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Abstract and Figures

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Properties of Therminol 66…

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EXPERIMENTAL ANALYSIS OF SINGLE REFLECTOR BOX TYPE SOLAR COOKER WITH THERMO FLUID

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Abstract
This study has been made to analyze the performance of singe reflector box type solar cooker to develop for the thermal evaluation by operating in ordinary fluid (water) and Therminol fluid (therminol 66). In this work, a box type solar cooker with thermal energy storage system is designed to decrease the cost of the device, and to enhance the amount of heat energy absorption and to analyze the amount of radiation from the sun, temperature of the working fluids, and efficiency of the solar cooker. It has been found that three days trail the high temperature in the therminol 66 it has more efficiency than that of water and also analyze the efficiency and temperature of therminol fluid and water using Ansys.

Keywords: Therminol fluids, Box type solar cooker, Water, Heat energy, Efficiency.

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INTRODUCTION

Now day's households are used LPG, biomass or wood for purpose of cooking but very less amount of solar cooker used for cooking [1] The main reason for this situation is solar energy is available only 9am to 4pm and takes more for cooing purpose and also solar energy used for heating of water with solar collector which can be store in the collector tank at 80ºC and it can used next day morning [2]. In India particularly box type solar cooker is used for cooking purpose in recent years. Different types with various models box type solar cookers have been sold commercially and to reach globally the scale acceptance, solar cookers essential to meet certain social conditions besides value and output requirements. Few research studies have been suggested that with latent heat storage materials in a box type solar cooker to cook the food in the late evening [3]. [4] Researcher studied the use of Therminol fluids to absorb the heat quickly in the late evening hours. The performance of a solar parabolic through collector with a heat energy stored and therminol 55 is used [5] as a heat transfer fluid. Different types of factors evaluated like useful heat gain and thermal efficiency. Generally latent heat storage unit contained nitrate mixtures and therminol fluids, oil is used as a heat transfer fluids, [6] it's circulates in separately to loop connecting the storage unit and collector. The thermal oil and therminol fluids are much more efficient than that of aluminium based storage unit, so [7] reduces heat losses in the absorber and pipe lines from inside the solar cookers. The used two different heat transfer fluids separately for heat is absorbed and circulating with the help of natural circulation methods. [8] It was noticed transfer fluid; amount of thermal energy stored by PCM is increased by a quantity of 26.6 % to 68.4 % as compared to water as heat transfer fluids.

In the present work an attempt has been made to propose and evaluate the thermal performance of therminol 66 and water using single reflector box type solar cooker and Ansys to compare the results of therminol 66 and water using Ansys geometry and FEA model. Generally FEA model want to do such a conversion for one of two reasons. The first is the legacy mesh, and then FEA mesh from the past that has no geometry. New [9] mesh use to create the FEA model another reason is the get a CAD part of a distorted in some way by a load.

EXPERIMENTS AND METHODS

The box type solar cooker consists of glass cover plate material filled with thermal fluids. The glass plate is 4mm thick and transmit visible, also it received high infrared radiation. In this plate designed air gap between the two glass plates with 2.5cm. The collector area of the solar cooker is 0.3 x 0.3 x 0.2 m and absorber plate is coated G.I sheet in 2 mm

Figure 1. Line diagram of the Experimental Se

Greenhouse fluids filled inside of the glass cover plate. The inner side of the wooden box and absorber plate is filled with glass wool for proper insulation. A mirror act as a reflector and it reflect high amount of radiation from sun to enhance the solar intensity from the absorber plate.

During the experiment investigations, the radiation are passing through the cover plate does not allows the radiations from the absorber plate. The solar radiations are measured with pyrometer and temperature is measured using thermocouples. The experiments conducted at two days of trails with 15 mins of time duration.

Table 1. Properties of Therminol 66

Name	**Particulars**
Appearance	clear, pale yellow liquid
Flash point	184 °C (363 °F)
Fire point	212 °C (414 °F)
Density at 25ºc	1005 kg/m ^{3}(8.39 lb/gal)
Pour point	-32 °C (-25 °F)
Normal boiling point	359 °C (678 °F)

RESULT AND DICUSSION

Figure 2. Time with respect to water temperature

The cooker is tested using water and therminol 66 with time interval at 15 mins per day. Figure 2. Shows the time with respect to water temperature, whenever the time increases the temperature of the fluid also get increased. Here two types of fluids are used water and therminol 66, in this work therminol fluid contain the more amount of sensible heat than that of water. So, day 1 maximum temperature of 103ºC achieved in therminol 66 fluids at 2 hrs. The ordinary fluid water is obtained the low temperature compare to the therminol fluids.

Figure 3. Time with respect to Efficiency

Figure 3. Shows the time with respect to efficiency from the whenever the time increases the efficiency of the fluid also get increase. The high t
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efficiency of 25% at the time of 1pm. The maximum efficiency attained by the solar cooker was temperature is 103ºC achieved in therminol 66 fluids.

Maximum solar intensity is 890 W/m^2 at 13.00 hr and the ambient temperature lies at the range of 270 ºC to 32 ºC. As a result indicate the solar cooker test on without load; it can be suitable for cooking and heating the foods compare to other day times. It is noted that evening cooking is very faster than noon cooking for same load, even without filling therminol fluids and the water in the gap to increase the heat transfer range.

Figure 4. FEA model result of water

Figure 5. FEA model result of Therminol

Figure 4 and 5, shows the FEA [Finite element analysis] of water and therminol fluids, Block 1 has right angle corners so the algorithm makes quick work of it and finds six surface and 12 edges. Expect that the top surface patch is defined by a nodal comment. The conjugate FEA [Finite element analysis] model is incorporated to the solid domain the top plate of the Ansys in CFD, having thickness ratio of 6mm, pro – E software is used to create the Cad design model followed by meshing with other element with the help of hyper mesh software [10] In the model found that the boundary condition in tube at temperature of water 348ºK and therminol 66 achieved 349ºK is the maximum efficiency obtained in the solar cooker. The CFD analysis reported that top surface of the tubes with a heat transfer coefficient of 120 and 255 W/m^{2}k respectively for the cooking surface with water and therminol 66. The heat transfer rate is maximum at when we are used in therminol fluids and temperature of the inside tube also very high compare to that of ordinary fluids water.

CONCLUSION

It was found that single reflector box type solar cooker with fluid filled cover system is analyzed and evaluated. The variation of the efficiency, water temperature of absorber plate is also analyzed. Heat transfer in all tubes and FRA node point temperature and efficiency is slightly higher compared to ordinary fluid system (water). The therminol 66 working fluid contain more sensible heat than that of water, it's one of the reason of produced higher temperature than that of water. The therminol fluids he
maximum density

overall heat transfer coefficient for heat the thermal energy storage system.

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