

1. Conventional and stepped solar still with different nanofluids

Principal Investigator: - Ravishankar. S

Abstract

This experimental work intensively study the effect of nano particle concentration on conventional and stepped solar still. Experimental study were conducted with concentration ranging from 0.05 to 0.2% with Al_2O_3 , CuO and TiO_2 both on conventional and stepped solar still. The results show that the effect of nano particles improves the yield of fresh water from conventional and stepped solar still. The water temperature of conventional solar still with different concentration of nanofluids improved by 3 and 5% for CuO , 4.2 and 6% for TiO_2 and, 3 and 7% for Al_2O_3 . Similarly, the average water temperature of conventional solar still is higher with 0.2% concentration of Al_2O_3 inside the basin. There is increase in the yield of fresh water about 50% and 67% for conventional and stepped solar still respectively with Al_2O_3 nano fluids ($\phi=0.2\%$).

From the literatures, it is identified that the use of nano fluids in stepped solar still were not carried out. In this work, a detailed experimental analysis is carried out on the conventional and stepped solar still with different nano fluid concentration were studied.

1. Conventional solar still and stepped solar still

Fig. 1 shows the experimental photograph of conventional and stepped solar still. The experimental setup consists of a storage tank, flat and stepped absorber for conventional and stepped solar still respectively. For regulating the mass flow inside the absorber control valve is provided. The fresh water is collected through the ditillate collector placed at the end of the inclined glass cover. The water is manually fed into the basin by adjusting the flow control valve. A constant water depth of 0.02 m is kept inside the basin as many researchers have

concluded that the optimum water depth is 0.02 m. Measuring instruments includes AM4836 cup type anemometer, TES 1333R solar power meter, calibrated flask, temperature indicator and PT100 (RTD) sensors for measuring wind velocity, solar intensity, fresh water, temperature of different elements of solar still respectively.



Fig. 1 Experimental photograph of different solar still arrangement

2. Conclusion

From the experimental study, the following conclusions are arrived:-

- With increase in thermal conductivity of Al_2O_3 nano fluid, the water temperature increases by 15 and 17.7% with 0.1 and 0.2% concentration respectively
- The maximum hourly yield from the solar still with Al_2O_3 nano particle in the base fluid is observed as 0.5, 0.35 and 0.34 kg/hr for 0.2, 0.1 and 0.05% respectively
- With lower specific heat content in CuO nano fluid, the yield of fresh water increases by only 33.33, 50 and 52.38% for 0.05, 0.1 and 0.2% concentration respectively

- The maximum average water temperature of Al_2O_3 nano fluid is found as 53°C and higher than 1.5°C as compared to conventional solar still with the same concentration of nano particle in the fluid.
- The maximum daily efficiency is higher in the case of Al_2O_3 nano fluid inside the stepped basin. Similarly, the daily efficiency of TiO_2 is higher than that of CuO nano fluid and lower than that of Al_2O_3 nano fluid with maximum concentration.

CENTRE FOR EXCELLENCE IN ENERGY AND NANO TECHNOLOGY

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PROJECT MEMBERS DETAIL:

S.No	Name of The Project	Lab Utilization	Student Participated in the Project
1	Experimental Analysis of Conventional Solar Still under different concentration of Nanofluids	Sonication, Inclined PV solar still test rig, solar power meter, temperature sensors, anemometer, calibrated flask,	K. Aravind S. Aravind V.I. Ashif
2	Performance Analysis and Energy Analysis of Stepped Solar Still under different concentration of nanofluids		J. Adithya R. Akash A. Balaji
3	Factors affecting the Performance of Conventional Single slope Solar Still with different Sensible Heat Storage elements		R. Manoj P. Joel B. Jaya Prakash V. Kabilan

PROJECT OUTCOME:

Paper Published

1. Madhu, Bala Subramanian, PK Nagarajan, Magesh babu and Sathyamurthy, R., 2017. Improving the Yield of Freshwater and Exergy Analysis of Conventional Solar Still with Different Nanofluids. *FME Transactions*, 45(4), p.525.
2. Kabeel, A.E., El-Agouz, S.A., Arunkumar, T. and Sathyamurthy, R., ENHANCING THE PERFORMANCE OF SINGLE SLOPE SOLAR STILL USING JUTE CLOTH KNITED WITH SAND HEAT ENERGY STORAGE. IWTC Conference, Hurghadha, Egypt.
3. B, Madhu & Balasubramanian, E, Nagarajan, Pk, Sathyamurthy, R, Kabeel, A.E., Thirugnanasambantham, Arunkumar, Mageshbabu, D. (2017). Improving the yield of fresh water from conventional and stepped solar still with different nanofluids. *Desalination and water treatment*
4. B, Madhu, Balasubramanian, E, Nagarajan, Pk, Sathyamurthy, R, Kabeel, A.E., Thirugnanasambantham, Arunkumar, Mageshbabu, D. (2017). Improving the yield of fresh water from conventional and stepped solar still with different nanofluids. ICWEES, American University of Sharjah.