and died due to the scarcity of water.

3. SOLAR DISTILLATION

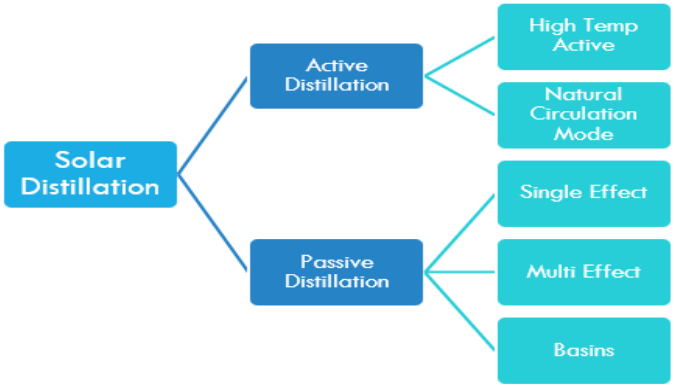
It is nothing but the process of using sunlight to precure the distill water from the salty water or saline water.



Single Effect Solar Distillation

4. TYPES OF SOLAR DISTILLATION

- Active Distillation
- Passive Distillation



4.1 Active Distillation Systems

4.1.1 High Temperature Active -:

This type of system requires high temperature to work on and this requires lots of amount of energy. Still this system has basic problems such as cleaning.

4.1.2 Natural Circulation Mode -:

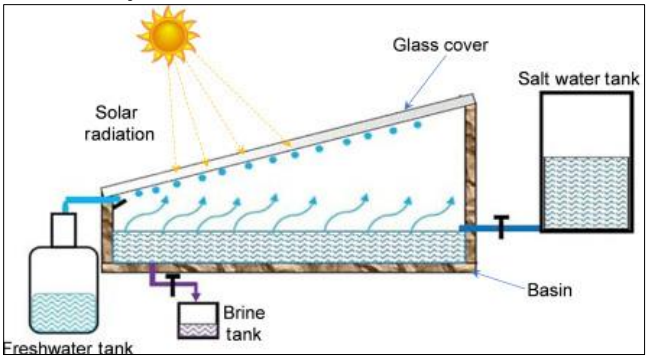
In this type of distillation, the process is comparatively slow as the water is continuously moving in the system. Thus, the system is again sluggish there is a chance of blockages in the pump.

4.2 Passive Distillation Systems

4.2.1 Single Effect-:

In the single effect distillation system as shown in fig below A single glass cover, beneath which a bed lies and the heat of the sun increases the temperature of the water . This increase in temperature led to the evaporation of the water . This water droplets reaches to the top and then get condensate . Due to the angular arrangement of the glass cover , the water droplets slides towards the lover polarity and thus taken out as a water . I.e., Fresh Water . And the remaining sludge has been taken as a saline water or a brine.

This brine is a salty water. Which can be from sea or from the saline line.



It is called as single effect because there is a single line for movement of water and it have single condenser and also a single evaporation system.

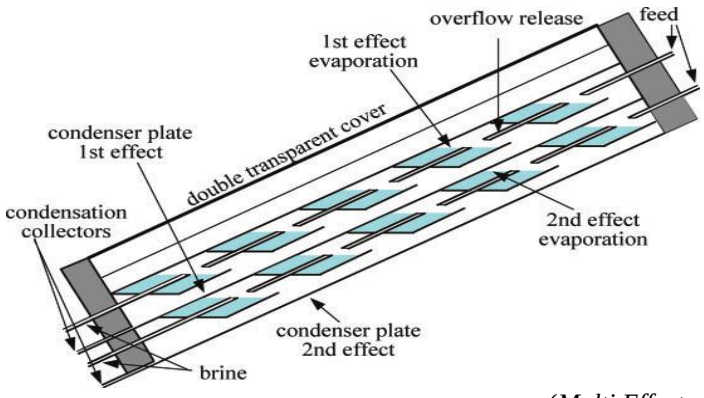
Parts-:

- Glass cover
- Solar radiation
- Salt water tank
- Brine tank
- Freshwater Tank
- Basins

4.2.2 Multi Effect/ Double Effect-:

Double effect Solar Distillation system consist of two evaporation systems, and also consist of two condensation systems. Thus, this systems effectivity increases. The increase in effectivity led towards the increase of output.

This process comparatively has high output result to the single stage or single effect distillation system.

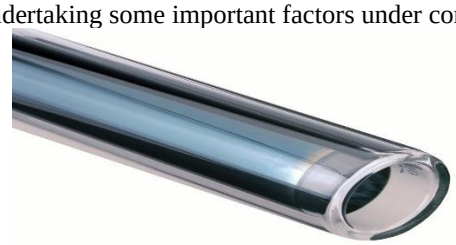


(*Multi Effect solar distillation system)*

4.2.3 Basins Types

Basin's type of the distillator just have a single entrance and the single exits. This type of the system requires manual cleaning. Maintenance of this system is too high. Regularly you have to keep watch on the particular aspects. Thus, now a days this type of systems is preferably not preferred by any of the segment. Not for personal and not for the regional aspects. The work of solar water distillation has been immensely increased in the water scarcity region.

The above all are the basic type of solar distillation system. Now beneath it is the Integrated solar distillation system designed by undertaking some important factors under consideration.



5. ADVANCE SOLAR DISTILLATION SYSTEM

A) Parts (Properties and Construction)
B) Process
C) Advantages and Disadvantages
D) Scopes and limitations
E) Conclusion

A) Parts-:

1) Evacuated solar tubes -:

The evacuated tube pipe line , is the newest idea. Earlier the solar evacuated tubes are used for the purpose of heating the water in the solar water heater. Here we are using same thing but in a extended length. This will help us to initially raise the temperature. Evacuated tube is a double layer tube 1st major level is of the glass and the secondary level is of metal especially black in colour. The glass tubes as well as the interior are cylindrical in shape. Therefore, the angle of the sunlight is always perpendicular to the tubes which make these collectors to perform very well at very low sunlight . Even it is early in the morning or late in the afternoon, or when the clouds\ are on. Evacuated tube collectors are particularly useful in all the areas with less or minimal sunlight to the high and optimal sunlight too.

2) Sieve for solid water particles-:

The water contains solid particles which can create problems in the basins hence we require to remove the solid particles . A fine sieve is what can do every thing which we require. Thus, the fine sieve of 200 mesh per sq. cm.

3) Solar panel-:

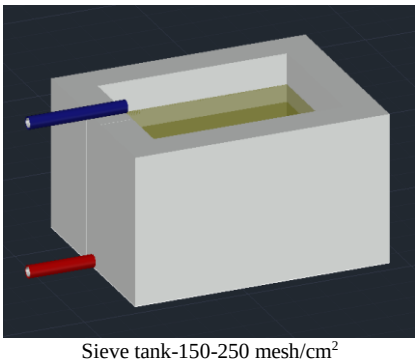
Solar panel is the solar energy collection device. The solar energy is converted into the electrical energy. As according to current information 5.5ft*3.3ft of solar panel can collect about 3 kg hp. Which can give energy about 2 hrs of working time of heater . Such 5 panels will do so they can make about 16kHp of energy .

4) Fresh water collection tank-:

It is the tank where the distilled fresh water has been stored and hence the stored water can be supplied from here . The water stored is aof a purly good quality . This storage tank need time to time cleaning.

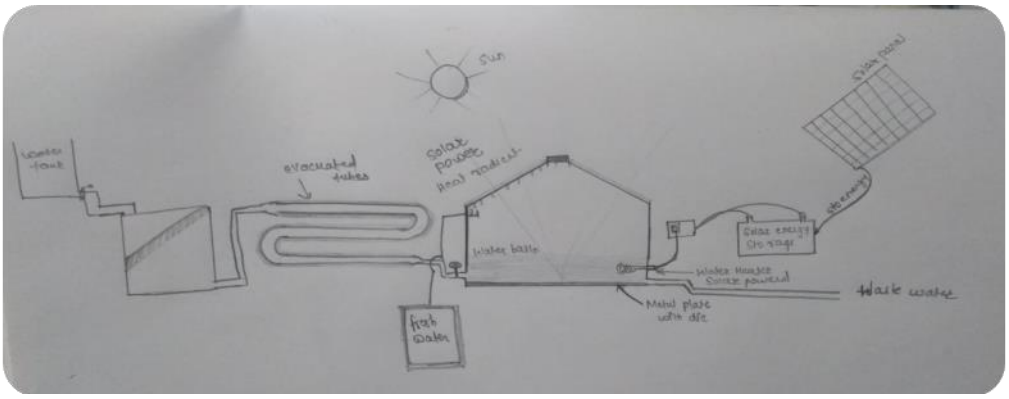
5) Waste water collection tank-:

It is the tank used to store the waste water . The waste water is nothing but the brine solution. This cant be utilized in the scenario.



Sieve tank-150-250 mesh/cm^2

B) Process-:



(Advanced solar distillation system)

- Water tank is the water storage tank, where we can store the saline water.
- The saline water is then goes through the fine sieve where the minute solid particles has been removed with the help of 250 mesh per cm sq.
- This water is then passed into or through the evacuated tubes where the temperature of water has been increased. Theoretically 25m long tubes, rise in temperature is about 10-250C. Particularly in the summers.
- Then this increased temperature water gets into the basins water distillation particularly happened here.
- The temperature raiser water heater is used in a system which is powered by the solar battery which is charged by the solar panel.
- Fresh water is collected from the top of glass through the droplet on the above glass

C) Advantages and disadvantages of system

- It can purify highly saline water (even sea water)
- Non-conventional source of energy is required.
- There is no requirement of skilled or trained operators for maintaining and handling the unit.

Effect of Basin Absorptivity: - Basin Plays an important role in solar water distillation system it helps to increase solar still productivity. The basin lined is used to absorb maximum solar radiation, therefore inner surface of basin is painted by matte black. The absorptivity of basin can be improved by following mechanism.

Effect of dye: - Most of the solar energy is passes through the transparent glass cover which is absorbed by Basin Water itself. It has been observed that dye improves the total output of the solar still by 16% (avg). Among blue, Black, Red dye black better output.

Influence of Algae formation: - Basin liner has the absorbing properties therefore formation of any kind algae prevents radiation to reach towards to the basin liner which effects to the efficiency of solar distillation, thus the efficiency rate of solar still decreases.

Effect of scaling in Basin – Effect of scaling depends on the salinity present in the basin during solar distillation. For higher saline water required frequent cleaning of solar still basin. The salinity of the sea water is 5* 104 ppm which required frequent basin cleaning as compared to the underground water having salinity 5*103ppm.

Effect of Ambient Temperature: - Solar Still gives maximum Daily/ Annual efficiency in location where low value of ambient temperature thus, high solar radiation absorbed**.** Morse observed that Due to decrease in temperature from 26.70c to 37.80c productivity has been decreases by 14%.

D) ROLE OF HEAT TRANSFER

Heat Transfer mode plays an important role in renewable Energy technologies. In general, heat is a of energy that can transfer from system to another. It is essential to determine rate of heat transfer, The rate of heat transfer depends on the temperature gradient. It increases as increase in temperature gradient. Basically, heat is transfer by three modes conduction, convection, radiation which is govern by three laws. Heat transfer through these modes always takes place from high surface temperature to low surface temperature.

Heat transfer in solar distillation system is mainly classified into two types

1) Internal heat transfer
2) External heat transfer

Internal heat transfer takes place through the modes of evaporation, convection and radiation. While external heat transfer takes place through convection, conduction and radiation. External heat transfer takes place from the glass cover, bottom to the ambient temperature and side of the insulation. The side and bottom losses of the external heat transfer of the distillation is undesirable, therefore it is essential to minimize heat transfer from side and bottom losses as much possible for better performance of solar distillation.

The different modes of heat transfer in solar distillation are conduction convection and radiation

Conduction occurs more readily in solids and liquids, where the particles are closer to together than in gases where particles are apart to each other. In conduction, the heat flow is within and through the body itself. The law of heat conduction also known as Fourier's law which states that the rate of heat transfer through a material is proportional to the negative gradient in the temperature and to the area.

$Q=-KA\ DT/dx$ where K is conductivity of the material

Q is the rate of heat transfer.

E) Scopes and Limitations-:

- Solar energy basically has lots of scope, and it can be further developing part.
- Mostly the solar energy is abundantly available and now a days due to increase in global warming temperature also increases . This temperature can be further used for many purposes.
- The development in the field of the basin is still required.
- The requirement of capital is large that's a main limitation in the country like India.
- There are several disadvantages i.e. problems in the functioning which needs more developments.

F) Conclusion: -

- Solar Energy play an important an useful role in solar water distillation system. Desalination is the best application of renewable energy.
- The Advantages of solar still that it uses low grade solar energy which is available forever.
- Solar still can provide a water supply more economically than other method.

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