Performance Enhancement and Improvement of Energy Efficiency In Evacuated Tube Heat Pipe Solar Collector with Nano composite –Review

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Abstract - The objective of this research is to investigate the performance analysis of evacuated heat pipe collector with Nano composite. Solar collector includes absorber unit in order to transfer the heat energy to a working fluid. In this research it was intended to evaluate performance considering with Nano composite. The Challenge in the production of future generation evacuated tube solar collector (ETSC) technology is the control and management of operating temperature and heat generation. An essential aspect of EVTC design and application is the heat produced by the evacuated tube solar collector. Losses are present in design of solar system but must be reduced into a heat recovery system. From the past research, Authors have analysed the performance with numerous trials. The result shows that evacuated tube heat pipe collector with Nano composites give the better result than heat pipe collector without Nano composites. The heat transfer coefficient increases with higher mass flow rate hence use of Nano fluid give more efficiency.

Keywords - heat pipe, Evacuated tube solar collector, base fluid, Nano fluid

INTRODUCTION

It is important to utilize the energy with low cost and more efficiency. India is running large renewable capacity expansion program in the world. The power generation in India depends on coal and oil mainly and that increases carbon di oxide emission to the environment. Solar energy has a capacity to save heat. The problem came in the engineering design of equipment for solar energy use is the low flux density that requires more area to collect solar energy for more utilization. It is partly true an economically feasible, eco-friendly energy source and can be used in a variety of heat applications like heating of air or water, removal of moisture of crops, heating of food, cooling and many more. In India 31 % population lives in urban area and they have more demand than rural area. Evacuated tube collector is a heat exchanger, transfers the heat energy of the sunrays to heat to a heat transfer fluid. In chemical process heat energy transfers from one process to another process. These processes provide a source for energy recovery and process fluid heating/cooling. The improvement of heating or cooling in an industrial process may saves energy, reduce process time, raise thermal rating and increase the working life of equipment. Some processes are even affected qualitatively by the action of enhanced heat transfer. The development of high performance thermal systems for heat transfer enhancement has become popular nowadays. Thus the advent of high heat flow processes has created significant demand for new technologies to enhance heat transfer. Heat transfer efficiency can also be improved by increasing the thermal conductivity of the working fluid

MATERIALS AND METHODS

The Challenge in the production of future generation EVTC technology is the control and management of operating temperature and heat generation. An essential aspect of EVTC design and application is the heat produced by the evacuated tube solar collector. Difficulties in filling ratio and concentration level of Nano fluids to increase the stability. Copper oxide Nanoparticles are used in this study with purity 99.9 % and average particle size of 50 nm. The copper oxide nanoparticle Dispersion ratio used is 0.1%, 0.2%, 0.5%, 1%, 2%, 3%.

TABLE I
Equipment's details

Sl. No.	Equipment's	
	Particular	Qty
1	Evacuated Tubes	30
2	Copper Tubes	4
3	Heat Pipe	4
4	Header for Heat Pipe	1
5	Inlet Outlet Pipe	1
6	Water Recirculating Pump	1

EXPERIMENTAL SETUP

Experimental system consists of Heat Pipe with Copper oxide mixed with DI Water to absorb solar energy and that solar energy transferred to Recirculating water and converts in Thermal Energy and completes the cycle. The mass flow rate at inlet of Header is controlled by Rota meter. Inlet and outlet Temperature measured by Thermocouples.

A.

Figures 01 Experimental Setup

RESULT AND DISCUSSION

The Ansys Fluent software is used to calculate the outlet temperature.

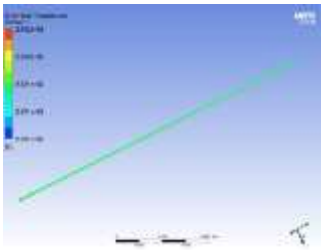

Figure. 2 Inner wall Temperature contour (Copper Tube)

The design of high performance thermal systems for heat transfer improvement has become popular in present days. A number of works has been performed to gain an understanding of the heat transfer performance for their practical application to heat transfer enhancement. Thus the improvement of high heat flow processes has created more demand for new technologies to increase heat transfer. There are many methods to improve the heat transfer efficiency. Some methods are utilization of extended surfaces, application of vibration to the heat transfer surfaces, and usage of micro channels. The efficiency can also be improved by increasing the thermal conductivity of the working materials.

CONCLUSION

Nano fluids are proposed and developed over the past decade for heat transfer applications. Thermo physical properties of the Nano fluids are quite essential to predict their heat transfer behavior. It is necessary to control for the industrial and energy saving in chemical processes. There is great industrial interest in Nano fluids. Nanoparticles have more potential to increase the thermal transport properties compared to conventional particles fluids of small size particles. In the last decade, Nano fluids have gained significant attention due to its enhanced thermal properties

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