Solar Distillation Based on Pyramid Shape Solar Still- A Review

Sandeepsinh Vala  
PG Scholar  
Department of Thermal Engineering  
Marwadi Education Foundation’s Group of Institution – PG Studies, Rajkot – 360003, India

Bhavesh Kanabar  
Assistant Professor & Head of Dept.  
Department of Mechanical Engineering  
Marwadi Education Foundation’s Group of Institution, Rajkot – 360003, India

Abstract

Water is essentiality of mankind. Water on the earth is available in large quantity but in form of saline water. Large sufficient amount of quantity of water resources are receivable on the earth but only 1% of the Earth's resources when get the fresh water. So accomplish the crucible demand of fresh water need to be convert saline water into drinking water. Distillation is one of the most hopeful methods for getting fresh water but now due to economic factor us of renewable energy for distillation process. Solar distillation most widely use. Solar distillation process becomes complete with help of solar still. Solar still classified mainly classified active and passive but according to shape, it classified based on different shape solar still. In this paper review the distillation process base on pyramid shape solar still and different affecting parameter to increase the yield output.

Keywords: Solar Distillation, Solar Still, Pyramid Shape

I. INTRODUCTION

Water is one of the most important connatural for the nourishment of mankind. Water is incumbent for all life cycle on earth plants and human etc. Thirds of earth's is covered with water of which around 97% is salty, 2.6% is present as icebergs and only less than 1% of fresh water is within human reach.[1] For fresh water needed humanity is dependent on ponds, rivers, lakes and underground water sources. The presently availability fresh water on the earth is prepared. Only the crucible demand of new water is increasing rapidly, due to population growth and modernization of industry, and increased life standards of mankind. It has been declare assumption by United Nations Organization that by 2025; nearly 1800 million people around the worldwide will be under severe water bareness. [2] This crucible fit in can be handling only if mankind finds some other ways to get fresh water solution. The water resources are available in world are much more but phasing the problem is it contain high salinity which will not be useful to as drinking water. Fortunately, desalination technology developed long back similar to handle this problem. Distillation process means convert the saline water into fresh drinking water.

There are different conventional methods of desalinating saline water like flash distillation, multi-effect distillation, membrane distillation, reverse osmosis, forward osmosis, ion exchange, capacitive deionisation, electro dialysis and seawater greenhouse technology. Advance desalination method like activated carbon filtration and vapour compression are also used to provide fresh water. Nathless, people living in rural areas can’t afford and use those costly technologies [3].so we need to use free of cost resources like renewable energy sources. Solar energy is the continues heat supply and collect the energy in different form.

Solar desalination on the discrete side suitable to be the most economical and feasible techniques of convert the saline water into drinking water. It uses the naturally available abundant supply of solar energy to form the water evaporate and thus this method has zero operational as well as free cost,[4] The solar desalination systems are take place in the some device called solar still. solar still works in the form of evaporation and condensation process. The saline water inside the solar still is evaporated using solar rays falling on them and the condensate is collected as the water output. The basic principle of solar still shown in Fig.1
The solar still is working as a collect for solar irradiation that passes through a transparent top cover it needed to of a basin containing saline water, a glass having slope at an angle (which prefer as latitude angle of where setup placed) above the basin and interlocution at the apex, made of a arrangement much like a greenhouse. The basin is generally painted black which is maximizing the absorption colour surface of falling radiation. Solar irradiation falls on the slope glass and the greenhouse effect that is produced in the inside increase the temperature of the saline water held in a basin. Water at the surface is evaporated, the water vapour rises in the still and reaches the sloping glass, where it condenses to liquid water and runs down the sides of the glass arrangement. The water is collected its fresh water.

II. CLASSIFICATION AND COMPARISON OF SOLAR STILLS

Solar still classified mainly two types one is Active and second is passive. Classified as active and passive type mainly base of resource of heat to evaporate water either directly through sun or using some external sources, like solar collectors, evacuated tube collectors and concentrating collectors which are coupled to the desalination unit. Solar still classified according to shape includes single basin single slope, single basin double-slope, Hybrid solar still, hemi-spherical, and triangular and pyramid type solar still. Different shapes are their own dimension configuration and specific advantage. Mostly used in solar distillation of solar still are single slope solar still because of their frequency of easy design factor. But now we research that pyramid shape solar still because of its own special advantages over other shape.

Ravishankar Sathyamurthy et al [5] survey that review of different geometrical variation of shapes in different solar still and conclude that geometry in the solar still effectively affecting parameter the output of fresh water from distillation process, mainly pyramid shape solar still throughout the flow with take out the heat from basin absorber improves the output water compare to single basin single slope solar still. Ravishankar Sathyamurthy et al [6] concluded that from experimental work that many researcher presents important different parameter effect on triangular pyramid shape solar still like depth of water also summarized that convective and evaporative heat transfer coefficient are important playing roll of design of solar distillation system.

![Fig. 2: shadow effect on (a) single basin single slope solar still (b) Triangular pyramid shape solar still.](image)

Another result found that solar still during the sun off time duration the effect of shadow on the water is being a Condemnatory criterion for the non-consistency of heat input, which usually affects the fresh water produce. Thus Fig. 1 shows the effect of shadow on single slope single basin and pyramid solar still. It is seen that the sidewalls of the conventional solar still have lower water temperature due to the shadow of side walls by resistance the heat inside the still which reduces the output of fresh getting water production in the solar still. In a pyramid solar still the shadow of side walls is reduced which increases the outturn, and maintain the water temperature by distributing the heat input inside the still. Also the solar radiation fall of single slope solar still is same as pyramid shape solar still and this kind of influence pyramid shape getting more output.

A.E. Kabeel et al. [7] could be found in literatures different design configurations. The production was raise with high system cost may also raise the average yearly cost of the distillate output. Cost estimate of different design configurations of solar still device is compulsory to define the advantage of changes from the economical view. The main aim of this research is to estimation of the production worth of different stills. In this research 17 design configurations are to be defined and analyze. The results shows that pyramid shape solar still get higher average yearly productivity among all. And also the lower cost per 1 litre of fresh water obtained from the pyramid-shaped solar still. H.E.S.Fath et al. [8] researchers are determining analytical and economic thermal analysis of pyramid and single basin single slope solar still. Single slope lower cost of production compare to pyramid shape solar still but most probably same efficiency. But main advantage is that the solar energy received by the both still in yearly as same but pyramid shape solar still 5% above to compare to single-slope still. Husham M. Ahmed et al. [9] In this research, comparative study has been carried out in order to find out the configuration effect on solar still yield productivity. Two shape was consider, single slope and pyramid shape solar still and designed same basin shape and dimensions, but different glass cover configuration. Experimental analysis conclude that pyramid shape solar still increase of 17.5% compare to single slope solar still. Eze J. I et al. [10] to study about comparative evaluation of two basin type passive solar stills of pyramid shape solar still and rectangular solar still and conclude that more area of basin get more output of yield. T. Arunkumar et al. [11] conclude their research that hemispherical and pyramid shape solar still both are depended upon the solar radiation incident on it and find
the solution that the productivity increase of to the receiving the solar radiation from the top cover glass without any loss is mainly parameter. In all above conclusion of many researchers we conclude that pyramid shape solar still for distillation process to get maximum output.

### III. INCREASE EFFICIENCY OF PYRAMID SHAPE SOLAR STILL

In many parameters influence the increase the productivity of different shapes. Passive solar still have modification done to get maximum output from still. All kind of shapes are increase efficiency to different parameter but here we review about the only pyramid shape solar still because of in above section we conclude that pyramid shape having good constructional feature to get maximum radiation and more effective basin area of among all. So many researcher investigation of different affecting parameter to increase the productivity of pyramid shape solar still.

Ravishankar Sathyamurthy et al.[12] researchers experimental work has been conducted and concluded that convective and evaporative heat transfer coefficients are very important for designing any solar still systems and the effect of temperature difference between the evaporative and condensing surfaces is also crucible role of the given temperature range. And also effect the water depth is minimum to the yield of the fresh water. Yazan Taamneh et al.[13] the experimental conclude than evaporation ration was increase when using photovoltaic fan for the putting on top cover of the glass. Forced convection is 25% of efficiency of increase compare to free convection. Ravishankar Sathyamurthy et al.[14] concluded based on experimental that effect of water mass on the performance of triangular pyramid solar still and utilize latent heat for increase productivity of using paraffin wax material. It conclude that lower mass of water in still basin give rapid and more efficiency among other conventional condition.

A. Senthil Rajan et al. [15] experimental setup of pyramid type solar still with 0.82 m × 0.81 m × 0.75 m has been fabricated with GI sheet and tried with different water depths of 2–4 cm integrated with biomass heat source and sensible heat storage material. Experiments were conducted with biomass heat source for once flow mode and continuous stream mode and solar heat Radiation mode. The performances of modified still were compared with conventional still and get result that sensible heat storage materials produce 48% more productivity than conventional still. A.Prakash et al.[16] conclude their research that fabricate and analyze a new pyramid wick-type solar still and conclude that wick type pyramid solar still 17.68% more than conventional pyramid solar still. T. Arunkumar et al.[17] investigation experimental that pyramid solar still with boosting mirror system for increasing the distillate yield. The daily average efficiency of the still increase to be 15%.the fig.3 shows the schematic diagram of it.

![Fig. 3: pyramid shape solar still with boosting mirror](image)

S. Kalaivani et al.[18] investigation experimental that the effects of using wax latent heat material with storage system in pyramid type solar still PCM increase the efficiency and also conclude that The addition of sensible heat absorbing materials were capable of incresing the productivity with heat retention causing continued evaporation.

### IV. CONCLUSION

This work reviews the various researcher investigation of different shape of solar still for getting maximum yield production. The conclusion is that Pyramid shape solar still has appropriate geometric shape of all among shape and boost up the production of fresh water compare to other shape. Here are also conclude that pyramid shape solar still more efficient than single slope solar still. Increasing efficiency of using different affecting parameter are also describe for pyramid shape solar still and conclude that pyramid shape solar still affect the various parameter better than single slope solar still for enhancing efficiency.
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