A Review of Experimental Investigation on Measurement of Heat Recovery With Electrolux Refrigeration From C.I. Engine With Blending of Ethanol

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Abstract- *Now a day's Environmental pollution have a global issue. Uses of non renewable recourses are increase every day. So there are very important to reutilize energy of engine exhaust gases. In diesel engine there are 30 to 40% heat is converted in to the useful mechanical work; the remaining heat is expelled to the environment through exhaust gases and engine cooling system. There are various techniques used in reutilization of engine exhaust gases. But vapour absorption system is most effectively compared to other system. The average COP of the system is about 0.1-0.3.Electrolux refrigerator is practical application of vapour absorption system. If Engine exaust gases areprovided in to the generator of Electrolux refrigerator then mixture of ammonia and water is easily burn. And therefore exhaust gases is also reutilize for heating purpose in vapour absorption system.*

Keywords- Electrolux refrigerator, Heat recovery, IC engine

I. INTRODUCTION

It is well known that energy shortage and environmental pollution have become global issues of common concern. As the most widely used source of primary power for machinery critical to the transportation, construction and agricultural sectors, engine has consumed more than 60% of fossil oil. On the other hand, the amount of CO2 gas released from engine, just for transportation applications, makes up 25% of all human activity related CO2 emissions. Thus, energy conservation on engine is one of best ways to deal with these problems since it can improve the energy utilization efficiency of engine and reduces emissions.

Given the importance of increasing energy conversion efficiency for reducing both the fuel consumption and CO2 gas emissions of engine, scientists and engineers have done lots of successful research aimed to improve engine thermal efficiency, including supercharge, lean mixture combustion, etc. However, in all the energy saving technologies studied, engine exhaust heat recovery (EHR) is considered to be one of the most effective means and it has become a research hotspot recently.

II. DIESEL ENGINES

Improvement of fuel economy and reduction of exhaust gas and particulate emissions are key development items for automotive internal combustion engines. Diesel engines are typically more efficient than gasoline engines and therefore preferred for professional use like mail or food delivery operations where fuel economy is an important cost factor.

A diesel engine is an internal combustion engine which operates using the diesel cycle. Diesel engines have the highest thermal efficiency of any internal or external combustion engine, because of their compression ratio. Diesel engines are manufactured in two stroke and four stroke versions. The diesel internal combustion engine differs from the gasoline powered Otto cycle by using a higher compression of the air to ignite the fuel rather than using a spark plug for this reason it is known as compression ignition and the petrol engine is referred as spark ignition engine. In the diesel engine, only air is introduced into the combustion chamber. The air isthen compressed with a compression ratio typically between 15 and 22 resulting into a 40 bar pressure compared to 14 bar in the gasoline engine. This high compression heats the air to 550 °C. At about this moment (the exact moment is determined by the fuel injection timing of the fuel system), fuel is injected directly into the compressed air in the combustion chamber.

III. REFRIGERATION

The production of cold has applications in a considerable number of fields of human life, for example the food processing field, the air-conditioning sector, and the conservation of pharmaceutical products, etc. The conventional refrigeration cycles driven by traditional vapor compression in general contribute significantly in an opposite way to the concept of sustainable development. Two major problems have yet to bead dressed:

The global increasing consumption of limited primary energy: The traditional refrigeration cycles are driven by electricity or heat, which strongly increases the consumption of electricity and fossil energy. The International Institute of Refrigeration in Paris (IIF/ IIR) has estimated that approximately 15% of all the electricity produced in the whole world is employed for refrigeration and air-conditioning processes of various kinds, and the energy consumption for Air-conditioning systems has recently been estimated to 45% of the whole households and commercial buildings. Moreover, peak electricity demand during summer is being re-enforced by the propagation of air conditioning appliances.

The refrigerants used cause serious environmental problems: The traditional commercial, non-natural working fluids, like the chlorofluorocarbon (CFCs), the hydro chlorofluorocarbon (HCFCs) and the hydrofluocarbon (HFCs) result in both ozone depletion and/or global warming. Since the protocol of Montreal in 1987, international agreements have been signed to reduce the emissions of these refrigerants. European Commission Regulation 2037/2000, which has been implemented on 1 October 2000, treats the whole spectrum of control and phase-out schedule of all the ozone depleting substances. It is indicated that till 2015 all HCFCs will be banned for servicing and maintaining existing systems.

During recent years research aimed at the development of technologies that can offer reductions in energy consumption, peak electrical demand and energy costs without lowering the desired level of comfort conditions has intensified. By reason that absorption refrigeration technologies have the advantage of removing the majority of harmful effects of traditional refrigeration machines and that the peaks of requirements in cold coincide most of the time with the availability of the waste heat, the development of absorption refrigeration technologies became the worldwide focal point for concern again. Waste heat energy can be transformed either to electricity or to heat to power a refrigeration cycle. During the past decade, more interests have been paid to the waste heat-driven refrigeration technologies, especially absorption and adsorption systems.

The most common types of refrigeration systems are as follows:

(1) Vapor Compression Refrigeration (VCR)System
(2) Vapor Absorption Refrigeration (VAR) System

IV. ELECTROLUX REFRIGERATION SYSTEM

A single-pressure absorption refrigerator uses three substances: ammonia, hydrogen gas, and water. At standard atmospheric conditions, ammonia is a gas with a boiling point of -33°C. The system is pressurized to the point where the ammonia is liquid. The cycle is closed, with all hydrogen, water and ammonia collected and endlessly reused.

1. The cooling cycle starts with liquefied ammonia entering the evaporator at room temperature. The evaporated ammonia is mixed with hydrogen. The partial pressure of the hydrogen is used to regulate the total pressure, which in turn regulates the vapor pressure and thus the boiling point of the ammonia. As the ammonia boils in the evaporator, it pulls heat from the refrigerators interior and provides are the cooling is required in this system.

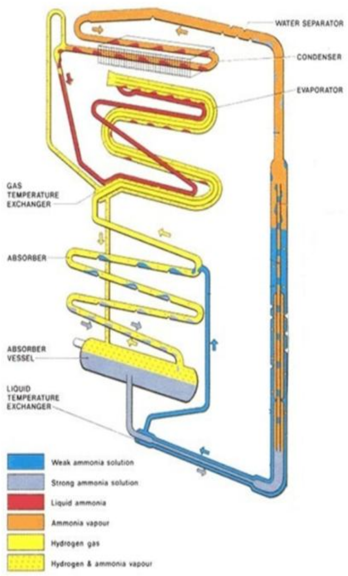

Figure 1 *Electrolux Refrigeration system*

V. LITERATURE REVIEW

Mageshwaran et al.(2016)have Development of Vapour absorption air conditioning system using engine exhaust gases. Here they take readings based on different load condition. The ultimate aim of this reserch is reducing fuel consumption of the vehicle by reducing the load on the engine by using the excess heat available in the exhaust gases and implementation the vapour absorption system for air conditioning.

Bhore et al.(2016) in this research paper they provide exhaust gases as a input of generator in vapour absorption system used foe air conditioning purpose. They take engine of maruti 800 3 cylinder engine. And working fuel as petrol. They noticed that large amount of low grade heat is available which can be recovered from the exhaust. Theoretically it is estimated to have COP of the system is 1.517 can be achieved.

Vakadevi et al(2015) In this paper they suggested different techniques for heat recovery from automobile engine. here there are one new technology compare to other. here engine radiator water is used for air-conditioning and refrigeration purpose.Here by using hot water there are running water absorption system. Here very large amount of heat 700^0 C and waste heat from coolant at about 120^0 C is used to run central air conditioning plant. other heat recovery system is common like organic rankine cycle.

Francesco baldi et al (2015) in this paper there are waste heat revory system from marine application is used. Here waste heat recovery is based on different thermal parameters of ship. Here take different parameters like mass flow rate, exergy analysis and entropy analysis is used. Here in this paper there are one type of case study is used for measurement of heat recovery from marine application. Here for analysis of waste heat recovery is used in vapour absorption system.

Bouazzaoui1 et al. (2014) in this paper they used two stage absorption cycle with disrobers by high temperature exhaust gases. Here they are used lithium bromide type vapour absorption system. Here they used two stage cycle that allows for the combined use of high and medium temperature waste heat of diesel engines to operate low temperature refrigeration cycle.

Alias Mohd Noor et al (2014) in this research paper they explained waste heat recovery techniques from turbo charged automotive engine.Here in this research paper they explained different techniques used in turbocharged engine for heat recovery. Here in this paper there are only review of different techniques is explained, there are no analysis is done based on different system.

John R Armsted et al(2014) in this paper they suggested different techniques for waste heat recovery from ic engine. Here common techniques are organic rankine cycle and thermoelectric generators. Here new things is that here suggested design of all parts related with thermo elcric generators and organic rankine cycle. Here they suggested combine diagram of organic rankine cycle and waste heat recovery cycle diagram.

Fredyvelez et al(2012) here in this research paper they checked technical,economical and market review of organic rankinecycle.here they checked different parameters in organic rankine cycle like working fluid energy sources etc. Because if any parameters is changed then it isdirectly affected to waste heat recovery. Here also in this research paper there are organic rankine cycle is used for different types of energy sources like solar geothermal,fuel and biomass is used for waste heat recovery in rankine cycle.

Amanhiraet all (2012) in this paper properties of biodiesel bled with diesel is checked. Fuel consumption of B-20 is lower than other fuel. BSFC is also lower compared to other fuel. Calorific value is almost same with diesel.CO percentage is lower compared to diesel. The HC temperature is depend upon exhaust temperature..

E.H.Wang et al (2011) in this paper they study about working fluid selection in rankine cycle based on waste heat recovery.here in this paper they checked different properties of working fluid based on their temperature, pressure, entropy and exergy. accordingly above parameters they selected appropriate fuel for organic rankie cycle. here they also generated computer map for thermal efficiency for different types of working fluid.

Loan E.Bell(2008) in this research paperthey explained different types of thermoelectric techniques for measurement of heat recovery. Here in this paper they explained practical thermoelectric device like p n junction. here also they explained thermoelectric cycle for heat recovery.

NubinM.Ribeiro et al(2007) in this paper they explained role of additives in Diesel. Generally by using ethanol blend there are no need to change in engine. And E-blends with 10% to 15% ethanol could reduce PM emissions by 20 to 27% and 30 to 41 % respectively. By increase percentage of Ethanol blend the brake –specific Fuel consumption and Brake thermal Efficiency Increase.

Nadal et al. (2003) in this paper they introduce different kinds of techniques which are used for heat recovery from IC engine Generally there are organic rankine cycle thermoelectric module are widely used. The all heat recovery system has their own benefits according to technical, economical and environmental aspect.

M Al Hasan et al (2002) in this research paper they check the engine performance and exhaust emission. Ethanol Addition results in an increase brake power, brake thermal efficiency, volumetric efficiency and fuel consumption. And also there is reduction in exhaust emission. The 20 % ethanol fuel blend gave the best result of the engine performance and exhaust emissions.

Lapuerta et al. (2001) in this paperthey check stability of diesel with ethanol blend. Their stability is mainly depend on temperature,water content and initial ethanol content. They take one experiment on mixture of diesel with ethanol blend.

Milkon et al. (2001) In this paper they suggested different kind of advance technologies used in heat recovery from engine. The advance technologies are Turbo compounding system, hermoelectricgenerators,Rankine cycle.

P Satge et al. (2000) in this research paper they providing different properties of ethanol blend with diesel engine. By using higher content ethanol blend pollutions and noise level is decreased. Ethanol blends with low Ethanol Content have little effect on the content of pollutant gases. A Mixture of 20% ethanol absolute ethanol was used in Diesel engine to demonstrate role of additives and also provide good combustion quality.

Ghivacs et al. (1999) in this paper they used organic rankine cycle in a passenger car for measurement of heat recovery. They conclude that combustion energy is much greater than the output power most of the operating region. At medium-high speed and medium high load the net power output of the combined system increased by 6-8 % generally organic rankine cycle is used for light duty vehicles.

Kumar et al. (1996) in this paper they used thermo electric generator for recovery of exhaust gases.it is very cheaper source to recover the engine exhaust gases. There are large temperature difference provide on both hot side ad cold size.Three different models of heat exchanger were modeled using CAD and their CFD analysis was done using FLUENT software. It was found that rectangular shaped TEG gave better results as compared to other two models. Rectangular model was then fabricated and tested on an engine dynamometer. The power produced by the TEG increased with the increase in power output of the engine. The temperature drop between the hot plate and the cold plate plays a major role in the working of the TEM.

Tianyou Wang et al (1994) In this paper Analysis of recoverable energy from light-duty gasoline engine.Herein this Experiment there are different operating conditions there is analysis of exhaust gases recovery using organic Rankine cycle.A new parameter, the recoverable exhaust energy efficiency which is actually the fraction of maximum recoverable exhaust energy in the total fuel energy is recommended for reflecting the effects of exhaust temperature and possible exhaust heat on EER efficiency under different engine operating conditions.

VI. CONCLUSION

Here by above all review we seen that there are large amount of heat is go in waste and Crete pollution in the environment. So it is most useful method to recover the heat of IC engine and used it to some useful purpose.

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