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THE STUDY OF DESALINATION OF WATER USING SOLAR STILL – AN OVERVIEW

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ABSTRACT
In this report we have researched many reports regarding the desalinating of water, phase change medium, copper trays and pyramid solar still. Solar still is not much attractive in the market due to the lower productivity. Using this solar stil,l desalination of water can be done. The paper reviews in the field of pyramid solar still and says that the pyramid solar still is more efficient and economical compared to the single basin still or double basin still. Thus this review paper will assist the researches to understood the fundamentals of pyramid solar still and desalination of water. Here the paper discusses the development and challenges in the pyramid solar still and desalination of water, to improve the performance and economy.
KEYWORDS: *desalinating of water, solar desalination, renewable energy*

INTRODUCTION

In this world 70% is covered by water and balance 30% covered by land though 70% of water are surrounded by world only 1% of drinking water is available in this world this makes the scarcity of drinking water, so many of people are dying for the scarcity of water, to overcome this desalination of water is the method to convert saltier water into drinking water, we have reviewed
some reports and we developed the review paper on the basics of desalination of water, due to the tremendous growth in the population deforestation accurse so the demand of clean and pure water are reduced which will increase in the demand in the drinking water so desalination is the method to convert saline water into drinking water, Due to environmental issues and limited fossil fuel resources, more and more attention is being given to renewable energy sources. In the recent years solar energy has been strongly promoted as a viable energy source. One of the simplest and most direct applications of this energy is the convergence of solar radiation into heat as shown in figure 1.1.

Supply of drinking water is a major challenge in underdeveloped as well as in some developed countries. This problem occurs in recent years due to population growth, climate change, drought, urbanization etc. Safe water is fundamental to life and sustainable development. Man has been dependent on rivers, lakes and underground water reservoirs for fresh water but the pollution of rivers and lakes by industrial effluent and sewages has caused scarcity of fresh water in many towns and villages near lakes and rivers. During 21st century, global access to safe water is disparate and inadequate particularly in south Asia and Africa. Today, most of the health issue is owing to the non-availability of clean drinking water. Most part of the world receives insufficient rainfall resulting in increase in the water salinity. In the world, 3.575 million people die every year because of water related disease. Although water occupies approximately 70% of the world, more than 90% of the water contain salt and is not suitable for drinking. Most of the water available is naturally impure or not drinkable and requires treatment. By the year 2025, it is estimate that 1/4 of the world population will be affect by water scarcity and 2/3 will experience water stressed conditions. By 2030, 1/2 of the world population will experience high water stress. Presently, African regions are experiencing water stress affecting up to 31% of the population, followed by Asia- 25%, America-7% and Europe-2% of high water stress.

In nature solar desalination produce rain when solar radiation is absorbed by the sea and cause water to evaporate. The first known application of solar distillation was in 1872, when a still, providing drinking water for animals and used in nitrate milling in Las Salinas on the northern deserts of Chile. More recently, several community scale solar stills have been built in Australia, Greece, Spain and elsewhere, and new technology and practical development has improving the productivity of solar stills. Surveys show that about 79 percent of water available on the earth is salty, only one percent is fresh and the rest 20 percent is brackish.

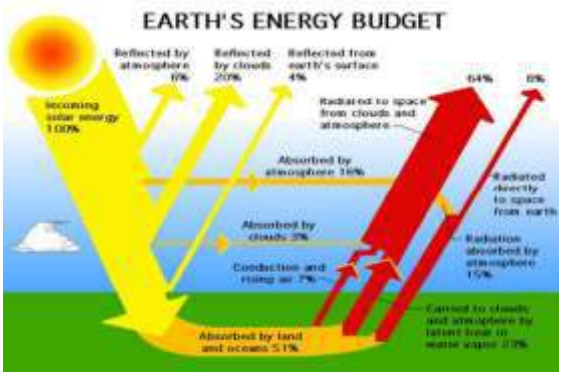


Figure 1.1 Earth energy budget

Desalination is one of humankind's most primitive forms of water handling, and it is popular treatment solution throughout the earth today. In addition, distillation technique used in land-based plants as well as in ships to provide water for a crew. There are many methods of converting brackish water into potable water such as Vapor compression osmosis.

Distillation is one of the important processes available for water purification and sunlight is one of the several forms of heat energy that can be used to power that process. Sunlight has the advantages of zero fuel cost but it requires more space and generally more costly equipment. A solar still works on the principle of the hydrological cycle, which is found in nature. In principle, the water from a solar still should be quite pure. The slow distillation process allows only pure water to evaporate form the basin and collect on the cover, leaving all particulate contaminants behind. Solar stills have been thoroughly studied and tested for the production of desalinated water using solar energy.

The components consists of glass cover, basin, absorber plate, insulation, distillate trough etc. solar still is a device, used for the potable water production form wastewater. It has lower distillate output; hence, it is required to be increased by any manner. Either solar stills are mainly graded accordingly to passive and active systems based on

the source of heat to evaporate salt water directly through sunrays or through some external source like solar heater, PV/T systems, waste heat source, solar ponds and concentrators are coupled to the stills. In addition, the active and passive is subdivided into single and multi-effect stills based on number of layer of glazing. The different factor that affect the solar still productivity such as Wind speed, ambient temperature, Water depth and Solar radiations.

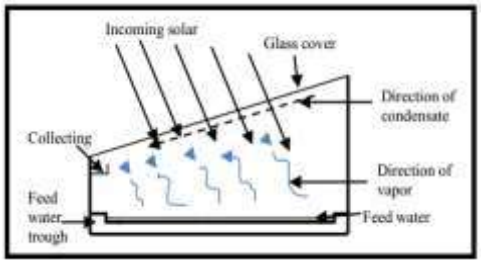


Figure 1.2 Operation of conventional solar stills

The operation of a conventional solar still is shown in figure 1.2. For the most case, even under operating conditions, the efficiency of the single basin solar still was in the range of 30-45% with less than 5 L/m^2 /day of fresh water production. A film or layer of sludge is likely to develop in the bottom of the tank and this should remove out as often as necessary.

Both efficiency and productivity depend on many operating and design parameters, which are discussed in this review. Solar stills is one of the prominent, cheapest and environmental friendly methods. There are various methods available in the water purification such as filtration, disinfection, sedimentation and distillation but solar desalination is acts as the most important purification process, the process of desalination of sea or underground water process is discussed with many papers and presented here

1.1 SEA WATER DESALINATION

Mohammed shadi s.abujazar, s. fatihah, a.e. kabeel have carried out an experimental and theoretical comparison for the seawater desalination using inclined stepped solar still with copper trays in a wet tropical climate author has fabricated the design using copper stepped solar sill the copper solar still is of inclined steeped solar still has internal dimensions of L1.8m,W1.2m,andH 0.20m and consist of 28 trays the tray dimensions are 0.6 m in height and 1.2 m in length the trays is made up of copper

Author have chosen the copper due to its high thermal capacity of copper (k=390W/mk) compared to that of steel (k=48W/mk) and aluminium (k=200W/mk) and it has higher evaporation rate and efficiency so copper still is used in this process , trays are placed on the stainless steel and insulated with saw dust

The experiments were performed for the 12 h a day from 8.00 am to 7.00 pm in 112 runs. 5 runs for each day, for three months from 27 th September to 23rd December 2016 the parameters are measured during the experimental

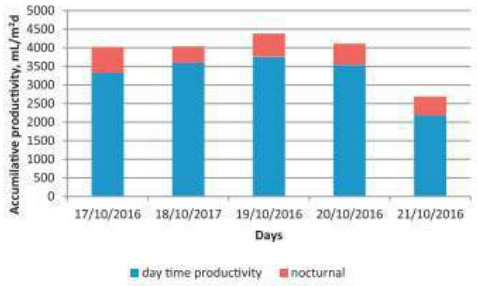


Fig. 17. Variation of the daily and nocturnal productivity of the inclined stepped solar still for the 4th run.

Sea water In the still was heated by solar radiation ,the water vapor was condensed o the inner glass surface, and the water droplets glided along the glass, the condensed water was collected o the stainless steel to record the volume The result gained by the author on the experiments is during the period of operation , the maximum hourly solar radiation were high at 17.00 and begins to decrees on later therefore increase in solar intensity increases the sea water temperature in the trays, which increase the productivity rate and low wind velocity increased the efficiency of the system compared higher wind velocity

Fig. 16. Hourly efficiency variation of the inclined stepped solar still.

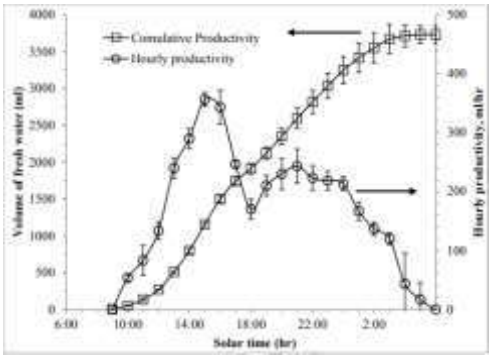
By using this process the sea water is desalinated and is now available to drink the desalinated of sea water through the process of process of sea water desalination

1.2 SOLAR DESALINATION USING SOLAR STILL AND PCM

Mohammad al- harashch, mousa abu-arabi mousa,zobaidsh alzghoul have carried out an experimental and theoretical comparison for the solar desalination using solar still enhanced by external solar collector and PCM The experimental set up consist of four main parts solar basin , solar collector, double glass cover and tubes filled with pcm and incline dot an angle of 35degree it is painted on black colour to improve absorption of solar energy It has a square bottom with an area of 1m2 , a heat exchanger of aluminum coil with 1 cm diameter is submerged in basin water it consist of 10 parallel copper tubes of 10 cm apart are covered with 4mm specular glass

Every tube was filled with PCM material (sodium thiosulfate penta hydrate) it will stores energy at day time and will uses the energy at night time the water in the basin is heated and evaporation takes place ,the vapor rises to the top reaching to the glass cover and then condensate on the inner glass surface of the glass cover

The authors have conducted the experiment for the 24 hrs using PCM which gives solar energy during night time also and also they have tested the experiment with the heat exchanger of supplying hot water and cold water
The maximum productivity obtained is 4300 ml the highest hourly productivity occurs at 14.30 and it is 400 ml. the amount of fresh water produced during the day is 2400 ml and that during the night is 1900 ml. The energy stored in the pcm was utilized to heat the basin water; water heated in the external solar collect through the still via a coil immersed in the basin, the basin is located above the solar collector



the basin water temperature and hourly productivity as hot water circulation flow rate was increased the highest daily productivity obtained is 4300 ml and also the effect of water level in basin also studied and its results in operating in lower water level in the basin i.e. 5cm made the temperature of water basin higher than when operating at 8 and 10 cm

1.3 VARIOUS SOLAR STILL DESIGNS

T.Arun kumar.el on their work done an experimental study on various solar still designs. The fabrication of seven solar still designs such as spherical, pyramid, hemispherical, double basin glass solar still, concentrator coupled single slope solar still, tubular solar still and tubular solar still coupled with pyramid solar still and their performance evaluation in converting brackish water into fresh water for these drinking are presented .The experiment was constructed and tested during January to May 2011.

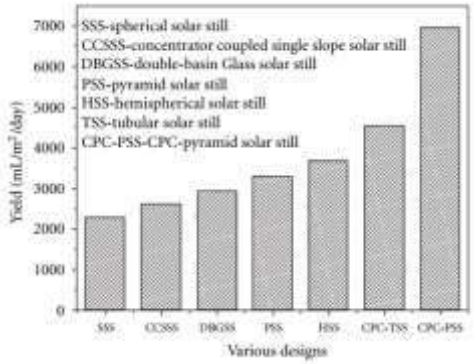
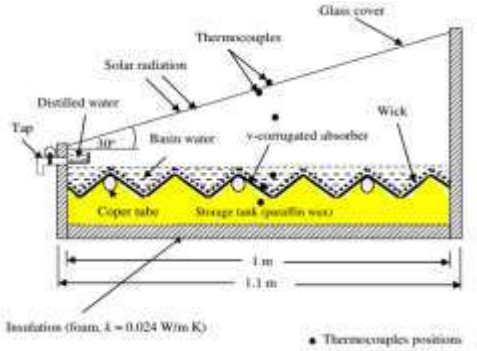


Figure 2.1 Variation of productivity with respect to total productivity

These tested are conducted at various stages which contains many designs from this testing result they have chosen one design is the best design for the solar still, it is tested on the basic of experimental and theoretical, the result is From the observations, the compound parabolic concentrator-assisted tubular solar still shows maximum yield.

1.4 SINGLE BASIN SOLAR STILL USING PCM

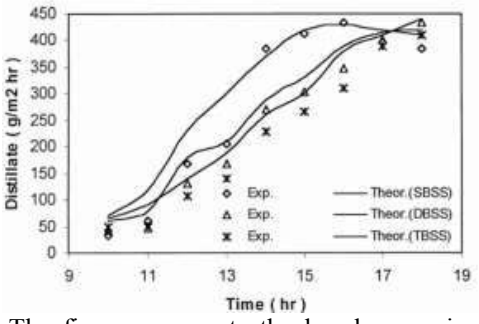
S.M Shalaby et al describes an experimental investigation of a v-corrugated absorber single-basin solar still using PCM. Paraffin wax is chosen as a PCM due to its medium storage, safety, reliability, uniform melting and moderate cost. The experimental investigation shows that the solar still with using the PCM beneath the corrugated plate with less basin water mass achieves the best thermal performance among other studied configurations.



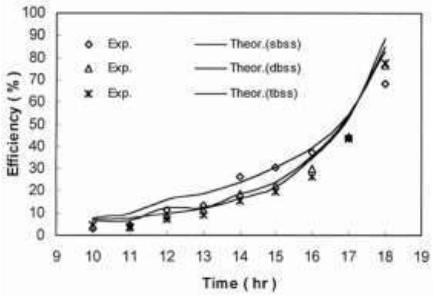
The daily productivity of the still with the PCM when mw = 25 kg is 12% and 11.7% better than those for the v-corrugated still without the PCM and with the PCM using wick, respectively. Cost analysis is also performed where the cost per liter (CPL) for the still without PCM, with PCM and with PCM using wick are estimated at 0.07182, 0.08369 and 0.09558 $/l, respectively.

1.5 PYRAMID SOLAR STILL

k.k.nayi, k.v modi renewable and sustainable energy reviews having top cover In the shape of square pyramid , author have fabricated the three models such as single basin, double basin, and triple basin solar still from 1mm thick GI sheet. The basin area of 0.96m×0.96m×0.15m was kept same for the three models. In the double basin still, upper most pyramid shape glass cover and glass cover which form the upper basin acts as condensation surface. Similarly, in triple basin solar still, additional condensation surface was provided by the two glass sheets forming the upper and middle basins. Sides of pyramid shaped cover were inclined at an angle 45°. In the experimentation, observations were noted on hourly basis for the solar intensity, wind velocity, distillate output and temperature of ambient, inside glass surface, basin and water. From the results, authors found that the temperature of lower basin plate is highest for single basin solar still, followed by double slope and then for the triple slope .They have mentioned the reason that the attenuation of solar radiation occurs due to increase in glass and water quantities



The figure represents the hourly experimental and theoretical distilled output they have found that the distillate output from triple basin solar still was 24% and 5.8% higher than that of single basin and double basin respectively.



They have obtained that maximum daily efficiency of triple basin, double basin and single basin solar still was 44%, 42%and 32% respectively.

REFRENCES

1.1 Mohammed shadi s.abujazar, s. fatihah, a.e. kabeeldescribes sea water desalination using inclined stepped solar still with copper trays in a wet tropical climate. Scholar Elsevier Vol 2017, Article ID 141148

1.2 Mohammad al- harashch, mousa abu-arabi mousa,zobaidsh alzghouldescribes the experimental study on solar desalination using solar still enhanced by external solar collector and pcm Scholar Elsevier Vol 2017, Article ID 11130

1.3 T. Arunkumar et al. describe the experimental study on various solar still designs. Internal scholarly Research Network. Vol 2012, Article ID 569381, 10 pages

1.4 S.M. Shalaby et al. describe an experimental investigation of a v-corrugated absorber single-basin solar still using PCM. Desalination 398 (20160 247-255

1.5 Hamdan MA, Musa AM, Jubran describes an experimental study on Performance of solar still under Jordanian climate. Energy Converts Manage 1999;40:495–503