



Review of study and analysis of solar still distillation unit with different parameters using CATIA and ANSYS software

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ABSTRACT

Potable water production from inefficient solar power is still too low to meet demand. To improve the yield of conventional solar distillation, the incoming water supply is preheated by connecting a solar distillation unit with separate collector plates. In this review article, several parameters affecting the evaporation rate of effective solar distillation and various combined methods are presented. Salt water contains soluble and insoluble substances, so it is not suitable for domestic use. Currently, the distillation process is done using active and efficient solar still systems. The biggest problem with inefficient solar power is meeting the increasing demand for clean water. Water is one of the most important sources of human life on Earth. Since the use of water resources on Earth is limited, people in rural and urban areas suffer from the use of sewage which causes waterborne diseases. Although groundwater is available in small quantities, it must be properly treated before using it indoors. The objective of this study is to perform CFD simulation for single slope solar still and compare natural and modified solar still to obtain the best results.

KEYWORDS- Solar still; Desalination; Glass wool insulating material; CFD simulation; Heat transfer rate.

1 INTRODUCTION

Salt water contains both soluble and insoluble substances, so it is not suitable for home use. Currently, the distillation process is carried out using active and efficient solar energy systems. The biggest problem with inefficient use of solar energy system is meeting the increasing demand for clean water. Fresh water production from passive solar stills is too low to meet demand. To improve on the conventional solar still, the water supply is heated by combining the solar still with separate collector panels. In this article, several factors that affect the effective solar distillation rate and several common methods are presented.

In addition to the efficient distillation system, forced charging technology can be combined to increase fresh water production by lowering the maximum temperature. Moreover, it has been determined that clean water in efficient CSS can be modified by storing effective and hidden thermal energy. This article explores the use of a concentrated solar distillation heater to store thermal energy. Paraffin wax was chosen as a suitable phase change and was used to store thermal energy in two separate insulated boxes. The paraffin wax receives hot water in a stationary solar pan. This solar energy is stored in the PCM as hidden thermal energy. The temperature switch is set before the pivot point. It is made of an aluminum container 20 cm wide and 7 cm deep. The container is covered with glass wool. The entire inner surface is designed in black so that it absorbs all kinds of radiation. To provide insulation for the fixture, the entire outer surface of the roof is covered with glass wool. The complete preparation is placed in a wooden box to fit the glass wool and give further insulation support and ease of handling. To prevent steam from escaping through the glass door, it is tightly closed with a rubber trim. Inlet and port pipes are provided for the sink. Since water is a working liquid, fill the basin 2 cm with water. Make sure all sink vents are closed to prevent loss of heat and steam from the vent. Fresh water is needed for one hour. The demand for potable water is growing rapidly due to population growth and rapid urbanization.

The solar base still has a fixed surface area and a fixed energy scale directed towards the sun, yet the water temperature is detected to be lower and thus remains less distilled. To increase the water temperature, the surface area assumes basic work, in this way, the scales can still be combined with the solar still to build up the surface area, thus increasing the water temperature. It is generally believed to be the process of converting salty or polluted water into drinkable water using thermal energy. Solar energy remains the ideal solution to power the refining process, and it is environmentally friendly, free, and accessible in large quantities throughout the planet. Solar desalination (SD) takes the spotlight from all other haphazard methods of water purification. Solar energy is widely used as part of the SD process, but the efficiency and effectiveness of the solar energy system are still low compared to other refining procedures.

The solar base still has a constant field and a fixed energy meter facing the Sun, although the water temperature is found to be lower and hence the distillation remains lower. In increasing the temperature of water, surface area plays an essential role, so scales can also be combined with solar energy to increase the surface area, and thus increase the temperature of the water.

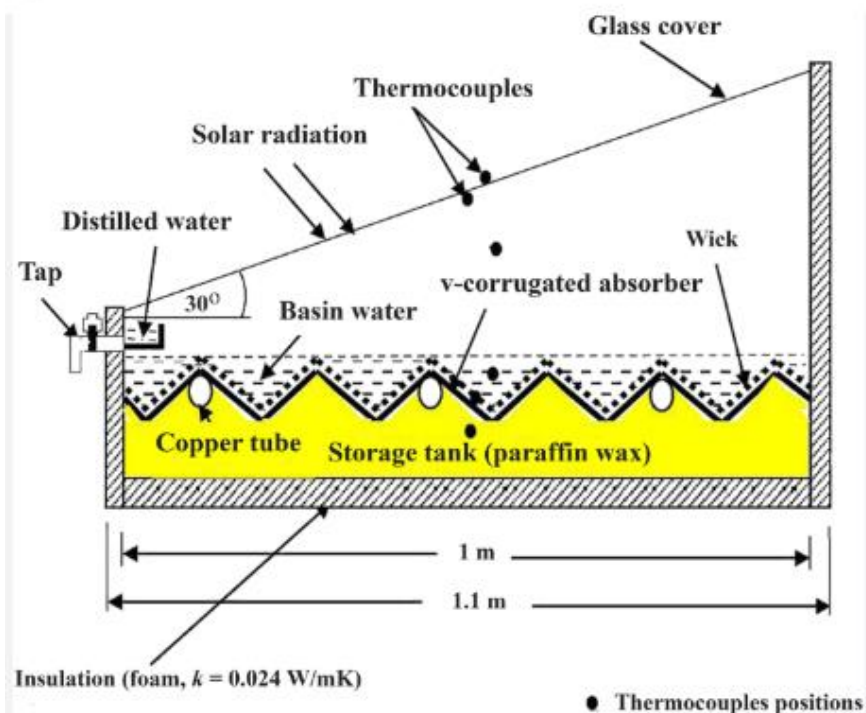


Figure 1 Diagram of solar still

In addition to an efficient distillation system, forced convection technology can be incorporated to increase fresh water production by lowering the exhaust temperature. Furthermore, it has been determined that clean water can be improved into an efficient desalination system by efficiently and accurately storing thermal

energy. This review will encourage researchers to identify the most effective solar distillation technologies to promote development. This study explores the use of thermal energy storage from a concentrated solar water distillation heater.

Paraffin wax was chosen as a suitable phase modulator and was used to store thermal energy in two separate, insulated boxes. Paraffin wax is given hot water in a fixed solar vessel. This solar energy is stored in the PCM as hidden thermal energy. The temperature switch is set before the pivot point. The container is covered with glass wool. The inner surface is completely painted black to absorb all types of radiation. To provide insulation for the stator, the entire outer surface of the device is covered with glass wool. The entire fixed setup is housed in a wooden case to accommodate the glass wool and provide additional insulation support and easy handling. To prevent steam from escaping from the distillation device, the glass door is closed tightly using rubber balls. Inlet and outlet pipes are provided for the sink. Since water is the working fluid, fill the container to 2 cm with water. Make sure all sink vents are closed to prevent heat and steam loss through the vent. Fresh water is needed for an hour. The demand for clean water is rapidly increasing due to population growth and rapid urbanization. In addition to consumer purposes, clean water plays an important role in many industrial processes such as batteries, pharmaceuticals, and research facilities.

It is generally thought to be the process of converting salty or polluted water into drinkable water using thermal energy. Solar energy is the perfect solution to fuel the refining process, in addition to being environmentally sound, free, and available in large quantities all over the planet. Among all other brackish water purification methods, solar desalination (SD) stands out. Solar energy is still widely used as part of the sustainable refining process, but the efficiency and cost-effectiveness of solar energy is still low compared to other refining procedures.

2 LITERATURE REVIEW

Bhupendra Gupta (2016) Renovation, regeneration and simulation of solar system operation. The daily routine cycle setting is to continue (1) paint the interior walls white and (2) stop water leakage and flow above 0.0001 kg/s. The effectiveness of solar radiation is still being evaluated and compared to solar radiation. The daily production of pure water has been achieved and continues to be 20% higher than the change mentioned above. Abdullah et al. (2021), this in-depth study used an elaborate design to maintain the depth of water tanks using a large cylinder. Three sunsets were selected as candidates for the nominated sun (DSS), the modified sun with (MDSS), and the regular sun with (CSS), and were tested under environmental conditions to measure their marketing performance. The DSS and MDSS were free to rotate the drums in a series of DC motor driven branches. The photovoltaic system was used to eliminate energy consumption.

Hamdi Hassan and others. (2020) evaluated the performance of a single-slip condenser in the surrounding area, as well as design, energy, economics, and economic methods. Effectiveness has been studied in the context of crop clearing and in warmer climates. Mohammad R. Salem et al. (2020) examined the causal effects of exhaust pump installation instead of daily adjustment. Different concentrations (16 to 35 kg/m³) and thicknesses (0 to 40 mm) of salt sponge were tested at different depths (10 to 40 mm) in the vessel. The result of the pump usage report in SSDU is that the operating order, temperature and operating information are changed, the pump set with a pressure of 16 kg/m³ produces water with higher humidity and better temperature than normal, the pump pressure increases and the pump pressure decreases.

Mohamed Abdel-Gayed and others. (2020) Tube shots show larger samples and condensate above the surface compared to the same straight slope. Therefore pins are mainly used to increase the volume, in addition to the external capacitor which is used to increase the volume. In order to obtain this indication, the test function usually includes two groups: including, in the first group, the non-use of tubes instead of the bright effect of the tube sun. The shots are studied and the best type of pin is obtained. **Suwailam, Fa Charshir, et al. (2020)** This work aims to find a new method to optimize solar energy (SSs) using different 3D devices to couple the fluctuating thermal conductivity at the water surface to water augmentation. These three types produced (a) graphite inserts and inserts, (b) carbon foam and inserts, and (c) roving carbon and foam. The experimental operations aim to establish a new method and adapt to the conditions in which heat is generated, water grows and heat dissipation results in SS heat. Furthermore, the effect of water depth on the contrast and natural production of SS was studied.

Youssef Abdel Aziz and Al Melhem Mohammed Al Taweel (2020) present an alternative method that can be used to provide low purity water to people with clean water technology, advanced technology, high

productivity and the environment. Two DSSS motion simulators with a length of 2 m, a width of 1 m and a height of 0.20 m were designed and installed on both sides. The plate is double sealed with a thickness of 4mm. The height of the large brine bottle was 1 m, and the water in conventional wastewater was about 0.20 m. Salt water is often transported to ponds via a floating lamp used to store large amounts of water in ponds. One of the planets is still used as a control system (CDSSS), while the other adds a simple priming method and wire flow to improve the sun's performance. The power cord is shaded with standard toilets to prevent black spots. The inner and right walls of the vase are covered with black cloth.

Imad M.S. Al-Saeed (2020) Metal wire mesh was used to improve the efficiency of input, dissipation and heat storage in existing pipelines. In addition, the vibrator is mounted on a wire mesh that provides powerful vibration. This vibrator is used to remove friction on the surface of soil and salt water which further deteriorates temperature and humidity. Thermodynamic and economic research and experiments are carried out. MA Porta Gandara et al. (2020) measured solar water consumption in one strip per day (BTSS) by mixing water. Improvement is achieved by injecting air into the bath water to build up the body, thus increasing the amount of moisture in the soil and encouraging increased transport. In general, water production increases gradually as resistance increases. First, the BTSS device records the temperature in the bath water, the glass surrounding the lid and the surrounding area, and is equipped with a rapid and air measuring device, as well as a thermometer for continuous measurement. Datatraya c. Subedar et al. (2020) Nanoparticles have been achieved and are very useful. The nanofluid pushes the nanoparticles underwater, emitting hot water. The system is designed to evaluate the effect of daily continuous flow cycling (CSP) combined with continuous flow collection (PTC) using a nanofluid.

Naseer T. Alwan et al. (2020), to optimize the circadian clock type (TSS) in two stages. In the first step, a shallow layer of sunscreen increases the amount of smoke inside and reduces the fraction of untreated water layer. Three resistance levels were tested (0.5, 1, 3 rpm). The second step is to use the solar collector and external solar system (MSS) to raise the heatsink. Analyzing the results of the experiment, the efficiency increased and the speed decreased, and it was found that the oven speed was less than the speed (0.5 rpm) at higher speeds. **Ahmed Al-Subaie and Abdel Moneim Khallaf (2019)** This work presents a deep numerical model for the solar pyramid that has not been tested in many previous studies. The computer program is designed to find out all the movements of the plum pyramid during the presence of the Sun and compare them to the clock shift of the solar events in the available frames. **Gurukarthik Babu Balachandran et al. (2019)**, the only regular solar eclipse (SSSS), has proven to be an expensive option. Solar energy is still being evaluated in terms of climate and performance of the study areas. Most climates include strong winds and internal temperatures. The single slope living sun base has a brine surface and a sloped surface suitable for glazing, which is conducive to clear water replacement in fish. Thus, three were evaluated in our study, regular absorbent layered solar (CSS), micro-absorbed layered solar (MALSS), and nano-layered solar (NALSS). The three days remain the same, the angles are high, the heat is intense, and the same goes for covering things up.

Abdel Nabi Qabil (2019) This article discusses the use of red-painted bricks to improve the production rate of water-based mixtures using the sun. Adding water adds to the flexible solar system (MSS), keeping the red brick sculptures within the concrete. The sorbent is the smallest amount used during testing in a swimming pool where the water temperature is high at 20 kg of water weight in MSS. Among the results, it was also found that there was a 38% improvement in water temperature. The daily weights taken at depths of 20, 30, 40 and 50 BB are 3.2, 2.8, 2.7 and 2.6 kg, while the daily shift is still 6.3, 6, 5, 8 and 5.6 kg. Due to the decrease in the daily water yield, the price of a liter of water has become normal and it converts its energy.

Kaushal et al. (2017) The high-temperature crossing temperature from the floating temperature above the first plate to the first plate, the increased distillation function due to preheating of the food from the hot waste, the lowering of the pool bottom and the loss of the sides, which increases the temperature rise of the spark plugs or cleaning. In many areas, water levels are decreasing significantly due to rising water levels for rice cultivation and commercial irrigation. **Kamel Rabi et al (2017)** This process enables a permanent solar system with welded pin blades. Testing takes place at midday, walls are placed, drawn and pulled, with installation stopped and normal. These experiments were obtained to control the characteristic temperature (humidity change and crystal temperature) and produce solar system water with sharp peaks. **H. Deshmukh and S. B. Thombre (2017)** In this research mode, a one-dimensional and one-dimensional energy structure was

tested in sand and benzene (thermoformed wood) method for storing elements under the base basin. An attempt was made to reduce the water in the sink. Once again, it turned out that the temperature of the inner glass was lower than the temperature of the outer glass for the first 2-3 hours.

2 SOLAR STILLS

2.1 Conventional solar stills (CSS)

This has a sink area of $1 \times 1 \text{ m}^2$, a back wall height of 520mm, and a front wall height of 100 mm. The picks are made of galvanized iron sheets with a thickness of 1 mm. The bottom and side walls are insulated with a layer of glass wool (25 mm thick) to reduce heat loss from solar stills in the atmosphere. The top of each of the stills is covered with 6mm thick glass.

2.2 Modified solar still (MSS)

The area of the sink is $1 \times 1 \text{ m}^2$, the height of the back wall is 520 mm, and the height of the front wall is 100 mm. Solar docks are made of 4 mm thick galvanized iron sheets. The bottom and side walls are insulated with a layer of glass wool (20 mm thick) to reduce heat loss to the atmosphere. 20 mm thick plywood is used to make the bottom of the solar still. The top of the pickup is covered with 6mm thick glass.

3 GLASS WOOL INSULATING MATERIALS

Glass wool (25 mm thick) was used to make the model, which is a protective material made of glass fibers assembled with a binder into a wool-like fabric. This process involves very small airbags in the middle of the glass, and these small 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 in objects so that a large amount of heat flowing through the object is forced to flow through the gas to increase efficiency. It is like air, which can be divided into small cells that can effectively transfer heat through natural processes.

4 PROPOSED METHODOLOGY

The floors are painted black to increase the absorption of the floor, and the interior walls are painted from the inside to give the wall more light. A water mist was used to spray water through the glass. Both solar collectors are still covered with insulation and tape to prevent steam from the aquarium from entering the atmosphere. Condensation from inside the cup collects at the bottom of the bowl. Many tools have been used to measure different performance depending on the parameters. The digital thermometer measures the temperature in various modern environments such as water, steam zone, inner glass, outer glass and average temperature. Several parameters such as ambient temperature, water temperature, evaporation temperature, glass temperature, solar radiation exposure and distillate emissions were recorded hourly at the water depth in each container.

5 CONCLUSIONS

Lack of potable water is a major problem in arid and remote areas. Most groundwater and surface water are salty, and contain some bacteria depending on the nature of the geological structures and regional topography. This study aims to develop effective desalination equipment that increases the production rate of distilled water and improves heat transfer in the evaporator. In addition, the effect of an energy storage system placed in two specific areas on the output of the distillation process with and without energy storage was studied. The heat exchange system provides energy to the water to be treated during the day, while the concrete portion provides energy storage for the desalination evaporator during the night.

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