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Study and Analysis of a Single Slope Solar Distillation System with Different Parameter Using the CATIA and ANSYS Software

Pushpamitra Jain and Dr. Shrihar Pandey

Department of Mechanical Engineering, Ojaswini Institute of Management and Technology, Damoh (M. P.), India

ABSTRACT

Solar distillation has been used since the 4th century using the developed idea.. and has been used since then to produce fresh water from impure water. Solar distillation has proven to be one of the most effective methods for providing fresh water from impure water and further investigations and research have been undertaken to develop its application. This study aims to perform a CFD simulation of a freestanding solar ramp. This study attempts to analyze the converted solar system so that anyone can use our results and data to get an accurate idea of how to build a photovoltaic system using CATIAV5R20 and ANSYS 18.0 software to achieve maximum efficiency.

KEYWORDS- Solar still; Desalination; Glass wool insulating material; CATIA Software; ANSYS Software

1. INTRODUCTION

Las Salinas was the first large-scale solar distillation plant and the first desalination process to be performed. Solar distillation is a system used for desalination of sea water and brackish water. The main function of solar distillation is to produce fresh water from polluted or brackish water sources. According to Kalogirou (2005), nature uses solar desalination to produce fresh water in the form of rain. The process begins with solar radiation emitted to the surface of the water in the ocean and other open water sources which begin to heat and evaporate the water. The evaporating water vapor is carried by the wind, and when it cools to the dew point (condensation), the water vapor turns back into a liquid and forms rain (fresh water). Solar distillation is a man-made system that replicates the principle found in natural solar desalination (this is also known as the hydrological cycle). The process is similar to natural solar desalination, however, in the solar distillation process, the movement of water is controlled within the narrow space between the basin and the transparent cover. In solar distillation, the path of the condensed water is controlled by the inclined structure of the transparent cover and the force of gravity. The condensed water travels down the inclined cover and is captured by the trough which directs it to storage through tubes. The feed water for solar distillation is sea water or brackish water that is not safe to drink. Before going into the distillation system, the feed water must be filtered from any debris and other larger particles that could affect the quality of the water produced and affect the efficiency of the system.

The simple solar distillation system component includes the following (sink type):

- A transparent cover (glass or plastic)
- Solar trough (can be of any shape - usually rectangular or square)
- Basin - to capture condensed water vapor
- Filter - to filter out any large particles before the feed water enters the system
- Pipes - for water inlet and water outlet for storage
- Storage tank - distilled water storage (output)

2 LITERATURE REVIEW

Ravi Guguluthu et al. (2015), Energy and fresh water are two basic human needs that affect the progress of any country and overcrowding and pollution from household waste. Solar energy is best for depleting fossil fuels to balance electric power and energy efficiency. These technologies have further enhanced the industry as they are the most reliable and available systems in the world. In many cases, equal use of sea does not allow you to add different types of salt. The day is divided into two phases of activities and events related to gaining energy. Besides the installation and control system, the solar power system is preferred due to its low cost. In addition, electricity needs a pump that needs electricity to operate. **Hitesh Panchal**

(2016), Closed glazing is an important component of beautiful sunscreen design. The sun's rays hit the glass cover first and then are transmitted to the solar energy to pump water to provide drinking water. The selection of the appropriate glass valve usually depends on the transmission. Therefore, the throwing effect on thick-cap lenses, three different thick-cap lenses such as 4mm, 5mm, and 6mm were selected and tested for evaluation in 3D lenses. In slow waves, the standing water in the pond simply ceases to burn in the rays that pass through the transparent panels.

The valve is used to absorb moisture and transfer heat to the air. The single-slide, single-tub unit modeled the window scattering and brightness with lower slopes and confirmed the usual daily modes, and the expected results were obtained. The Sun still has 4 mm thick crystals found on other planets, and the 5 mm thick and 6 mm thick crystals increase the diurnal activity of the Sun, increasing the distillate function. The 4mm solar glass filter not only improves distillation performance during the day due to the high temperature during the day, but also improves it in outdoor weather conditions. **Moghadam Teshan and Hussain A. Kazim (2015),** this article discusses the use of renewable energy from solar temperature monitoring to water pollution. Paraffin wax was selected as a suitable ingredient and used to store energy oil in two different consumer smelters. The paraffin wax receives hot water from a dedicated solar vessel. The solar energy stored in the PCM is the secret to the heat. Solar energy is stored in the cloud in large quantities along with other thermal energy for later use. The water temperature was measured in time. The voltage was checked to improve and regulate the conical drying. Solar energy is used to increase energy and save time to change the elements to convert electricity into electricity. It aims to improve what has been developed. Both seals are machine cleaned to remove damaged grease from the outer surface. The device has two windows, one at the top and one at the bottom. The fill tube from the outlet and two plastic pumps connected to this pump are connected to one heat switch.

Mujtaba Idalatpur (2015), the nature of heat transfer and flow rates in a single solar system are analyzed. Evaporative heat transfer, radiation and radiation are different approaches to the rate of heat transfer in an evaporative cloud and the selection of heat transfer chains that are independent of heat transfer. The heat dissipation phenomenon occurs in the form of normal double scattering in the current. The same wave found that there is a large vortex with an imbalance in the heat treatment and the permeability of the brine and this vortex increases. Adjusting the surface to the final position and correct height changes dramatically, deforming the vortex to make it much smaller and more dynamic, as well as increasing the depth of flow. **R. Alvarado-Juarez et.al (2015),** series of two studies consecutively mapping solar radiation within the horizontal angle of angles resulting from heat dissipation and thermal conductivity observed in cover glass. It is applied that solar energy and smoke collect as a purifier after cleaning. The common use of this device is to use solar energy. A different work is observed to assess solar activity. Boundary conditions such as isothermal walls, living above room temperature, or crossed depth limits on walls have been tested, but no suitable tests were found for such a study with daily, daily, or similar equipment. Heat dissipation is shown in the glass and the blunt force is transmitted through the cover glass with a large force in the flow path (step c) As a result, there was symmetry. Energy increases with increasing water, as well as with increasing temperature and pace of movement.

Kabeel et.al (2014) the water purification effect of mono solar pond power is still very low. In this case, the flexible design of the single-bath pool has already been studied to improve the solar performance and increase the efficiency of the water filtration system. An experimental process of increasing solar radiation was carried out using a nanofluid in combination with a cleaning bath and an external condenser. The use of small electrical equipment powered by solar PV panels has been observed to improve evaporation and save costs by preventing non-carbon gases from spoiling and creating atmospheric disturbances.

Moftah et al. (2014), a series of studies conducted on aspects affecting solar activity. Results vary from conditions such as solar water production internal temperature, operating conditions (eg water depth, various dyes, salt and hot water), configurations (eg solar foam/utility styles, gate valves, equipment selected, storage, display, packaging, distance and system sun protection). It was found that the quiet activity of the sun improved with increasing sunlight, air temperature, wind speed, and water respiration. Important factors include climate, design and performance. The lower glass corner performs high traffic. In addition, the production itself, the depth of the water, the thickness of the container, and the surface, are related to the distance between the application of the paint and the coating covering the added water and the first surge of hot water. **Kabeel et.al (2010),** increases in operational efficiencies and higher costs may also increase the average annual cost of distillates. Examining the costs of two differences makes the differences important for assessing the benefit of transformation from an economic perspective. Nearly 100 percent of the desalination technology was used on site and in the canals to supply water to the crew. The spread of technology has increased due to the need for clean water in dry lands. Their planet didn't need fuel, but it required more space (for assembly) and more expensive equipment in general.

3 GLASS WOOL INSULATING MATERIALS

Glass wool (30 mm thick) was used to make the pattern, which is a protective material made of glass fibers arranged together with a binder into a wool-like texture. This process involves very small airbags in the center of the glass, and these tiny airbags result in high thermal insulation properties. Gases have poor thermal conductivity properties compared to liquids and solids, and are therefore good insulators when they can be confined to objects such that a large amount of heat flowing through the object is forced to flow through the gas to increase efficiency. It comes from like air, which can be broken down into tiny cells that can effectively transfer heat through natural processes.

4 MODELLING

It has a 1 x 1 m^2 sink, the back wall height is 600 mm and the front wall height is 110 mm. It is made of sheet metal with a thickness of 1 mm. The floor of the basin is placed over a layer of glass wool (30 mm) to reduce heat loss from the sun to the atmosphere. The upper part of the stator is covered with 4 mm thick glass. For liquid flow analysis, the flow system has been divided into smaller parts (including geometric variables such as three-dimensional hexahedron, tetrahedron, two-dimensional tetrahedron and triangle). The ruling numbers are then banned and resolved within the following areas. In general, one of three methods is used to solve a finite version of a mathematical graph: constant volume, constant object, or continuous difference.

5 RESULTS AND DISCUSSION

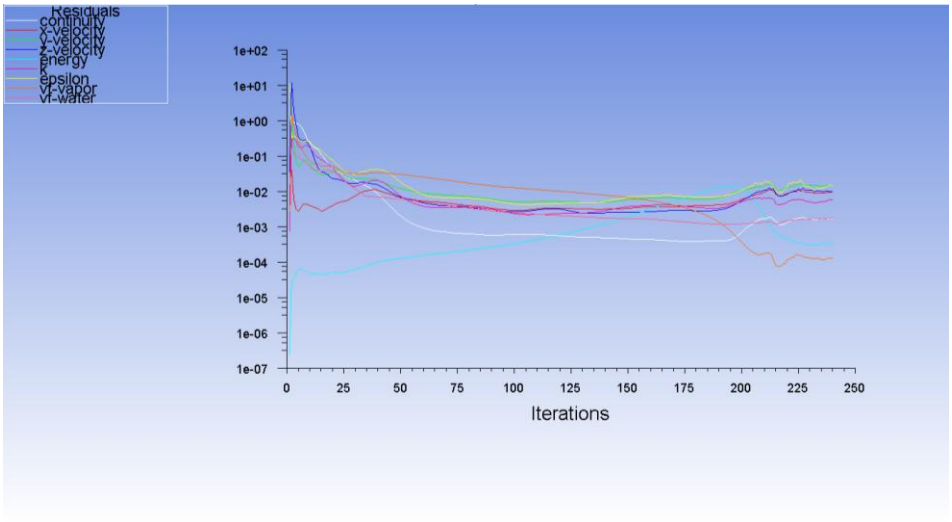

Figure 1 Life cycle of solar energy

In Figure 1, lines shows the life cycle of solar energy where the upper color lines indicate the temperature which becomes constant after a period of time as the temperature rises and remains constant due to the insulator being placed outside the room and the last lower graph shows the temperature of the insulator which means that Continuous Cycle.

The temperature becomes minimum at the outer surface of the insulator where it locks the heat inside so that the solar energy remains able to maintain a constant temperature over the long term.

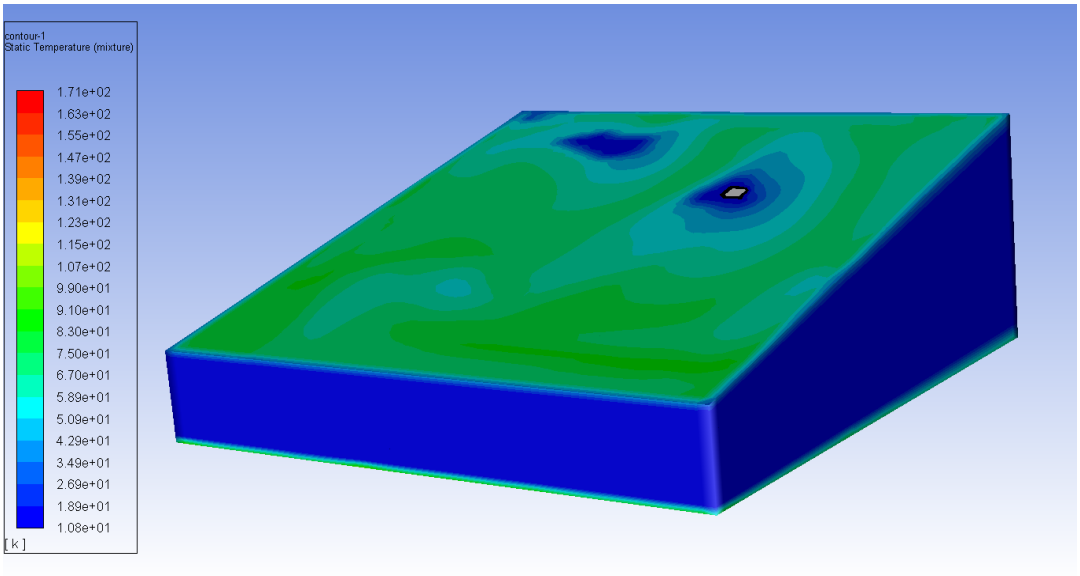

Figure 2 Heat transfer of the insulator

In Figure 2, these patterns show its transfer of the insulator which means that the blue color indicates the cold region where the red part indicates the hot region, due to the insulator, the left part region becomes heat from the inside but is unable to transfer heat outside due to the bad conductor of heat.

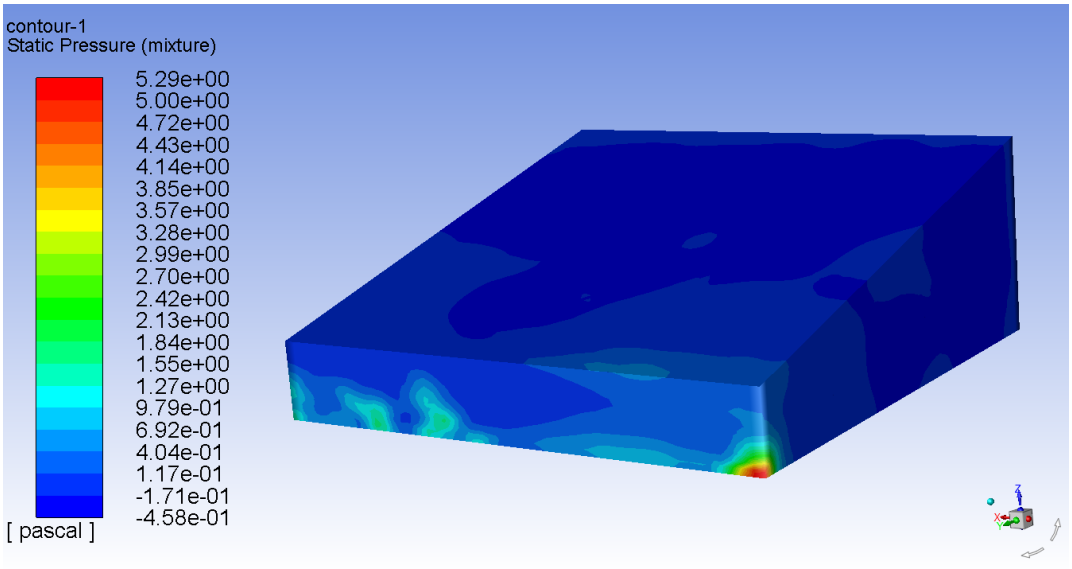

Figure 3 Complete closed loop of heat transfer inside the insulator

In Figure 3, this line is the complete closed loop of heat transfer inside the insulator, and these lines consist of a rectangular pattern which means that inside the room the heat stays inside.

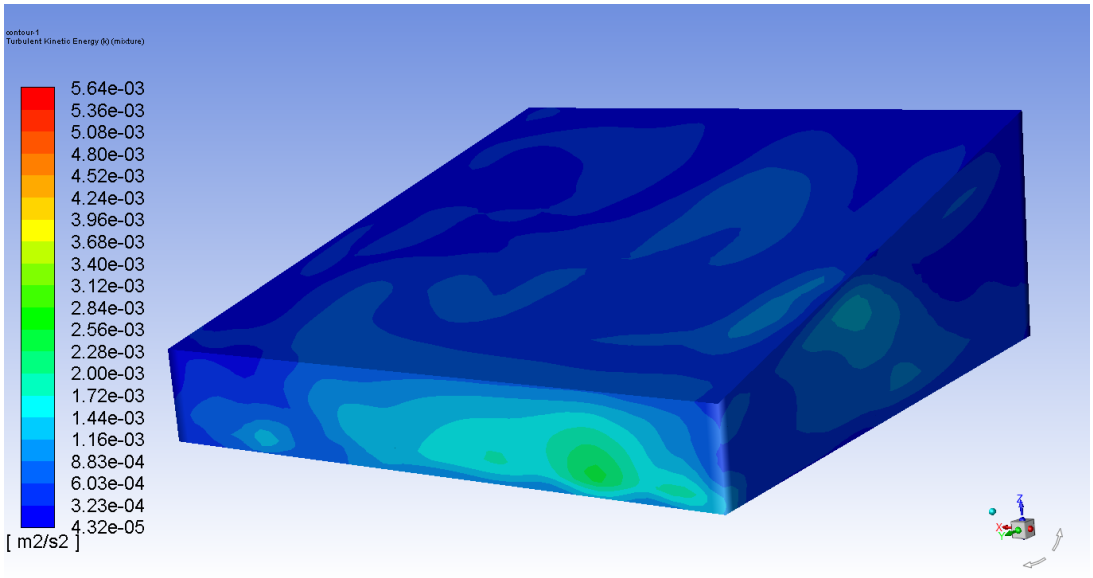

Figure 4 Amount of energy absorbed by the solar distillation

In Figure 4, This contour shows that the amount of energy absorbed by the solar distillation, or the amount of energy (thermal energy) entering the chamber will remain inside only due to the insulation, the amount of heat that is exchanged by the chamber will not come out due to the glass wool insulation.

6 CONCLUSIONS

The results obtained from the simulation are fairly consistent for solar still. The maximum temperature (348.523 K) was found during the solar distillation. The temperature was determined by CFD measurement. The diagram shows that the amount of energy absorbed by the solar occupant, or the amount of energy (thermal energy) that enters the occupant will remain inside simply due to the installation of the insulation, and the amount of heat exchanged. From the analysis carried out, it was found that the closest and most accurate results were obtained from this analysis. Using normal solar energy at 1 PM, the water temperature was 342.754 K and the glass temperature was 329,685 K.

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