Research Paper on Performance & Analysis of AL_2O_3 Nano-Fluid & Water in Radiator

Mengade Akshay[1] Mohite Amit[2] Patil Govind[3] Thorat Rohit[4] Prof. Kambale S. P.[5]
[1,2,3,4]Student [5]Professor
[1,2,3,4,5]SBPCOE, Indapur, India

Abstract— This project aim to increase the heat transfer rate of the coolant with the help of nano particles Al2O3). It further increases the efficiency of the radiator, coolant & the engine. The best proportion of flow rate and concentration of nano - particles (Al2O3) have been achieved to maximize the heat transfer rate of the coolant. Newly emerging technologies due to their compactness are not being effectively served by the conventional heat transfer fluids. To serve these emerging technologies, Nano fluids are found to be better alternatives to the conventional heat transfer fluids. The heat transfer enhancement for many industrial applications by adding solid Nano particles to liquids is significant topics in the last few years. In this Paper, an attempt is made to review literature related to radiator effectiveness and its efficiency improvement techniques. Finely good technique is selected for further study. it is observed that by adding nano-sized particles to the coolant fluid in radiator, one can significantly reduce its output temperature. In addition, it has been demonstrated that by adding 5% of nano-particles to the coolant fluid, thermal performance of the radiator in a hot weather of 50˚ C can be better than its performance in the weather of 20˚C.

Key words: Radiator Effectiveness, Nanofluids, Efficiency improvement techniques

I. INTRODUCTION

Nowadays, the problem of engine overheating is one of the major drawbacks in the engine. If the coolant level falls below the normal then engines tends to fail due to improper cooling and hence resulting in knocking & pre-ignition of fuel. To overcome this problem the heat in the engine needs to be dissipated and the thermal conductivity of the coolant plays an important role in dissipating the heat produced by the engine. Radiator is the element responsible for the circulation of the coolant in the engine. By using nano-particles in the coolant, the problems faced by the engine due to low level of the coolant hence resulting in overheating are eliminated. Moreover the size of the radiator can be decreased and also helps in decreasing the cost of the vehicle. Technical improvement in car industries has augmented the need for engines with high efficiencies. High efficiency of an engine is not only dependent on its function, but also it relies on the optimal fuel consumption and lower production of pollution. Reducing the weight of a car with optimal design of its radiator is a necessity for ecological systems. Adding fins is one of the ways to increase the rate of cooling in automobile radiators, in which more amounts of surface for heat transfer is created and convection heat transfer of air can enhance. Nonetheless, this method has been the subject of study of many researchers in the past and has almost reached its limit. One of the other proposed ways to increase the rate of heat transfer in automobile radiators is the employment of a coolant fluid with high conductivity coefficient or augmentation of the conductivity in a common coolant fluid.

II. WORKING

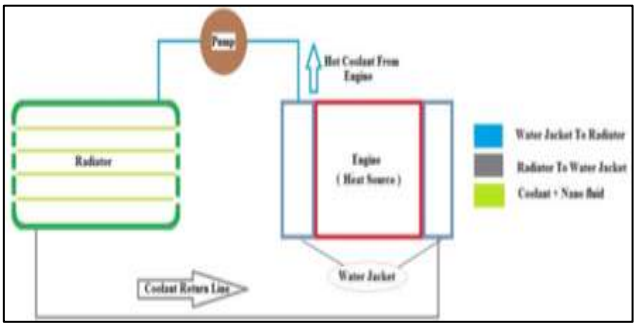

Fig. 1:

The water is heated by the heater and the pump circulates water in the setup. There is gradual increase in temperature of water in the setup which is indicated on the temperature sensor. There is heat transfer between the system and the surrounding by natural convection. When the radiator fan is switched on, there is forced convection between system and the surrounding i.e. there is increased heat transfer rate. The fins of the radiator also play an important role to increase the heat transfer rate of the radiator. The coolant flows from the inlet to the outlet through many tubes mounted in a parallel arrangement in radiator. The fins conduct the heat from the tubes and transfer it to the air flowing through the radiator. The tubes have a type of fin inserted into them called a turbulator, which increases the turbulence of the fluid flowing through the tubes.

If the fluid flows very smoothly through the tubes, only the fluid actually touching the tubes would be cooled directly. The amount of heat transferred to the tubes from the fluid running through them depends on the difference in temperature between the tube and the fluid touching it. So if the fluid that is in contact with the tube cools down quickly, less heat will be transferred. By creating turbulence inside the tube, all of the fluid mixes together, keeping the temperature of the fluid touching the tubes up so that more heat can be extracted, and all of the fluid inside the tube is used effectively. The air inlet and outlet temperature, water inlet and outlet temperature are observed and calculations are carried out.

III. ADVANTAGES

- Increases the efficiency of the radiator.
- Achieve maximum heat transfer rate of the coolant.
- Reduces the size of the radiator.
- Reduce the weight of vehicle.
- Reduces the cost of raditor.

IV. DISADVANTAGES

- Because of Al2O3, the corrosion in the radiator is takes place.
- High production cost of nanofluid.

V. PROBLEM STATEMENT

We intend to reduce the size of the radiator using nano particles. Reducing radiator size hence reducing fuel consumption and higher efficiency. Improve heat transfer capacity of Radiator. Nano-fluids in car radiator will increase heat transfer of the engine. The performance comparison will be made between pure water or ethylene glycol and Nano-fluids tested in an automotive radiator.

VI. OBJECTIVE

An engine coolant is mixture of ethylene glycol and water in various ratios like 30:70, 40:60 and 50:50 respectively are mostly used in auto-mobiles. Water and ethylene glycol as conventional coolants have been widely used in an automotive car radiator for many years. These heat transfer fluids offer low thermal conductivity. An innovative way of improving the heat transfer performance of common fluids is to suspend various types of small solid particles (metallic, nonmetallic and polymeric particles) in conventional fluids to form colloidal. However, suspended particles of the order of μm or even mm may cause some severe problems in the flow channels like; increased pressure drop, quickly settling of particles suspension, erosion etc.

VII. LITERATURE REVIEW

A. Wang et al.

reviewed summarizes recent research on fluid flow and heat transfer characteristics of Nano fluids in forced and free convection flows and identifies opportunities for future research. Among the nano particle, alumina (Al2O3) is one of the most common and inexpensive nano particle used by many researchers in their experimental investigations.

B. Nasiruddin et al.

Presented heat transfer enhancement in a heat exchanger tube by installing a baffle. The effect of baffle size and orientation on the heat transfer enhancement was studied in detail. Three different baffle arrangements were considered. The results show that for the vertical baffle, an increase in the baffle height causes a substantial increase in the Nusselt number.

C. N. Umeda, M. Takahashi

They investigated Numerical analysis for heat transfer enhancement of a lithium flow under a transverse magnetic field. A laminar lithium flow in a conducting rectangular channel in the presence of a transverse magnetic field was analyzed numerically, and they obtained conclusions that, the jets appeared adjacent to side walls that were parallel to the direction of an applied magnetic field

VIII. METHODOLOGY

We will be using car Radiator and will be using Al2O3 Nano-fluid as a coolant. The Nano -fluid will be prepared by two step method or one step method. Nano-fluid is prepared by mixing Nano particles in water in different compositions. Later performances of the Radiator are tested with water, ethylene glycol and Al2O3as coolant. Comparison will be made between coolant flow rates and temperature difference, coolant flow rates and average heat transfer, coolant flow rates and effectiveness, time and temperature difference, time and average heat transfer.

IX. SCOPE OF WORK

In recent years, with the advancement in nanotechnology, it has been become possible to produce suspension of nano particles based suspensions, called nano-fluids. Nano-fluid term was first introduced by Choi in 1995 at the Argonne National Laboratory. The ultrafine nano particles are normally smaller than 100 nm and have remarkably higher thermal conductivity than base liquids. Various Researchers expect that these fluids may offer higher thermal conductivity compared to that of conventional coolants. Major properties of nano-fluids make it suitable to be used in Radiator coolant one already seen is high thermal conductivity, low viscosity, high convective heat transfer coefficient, high area per unit volume.

X. CONCLUSION

From Literature Review it is observed that, by using Different Technics We can improve the radiator effectiveness using twisted tape inserts, by using Nano fluids etc. Nano Fluids can be used to improve the heat exchanger effectiveness with mixing the conventional lubricants in different percentage. Nano Fluids have high surface area therefore it gives more heat transfer surface between particles and fluids.

REFERENCE

[1] Das S.K., Putra N., Peter T., Roetzel W., "Temperature dependence of thermal conductivity enhancement for Nano fluids", Journal of Heat Transfer, Vol. 125, (2003), 567-574.
[2] Wang X.Q., Mujumdar A.S., "Heat transfer characteristics of Nano fluids – a review", International Journal of Thermal Sciences, 46, (2007), 1-19.
[3] Nasiruddin, M.H. Kamran Siddiqui., "Heat transfer augmentation in a heat exchanger tube using a baffle", International Journal of Heat and Fluid Flow, Volume 28, Issue 2, April 2007, Pages 318-328.
[4] S.M. Peyghambarzadeh, S.H. Hashemabadi, M. Seifi Jamnani, S.M. Hoseini., "Improving the cooling performance of automobile radiator with Al2O3/water Nano fluid", Applied Thermal Engineering, Volume 31, Issue 10, July 2011, Pages 1833-183

