

Performance Analysis of V-Trough Solar Collector By Using Nano Fluids (CuO)

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Abstract- solar is a renewable energy source. In this project we design a v –trough solar collector. It developed from a flat plate collector. We add a Copper Oxide Nano power to improve the heat absorption. Here adding a Nano fluid in three different concentration, then check which is the most efficient method. There are various types of solar water heating systems available in the commercial market to fulfill different customer's demand, such as flat plate collector, concentrating collector, evacuated tube collector and integrated collector storage. A cost effective cum easy fabricated V-trough solar water heater system using forced circulation system is proposed. Reason behind the selection of v-trough is that it is not only economical but also heat transfer rate is increased by positioning the glass plate at angle of 60degree. And also base plate collector maintaining maximum absorptivity due to given black coating. The radiation which incident on the V-trough are reflected back inside the entire setup and makes less radiation losses. Integrating the solar absorber with the easily fabricated V-trough reflector can improve the performance of solar water heater system.

Keywords- CuO, V-Trough solar collector, Nano fluid

I. INTRODUCTION

In this project provide basic information about the V-Trough solar collector. It developed from the flat plate solar collector. Here we adding the Nano powder in the base fluid. Then check the thermal conductivity of the solar collector. This project work provides basic information on the components and types of solar water heaters currently available and the economic and environmental benefits of owning a system. It's eco-friendly system It doesn't affect the environment. The water tank is insulated to avoid water transfer to atmosphere. Copper have good ability to absorb the heat. So we using the copper oxide as a Nano powder then we get a results with Nano fluid and without Nano fluid, which one is most efficient and get temperature difference. These systems use the sun to heat either water or a heat-transfer fluid, such as a water-glycol antifreeze mixture, in collectors. The heated water is then stored in a tank similar to a conventional gas or electric water tank. Some systems use an electric pump to circulate the fluid through the collectors. Solar water heaters can operate in any

climate. Performance varies depending, in part, on how much solar energy is available at the site, but also on how cold the water coming into the system is. The colder the water, the more efficiently the system operates.

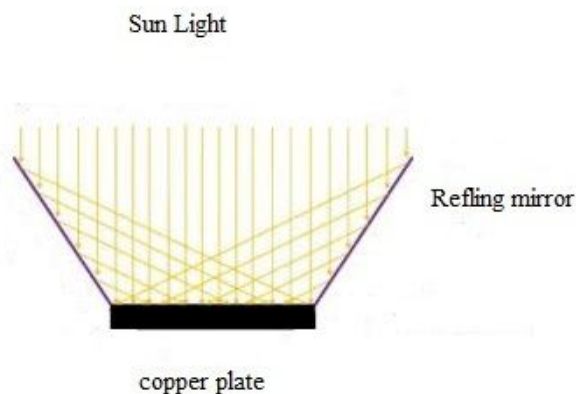
Solar collector basically classified into two type,

- i. Non concentric
 - Flat plate
 - Evacuated tube collector
- ii. Concentric
 - Parabolic dish
 - Parabolic trough
 - Compound parabolic collector

II. FABRICATION

V-Trough solar collector consist of copper tube, copper plate, reflecting mirror. copper tube placed between the reflecting mirror. The sun light falls on the copper plate and reflecting mirror.

- Type of reflector back - Coated float glass mirror
- Total number of mirrors Per V- Trough reflector
- Inclined angle of each mirror
- Total reflective area of each V- Trough collector
- Dimension of each absorber plate
- Total sets of V- Trough collector
- Total mass of water in the storage tank



III. FLUID PREPARATION

Demineralized water used as a base fluid because any other minerals present in this water. copper oxide mixed with this water. We mixed Nano powder in three different concentration like 0.1%, 0.3%, 0.5%. We using the magnetic stirrer for proper mixing. It takes One hour time formixing. Now the copper oxide mixed with the base fluid .in another way we using ultrasonic vibrator for fluid mixing.

In a typical procedure, 25 ml ethanol solution of 0.2 M $\text{Cu}(\text{CH}_3\text{COO})_2$ was mixed with 25 ml ethanol solution containing 0.01 mol NaOH in a round-bottom flask. Then 0.5 g PEG-19000 was dissolved in the stock solution. The mixture was placed in the microwave reflux system and the reaction was carried out under ambient air for 10 min. The microwave oven followed a working cycle of 6 s on and 24 s off (20% power) and altogether the on/off heating procedure was repeat temperature, the precipitate was centrifuged, washed with distilled water, absolute ethanol and acetone in sequence and dried in air at room temperature. The final products were collected for characterizations. ate 20 times. Then a great amount of dark brown precipitate occurred. After cooling to room temperature. The final products were collected for characterizations.

IV. NANO FLUID

Now a day'sNano is the developing technology. It plays the major role in all department. In this project also Nano powder plays the major role. We using copper as the Nano power.

- TiO_2
- Al_2O_3
- CuO

These are all the nano fluid used in the solar collector. CuO having the high heat absorbing capacity so we select the CuO . Size of the copper oxide is less than 100 nanometer. Very small size power can properly mix the base fluid. Copper nanoparticles with great catalytic activities can be applied to biosensors and electrochemical sensors. Redox reactions utilized in those sensors are generally irreversible and also require high over potentials (more energy) to run. In fact, the nanoparticles have the ability to make the redox reactions reversible and to lower the over potentials when applied to the sensors.

One of the examples is a glucose sensor. With the use of copper nanoparticles, the sensor does not require any enzyme and therefore has no need to deal with enzyme degradation and denaturation. Consequently, the resulting diffracted light gives a different color based on the level of glucose. In fact, the nanoparticles enable the sensor to be more stable at high temperatures and varying pH, and more resistant to toxic chemicals. Moreover, using nanoparticles, native amino acids can be detected. A copper nanoparticle-plated screen-printed carbon electrode functions as a stable and effective sensing system for all 20 amino acid detection.

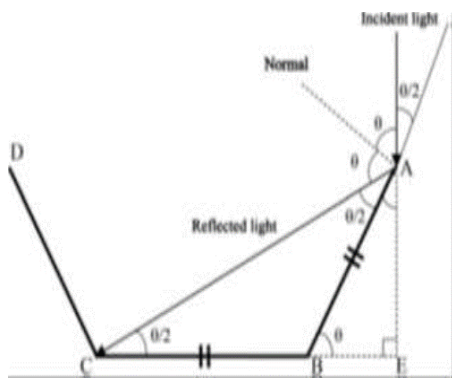
V. EXPERIMENT

The experiment conduct 10.00 AM to 5.00 AM timing. atmosphere temperature differ in every days so atmospheric temperature also measured in every day .That atmospheric temperature help to find the temperature difference between the atmosphere and copper tube. Then 0.1% mixed CuO flow through the copper pipe then measure the temperature of atmosphere and outlet of the copper tube. its continuous 0.3% and 0.5%. Then draw the graph with the help of the result which percentage of the copper oxide absorb the higher temperature. It is an insulated, weatherproofed box containing a dark absorber plate under one or more transparent covers. Evacuated-Tube Collectors are made up of rows of parallel, transparent glass tubes. Each tube consists of a glass outer tube and an inner tube, or absorber, covered with a selective coating that absorbs solar energy well but inhibits radioactive heat loss.

The air is withdrawn ("evacuated") from the space between the tubes to form a vacuum, which eliminates conductive and convective heat loss. Concentrating collectors use mirrored surfaces to concentrate the sun's energy on an absorber called a receiver. A heat-transfer fluid flows through the receiver and absorbs heat. These collectors reach much higher temperatures than flat-plate. collectors and evacuated-tube collectors, but they can do so only when direct sunlight is available. Most commercially available solar water heaters

require a well insulated storage tank. Thermal storage tank is made of high pressure resisted stainless steel covered with the insulated fiber and aluminum foil. Here it can be seen the combined efficiency of the concentrator module is over 30%, whereas photovoltaic modules typically have efficiencies in the order of 15%. Hence a concentrator offers a significant benefit in terms of use an increased fraction of the incoming solar energy.

A heat transfer fluid is used to collect the heat from collector and transfer to the storage tank either directly or with the help of heat exchanger. In order to have an efficient SHW configuration, the fluid should have high specific heat capacity, high thermal conductivity, and low viscosity. And low thermal expansion coefficient, anti-corrosive property and above all low cost. Among the common heat transfer fluids such as water, glycol, silicon oils and hydrocarbon oils, the water turns out to be the best among the fluids.



V-Trough Collectors

VI. PROBLEM DEFINITION

Now at present the horizontal solar water heater setups are gives some satisfaction level of Heat Transfer Performance, again it has chances to improve the heat transfer performance by conducting further more research work by means of Design and reconstruction, Operating technique, also material selection. Which may influences better results in heat transfer and performance improvement.

VII. ENERGY

Energy is the capacity to do work. Energy comes in various forms, such as motion, heat, light, electrical, chemical, nuclear energy, and gravitational. Total energy is the sum of all forms of the energy a system possesses. In the absence of magnetic, electrical and surface tension effects, the total energy of a system consists of the kinetic, potential, and internal energies. The internal energy of a system is made up of sensible, latent, chemical, and nuclear energies. The

sensible internal energy is due to translational, rotational, and vibration effects of atoms and molecules. Energy is a conserved quantity; the law of conservation of energy states that energy can be converted in form, but not created or destroyed.

Various Forms of Energy

There are two types of energy - stored (potential) energy and working (kinetic) energy. For example, the food we eat contains

- Chemical energy
- Kinetic Energy

Heat transfer

Heat is defined in physics as the transfer of thermal energy across a well-defined boundary around a thermodynamic system. It is a characteristic of a process and is never contained in matter. The term heat transfer has acquired a specific usage, despite its literal redundancy of the characterization of transfer. In these contexts, heat is taken as synonymous to thermal energy.

Heat transfer is a discipline of thermal engineering that concerns the generation, use, conversion, and exchange of thermal energy and heat between physical systems. Heat transfer is classified into various mechanisms, such as thermal conduction, thermal convection, thermal radiation, and transfer of energy by phase changes. Engineers also consider the transfer of mass of differing chemical species, either cold or hot; to achieve heat transfer. Fundamental methods of heat transfer in engineering include conduction, convection, and radiation.

Methods of Heat Transfer

There are three major methods of heat transfer

- Conduction
- Convection
- Radiation

VIII. CONCLUSION

This project is giving the idea for developing the solar water heater without using the electric power and other resources, to understanding the efficiency comparison of with and without nanofluid. Finally the result is more efficient are with nanofluid when compared to without nanofluid. The construction of the project is very simple and the cost of product is less. The cost of nano fluid used is little higher and

it should be utilized within a year. The novel stationary V-trough solar water heater with the maximum solar concentration ratio of 1.8 suns has been proposed to improve the thermal efficiency of the whole system. The advantages of the new proposal are that easy to be fabricated, cost effective and high thermal efficiency. The collected data has shown that the prototype has achieved the optical efficiency of 70.54% or 1.41 suns and the temperature of 85.9 C. The prototype can be easily constructed through DIY using off-the-shelf materials with total cost of RM 1489.40 and total payback period of 12.2 year for discounted form or 8.9 years for undiscounted form. Less maintenance is needed for this setup. Based on the above analysis, solar water heating system is the most inexpensive type heater in use. By considering cost to benefit hierarchies, the solar water heating system produces the most inexpensive but more convincing results. The various type of solar collectors described includes flat plate, compound parabolic and evacuated type. In the further work, will planned to construct a V-type collector with enhancement in following parameters,

- Incident radiation
- Heat transfer rate
- Thermal analysis parameters

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