International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Experimental Study of the Performance of Automobile Radiator Heat Transfer by Using Different Coolants

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ABSTRACT

The performance of its vehicles is something that the automobile industry is continuously working to enhance. The demands on the engine cooling module in terms of the amount of heat they must disperse have increased as automotive engines become more potent and compact. Teenagers especially enjoy off-roading, and the range of cars available grows as technology advances. Designing cooling systems and enhancing their performance are consequently taking on greater significance. Automobile producers also strive to lower the vehicle's aerodynamic drag, which, among other things, improves fuel economy. As a result, automakers have worked to reduce the amount of cooling air intakes and air passing through the radiator core.Vehicle radiators frequently employ cross-flow heat exchangers made of aluminium. It is quite challenging to raise the size of the heat exchangers (HEXs) situated in the front of the cars because of the rising power requirements and the constrained inside space. Through this experimental investigation, we hope to learn how various coolant flow parameters impact the overall heat transfer performance of a Maruti Suzuki radiator. The addition of other additives to clean water enables a thorough examination of the variation. It has been demonstrated that ethylene or propylene-based glycol lowers the coolant's freezing point while raising its boiling point. Our radiator needs both of these qualities in order to function properly under difficult conditions. You can alter the volume of glycol in pure water.

Keywords – Heat transfer, Radiator, Coolant, Thermal conductivity

INTRODUCTION

The automotive industry is one of the most significant economic sectors undergoing quick technological change. We expect our cars to operate smoothly and promptly now more than ever. Design adjustment is therefore required. A vehicle's weight must be kept to a minimum to go more quickly. Various attempts are made, such as modifying the chassis's material, creating a lighter engine, and putting into place every other imaginable safety precaution. Cooling is the primary issue that arises at high speeds. The large capacity engines run so quickly that they become warm very quickly. In order to keep the engine running for a longer period of time without breaking down, an appropriate cooling system must be constructed.It must be large enough to lower the engine temperature to acceptable safe operating ranges. Coolants are essential parts of liquid cooling systems because they can change how much heat is transmitted, how well it transfers heat, and how much overall pumping power is required. Smaller cooling systems could result from this, which would ultimately mean lower costs and weight—two things that are urgently needed and widely sought.

OBJECTIVES

The main objectives in this research work are

1. . To investigate how various coolants differ from one another in terms of how they transmit heat.
2. To examine the same coolant's heat transfer characteristics at varied coolant mass flow rates.
3. Examine the characteristics of heat transfer by altering the coolant's makeup. i.e., by boosting the composition of the glycol's ethylene and propylene glycol volumes.

METHODOLOGY

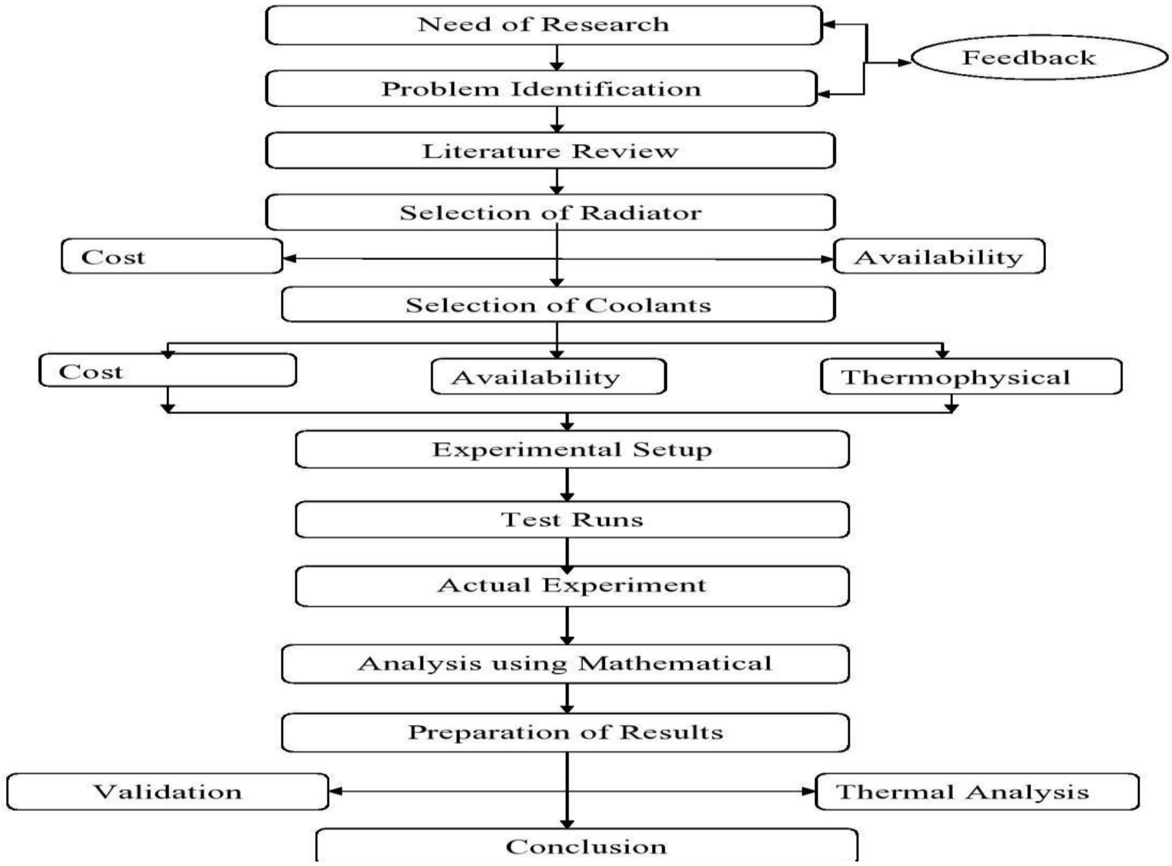


Figure3.1:Schematic diagram for the methodology adopted

EXPERIMENTAL SET UP

The heat exchanger in our experiment is an automobile radiator. The back has a pull-type fan available. To heat the coolant, we require a heating element or reservoir. To move the coolant through the radiator circuit, a pump is offered. To finish the circuit, pipes are fitted. The fan is powered by a battery, an outside power source (DC in nature). The heating element and the pump are both powered by an AC power supply. At the radiator's coolant entrance and outlet, two thermocouples are installed. A multipoint temperature controller is used to determine the corresponding inlet and exit temperatures. Following are the main components used in our experimental setup

1. Radiator and fan Assembly
2. Heating element and reservoir
3. Circulatory Pump
4. Thermocouples
5. Temperature sensor and controller
6. Battery
7. Pipes for circuit

RESULT AND ANALYSIS

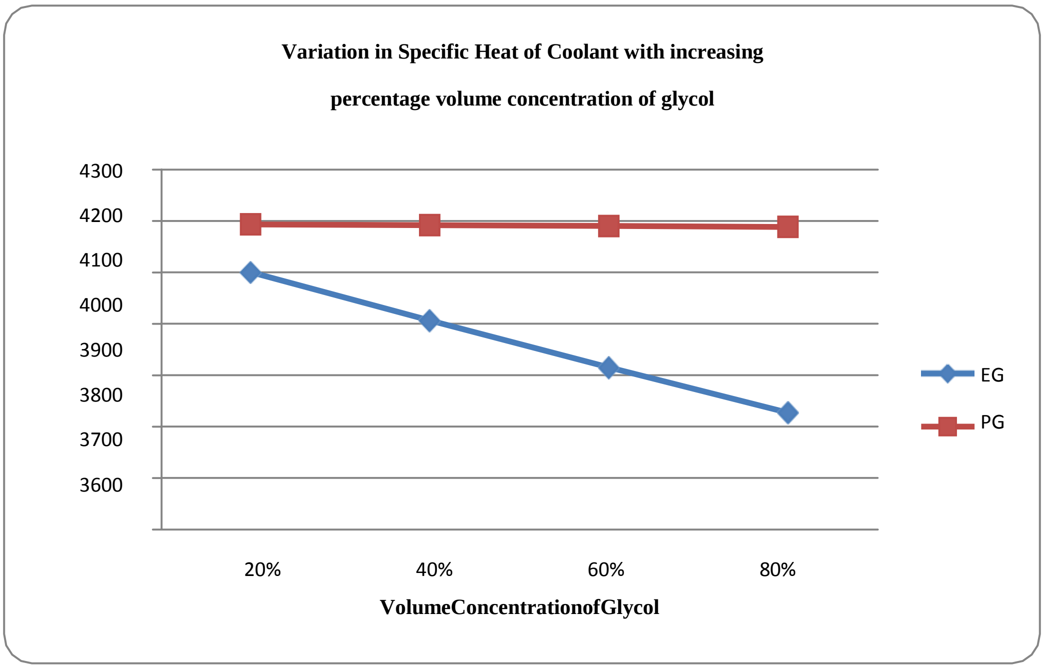
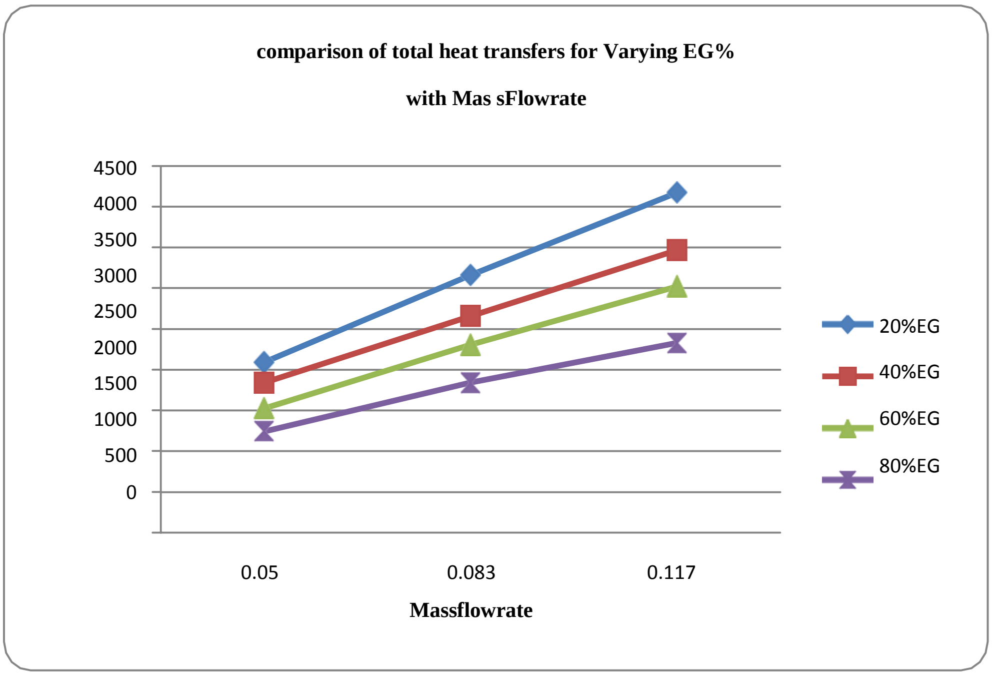
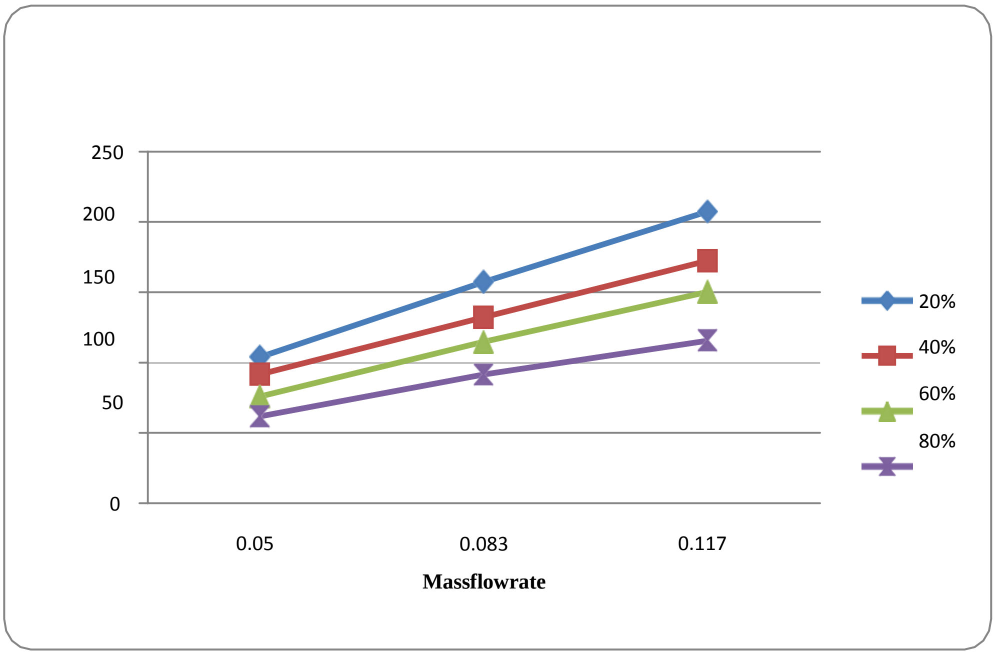


Figure 5.1 Variation in Specific Heat with Percentage Volume Concentration of Glycol

Comparison of total heat transfers for Varying EG % with Mass Flow rate



Comparison for overall heat transfer coefficient for varying EG% with mass flow rate



CONCLUSION

In our experiment we kept the Coolant inlet temperature at a constant value of 85°C also the air mass flow rate was kept constant.

From our study we can conclude that: -

- By varying the coolant mass flow rate, the total heat transfer can be varied. The heat transferred and mass flow rate holds a linear relationship i.e. by increasing the coolant mass flow rate the heat transfer increases and vice a versa.
- By varying the Coolant Reynolds number, a linear variation in heat transfer is observed
- i.e. for higher Reynolds number the heat transfer is higher.
- At same mass flow rate, as the volume percentage of glycol (Ethylene Glycol and Propylene Glycol) increases the heat transfer decreases.
- At constant volume concentration the heat transfer rate increases with increasing mass flow rate.

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