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"MODELING AND SIMULATION OF EGR COOLER WITH TRAPEZOIDAL AND RECTANGULAR TYPES OF FINNED TUBE FOR DIESEL ENGINE"

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ABSTRACT

An experimental study was performed to bring out the factors by which the thermal conductivity of nanofluid can be increased. The nano particle used in the present study are ZrO2 it is shown that there is rise in conductivity of water with particle volume fraction. The presence increases the stability and circulation will prevent the deposition of sedimentation within the water. The decrease in size of nanoparticle will increase the conductivity of water which is attributed to increased surface area. Efficiency of DASC increases due to increase in thermal conductivity of heat transfer fluid (HTF) when water is replaced by NF and increases with the concentration of NPs The efficiency of DASC is increased upto 3-4%

Key Words: *Nanofluid, ZrO2, DASC, conductivity, HTF, water, Efficiency*

I. INTRODUCTION

Sun oriented Energy gas been around us for quite a long time and is pretty much as old as the actual mankind. Significantly more established truth be told was the utilization by the plants for chlorophyll. In any case, if there should arise an occurrence of people the best approach to utilize the sun powered energy has changed. From warming himself to drying our garments and now warming water and creating power through sun. This would not have been a decent joke years and years prior. Our venture manages the sun powered water warming through sun oriented gatherers..

Fig.1.1 Sun The ultimate Source

Sun-based gatherers are gadgets which as their name gather sun or in a practical sense a piece of the sun's radiation transmitted for the day. Presently this radiation is changed over into heat and is used in alternate manners either

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straightforwardly or by moving it to some other medium. Truth be told sun oriented authorities regularly allude to the motors of any sun-based warming frameworks. It is to be remembered that the radiation need not be extreme however the typical everyday radiation will do the trick for any sun-based authorities. The sun-powered authority is grouped by the temperature that is achieved by temperature. They are characterized by the temperatures that are accomplished by the sun-based collector. Solar Energy is the most seasoned wellspring of energy utilized by Algae, Plants, and so on There are in everyday 3 different ways:-

1. Photovoltaic cells
2. Solar warm innovation
3. Passive sun oriented warming

The fundamental deterrent is the cutoff on efficiency. Although the sun transmits a huge measure of radiation yet we can just use a Fraction of it. The materials are not almost productive nor are the imperatives of science helping correctly. For instance, the environment mirrors an impressive piece of the radiation, the air diffuses the radiation by dissipating the light because of the little particles in it. At that point comes the productivity of the moving gadgets including the lines of metal the glass with not 100% Permeability. This outcome is extremely low effectiveness.

II. DESIGN OF EGR COOLER

Solar collectors have helped us utilize most out of the sun that technology can. In this project, the scholar is to build a DrAb Solar Collector (DASC) and to test the results of the solar collector and to increase its outlet temperature if possible. The efficiency of the collector is to be tested in this study and if possible it is to be improved as well.
The goal of the study is to test the device in many kind of situations and with different heat transfer medium:-

- Air
- Water
- Nano – fluid (25 gram)
- Nano – fluid (50 gram)

III. MODELLING

The Project focuses on taking readings I.e. observation of the DrAb Solar Collector on several day with different transfer fluids. The setup is kept on a terrace to receive maximum heat from radiation of the sun. The setup will be the dame in the case of implementation of the product even in winter so that it delivers high output. The transfer at different days is given in the table given below:-

Table 3.1 Experimental Conditions

Serial no.	Weather Condition	Transfer Fluid
1	Sunny	Air
2	Sunny	Water
3	Sunny	Nano – Fluid (25 grams)
4	Cloud	Nano – Fluid (50 grams)

IV. EXPERIMENTAL SETUP

4.1 Physical Setup

This section describes the experimental setup as well as the preparation of the setup.
Preparation of the primary tank:-

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The tank is to be of length and breadth and height as 39in, 39in, and 7 in respectively.Then is sealed with greenish glue from the tank makers. On non – adjacent walls one hole at a height of 3.5 inches is to be created as shown in the figure given below so that they look identical when the tank is rotated at an angle difference of 180^o from the side view and are not concentric. On the rest two walls 1 hole at a height of 4.5 inches each is to be created as shown in the figure given below so that they look identical when the tank is rotated at an angle difference of 180^o from the side view and are not concentric. All the four holes are to be taken at the distance of 4 in from the corner horizontally. The tank after the construction of the holes is to be made leak proof by most stable compound available – in this case being m - seal (It can only be deactivated by a lot of heat).

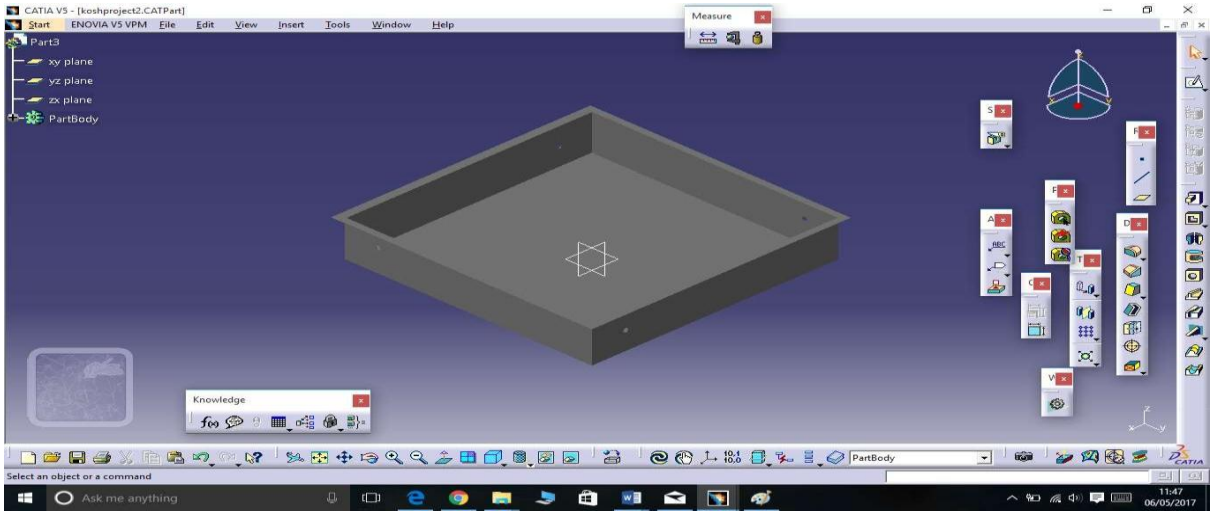

Fig 4.1 Tank Primary

Preparation of the copper pipes:-

Copper pipes are to be cut into 5 parts each of two feet size and two parts each of 3 feet. Twelve suitable elbows are to connect the pipes with 3 feet on the side and two feet pipes in the middle as shown in the figure given below. The water to be heated will pass through these pipes therefore the connection is to be made leak proof by welding preferably with the help of brazing powder.

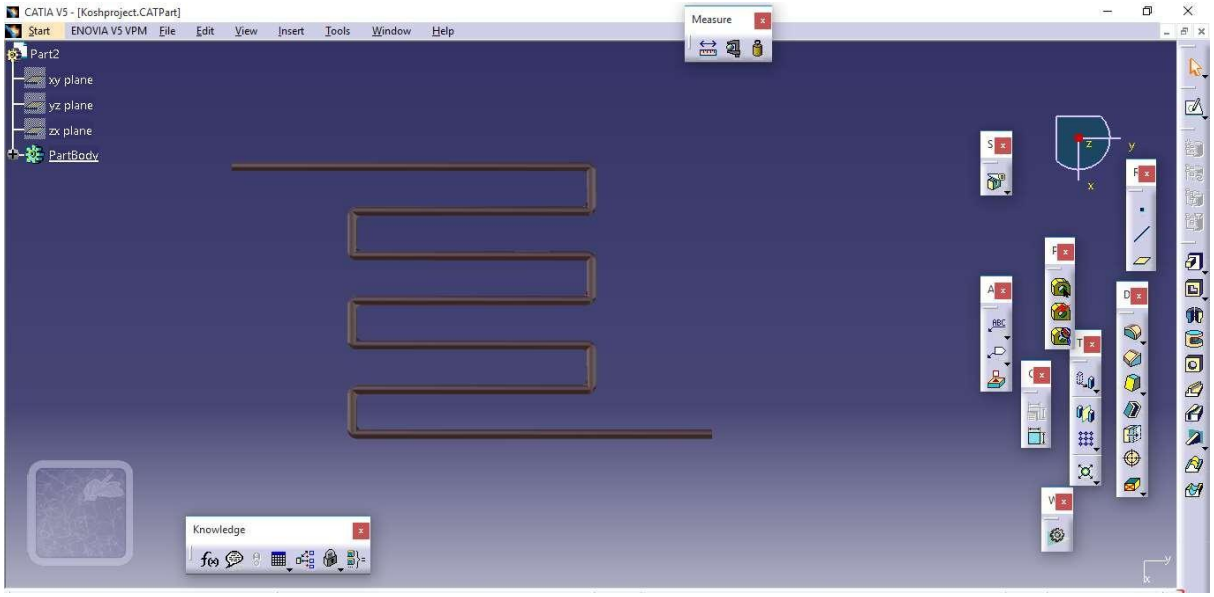

Fig 4.2 Copper pipes model

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Preparation of the glass:-

A glass which will prevent evaporation of the fluid from the tank and also prevent any impurities like dust ,etc. to go inside tank) of dimensions 101 cm x 101 cm x 0.6 cm is to be toughened for the purpose of safety of the setup inside tank.

.**Preparation of the circulation:-**

A motor of 0.5 HP is used for circulation but because of the high mass transfer rate it is used only for the prevention of sedimentation for short intervals of maximum 30 sec. Which will take water from ground level to an elevation of approx. 1.15 m? From here the fluid is automatically transferred to the tank . And the inlet of the motor is connected to the outlet of the tank in the below given fashion. The inlet of the motor is indirectly connected to outlet of the tank and vice – versa with tanks in between to break the high velocity flow rate. These outlet and inlet of the tank are to be connected at holes at height of the 4.5 inches.

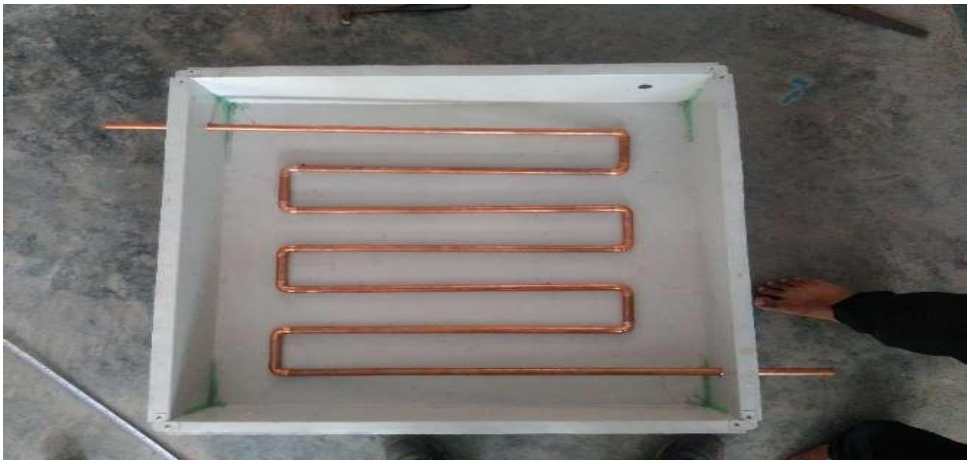

Fig 4.3 Setup 1

Preparation of the DASC part:-

The tank is now kept atleast at an elevation of 0.7 metres from the ground and is supported by a wooden table to prevent heat loss from the bottom surface. The main tank is to be connected with the copper pipes with the help of welding. The two ends of the pipes are to be welded into the tank at the holes of elevation of 3.5 inches. The copper pipes are heavy therefore they are given support. After set up of tanks and copper pipes is complete it looks similar to this.Copper pipes ends are to be welded with metallic nipples/sockets.These sockets help us connect the FABTs.This FABT then connects to the pvc pipes to prevent heat loss to atmosphere through copper pipes and is also cheap.

4.2 READINGS

4.2.1 AIR

Table 4.1 Readings of DASC with HFT as Air

SERIAL NO.	TIME	AMBIENT TEMP. (^{0}C)	INLET TEMP. (^{0}C)	OUTLET TEMP. (^{0}C)
1	11AM	39.7	35.8	66
2	12AM	40.1	37.6	68
3	1PM	42.1	39.6	72.9

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4.2.2 WATER

Table 4.2 Readings of DASC with HFT as Water

SERIAL NO.	TIME	AMBIENT TEMP. (^{0}C)	INLET TEMP. (^{0}C)	OUTLET TEMP. (^{0}C)
1	11AM	38.2	34.1	41.1
2	12AM	39.8	35.6	45.2
3	1PM	41.6	37.5	49.6
4	2PM	42.6	38.6	51.1
5	3PM	41.9	40.1	52.1

4.2.3 NF (25 GRAMS)

Table 4.3 Readings of DASC with HFT as NF (25 gm)

SERIAL NO.	TIME	AMBIENT TEMP. (^{0}C)	INLET NF TEMP. (^{0}C)	OUTLET NF TEMP. (^{0}C)	INLET TEMP(^{0}C)	OUTLET TEMP. (^{0}C)
1	12AM	41	43.5	47.3	38.6	48.6
2	1PM	41.7	44.6	48.6	39.5	49
3	2PM	42.6	45	49.6	40.8	50.1
4	3PM	43	45.8	50.3	41.7	51.1
5	4PM	43.3	46.9	51.5	39.2	51.5

4.2.4 NF (50 GRAMS)

Table 4.4 Readings of DASC with HFT as NF (50 gm)

SERIAL NO.	TIME	AMBIENT TEMP. (^{0}C)	INLET NF TEMP. (^{0}C) t1	OUTLET NF TEMP. (^{0}C)t2	INLET TEMP(^{0}C) T1	OUTLET TEMP. (^{0}C) T2
1	10AM	40.5	37.4	38.5	35.5	40.7
2	11AM	41.7	39.4	43.8	37.3	46.6
3	12AM	42.1	41.8	46.8	39.2	49.6
4	1PM	43.4	43.4	48.3	41.7	51.6
5	2PM	43.8	45.4	49.5	43.3	52.3
6	3PM	42.6	47.1	50.7	44.3	50.4
7	4PM	42.1	48.8	50.4	44.3	50.4

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V. RESULT

5.1 Result

As can be seen above that the Efficiency of DASC increases du to increase in thermal conductivity of HTF when water is replaced by NF and increases with the concentration of NPs. Also, in the above given figure the Efficiency of Air as HTF is higher than NF. Although it is misleading but this is a result of changed mass flow rate and the Greenhouse effect.

In the experiment it was found that the efficiency is increased noticeably when NF is used. The increase in efficiency was on an average 3-4%.

The graph for efficiency under various HTF is given below:-

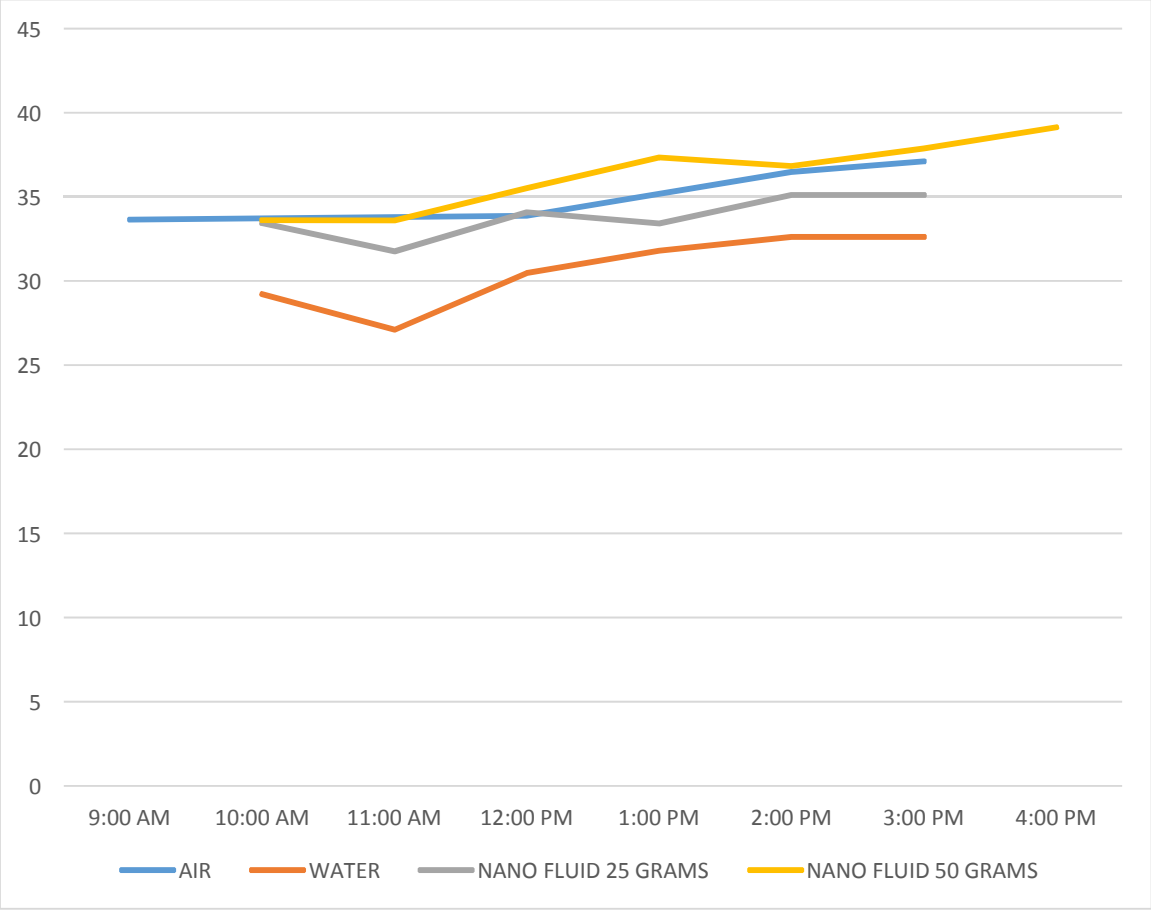

Fig 5.1 The graph for efficiency under various HTF Results

VI. CONCLUSION

6.1 Conclusion

An experimental study was performed to bring out the factors by which the thermal conductivity of NF can be increased. The NP used in the present study are ZrO2 it is shown that there is rise in conductivity of water with particle volume fraction. The presence increases the stability and circulation will prevent the deposition of sedimentation within the water. The decrease in size of NP will increase the conductivity of water which is attributed to increased surface area. The efficiency of DASC is increased upto 3-4%.

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