

Active Solar Still recent development in design and related performance- Review paper

Varsha Mohan Kapse¹, Dr. R.R.Gawande²

¹Lecturer

Government Polytechnic Gondia , India,441601

²Associate , Professor

Bapurao Deshmukh College of Engineering Sevagram ,
Wardha City, Country, Pin

Abstract – This review paper mainly focuses on different solar still .It considers advanced modification in design and development of material.Single and multiple effect solar still with augmentation of different material ,Energy absorbing insulator and mechanism of heat and mass transfer to improve the loss of head and enhancement of productivity of solar still .The cost benefit analysis along with progressive advancement is the major contribution to this review. To increase the output of the solar still the application of advanced modification is a promising tools , and it anticipant more improvement will shortly added in this area with the significant modification in design of solar still.

Keywords - Distillation , Desalination. Solar still

I- INTRODUCTION

Solar energy has the greatest potentials of all the sources of renewable energy and if only small amount of this form of energy could be used it will be one of the most important sources in the country have depleted .The solar power where the sun hits atmosphere is 10^{17} watts whereas the solar power on the earth surface 10^{16} watts. Therefore ,the sun gives us 1000 times more power we need. If we can use 5 % of this energy, it will be 50 times more what will be the world be needed. The energy radiated by the sun on a bright sunny day is approximately 1 kW/m². Attempts have been made to make use of this energy in raising steam which may be used in driving the prime mover. Fresh water is a necessity of life and key to mens prosperity It is generally observed that in some arid, semi-arid and coastal areas which is thinly populated and scattered one or two family members are always busy in bringing fresh water from a long distance. In these areas solar energy is plentiful and can be used for converting saline water into distilled water. The pure water can be obtained by distillation in the simplest solar still generally known as

“basin type solar stills” Such a solar and community use in several countries. stills have been operated for farm and community used in several countries. It consists of blackened basin containing saline water at a shallow depth over which is a transparent air tight cover that encloses completely the space above and is absorbed and converted into heat in the black surfaces. Impure water in the basin or tray is heated and evaporated known as in distillation. Water is extremely energy extensive to heat solar thermal is a grid off technology. When you walk of your door even if it is cold wet or windy you can still get “infrared light” spectrum. An evacuated tube is basically a little bit like thermo glass in that the infrared goes through it but it can be escape and just keep heating and heating forever whatever you want to heat inside. All new builds should be designed with solar thermal system .That a complete no barrier because at the planning stage you have got a bstates to do what you want. Solar thermal power system is self sufficient system and they produce over million liters of water a year free with no carbondioxide.

The world wide demands of fresh water is growing while the supply of readily available fresh water is dwindling. Several diverse techniques have been implemented try to meet the growing demand for fresh water. With variable degree of success and that continuous to grow the application desalination. Desalination encompasses a host of technologies such that clean water may be generated reardless of location ,make up sources. This review paper explores recent development numerous desalination technology that are highly commercialized and are in extensive use today while other are under development and may be varaiety of uses.

The availability of fresh water on the planet is finite and natural fresh water makes up only about 0.5% entire water supply on earth .This limited supply with growing population of the earth and the growing industrialization of many developing countries is driving global fresh water stress and scaracity to found fresh water to meet the future need. Method to find more fresh water include conservation and reduce/reuse/recycle of existing fresh waterfrom rich region to water at poor region and creating fresh water from other sources. There are several factors which steadily increasing fresh water consumption among them being the world demographic increase and general improvement in quality of life at all level with consequential increase in fresh water demand for wide varaiety of uses.

It is expected that by the year 2040 the world demand of fresh water will be greater than amount available. All possible efforts are made in order to ensure fresh water demand fulfillment. To this end considerable effort has been made to optimize the management of convention water resources in order to achieve efficiency of water utilization.

Energy and water are very important for life on earth and sustain the modern world. Inmany parts of the developed world the control and utilization of water and energy has driven economic development and progress In the developing world many region suffers from the shortage of fresh drinking water and energy supplies. The United Nation Enviroment Programs (UNEP)stated that one third of the world population lives in countries with insufficient drinking water to support the population.Consequently by 2025 two third of world population will face water scaracity What is distilled water can you drink it?. Solar water stills, the no cost method to distill water. Virtually every living being on this planet is dependent on water on one way or another. Distilled water is purifiedusing methodin which pure

water H₂O.It is made by boiling into vapor then condensing steam back into liquid. Distilled water is the purest form of water but there are the risk associated with it . Distilled water is purified by using method in which water is separated from its contaminates. If your diet is already rich in minerals you don't worry about potential effect.Portable or fresh water (water less than 500 ppm salt content) is one of the fundamental necessities of life for a man. Industries and agriculture also require fresh water without which they cannot live. Man has been dependant on river, lakes and underground water reservoir to fulfil the need of fresh water. It is intimately associated with evaluation of civilisation. Because of rapid industrialization and population explosion demand of fresh water has been increasing enormously. With standard of living the average per capita consumption of fresh water has also increase. Due to climatic changes and less rainfall in many part of the world fresh water which is available in abundance from river lakes and ponds is becoming scarce Also available source are getting polluted due to discharge of industrial effluent and sewage in large quantities Thus due to climatic changes pollution and overconsumption at present 2000 million people have no regular access to adequate fresh water .

According to one estimate about 79 % of water available on earth is salty 20% brackish (less salty from lake) and only 1 %is fresh.Therefore, conversion of brackish or saline water to fresh water through distillation process using solar energy is good idea where plenty of saline water ,brackish water and sun is available

The most important aspects for sustaining life on earth is water. Inspite of its abundant availability a small percentage can be used for drinking purpose (approximate 1%) .The conversion device is known as Solar stills. The solar distillation comes out to be nontoxic and promising device which purifies water that uses a renewable solar energy source. Efficiency of the Solar water distillation devices can be enhanced by increasing evaporative rate.

The principle of solar distillation is simple and explained in fig 1. in which conventional basin solar stills are used. The still consist of shallow air tight basin with black and impervious material which contain saline water. A sloping transparent cover is provided at the top solar radiation is transmitted through the cover and is absorbed in black lining at the basin, Its heat up water about 10 to 20 degree centigrade and causes it to evaporate, The resulting vapour rises , condenses as pure water on the underside of cover and flow into condensate channel on the sides. An output of about 3 lit/m²with

an associated efficiency of 30 to 35 % can be obtained in a well design solar still.

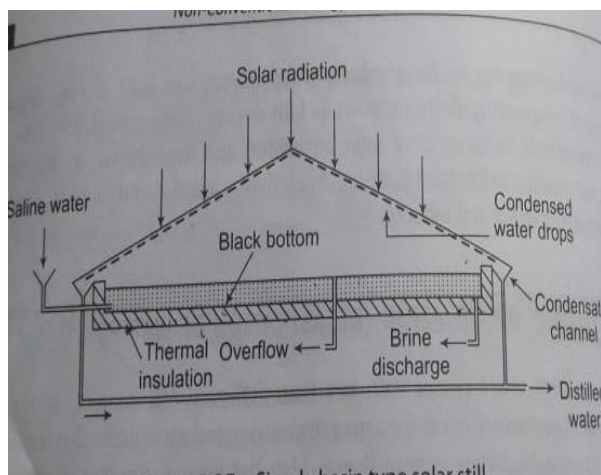


Fig 1 Simple basin type Solar Still Solar energy
S.P.Sukhatme,J.B.Nayak[1]

Motivation behind Study:- India receives solar energy equivalent to more than 5000 trillion kwh. which is far more than its annual consumption. The average daily global radiation is around 5 kw-h per sq.m per day which is ranging 5 kwh per sq. per day with sun shine ranging between 2300 and 3200 hour per year in most of world Though energy density is low and availability is not continuous it is possible to harness energy.

As pointed out above conventional method output of typical still in Indian climatic condition varies from 5.3 l/day in summer to 0.91 l/m² in winter Even in Maharashtra the region like Murtizapur, Latur Osmanabad, Bhid and coastal areas of Maharashtra suffers from severe brackish and saline water that's creates hazardous health issue. The efficiency of conventional solar desalination devices such as solar stills are decreases drastically with increasing bulk water quantity due to heat loss due to bulk water.

The idea to enhance performance of the domestic use of solar still like solar water heater, solar dryer, is topic of great research. And it is long way to go that every roof of India has mounted with solar still, It is therefore necessary to carryout research to satisfy the need of fresh, clean reliable drinkable water of a common man. Solar still is one of the oldest and simplest techniques for desalination of saline water from the renewable energy i.e. solar energy. The main associated problem with the solar still is the low productivity of fresh water in

comparison with the energy input from sun. Other use of Desalinated water /Distilled water

- 1) It is used to reduce descaling depending upon the purity of water
- 2) Distilled water uses for a coolant system for automobile
- 3) It is used for charging of battery
- 4) It is used in various testing laboratory
- 5) It is used in Medical field
- 6) Chemical, Oil, refinery, Soap, Perfumes industry, Beverage industry etc.

Literature survey

Keeping the above objective in mind the available literature is studied and brief factors are listed below

1. Combined effect of solar radiation on tilt angle of solar stills
2. Evaporative heat transfer coefficient
2. Glass cover temperature/ tilt of cover plate
3. Water contamination Density
4. Base plate absorvity
- 5 Importance of water depth
- 6 Mass flow rates of water
7. Solar energy storage material
8. Free surface area of water
9. Action of buoyancy force of air

1) *Abd Elnaby Kabeel, Yazan Taamneh* 2) *Ravishankar Sathyamurthy,*

Experimental study on conventional solar still integrated with inclined solar still under different water depth year 2019 Science direct Elsevier

2) *Padmanabhan Naveen Kumar* :This study primarily focuses on comparative experimental analysis on standalone conventional solar still (CSS), inclined solar still (ISS), and integrated conventional and inclined solar still (CSS- ISS) for different parameters that affect the freshwater yield. For enhancing the freshwater yield only water depth and mass flow rate is taken into consideration and 20% increase in solar distillate importance of water depth (dw) and mass flow rate of water (mw) in the solar still is taken into consideration.

3) *Majid Khan & Mohammad Mustafa generous* Solar Still Distillate Productivity Enhancement by Using Reflector and Design Optimization Research Gate 2019 .Solar still is one of the oldest and simplest techniques

for desalination of saline water from the renewable energy i.e. solar energy. The main associated problem with the solar still is the low productivity of fresh water in comparison with the energy input from sun. Different design and operational parameters as well as heat losses are the causes of low performance ratio of this system. This report presents the synopsis of the effect of all design and operational parameters that greatly influence the productivity of still.

In this research paper reflector are used however they are suffer from complexity and High cost out of reach of common man.

4) **Thomas Thield** : PVMAPS: Software tools and data for the estimation of solar radiation and photovoltaic module performance over large geographical areas Elsevier 2019 A set of computational tools and climatic data, tentatively named PVMAPS, is presented which makes it possible to calculate solar radiation and photovoltaic system power on inclined and/or sun-tracking surfaces over large geographical areas at arbitrarily high spatial resolution. Calculations of solar radiation and photovoltaic performance are done using validated models published in the scientific literature.

Here we are using Flat plate collector with solar still with EXPERIMENTAL ANALYSIS

5) **Ammar.H. Elsheikh, Swellam. W. Sharsh** :Thin film technology for solar steam generation ScienceDirect .The sun is considered as the most promising abundant renewable energy source that can be exploited to solve many of human beings' challenges such as energy and water scarcity. Solar energy can be utilized in steam and vapor generation processes which has a great importance in many engineering applications such as water desalination, domestic water heating, and power generation. However, dilute solar flux (~1000 W/m²) cannot supply the absorber with enough power required to overcome water latent heat of vaporization to evaporate water. Optical concentrators such as parabolic trough collector, parabolic dish reflector, and circular Fresnel lens can be used to concentrate the solar radiation to achieve the required power however they suffer from complexity and high cost. Moreover, the efficiency of the conventional solar desalination devices such as solar stills decreases dramatically with increasing bulk water quantity, due to the heat loss to bulk water.

Here we are replacing solar steam generation device with evacuated tube flat plate collector harnessed heat

by solar resources and not by any conventional sources

5) **Abdul jabbar N. Khalifa** :On the effect of cover tilt angle of the simple solar still on its productivity in different seasons and latitudes Elsevier 2010

Many experimental and numerical studies have been carried out on different configurations of solar stills to optimize the design by investigating the effect of climatic, operational and design parameters on its performance. One of the main parameters that have received a considerable attention is the cover tilt angle. A large number of studies on the effect of cover tilt angle on productivity in different seasons and latitude angles are cited in this article. The investigation that tackle the detailed effect of the cover tilt angle on productivity report contradictory conclusions about the effect of tilt angle on productivity and the value of the optimum tilt angle. A relation between the cover tilt angle and productivity of simple solar still in various seasons is established together with a relation between the optimum tilt angle and the latitude angle by an extensive review of the literature. The conclusions of this study should assist in choosing the proper cover tilt angle in various seasons and latitudes.

On the same factor Flat plate collector with IASS (Inclined automated solar stills) with EXPERIMENTAL ANALYSIS technique is used to optimize the data.

6) **Hitesh Panchal**: Effect of Glass cover on performance of Solar Stills. Research gate. Analysis of a various glass cover thickness increases the distillate water output, water temperature evaporative heat transfer co-efficient and efficiency of solar still

7) **Hanane Aburiden, Adel Deliou. Brahin Abbad** : Experimental study on various solar still design August 2012 Fabrication of seven solar stills a) Spherical solar still b) Tubular solar still c) Pyramid solar still d) Hemispherical solar still e) Double basin solar still f) concentrators coupled solar still g) Tubular solar still coupled with pyramid solar still and their performance analysis in same climatic condition to analyse influence on the modification of productivity The Compound parabolic concentrators assisted tubular solar still shows the maximum yield. But flat plate collector with Automated inclined stills are not manufactured yet.

8) **Alibagh** Passive solar Still 10 May 2018 Taylors and Francis .Augmentation of different material, energy absorbing insulator and mechanism of loss of the heat to enhance productivity.

II-METHODOLOGY

Field visit:

1. Visit to various laboratory such as NEERI/CSIR LABORTORY/REGIONAL PUBLIC HEALTH CENTER/ JIVANPRADHIKARAN/KVIC/ and various local industries of Rice Mill ,Maheshwari solvent extract Industry for the collection of data
2. Determine the various parameter for optimization
3. Optimized the various parameter by Taguchi technique
4. Design, manufactured and install solar by optimized parameter
5. Experimental optimization of solar still for maximum yield of distillate.

[6] *Effect of Glass cover on performance of Solar Stills. Research gate*

[7] *Hanane Aburiden Adel Delious Brahin Experimental study on various solar still design August 2012*

[8] *Passive solar Still 10 May 2018 Taylors and Francis*

[9] *Solar stills: A comprehensive review of designs, performance and material advances*

[10] *Ab 1 Abhishak saxena and Navneet Deval Solar Water Distillation Unit for Solar Elsevier*

[11] *Geeta Verma¹*, Abhay Kumar Singh Development of Solar still system*

III - CONCLUSION

The promises are forgotten and human greeds goes on fleecing with the little left resources of the bleeding earth in the triumphant dance of progress. The need of the hour is for everyone to do whatever possible in whatever measures to stem crises of fast snowballing into catastrophe. Mismanagement of waste water contaminated both surface and groundwater lack of Liquid waste management, poor sanitization condition and habits contributed a significant portion of population suffering from waterborn disease,Hence There is need to develop self sustained system which is free from fossils fuel to purify available water into potable water for keeping healthy humanbeing

REFERENCES

- [1] *Abd Elnaby Kabeel 1Yazan Taamneh,Ravishankar Sathyamurthy Padmanabhan Naveen Kumar 3, Experimental study on conventional solar still integrated with inclined solar still under different water depth year 2019 Science direct Elsevier*
- [2] *Majid Khan 1,Mohammad Mustafa 2, Solar Still Distillate Productivity Enhancement by Using Reflector and Design Optimization ResearchGate 2019*
- [3] *Thosmos Theld PVMAPS: Software tools and data for the estimation of solar radiation and photovoltaic module performance over large geographical areas Elsevier 2019*
- [4] *Ammar.H Elsheikh, Swellam.W.Sharsh Thin film technology for solar steam generation ScienceDirect*
- [5] *Abdul Jabbar N. Khalifa *On the effect of cover tilt angle of the simple solar still on its productivity in different seasons and latitudes Elsevier 2010*