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Latest Developments in Solar Desalination with Energy Storage

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Abstract- Solar is quite extremely assured choice for obtaining fresh water from saline or brackish water as it uses solar energy which is free, non-toxic and inexhaustible. Continuous hard work has ended by various researchers worldwide to increase its productivity. Solar quite can be integrated with energy storage materials to improve the concentrate output. A power cache material supplies the force in the form of rational warm or covert warm through day and discharge in off light hour's resultant in enlarge of clean irrigate production. In the current exertion, an importance has known to appraisal the arrangement and concert of solar quite included with different thermic repository resources.

Keywords: desalination, energy storage materials, PCM (phase change materials), productivity **enhancement**, solar still.

I. INTRODUCTION

Water is essential for existence of human life. The fresh irrigate is essential for various domestic and industrial applications. The main sources of fresh irrigate the ground are lakes, rivers, ponds and underground water which form very less proportion of earth's total water. Further, out of this fresh water, the potable water availability is very less. The major proportion of earth's facade is enclosed by ocean water which has high proportion of salinity and cannot be directly used. Hence, potable water production and distillation of saline water are necessary which can be done by many conventional and non-conventional techniques. One of the techniques to extract new irrigate since of salty irrigate by using solar distillation because it is easy to manufacture, inexpensive and maintenance free. The stellar cleansing scheme use solar energy which is renewable source of energy and hence solar distillation is always a prettyoption.

Solar systems are of two types: active solar system and passive solar system. In active solar system, some external source of energy is provided in order to enhance the evaporation rate and the output of the structure. In case of passive solar still, only sunlight is necessary for the operation of solar system which results in lesser evaporation rate and hence low productivity. The output of passive system is less as compared to active solar system. Solar still is passive type solar system which works on very simple principle of water evaporation and condensation. The salty irrigate is full in black basin to absorb the maximum solar radiation. The water temperature increases and starts evaporating. The vapour rises up leaving the impurities and salinity behind it which gets condense on the underside of the glass cover and the vapour condenses to fresh water? The parameters that affect the solar still includes the material of basin, wind speed, deepness of irrigate in the sink, solar insolation, inclination angle of glass cover and ambient temperature. The warmth dissimilarity among the sink water and inner side of glass cover greatly affects the output of the stellar silent. Higher the heat dissimilarity among the inner side glass cover and water, higher will be the output of stellar silent. The main disadvantage of stellar silent is small output and hence it is not used for commercial and industrial applications. The solar still is solar energy dependent and only produces the output during daytime. The output during the off light moment is zero. A technique to use for civilizing the output of stellar silent by means of repository scheme. This scheme might rational or underlying warm scheme. This technique use warm dissolute as of base at rest. The latent heat thermal energy storage systems have many advantages over sensible heat storage systems including a large energy storage capacity perunit volume and almost constant temperature for charging and discharging. Various researchers have therefore integrated the astral silent by various energy storage materials to enhance the productivity. Fig. 1 to 13 shows the schematics of various possible ways of distillate enhancement by different researchers and their outcomes be scheduled in bench 1.

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Sl. No.	Name of the author	Location and Year of Publication	Desalination Process	Augmented by	Improvement in efficiency (Distillate) / Remarks
1	Arunkumar et al. [1]	India (2013)	Hemispherical basin solar still with concentrator	Without copper balls with Paraffin wax	3.520 kg/m^2- day
				With copper balls with Paraffin wax	4.460 kg/m^2-day (26%)
2	Sathyamurthy et al. [2]	Hyderabad, India (2014)	Triangular pyramid solar still	Without LHTES	3.5 L/m^2–day
				With LHTES	5.5 L/m^2–day
3	Chaichan and Kazem [3]	Baghdad, Iraq (2015)	Conical distiller integrated with concentrating dish	Paraffin wax	Increased system productivity with by 307.54%
4	Gugulothu et al. [4]	Hyderabad, India (2015)	Single slope solar still	Potassium dichromate Sodium Sulphate Sodium Acetate	Sodium Sulphate provided better yield compared to Potassium Dichromate and Sodium Acetate
5	Kabeel et al. [5]	Tanta City, Egypt (2016)	Single slope solar still	Without paraffin wax	4.51 L/m^2–day
				With paraffin wax and double pass solar air collector	9.36 L/m^2-day
6	Patel and Kumar [6]	Rajkot, Gujarat (2016) India	Single slope single basin passive solar still with 2 cm water depth	With Thermic fluids	11.24%
				With increased frontal height	23%
7	Samuel et al. [7]	Chennai, India (2016)	single slope solar	Still alone	2.4kg/m^2
				With spherical ball heat storage	3.7kg/m^2
				With sponge	2.6kg/m^2
8	Shalaby et al. [8]	Tanta, Egypt (2016)	V-corrugated absorber solar still	Without Paraffin wax	3.36kg/day
				With Paraffin wax	12% (3.76kg/day)
				With PCM and wick	11.7% (3.32 kg/day)
9	Kabeel and Abdelgaied [9]	Tanta City, Egypt (2016)	Single slope solar still	Without paraffin wax	4.51 L/m^2 – day
				With paraffin wax	7.54 L/m^2 – day
10	Mousa and Gujarathi [10]	Jordan (2016)	Single slope solar still	PCM	49%
11	Kabeel and Abdelgaied [11]	Tanta City, Egypt (2017)	Single slope solar still	Without Paraffin wax	4.48 L/m^2 - day
				With Paraffin wax and oil heat exchanger using cylindrical parabolic concentrator	10.77 L/m^2-day
12	Sharshir et al. [12]	Wuhan, China (2017)	Single slope solar still	With Paraffin wax and flake graphite nano particles	65%
				With Paraffin wax and flake graphite nano particles and film cooling	73.80%
13	Faegh and Shafii [13]	Tehran, IRAN (2017)	Single slope solar still	Without PCM and with external condenser	56%
				With PCM and with external condenser	86% (6.555 kg/m^2-day)
14	Deshmukh and Thombre [14]	Maharashtra, India (2017)	Single slope single basin solar still	Still alone	4.734kg/m^2
				With servotherm medium oil	4.778kg/m^2
				With sand	4.566kg/m^2
15	Arunkumar and Kabeel [15]	Coimbatore-India (2017)	Compound parabolic concentrator (CPC)-concentric circular tubular solar still	Without Paraffin wax With Paraffin wax	5.330 L/m^2 – day 5.779 L/m^2 – day (8%)
16	Refalo P	Iraq (2018)	triple basin solar still assisted with collector yielded maximum productivity	With collector yielded maximum productivity	16.94kg/m2/day
17	Muftah AF	Iraq (2017)	the stepped solar still with external reflectors for fresh water production,	With various modifications such as addition of internal and external reflectors, absorber materials and an external condenser cooling unit	8.9kg/m2/day
18	Kabeel and Abdelgaied	Egypt	solar stills with PCM and with PCM and hot air injection,	PCM and solar air heater	9.36l/m2/day
19	Kabeeletal	Egypt	Multi-eject solar still with wicks	Solar operated vacuum was used	14.2kg/m2/da yat 0.5 bars of vacuum pressure
20	Parketal	Korea	Multi-eject solar still coupled with heat pump	Solar collector was integrated with the lower basin of the multi-stage	28.04kg/m2/day
21	Ahmedetal.	Malaysia	hemispherical solar still	The aluminium absorber plate	5.71l/m2/day at 12mm water depth

22	Ismail	Canada	Tubular solar still	The length, diameter and thickness of the outer tube was 0.52m, 0.13m and 0.15mm respectively	5kg/m2/day
23	Kumaretal.	India	Inclined still coupled with pyramid still	The inclined structure with bases increases the heat transfer area of the solar still, thereby improving productivity	The maximum productivity of 7.05l/m2 was achieved with the water mass of 20kg
24	Ahsanetal.	Malaysia	Cascaded solar still	Solar still possess two significant qualities i.e. It has inclined structure with stepped basin and it has a single condensate channel to get the distillate yield	6.7l/m2/day
25	adinenietal.	USA	Inclined solar still	Weir type inclined solar still with single and double glazing arrangement	5.5l/m2/day

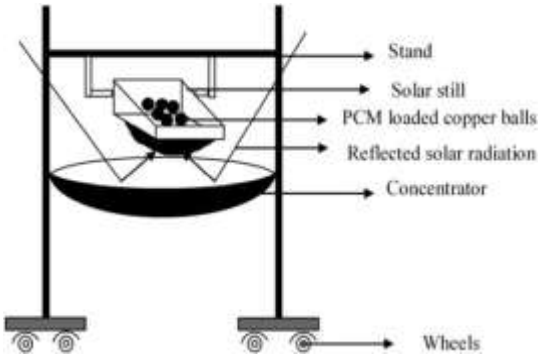

Figure 1. Schematic view of a solar establish joined curved sink solo grade stellar tranquil

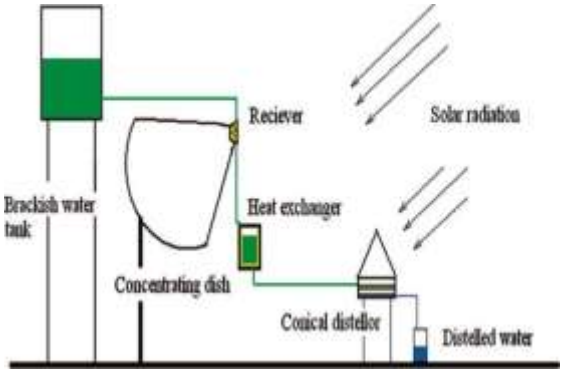

Figure 2. A schematic diagram solar distiller integrated with concentrating dish

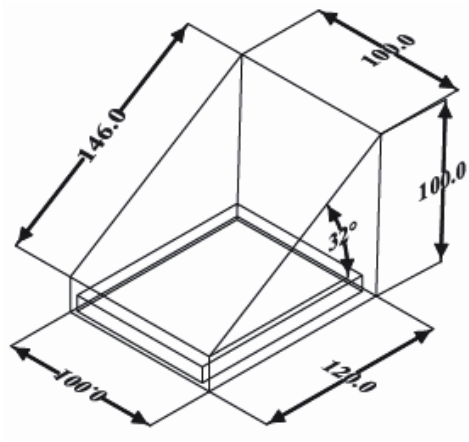

Figure 3 solo grade stellar motionless with thermal storage material in basin

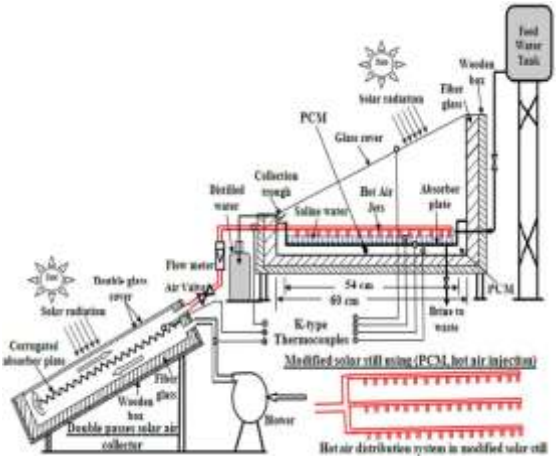

Figure 4. Graphic representation of the dual pass stellar atmosphere antenna integrated customized stellar tranquil with PCM

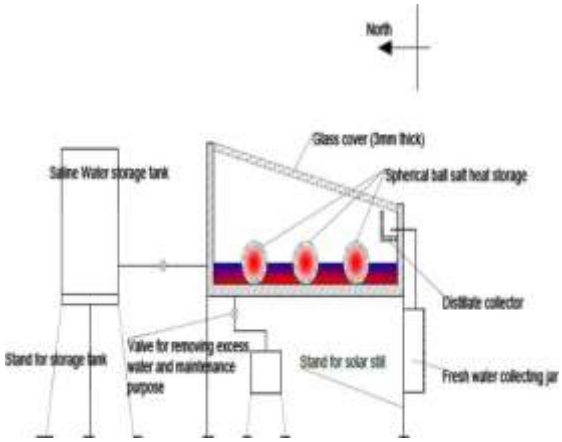

Figure 5. Graphic representation of a conservative stellar tranquil with encapsulated sphere-shaped sphere salty warm repository

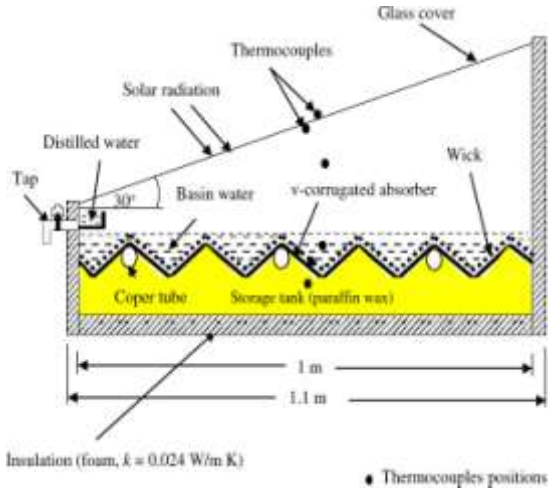

Figure 6. Distinct grade sole sink stellar tranquil with ridged absorber cover (VSBSS) with PCM as a thermic warmth repositry medium

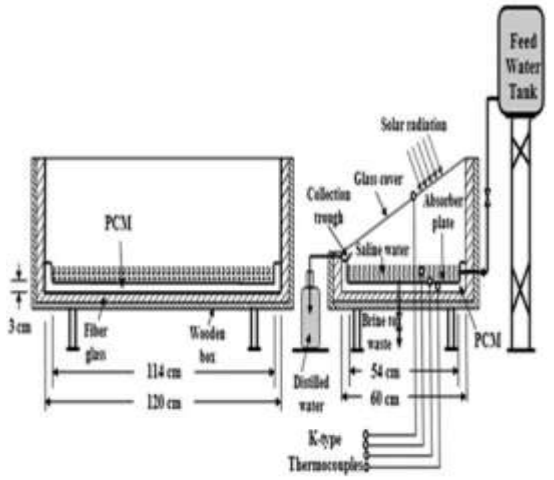

Figure 7. Graphic representation of the empirical system of stellar tranquil with point modify substance

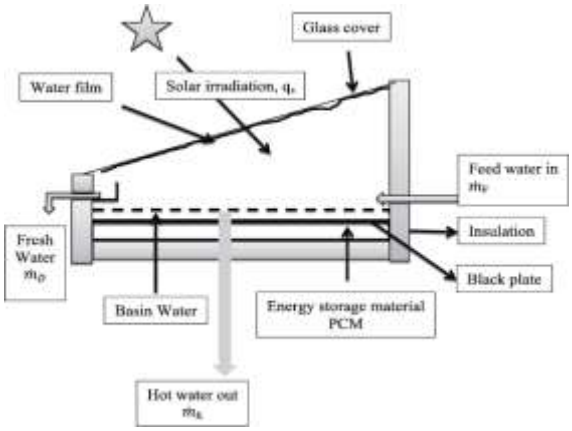

Figure 8. Schematic of desalination unit with PCM

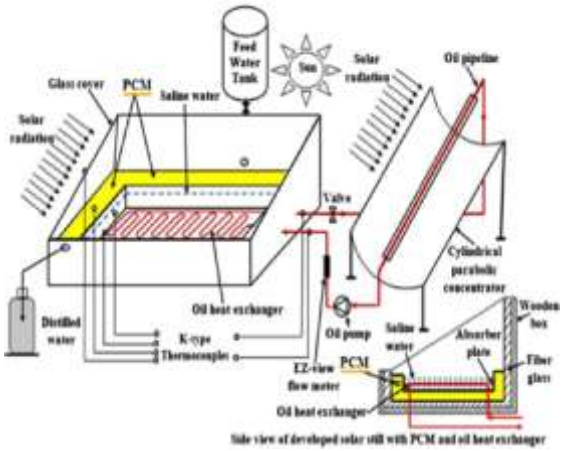

Figure 9 Schematic diagram of slar still with (oil heat exchanger, PCM)-coupled with a cylindrical parabolic concentrator

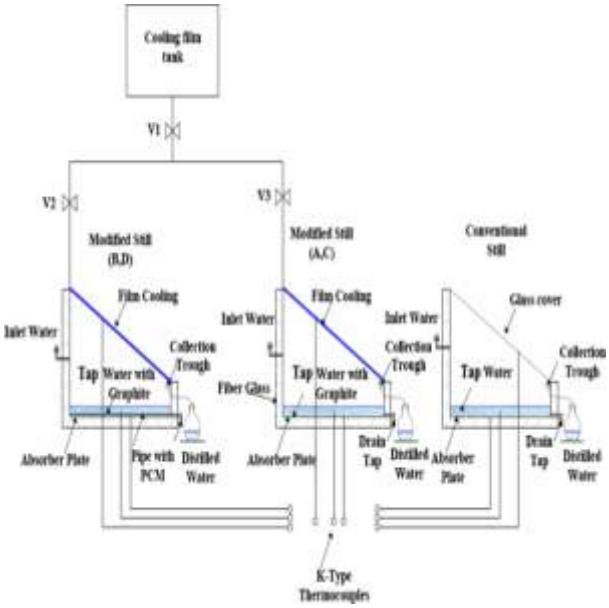

Figure 10. Schematic sketch of experimental setup to study the effect of chip soot nano-particles, phase change material, and film fresh on the stellar tranquil presentation

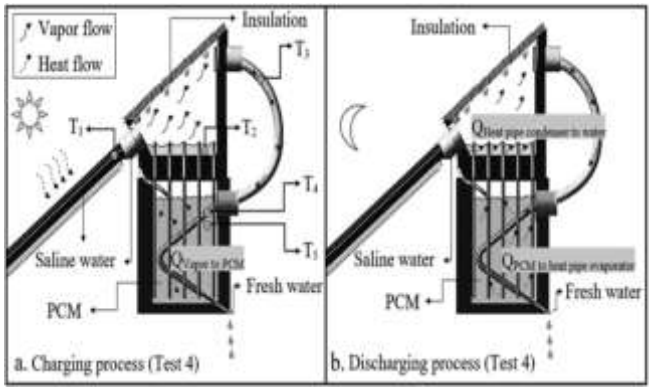

Figure 11. Diagram for operation of the system with external condenser include PCM and temperature tube (a) accuse procedure (b) free procedure

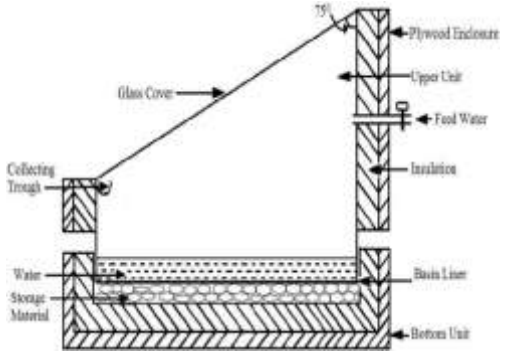

Figure 12. Schematic of solar still with single basin solar still using rational heat storage materials

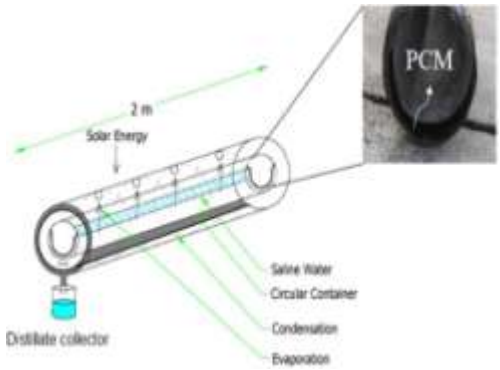

Figure 13. View of parallel round tubular stellar still-Integration with PCM portion

II.CONCLUSION

The various researchers as discussed above have used various thermal energy storage materials like dyes, oils, sand and point vary resources to enhance the productivity. The energy storage materials were also accompanied by various techniques such as film cooling, external condenser and double pass air collector to further improve the efficiency of solar still. On the basis of available open literature, the closing can be incidental:

- It is found that the effect of mass of PCM plays an important role in designing the solarstill.
- Once nightfall, the PCM act as a warm basis for sink irrigates to keep the hotness difference with glass cover. The effectiveness of PCM becomes more compelling at lower masses of the basin water during low sunshinehours.
- The hourly distillate output of the stellar tranquil with and without the PCM depends powerfully on the sink irrigate glass cover temperature difference.
- It is observed that overnight output increase with increase in repository and irrigates accumulation as daylight output, in common decrease in repository and dampen accumulation.
- Integration of concentrating collectors with solar still shows considerable enhancement of distillateoutput.

The further work carries by using nano fluids along with the external condenser, PCM and concentrating collectors to maximize the fresh water output.

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