

Solar Water Purification Using Evacuated Tubes

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Abstract

The need of purified water is increasing with time, and distillation is one of the process to purify contaminated water which can be used in hospitals, industries at larger scale since lower rate of water purification through solar still is one of the disadvantages of it therefore using Evacuated Tubes to increase the rate of heating up the water can help in increased rate of purification.

Keywords: Solar still, Evacuated tubes, Distillation

1. Introduction

Solar water purification is not a new idea, but the efficiency of this process can be improved by installing some devices. Since water purification has its vast demand in rural and in urban areas due to lack of waste management and pollution. Purification of water with chemicals may destroy the minerals of water which are required and by chemical process the see water can't be purified but the single vaporization process can purify see water also. And Solar Energy (renewable energy source) make this process very cheap but one-time investment. Now with the help of Evacuated tubes we will improve the efficiency of the purification process.

2. Solar Still

The water vapor is condensed through a solar still and harmful chemical is settle down is the basin. It works like rain water cycle, the contaminated water in the solar still basin is heated up by the heat trapped in the solar still by covering it with glass. The water evaporation takes place after a certain temperature, the water vapor is collected on the ceiling of glass, when the temperature of water vapor gets cool down then it slide to the collector tank and then the distilled water we get through solar energy.

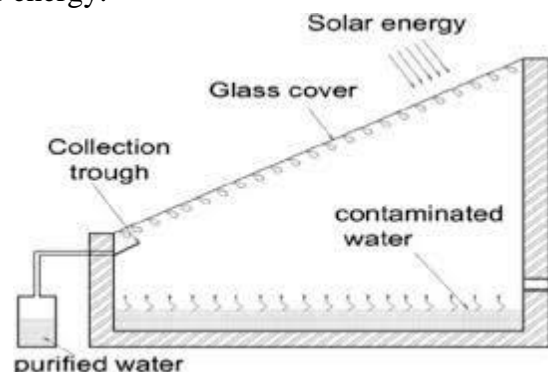


Figure1. Solar Still

3. Evacuated Tube

Evacuated Tube gathers the solar energy as heat energy, There are basically two glass tubes one inside another, there is vacuum between these two glass tubes which act as insulation, the inner glass tube has the coating of Aluminum nitride, when sunrays fall on the tubes heat is trapped inside the inner tube and due to vacuum it cannot get out of it. Now the heat entrapped in the inner tube can be used to heat up the water, which is used to increase the purification rate in solar still.

4. Experimental Setup

The Solar still is made up as a box where it has a slope of 30° and covered with plane glass cover. The tubes are directly inserted in the solar still unlike the using Solar water heater as a separate entity and the direct insertion help to decrease cost and heat loss in conduits. The Solar still box is made up of Tin sheet with black coating in insulation is provided with Rock Wool which can easily withstand with this much certain temperature. The outer most cover is of wooden box. The inlet and outlet are provided in the still itself. An open PVC pipe is inserted at the end of the glass slide so that the condensed water vapor can be collected in the fresh container through the pipe.

Table1. Design Parameter of Solar Still

Area of basin	100 cm x 45 cm
Material	Tin sheet
Glass Cover	
Thickness	5 mm
Inclination	30°
Insulation	
Material	Rock Wool
Thickness	50 mm
Density	48 Kg/cum

Table 2. Design Parameter Evacuated Tubes

Length	1800 mm
Outer diameter	59 mm
No. of tubes	3
Inclination	30°



Figure2. Experimental Setup of Solar Still with Evacuated Tubes

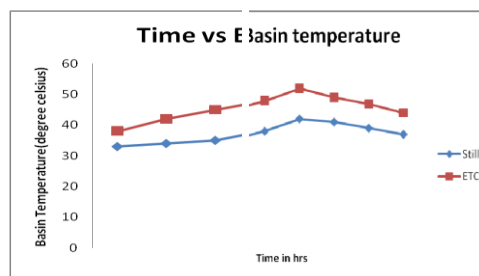


Figure 3: Variation in Basin Temperature

5. Results and Discussions

The rate of heating up the contaminated water is higher than usual due to insertion of Evacuated Tubes.

The Direct Insertion of Evacuated Tubes in Solar still results in decreased heat loss in conduits if inserted in the heating tank separately.

Rock Wool is used to insulate the heat which is working well.

The Temperature in basin increased by 10°C every time at reading.

6. Conclusion

The Single slope desalination unit is setup with Evacuated tubes which helped in increased water temperature inside the basin through thermo-syphon principle. The Major findings of this work is evacuated tubes helps in increasing the water temperature inside the basin and direction insertion of tubes in basin helped in the conservation of heat loss.

7. Future Directions

There can be a lot changes to improve the performance of this solar still following changes can be considered as future directions

The productivity can be improved by making a double slope solar still.

Mild steel can be used instead of Metal Tin Sheet Since Mils steel has greater heat absorbing capacity.

Reflectors can be used inside the basin.

Heat absorbing material can be made as a layer inside the basin.

8. References

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