

# Performance and analysis of advanced solar distillation

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**Abstract ---** Deficiency of drinkable water is the major trouble facing by the world for saving the human beings because very less amount of clean/pure water for consuming is available on the earth almost 1% .to fulfill this need we have to develop new technology, new concept, new ideas to enhance the output of distillation. By using solar distillation with advanced mechanism.

Considering this things into brain, we have designed distillatory to convert more dirty/ unclean water into cleaned/drinkable water using sun's energy (e.g. sun radiation) by feeding externally pre-heated water to the basin of solar still. This modified design produces maximum clean water as output and enhances efficiency of the distillation.

**Keywords:** - sun's energy, pre-heated water, cleaned water, advanced distillation etc.

## I. INTRODUCTION

One proverb is there regarding clean water for drinking that is "Water is life, do not compromise", therefore to avoid the serious problem due to water used for drinking. We have to think for the more cleaned water to serve all hence by increasing output of distillation it means that enhancing efficiency of the plant as it is having social and economical significance and feasible solution in this purification field.

Construction and working of advanced solar distillation to convert more dirty water into clean/ pure water is so simple.[1].Energy of sun which is abundantly available in the nature having great potential of heat energy as freely obtained from the sun without any cost only require more collection area.[1.2] For remote areas where fresh water is scarce this advanced solar distillation provides maximum clean and safe water.

By providing pre-heated water to solar still with external heater (flat plate) and reflector which removes almost all the contamination from the dirty water. This attempt is done experimentally to maximize clean water as o/p with no fuel cost.

## II.EXPERIMENTAL SETUP

For the requirement of higher purified water as an output or to increasing the efficiency of solar distillatory. We have designed completely new experimental setup of solar still.which is explaining as shown in Fig.No.1.



Fig 1. Experimental setup of advanced solar distillation system.

- Experiment Date** -- 25 June 2016 and 26 June 2016.  
**Place** -- Terrace of residential building.  
**Climatic condition** -- Bright Sunny day.

For the comparison experiment done within two days in bright sunny day. First day an hourly reading taken for the measurement of basin temperature and energy of sun (i.e. Radiation).clean water output is measured in milliliter for the calculation of efficiency by supplying 14 liters of water. And also observed that during noon time between 12.00 pm to 2.00 pm clean water and sun radiation is higher. Table no.1 shows that the experimental data obtained for solar still without external arrangement which we have got on the first day.

Table 1. Experimental parameters of solar water distillation without heater.

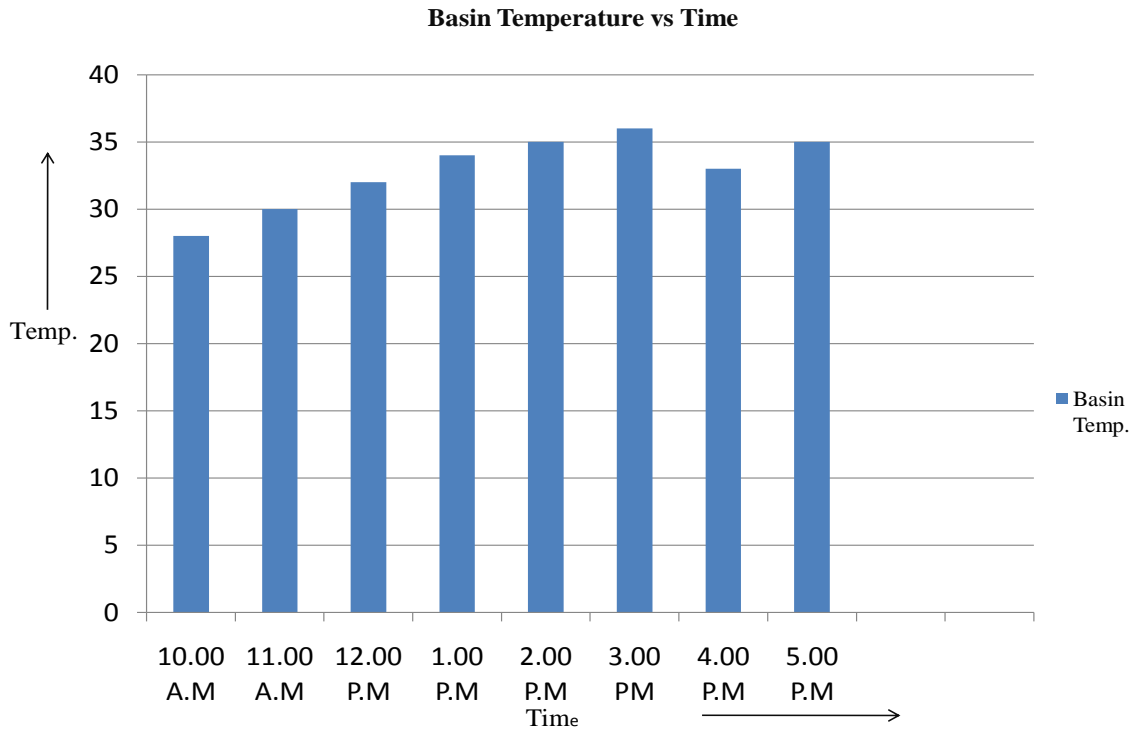
Sr.	Time		Basin	Qty of	Cumulative	Hourly Yield	
	No.	From	To	Temperature	Water		Water
°c						m <sup>3</sup> /Sec	
		From	To	°c	m <sup>3</sup> /Sec	m <sup>3</sup>	%
1	09:00AM	10:00AM	28	0.000025	0.000025	8.42	
2	10:00AM	11:00AM	30	0.000035	0.00006	11.79	
3	11:00AM	12:00PM	32	0.000042	0.000102	14.14	
4	12:00PM	01:00PM	34	0.000058	0.00016	19.53	
5	01:00PM	02:00PM	35	0.000062	0.000222	20.88	
6	02:00PM	03:00PM	36	0.000072	0.000294	24.25	
7	03:00PM	04:00PM	33	0.00009	0.000384	30.31	
8	04:00PM	05:00PM	35	0.000105	0.000489	35.37	
Total	Test Duration		Min temp :28	0.000489	0.000489	Min Yield :8.42 %	
	8 Hrs		Max Temp: 36			Max Yield: 35.37%	

Next day we have supplied same amount of water and experiment start at morning 9.00 am and last reading taken at 5.00 pm with external heater (Flat plate collector) and reflector water receives more heat due to this arrangement and this higher temperature of water is measured with the help of thermometer and note down. Here one point is cleared that the temperature of solar still (basin) is lower than temperature of water obtained by external heater with reflector then this pre-heated water is supplied into the basin of distillatory which causes to increase the overall temperature of basin and hence rate of evaporation also enhances to great extent, follow condensation for further distillation. Therefore, purified water obtained by doing this advanced solar distillation is really higher than the normal solar still is experimentally observed and proved.

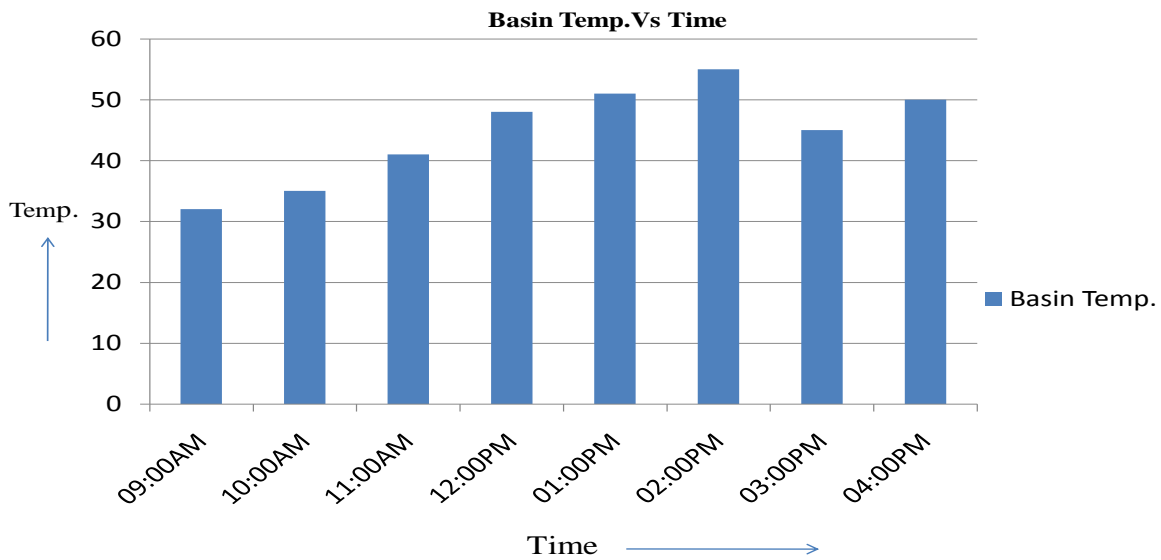
Table 2. Experimental parameters of solar water distillation with heater and reflector.

Sr.	Time		Basin Temperature	Quantity of Pure Water	Cumulative	Hourly yield
					Quantity of Pure Water	
No	From	To	oC	m <sup>3</sup> /Sec	m <sup>3</sup>	In percentage
1	09:00AM	10:00AM	32	0.000035	0.000035	11.79
2	10:00AM	11:00AM	35	0.000041	0.000076	13.81
3	11:00AM	12:00PM	41	0.000097	0.000173	32.67
4	12:00PM	01:00PM	48	0.000186	0.000359	62.65
5	01:00PM	02:00PM	51	0.000195	0.000554	65.68
6	02:00PM	03:00PM	55	0.00017	0.000724	57.26
7	03:00PM	04:00PM	45	0.00014	0.000864	47.16
8	04:00PM	05:00PM	40	0.00012	0.000984	40.42
	Test Duration		Min temp :32			Min Yield 11.79%
Total	8 Hrs		Max Temp: 55	0.000984	0.000984	Max Yield 65.68%

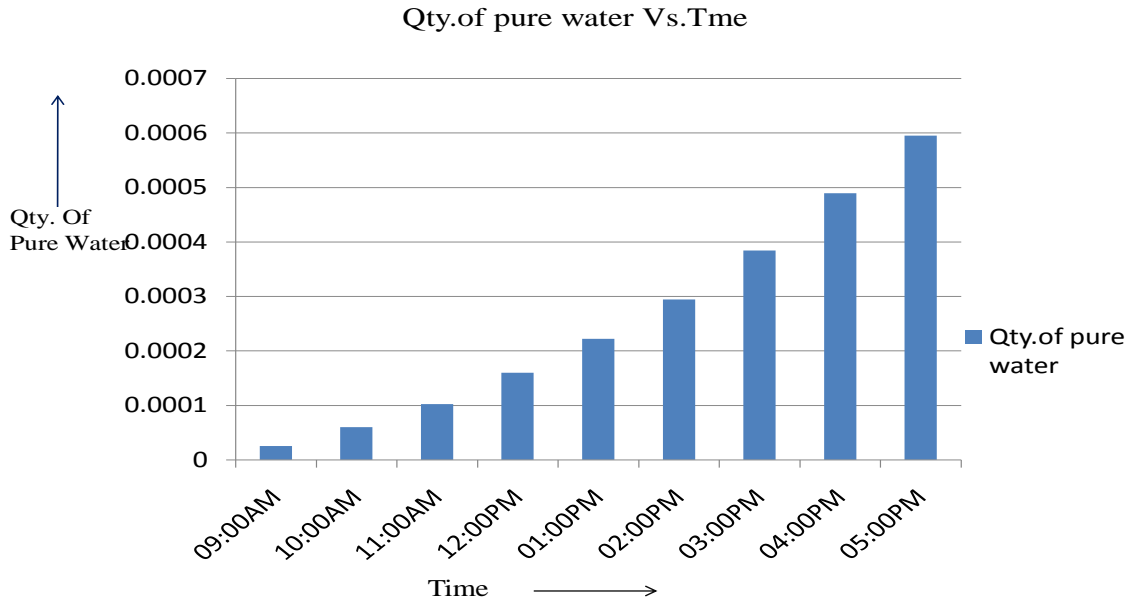
Graph 1. Graphical representation of water distillatory without heater.



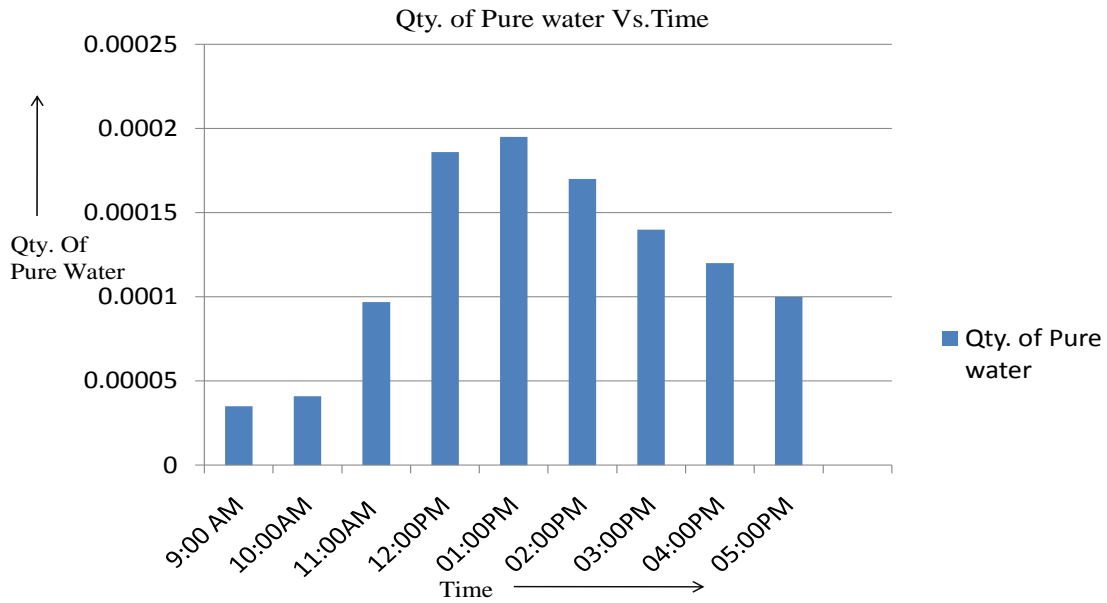
Graph 2. Graphical representation of water distillatory with heater and reflector.



Graph 3. Graphical representation of water distillatory without heater.



Graph 4. Graphical representation of water distillatory with heater and reflector.  
**Quantity of Pure water vs. Time**



Efficiency of advanced solar distillation system -

It is the product of latent heat of evaporation and pure water as an output divide by daily solar radiations.

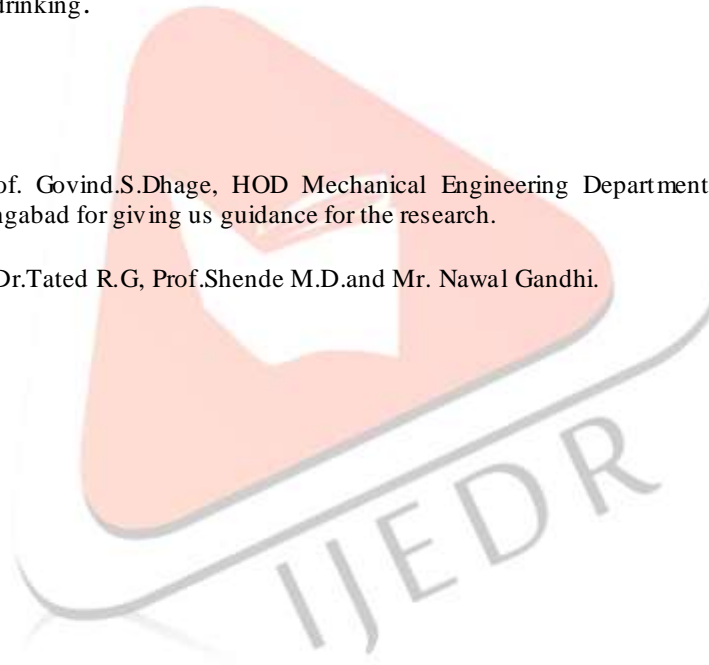
$$\begin{aligned}
 \text{Maximum efficiency} &= \frac{\text{Latent heat of evaporation} \cdot \text{Water output}}{\text{Daily Solar radiations}} \times 100 \\
 &= \frac{2257 \times 0.000195}{0.67} \times 100 \\
 &= 65.79 \%
 \end{aligned}$$

### III.RESULT AND CONCLUSION

During the day of above dated experiment when performed from morning 9.00 am to 5.00 pm within 8 hours. By observing Table.1 and Table.2 and considering all graphs regarding increased temperature and increased efficiency in terms of clean water it is concluded (Analytically and Graphically) that temperature and water as an output is really maximum obtained by this advanced solar distillation system.TDS of this cleaned water is less than 100 ppm so that it is best for the drinking.

### IV.ACKNOWLEDGEMENT

- We are thankful to Prof. Govind.S.Dhage, HOD Mechanical Engineering Department, Dr.R.S Pawar, Principal SYCET, Aurangabad for giving us guidance for the research.
- We are also thankful to Dr.Tated R.G, Prof.Shende M.D.and Mr. Nawal Gandhi.



## REFERENCES

- [1] Prem Shankar, “Effect of Glass temperature and nanoparticales (cuo) on the performance of single basin solar still: An experimental study” IRJSSE/Volume:3/ issue:9/sep.2015 , pp2347-6176.
- [2] Wasil Jamal, “Effect of water depth and still orientation on productivity for passive solar distillation” Vol.2, Issue 2, march-april-2012, pp.1659-1665.
- [3] HikmetS.Aybar, “A Review of desalination by solar still” L.Rizzuti et solar Desalination for the 21<sup>st</sup> century,pp207-214.
- [4] Jenny Lindblom, “Solar thermal technologies for seawater desalination state of art” Renewable energy system, pp1-17.
- [5] Hitesh N. Panchal, “Enhancement of distillate output of double basin solar still with Vacuum tubes” Received 19 March 2013; accepted 15 June 2013.
- [6] S.H.Sengar, “Design and development of wick type solar distillation System” Journal of Soil Science and Environmental Management Vol. 2(7), July 2011 pp. 125-133.
- [7] Prof. Alpesh Mehata, “Design of Solar Distillation System” vol. 29, April 2011, pp 67-74.
- [8] Dr.Bhupendra Gupta,”A Review of Thermal Modeling and Efficiency of Solar Water Distillation”:AJER/ Vol-02,Issue-12,pp-203-213,19 March 2013.



Mr. Sagar .S. Shinde, is a graduate in Mechanical Engineering from Pune University, since last 9 years he is in the field of engineering education.

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