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ANALYSIS OF AUTOMOBILE RADIATOR-A REVIEW

Vishal Bhuria
Dept. Of Mechanical Engg.
GVIET, BANUR, PUNJAB

Shashank Shekhar
Dept. of Mechanical Engg.
GVIET, BANUR, PUNJAB

Ramesh Kumar Soni
Dept.of Mechanical Engg.
GVIET, BANUR, PUNJAB

Abstract—Automobile radiator carried out the unusual heat generated during the engine performance. The radiator governs the surface of engine at a temperature to generate an optimum efficiency .The recent evolution and progression in an engine cooling system to develop new technique to improve the performance efficiency of the radiator .The technique also reduce the environmental pollution and fuel intake .This paper give an idea about the fuel intake and pollution reduction approaches. Computational fluid dynamics and numeral analysis for the improving the efficiency is basically focus in this review paper by the help of various research papers.

Key words: **-computational fluid dynamics, Cooling System, Radiator, coolant**.

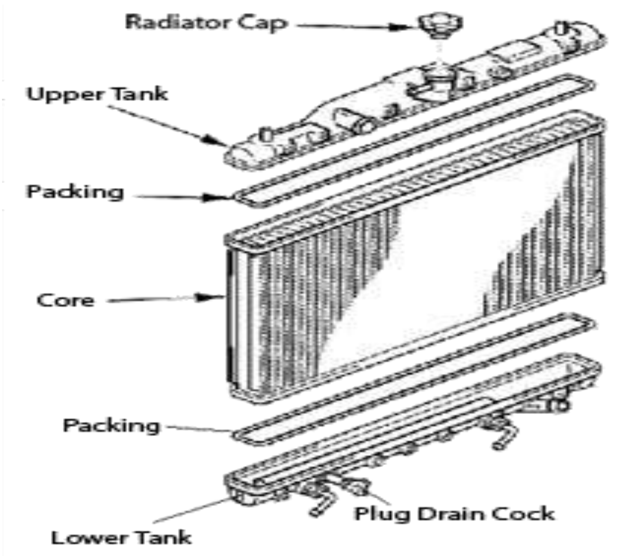
I. INTRODUCTION

Automobile radiators are basically the heat exchanger which are used to transfer unusual heat from one medium to another for the purpose of cooling or heating if radiator perform desirably if they work in the system properly. They are basically applied for the cooling purpose in automotive engine, aircraft, rail engine, spacecraft, and various other machinery. The machine cooled by radiator water or some other fluid called coolant to cold and circulate around the machine component to being cooled. The hot surface loose the heat which fluid circulate around it commonly water pump or some other external force is applied to circulate the fluid for the better performance.

II. LITERATURE SURVEY

Yiding Cao and KhokiatKengskool[1]had presented use of heat pipe in automobile engine in this heat pipe work integrated into the automobile radiator of the engine to increase the heat transfer ratio by the use of heat pipe cooling load on the radiator can be increased and the power expenditure of the fan can be minimised with the increased in the efficiency two phased closed the thermo siphon which is used as a heat pipe which are hundreds of times higher efficiency than that of other conventional material like copper for the tellurious application of the gravity was used to draw back the condunsate fluid and no temper structure was required inside the pipe used for carry heat small quantity of working of fluid was filled in a tube or other type of system contain the fluid .Air was evacuated from the system having fluid and it was sealed .

The fluid is vaporised due to the applied heat. After this the vapour than move from hotter portion due to the high vapour pressure to the colder section of the heat pipe where it has to be condense. The fluid condensed and returned to the evaporator portion from the condenser portion under the influence of gravity.



This study adopt an alumina (Al_2O_3) and titanium (TiO_2) Nano-coolant to raise the heat looseness performance of an air-cooled radiator. The two-step deduction method is used to produce different immersion of Al_2O_3 and TiO_2/water (W) Nano fluid by using a 0.2 wt. % chitosan dispersant, and the Nano fluid is mixed with ethylene glycol (EG) at a 1:1 volume ratio to form NC1 to NC6(Nano Coolant). The experiments were conducted to measure the thermal conductivity, viscosity, and specific heat of the NC with different concentrations of nanoparticles and sample temperatures, and then the NC was used in an air-cooled radiator to evaluate its heat dissipation capacity, pressure drop, and pumping power under different volumetric flow rates and heating temperatures. The experimental results show that the heat dissipation capacity and the EF of NC are higher than EG/W, and that the TiO_2 NC are higher than Al_2O_3 NC in most of the experimental data. The enhanced percentage of the average EF increases as the concentration and volumetric flow rate of the TiO2 NC increases. In this research, the overall heat transfer coefficient of CuO /water Nano fluids is investigated experimentally under laminar flow regime (100 _ Re _ 1000) in a car radiator. The stability of all the nano fluid in this experiment is carried with the variation of pH and use of best suited wetter. By the help of this experiment it is showed that how overall heat transfer coefficient is greater than the base fluid .The overall heat transfer coefficient increase with the increase in the nano fluid density from 0 to 0.4%.The overall heat transfer coefficient decreases with the increase in the inlet of nano fluid temperature from 50-80degree Celsius.

In this article, the experimental overall heat transfer the experimental overall heat transfer coefficient in the automobile radiator has been measured using CuO/water nano fluid concentrations and several inlet temperatures of the liquid. Also the results have been statically analysed using taguchi method. The use of "Nano fluids" have been developed and these fluids offer higher heat transfer properties compared to that of conventional automotive engine coolants. Energetic analyses as well as theoretical performance analyses of the flat fin tube automotive radiator using nano fluids as coolants have been done to study its performance improvement. Effects of various operating parameters using Cu, SiC, and AlO and TiO nano fluids with 80% water-20% ethylene glycol as a base fluid as coolant in radiator improves the effectiveness, cooling capacity with the reduction in pumping power. Sic-80% HO-20% EG (base fluid) yields best performance in radiator having plate fin geometry followed by AlO base fluid , TiO base fluid and Cu base fluid. The maximum cooling improvement for SiC is 18.36%, whereas that for AlO is 17.39%, for TiO is 17.05% and for Cu is 13.41% as coolants. Present study reveals that the nano fluids may effectively use as coolant in automotive radiators to improve the performance. The cooling properties of a locally formulated coolant (sample c) vis-à-vis, its boiling characteristics and specific heat capacity were investigated alongside with a common coolant-water (as sample A) and a commercial coolant (sample B). The result of the investigation showed that sample C gave the best performance compared to the other two samples A and B: the boiling point of sample C was 110 C, sample A 100C, and sample B 101 C. This means that the possibility of a boil-out of sample C from the radiator is little compared to sample A and B. Also, for the same quality of coolant more heat would required to raise sample C to its boiling point than for samples A and B. In other words, better cooling would be achieved using sample traditionally forced convection heat transfer in a car radiator is performed to cool circulating fluid which consisted of water or a mixture of water and anti-freezing materials like ethylene glycol (EG). In this paper the heat transfer performance of pure water and pure EG has been compared with their binary mixtures. Furthermore, different amounts of AlO nano particles have been added into these base fluids and its effects on the heat transfer performance of the car radiator have been determined experimentally. Liquid flow rate has been changed in the range of 2-6 per minute and the fluid inlet temperature has been changed for all the experiments. The result demonstrate that nano fluids clearly enhanced heat transfer compared to their own base fluid. In the best condition , the heat transfer enhancement of about 40% compared to the base fluid has been recorded. The heat transfer performance of the automobile radiator is evaluated experimentally by calculating the overall heat transfer coefficient (U) according to the conventional E-NTU technique. Copper oxide (CuO) and Iron oxide (FeO) nanoparticles are added to the water at three concentration 0.15, 0.4, and0.65 vol. % with considering the best pH for longer stability. In these experiments, the liquid side REYNOLDS number is varied in the range of – and the inlet liquid to the radiator has a constant temperature which is changed 50, 65 and 80 C. The effect of these variables on the overall heat transfer coefficient are deeply investigated.

- Nano fluids showed greater heat transfer performance comparing with water.
- Increase liquid and air re increase to overall heat transfer coefficient.
- Increasing the inlet temperatur decreases the overall heat transfer coefficient.

An investigation on the heat transfer potential and rheological characteristics of copper-titania hybride nano fluids using a tube in the tube type container flow heat exchanger. The nano fluids were prepared by dispering the surface functionalized and crystalline copper-titania hybrid nano composite in the base fluid, with volume concentrations ranging form 0.1% to 2.0%. The surface functionalized and highly crystalline nature of hybride nano composite have contributed to the creation of effective thermal interfaces with the fluid medium, thereby enabling the achivement of achiving improved the thermal conductivity and heat transfer potential of nano fluids. The effective thermal conductivity and diffusion kinetics of hybride nano compositye in the fluid medium paved the way for the improved heat transfer characteristics of hybride nano fluid. The heat transfer relations between airflow and nano fluid coolant have been obtained to evaluate local convective and overall heat transfer coefficients and also pumping power for nano fluid flowing in the radiator with a given heat exchange capacity. In the prasent study, the effect of the nano fluid in the different volume concentrations on the radiator performance are also investigated. The overall heat transfer coefficient of nano fluid is greater than that of water alone and therefore the total heat transfer area of the radiator can be reduce. However, the considerable increase in associated pumping power may impose some limitations on the efficient use of use this type of nano fluid in automotive diesel engine radiators. The graph of heat transfer performance vs coolant flow is shown as.

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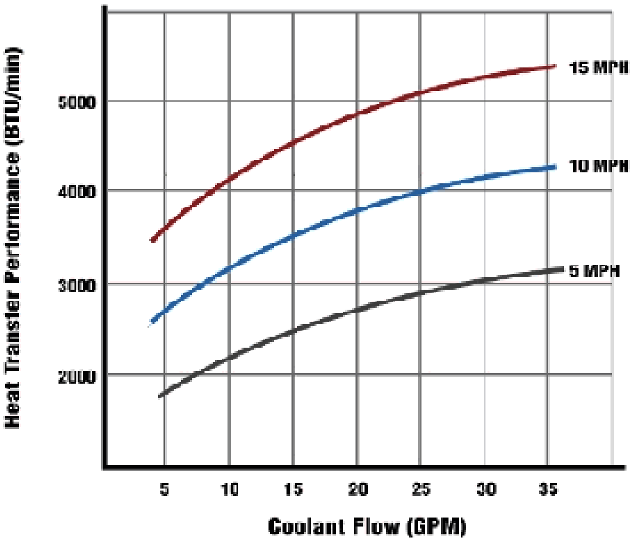

A magnetic nano fluid was prepared by dispersing magnetic Ni nanoparticle in distilled water. The nanoparticles were synthesized by chemical co-precipitation method and characterized by X-ray diffraction and atomic force microscopy. The average particle size was measured by the dynamic light scattering method. Thermal conductivity and absolute viscosity of the nano fluid were experimentally determined as a function of particle concentration and temperature. In addition, the nusselt number and friction factor were experimentally estimated as a function of particle concentration and Reynolds number for constant heat flux condition in forced convection appratus with no phase change of the nano fluid flowing in a tube. The experiments were conducted for a particle concentration range from 0% to 0.6%. The result indicate that both nusselt number and friction factor of the nano fluid increase with increasing particle volume concentration and Reynolds number. For 0.6% volume concentration, the enhancement of nusselt number and friction factor is 39.18% and 19.12%, respectively, as compared to distilled water under the same flow condition. It was verified the classical gnielinski and notter-rouse corrections under predict the nusselt number of the nano fluid; therefore , new generalize correction are proposed for the estimation of the nusselt number and friction based on the experimentally data. In this paper, forced convection heat transfer in a water based nano fluid has experimentally been compared to that of pure water in an automobile radiator. Five different concentration of nano fluids in the range of 0.1-1 vol % have been prepared by the addition of Al O nanoparticles into the water. A 3-dimensional steady-state numerical analysis was performed in a room heated by two-pannel radiators. Avirtual sitting manikin with real dimensions and physiological shape was added to the model of the room, and it was assumed that the mamikin surface were sabjected to constant temperature. Two different heat transfer coefficient for the outer wall and for the window were considered. Heat intractions between the human body surfaces and the room environment, the air flow, the temperature, the humidity, and the local heat transfer characteristics of the manikin and the room surfaces were computed numerically under different environmental condition. Comparisons of the results are presented and discussed. The result shows that energy consumption can be significantly reduced while increasing the thermal compfort by using better-insulated outer wall materials and windows.

III. CONCLUSIONS

From this literature survey we can conclude that automobile radiator cooling system is an important in any machinery of any type of engine. We can conclude some points such as-

- By the use of heat pipe the overall efficiency of radiator can be increased.
- Mass flow rate can be increase the effectiveness.
- By increasing the inlet temperature reduction in heat coefficient can be seen.
- Nano fluid in radiator can minimize the pumping power.
- Water along is a good coolant but the corrosion problem by the use of water make it avoidable.
- Particle concentration is important factor on which heat transfer behaviour depends. It also depends upon flow of condition and temperature.

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