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A Review of Various Techniques used for the Improvement of Solar Still.

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ABSTRACT

Although, more than two-thirds of the Earth is covered by water, storage of salt water is main serious issue that suffers worldwide. Furthermore, many countries rapid growth of industry and population has resulted in a huge demand for fresh water. The solar still, in many respects, is an ideal source of fresh water for both agriculture and drinking. It is one of the most technically valuable applications of solar energy. There are many types of solar still. An extensive review for solar desalination systems has been carried out in this paper.

Keywords: solar water distillation, solar energy, active and passive technique.

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INTRODUCTION

In India, the solar still was started in 1950 at the national physical laboratory-New Delhi. Initially, the desalination technology using Solar still was a cheap and simple process. A number of efforts have been made by researchers to improve the performance of solar stills by enhancing evaporation and condensation. For conventional solar still, the evaporation depends on basin water temperature. Numerous of methods are available to improve the effectiveness of the still. Depending on the methods used, the stills are of two types passive and active still. When compared with other parameters, the basin water depth is having significant effect on productivity of the still. Investigations show that the water depth is inversely proportional to the productivity of the still. Experiment with deep basin reveals that the productivity of the still decreases with an increase in depth of water during daylight and reverse is in the case of overnight.

A solar desalination (SD) is a technology to convert salt water into pure water.

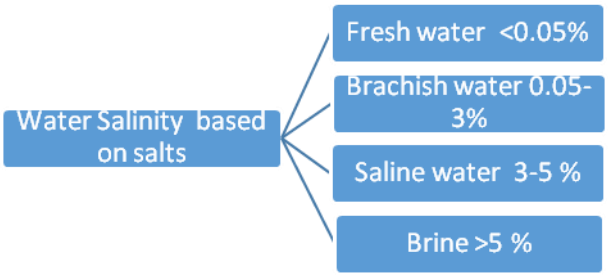

Fig.1Water Salinity based on dissolved salts

Solar desalination is an environmental friendly technology and it produces water. It can be used as portable water for drinking and other uses. The performance depends upon the climate condition and solar still design.

Principle of solar still

- Solar still is an air tight basin, usually constructed out of concrete/cement, galvanized iron sheet (GI) or fiber re-enforced plastic (FRP) with a top cover of transparent material like glass, plastic etc.
- The solar energy heats the water to the point of evaporation. The water evaporate, water vapor rises, condensing on the glass surface for condition.This removes the unwanted particles such as salt, metals, the end of result pure water cleaner than rain water.

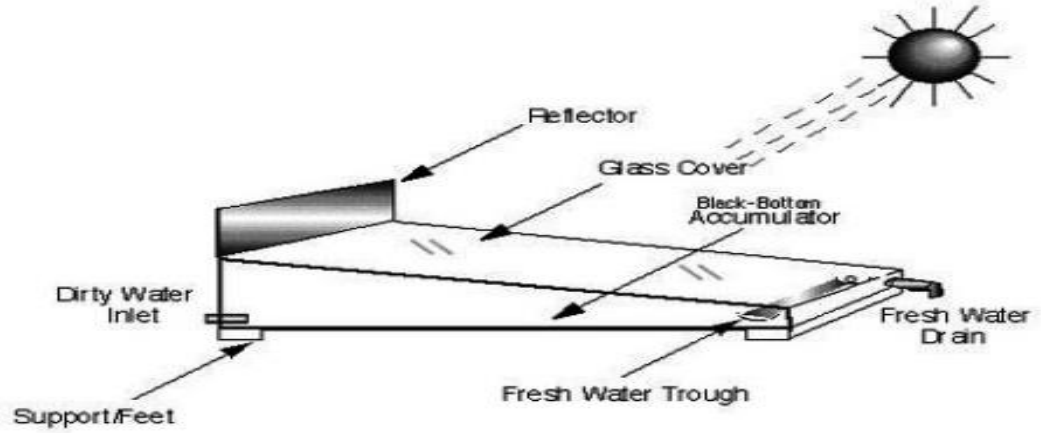

Fig 2 solar still

Problems and justification

1. Algae formation on the inner surface

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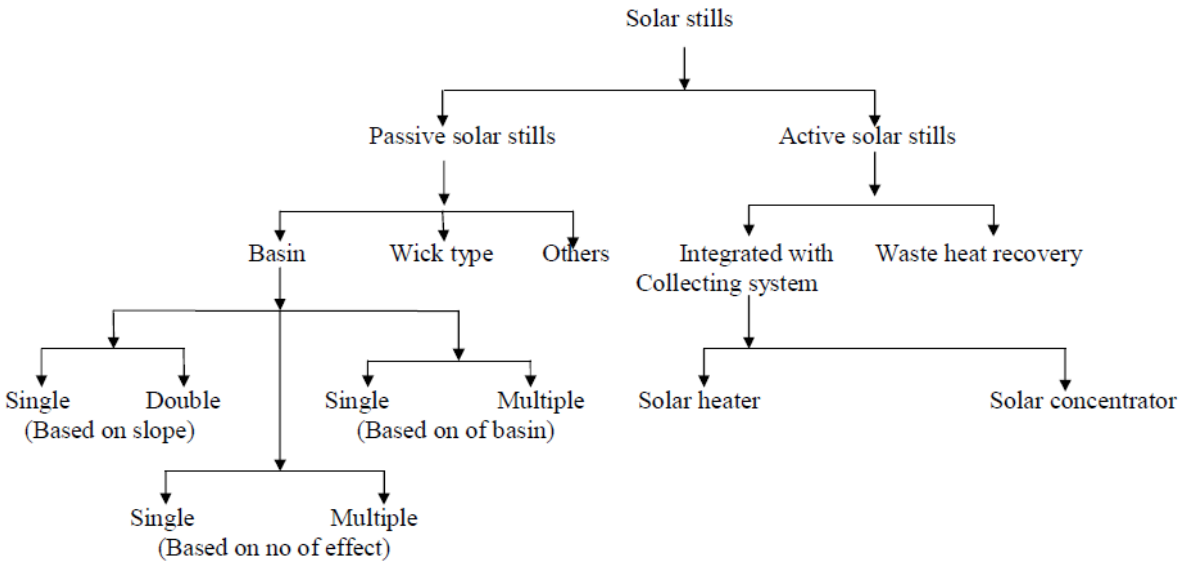
2. Dust on transparent cover.

Application of solar still

1. Industries
2. Hospital and dispensaries
3. Telephone exchange
4. Laboratory use
5. Marshy and costal area
6. For industrial processes
7. Radiator and battery maintenance

Classification of solar desalination system



Passive solar still

1. Passive solar still operate in low temperature.
2. Daily production is low.
3. Only internal modification and no external modification.

Active solar still

1. Increase the evaporation rate
2. due to external modification high thermal energy is fed in basin
3. Production is high.

Performance of Solar Still

The important parameters namely

1. Sky temperature,
2. Ambient temperature,
3. Wind velocity,
4. Solar radiation,
5. Salt concentration,
6. Algae formation on water and mineral layers on basin liner

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Affect significantly the performance of solar stills. It is observed that there is about 10–15% effect in overall daily yield due to change of climatic and operational parameters within the expected range.

Various studies on solar stills of multiple designs to increase the productivity of potable water and efficiency of solar still have been carried out theoretically and experimentally. the work done by previous researchers in obtaining distilled water using solar energy is work carried out.

ALPESH MEHTA et al (2011)

In this experiment a model convert the salty water into portable water using the solar energy was devised. The designed model produced 1.5 liters of pure water from 14 liters of dirty water during six hours. From their study, they found that, with the addition of salt increases the surface tension and thus it decreases the rate of evaporation in basin. One of the best performance was that a single basin solar still has been coupled with a flat plate collector having forced circulation.[1]

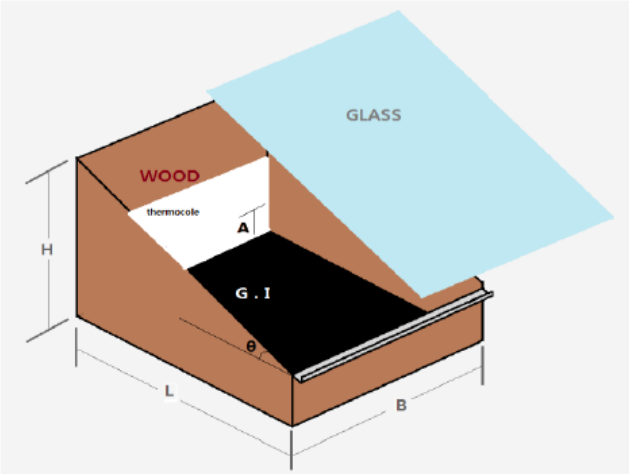

Fig 3 Proposed Model Of Solar Distillation System

TENTHANI et al (2012)

In this experiment, the internal surface of the walls of the still was painted white. This improves the output on the still. The amount of distilled water varied from 1.452 to 3.208kgm^{-2}. They conducted the experiments on double basin solar still coupled to a collector in the thermo syphon made. The solar still was coupled to a collector in the forced circulation made. In double basin solar still coupled to a flat plate collector performs better in the forced circulation mode than the thermo syphon mode. The efficiency of high temperature distillation system decreases with increasing area of the collector panel.[2]

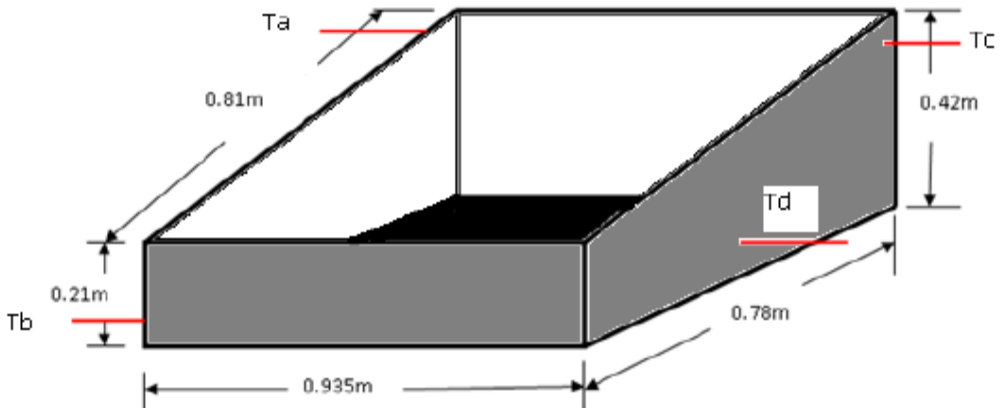

Fig 4 Perspective Diagram Showing The ISS

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HITESH.N.PANCHAL (2015)

In this work double basin solar still was integrated with evacuated tubes, when the vacuum tubes were added, the output increased to 56%. When the black granite gravel was used in the experiment the productivity increased to 65%. They have conducted that for maximum productivity of 78% occurred when fin and sponge were used in the stepped solar still. It is also found that the productivity was improved during night when pebbles were used in the solar still. Thus for the productivity augmentation, pebbles, baffles plates fins and sponge were used.[3]

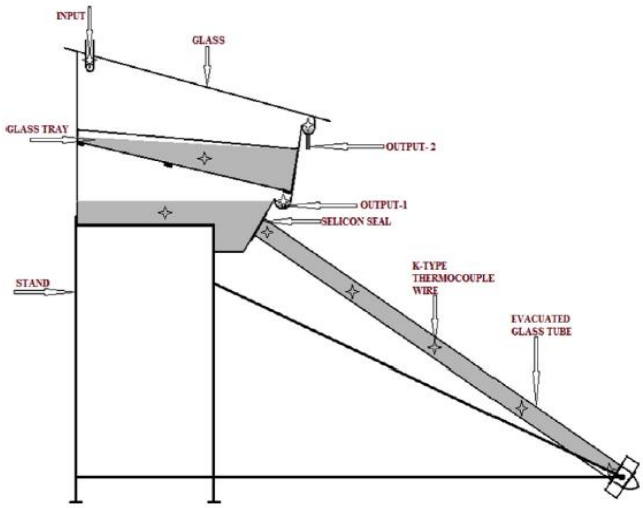

Fig 5 Experimental Set Up Of Solar Still Coupled With Vacuum Tubes

K SHANMUGASUNDARAN (2013)

An attempt was made to enhance the productivity of the single basin double slope solar still by integrating it with shallow solar pond. The performance was analyzed theoretically and experimentally. The integration of solar still with solar pond increase the productivity. There are some more factors which may affect the output of solar still, such as the intensity of sun, latitude, absorbing material, number basin attach to the solar still, north-south direction, productivity of the still increases with the intensity of solar radiation and temperature of feed water.[4]

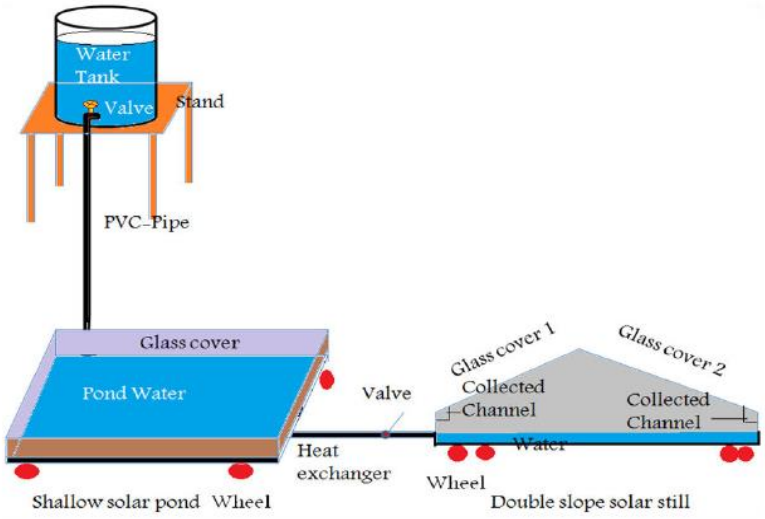

Fig 6 Schematic diagram of the single basin double slope solar still integrated with shallow solar pond

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SRITHAR et al (2010)

There, many solar ponds were used to store the solar thermal energy for preheating the saline water in single basin solar still. The heat energy in the solar pond was used. Further sponges were, pebbles and sand were used to increase the productivity. As a result productivity increases by 32.22%. For increase the efficiency, pebbles baffle plates. Fins and sponge were used in the stepped solar still. It is also found that the productivity was improved when pebble were used in the solar still during nights[6]

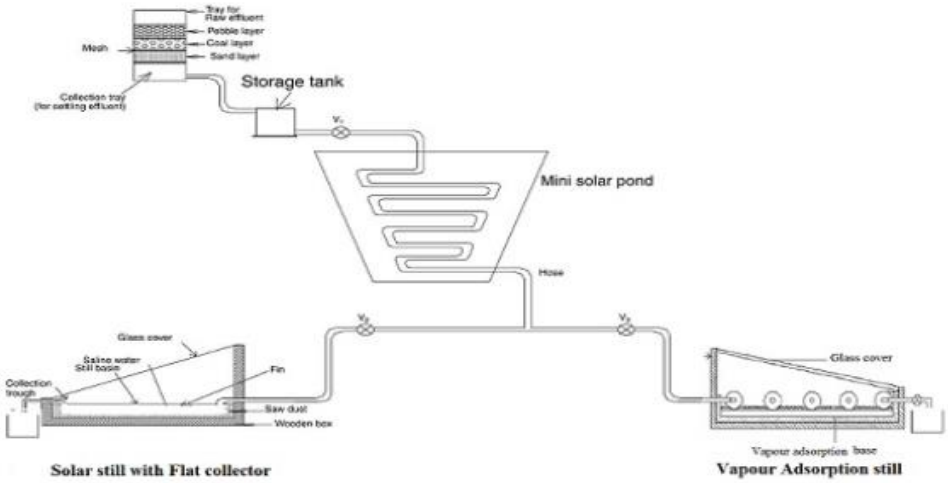

Fig 8 Experimental setup

VELMURUGAN et al (2010)

The experimental was undertaken to get portable water from industrial effluents. To increase the productivity some modifications were made in the solar still. The performance of single basin solar still and stepped solar still was made. For the further in increase of productivity, solar still was connected with solar ponds. Fin, black rubber, sponge, sand and pebbles were also used. The modifications were made, the performance increased by more than 100%. The deviations between experimental and theoretical performance was not more than 10%.[7]

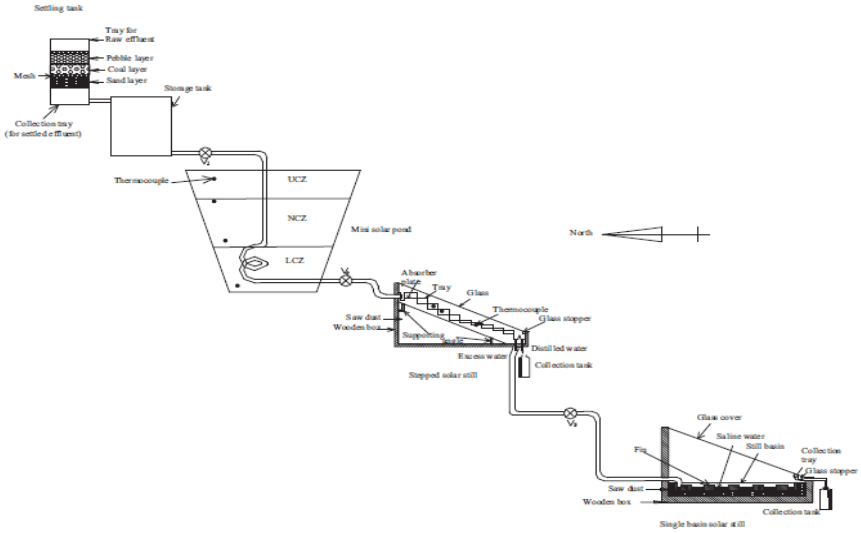

Fig 9 Combination Of Stepped Solar Still And Single Basin Solar Still With Solar Pond

VELMURUGAN et al (2006)

The solar still was integrated with mini-solar pond for increase in productivity several modifications were made in the solar still. Sponge cubes were used in the solar still. Sponge cube were used in the solar still. This increase the evaporation rate this was a considerable increase in productivity. Thus the average daily productionof distilled water has been found to be increased with the integration of sponged solar still with a mini solar pond There was a goal agreement from theoretical result and experimental results.[8]

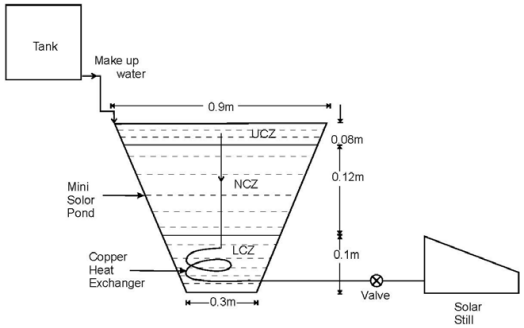

Fig 10 Schematic Diagram Of The Experimental Set Up

VELMURUGAN et al (2009)

In this experiment to store the solar thermal energy, solar pond was used. The heat energy from the solar pond was used for heating water, in the solar still. In the solar still, industrial effluent was used as a raw material. The performance of single basin solar still and stepped solar still were calculated when they were connected with mini solar pond for further increase in productivity, solar basin was modified with fin, black rubbers, sponge and sands. Maximum productivity of 100% was obtained, when the fin type, solar still was integrated with pebbles and sponge. The increase in solar intensity and water –glass temperature difference increase the productivity. But the increase in wind velocity, decrease the productivity.[9]

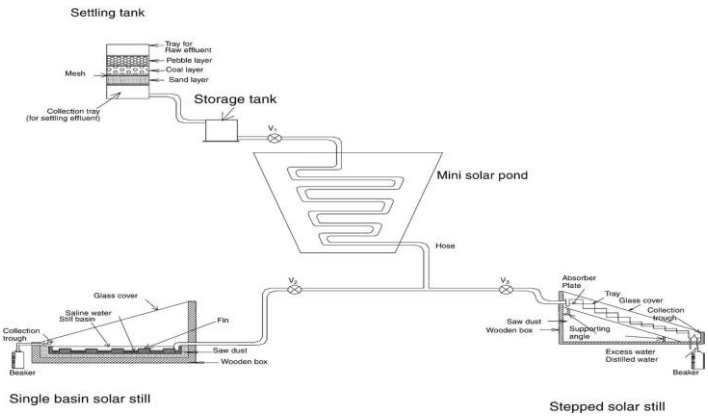

Fig 11 Schematic Diagram Of Experimental Set Up

VELMURUGAN et al (2009)

The performance of stepped and single basin solar stills with mini solar pond was studied. The solar ponds, stepped solar still were connected in series to enhance the productivity of the solar stills. For further increasing the productivity of the solar stills for further increasing in the productivity, pebbles, baffle plate, fins and sponge were used the solar stills. As a result, productivity increased to 80% theoretical results agreed with the experimental results.[10]

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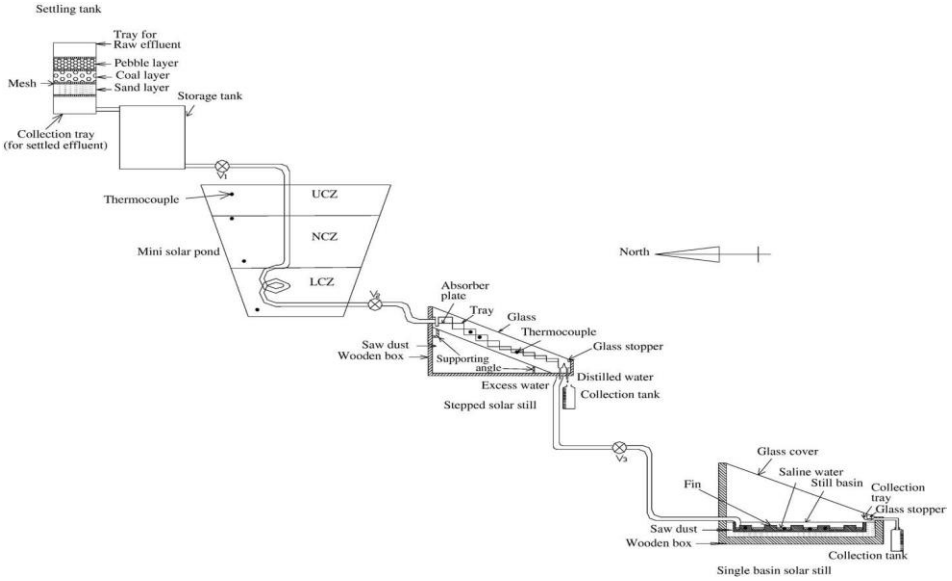

Fig 12 Combination Of Stepped Solar Still And Single Basin Solar Still With Solar Pond

CONCLUSION

The above investigation presents a clear view of productivityon different types of inclined solar still with different techniques. This section summarizes and presents the investigations carried out:

- The glass cover angle is equal to the latitude of the place for maximum desalination.
- Maintaining vacuum conditions in the still improve the productivity.
- The performance of the still with double basin is comparatively high than the single basin stills.
- Multi effect wick stills are produced more the yield than basin still during sunshine hour, and reverse in the case of night.
- Providing additional area for condensation increases the condensation rate as well increases the evaporation rate in basin.
- the hourly yield is possible in active mode of operation and its used for commercially

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