International Journal of Research Publication and Reviews

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

Heat Transfer Study in Automobile Radiator

Amit Udaypuray[1], *Amit Soni*[2]

[1]PG scholar, Department of Mechanical Engineering, SAGE University,Indore
[2] Assistant Professor, Department of Mechanical Engineering, SAGE University, Indore

ABSTRACT

The automotive industry is constantly attempting to improve the performance of its vehicles. Automotive engines are becoming more powerful and compact, which has raised the demands placed on the engine cooling module in terms of the amount of heat they must dissipate. Additionally, as technology develops, the variety of cars increases, and teenagers have a special interest in off-roading. As a result, designing cooling systems and improving their performance are becoming more and more important. Automobile manufacturers also work to reduce the aerodynamic drag of the vehicle, which, among other things, increases fuel efficiency. Automakers have therefore made an effort to cut back on the volume of cooling air intakes and air travelling through the radiator core.Aluminium cross-flow heat exchangers are often used in vehicle radiators. Due to the increasing power requirements and the limited inside space, it is extremely difficult to increase the size of the heat exchangers (HEXs) found in the front of the cars. In this experimental inquiry, we wish to find out how different coolant flow parameters affect a Maruti Suzuki radiator's total heat transfer performance. The introduction of additional additives in pure water allows for a full analysis of the variation. Glycol—ethylene or propylene—has been shown to lower the coolant's freezing point while enhancing its boiling point. We require both of these properties for our radiator to operate properly in challenging circumstances. Glycol volume in pure water can be changed.

Keywords – Heat transfer, Radiator, Coolant, Thermal conductivity

INTRODUCTION

One of the most important sector of the economy seeing rapid technological transformation is the automotive sector. More swiftly than ever, we want our cars to run smoothly and quickly. As a result, design modification is needed. For a vehicle to go more swiftly, the weight must be kept to a minimum. Various efforts are made, including changing the material of the chassis, developing a lighter engine, and implementing every other conceivable safety measures. The biggest problem that develops at high speeds is cooling. The big capacity engines operate so swiftly that they heat up quickly. A proper cooling system must be designed in order to keep the engine operating for a longer amount of time without malfunctioning. 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.

As was previously mentioned, water has excellent cooling properties on its own. However, even at higher pressures, water's freezing and boiling points do not change significantly, which is needed especially when operating in colder regions. For this reason, antifreeze is combined with water in northern regions to prevent coolant from freezing. Rusting is another issue that can occur with pure water. Anti-rusting compounds are used with water because it may result in the rusting of cooling system components.

PROBLEM IDENTIFICATION

There are several coolants available, better heat transfer is always desirable. However, the coolants have a tendency to either freeze or evaporate in excessively hot or cold areas, thus this problem needs to be resolved. Water used for cooling has strong heat transmission capabilities, but because its boiling point is near to operational temperatures, it evaporates quickly, reducing the volume of water circulating in each pass and necessitating frequent replenishment. Rusting is another issue that arises with water. We need to research the heat transfer performance for the coolant mixtures we use because additives used to combat evaporation or freezing problems frequently have a tendency to alter the thermophysical properties of the water-additive mixture.

OBJECTIVES

The main objectives in this research work are

1. To research how different coolants function and behave differently in terms of heat transmission.
2. To investigate the heat transfer properties of the same coolant at various coolant mass flow rates.

3. Investigate the features of heat transport by modifying the coolant's composition. i.e., by increasing the volume of both ethylene glycol and propylene glycol in the composition of the glycol.
4. To investigate how different coolant Reynolds numbers affect many aspects of heat transfer, including the efficiency, efficacy, and overall heat transfer.
5. To compare the heat transfer capabilities of coolants at the same mass flow rate.
6. To research how the composition of the coolant affects the variation in pumping power at the same mass flow rate.

SPECIFICATION OF RADIATOR

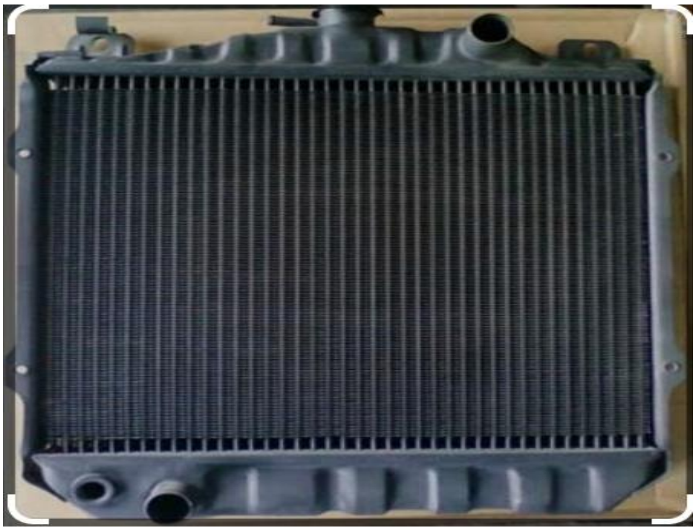
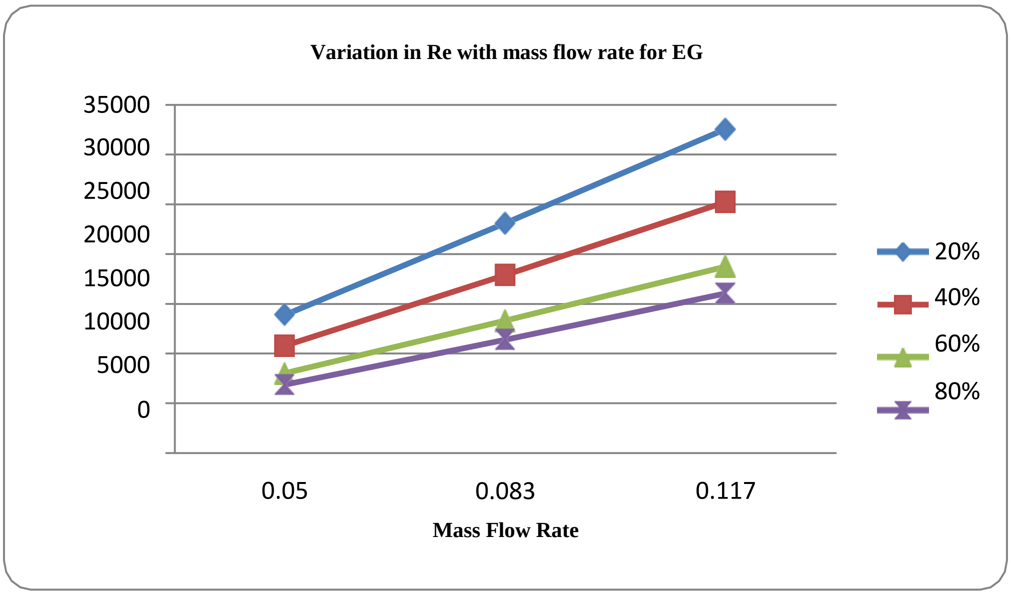


Figure 1.1 - Radiator

1.1: Physical dimensions of Radiator

Radiator type	Cross flow
Model and make	MarutiWagonR/Alto 800
Number of tubes	38
Outer diameter of tube	9.66 mm
Inner diameter of tubes	8.73 mm
Number of fins	177
Length of fin	13 mm
Thickness of fin	1 mm
Length of radiator	350 mm
Width of radiator	300 mm

EFFECT OF REYNOLD NUMBER ON HEAT TRANSFER



Effect of Reynold Number 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 andPropylene Glycol) increases the heat transfer decreases.
- At constant volume concentration the heat transfer rate increases with increasing massflow rate.

REFERENCES

1. Yasin Karagoz, Azade Attar, Altay Arbak , Saban Pusat."Heat transfer performance of sol-gel synthesized CuONP-doped coolant in diesel engines" Science direct 37 (2022) 102264.

2. Hatice Mercan , Furkan Sonmez, Ahmet Selim Dalkilic , Somchai Wongwises " Experimental comparison of heat transfer characteristics of Enhanced Truck Radiators" science direct 36 (2022) 102092

3. Yasin Karagoz, Azade Attar, Altay Arbak , Saban Pusat."Effect of Al2O3 addition to an internal combustion engine coolant on heat transfer performance" Science direct 31 (2022) 101847.

4. Beytullah Erdog , Ibrahim Zengin , Serdar Mert , Adnan Topuz , Tahsin Engin "The experimental study of the entropy generation and energy performance of nano-fluid flow for automotive radiators"Engineering Science and Technology, an International Journal 24 (2021) 655–664.

5. Khodani Sherrif T shivhiOluwole Daniel Makinde "Magneto-nanofluid coolants past heated shrinking/stretching surfaces: Dual solutions and stability analysis" Science direct 10 (2021) 100229.

6. Zhijun Wu Jingtao "A review of water-steam-assist technology in modern internal combustion engines " energy report 7 (2021) 5100 5118.

7. DanZhengJinWangZhanxiuChenJakovBaletaBengtSundén " performance analysis of plate heat exchanger using various nano fluids." International journal of heat and mass Volume 158, September 2020, 119993