EFFECT OF PREHEATED FUEL ON I. C. ENGINE VARYING COMPRESSION RATIO– A REVIEW

Dhruval V Patel[1], A. R. Patel[2], Tushar Patel[3]

[1]*Student, Mechanical Department, LDRP-ITR, Gujarat, India*
[2]*Professor, Mechanical Department, LDRP-ITR, Gujarat, India*
[3]*Associate Professor, Mechanical Department, LDRP-ITR, Gujarat, India*

ABSTRACT

Diesel is very important in the field of automation and power plant. The exhorting advancements in future ought to upgrade technology with regards to power, gas economy and emission. Modified technology can improve the efficiency of engine run by diesel fuel. The gas inlet temperature also can effect in engine parameter. By preheating fuel technology, engine efficiency is improved. In the current literature review work, two sections are provided. One section give brief idea about modified preheating techniques and their effect on performance on ic engine. Second section covers importance of compression ratio on fuel consumption and efficiency of an engine. Through the literature survey it is clear that preheating regarding fuel is beneficial technology to further improve the overall performance and emission associated with an engine. Compression Ratio associated with an engine has important position on performance associated with an engine. Combine effect of preheating of fuel and variation compression ratio can make an i c engine more stable and more capable by which fuel consumption reduced. As the compression ratio increases, it will reduce CO and HC emission and increase NOx emission. Preheating increase BSFC and BTE of an engine which is beneficial to increase efficiency. To increase the fire point of fuel, mostly blends are used so that their fire point temperature increases but it reduces the efficiency. Optimum mixtures between inlet gas temperature and compression ratio can be find out to boost the overall performance and slow up the emission associated with an VCR engine. In this particular literature examine work, a diverse type of IC engines are covered.

Keyword: - *preheating of fuel, variable compression ratio, C I Engine, Efficiency, Emission Characteristics*

1. NOMENCLATURE

CR	Compression ratio
IT	injection timing
DI	direct injection
BTE	brake thermal efficiency
HCCI	homogeneous charge compression ignition
BMEP	brake mean effective pressure
EVC	exhaust valve closing
IVC	intake valve closing
ECR	effective compression ratio
MPRR	maximum pressure rise rate
ITHE	indicated thermal efficiency
HRR	heat release rate
ICP	in-cylinder pressure
UHC	unburned hydrocarbon
BSFC	brake specific fuel consumption
BTE	brake thermal efficiency
CPO	crude palm oil

2. EFFECT OF COMPRESSION RATIO ON PERFORMANCE AND EMISSION OF ENGINE

V ganamoorthi et al [1], When worked on 4 stroke single cylinder , naturaly aspirated DI engine using ethanol-diesel blend as fuel, he observed the effect of CR on thee ability of an enginne , its emission characteristics and combustion phenomenon. compression ratio is changed by changing the dimension of piston and keep the constant stroke volume.various CR like 17.5:1, 18.5:1 & 19.5:1 are considered for experimentation. E0, E10, E20, E30 and E40 blends are used in performance .it is found that the BTE is higher at higherload and max CR. The improvement in CR improves the capability of the engine and reduce the emission like HC,CO.

D.T Hountalas et al [2], developed the methodology for measurig the compression ratio of compression ignition engines.by performing the experimentation the effect of CR on the DI engine is estimated. The main purpose is to find out the perfect methodology which can use as a diagnostic tool to get the CR of an engine. as the CR effects the engine performance it is important to find a non-catastropicc method by which we get the idea of cylinder compression condition without affecting the cylinder. The results are reduction in maintenance cost. Three factors mainly affect the engine performance which are peak compression pressure, heat losses and initial pressure at inlet valve closure. From this study it is possible to find the condition of compression using measured cylinder pressure traces.

O. Laguitton et al [3], Observed the effect of CR on the exhaust emissions from CI engine. the engine used is single cylinder 4 stroke CI engine. The target was to find out technique by which engine exhaust NOx emission can be reduced to fill the target off Euro 6. For this cold start facility is used and evaluate the effect by decreasing the CR from 18.4 to 16. By reducing the CR or injection timing reduces the NOx emission and soots.

Mao-Bin Liu at al [4], Study the effect of air dilution and CR on performance of HCCI engine in which n-butanol is used as fuel. EVC and IVC timings are changed and fuel injection remain same and then HCCI operation was performed. To reduce the auto ignition effect of HCCI, the effect of ECR as well as effect of excess air was studied. Results shows that the air mixing and ECR reduction can retard the timing of auto-ignition and reduce MPRR. It increases the ITHE and reduce IVC timing temperature.

Cenk Sayin et al [5], Worked on the effect of CR on the performance capability off CI engine in which iso butenol was used as a fuel. Three different blends (E10, E30 and E50) were used during the performance. Constant speed of 2600 rpm was used. Results shows that BSFC, BTE & emissions like CO2 increases while UHC & CO decreased when increase the blending ratio at all CR. Best results were found at highest CRs. The ICP & HRR increases in blended fuel then the normal gasoline.

Bilap K Debnath et al [6], Analyed the the VCR effect on engine which run using palm oil methyl ester. The effect of CR and IT was analyed and exergy change of engine is observed. A single cylinder, DI, water cooled)vcr engine used for experimentation at rpm and BMEP which includes 4 CRs (16,17,17.5,18) and 3 IT(20,23,28) BTDC. Exergy analysis is carried out to find the available work, net available cooling water, destruction and entropy generation. as the CR increases , it will increase the availability and decrease the exergy destruction.

Mustafa Kemal Balki et al [7], Worked the VSR effect on the performance of a SI engine when fuel used were methanol, ethanol & unleaded gasoline. Various CRs(8:1, 8.5:1, 9:1, 9.5:1) were used at speed of 2400 rpm. BMEP, CGP, BTE BSFC were obtained by experimentation. When increases CR, CGP increases. Methanol was found more effective than unleaded gasoline.

3. EFFECT OF PREHEATING SYSTEMS ON PERFORMANCE AND EMISSION OF DIESEL ENGINE

Deepak Agarwwal et al [8], Analysed the performance characteristics of preheated jatropha oil blend in DI compression ignition engine. Vegetable oil and animal fats gives promising alternative of conventional fuels. They are able to reduce CO2 emission because of their higher viscosity and low volatility compare to conventional fuels. In this experiment preheating technique is used to reduce the viscosity of the jatropha oil

blend. various parameters like BSFC, CO, CO2, HC emissions were measured. From results it can be concluded that preheated jatropha oil blend gives same performance as diesel gives so it can be use as a alternative of diesel fuel.

S. Bari et al [9], Worked on preheating of CPO to increase the engine performance. CPO is a non conventional fuel and safe. at 30 C , density of CPO is 10times higher than the diesel fuel , so to reduce its viscosity preheating technique was used. To lower the viscosity to normal fuel, preheating of fuel upto 92 C is requied. Best efficiency was achieved by preheating the CPO to 60C which produce higher peak pressure of 6% and short delay of ignition. Emissions were higher than the diesel fuel.

Bhupendra Singh Chauhan et al [10], worked on performance enhancement of diesel engine by preheating technique while using jatropha oil as a fuel. The aim is to decrease the viscosity of fuel using EGR system. Shell and tube type heat exchanger was used to preheat the fuel before entering to the engine which reduce the viscosity of blend. From results it was conclude that preheated blend having high BTE and low BSEC. 80 C was found to be optimum for the jatropha oil use.

Sagar Pramodrao Kadu et al [11], Investigate the use of preheated neat karanja oil in CI engine. the engine used for experiment was 4 stroke , single cylinder CI engine by preheated blend from 30-100 C and speed between 1500-4000 rpm. Various parameters like brake power, thermal efficiency, BSFC, emissions were compared. Result shows that SFC was higher compared to diesel for all loads.

Hanbey Hazar et al [12], Investigate the the effect of preheated raw rapeseed oil diesel blend. Initially RRO was blended with diesel by 50% mix (O50). 20% oil – 80% diesel (O20) gives optimum results. Fuel was heated to 100C on the engine. Results showed that preheating of rapseed oil was lowers its viscosity and gives smooth flow.

A.K. Hossain et al [13], worked on the indirect injection CI engine which uses neat jatropha and karanj oil as fuel. Modifications were done on the cooling water circuit and fuel supply system such that jacket water was preheated. BSFC increases 3%, CO2 & NOx increases by 8%, as compared to diesel. From this it is concluded that the IDI compression ignition engine can be used with pure preheated jatropha oil by jacket water.

M. A. Kalam [14], Investigate the deposition characteristics and emission characteristics of and compression ignition engine which use preheated crude palm oil.CPO is mixed with the water immulsion(1%, 2%, 3%). Experiment was performed for 100 hours. From esults , it was concluded that NOx emission increases in emulsified fuel.

Murat Karabektas at al [15], Working on preheating of cottonseed blend on ability of an CI engine. COME was the combination of potassium hydroxide , cottonseed oil and methyl alcohol. engine used was single cylinder , 4 stroke DI compression ignition engine. Four temps(30, 60, 90, 120)C used for preheating. From the test data , BTE, BSFC were found. From the results it can be concluded that when we heated the blend upto 90 C it gives better results than normal conditions.

O.M.I Nwafor et al [16], Investigate the effect of preheated vegetable oil keeping speed constant. Indirect injection system was used. The main target was the fuel droplet size which leads to poor combustion. Objective was to increase viscosity and performance in under load condition.. high temperature and high speed affect the efficiency at higher level.

Can Cinar et al [17], Concentrate on the temperature of intake air on combustion and emission capability of engine. The engine used was HCCI engine having a blend of 20% n haptanne & 80% iso-octane. Temperature of intake manifold was increase from 40 C to 120 C. It runs on a constant speed of 1200 rpm. From experiment it was found that at 70 C temp, torque reduce by 3.1%. as the temp increase to 100 C emission ratio increases.

M. Pugaazhvadivu et al [18], Investigate the effect of waste frying oil when we use as fuel in CI engine. Preheating technique was used to reduce its viscosity. Various factors like density, viscosity, BSFC, flash point were collected by readings. From results it can be concluded that we have to preheat the blend upto 135 C to match the viscosity of diesel fuel at 30 C.

M. Senthil Kumar et al [19], working on the use of animal fat as a fuel by providing preheating technique to it. engine uses was direct injection engine having power of 2.8 kW and speed of 1500 rev/min. Various inlet temp

(30,40,50,60) were used in experiment. By preheating method the ignition delay was reduced and peak pressure found as high compared to diesel. From result it found that smoke density is reduced to KZ6.5 mKl. Preheating temp of 70.8 C was found to be optimum for animal fat.

4. EFFECT OF COMPRESSION RATIO ON PERFORMANCE AND EMISSION OF PREHEATED DIESEL BLEND.

S. Nagaraja et al [20], Investigate the CR effect on preheated blend. Palm oil diesel blend is used as a fuel. 5%, 10%, 15%, 20% blend is used with diesel. preheating upto 90 C giving efficiency near to diesel fuel. Various CR of 16:1, 17:1, 18:1, 19:1 and 20:1 is used for experimentation. From result it is found that O20 is found to give maximum efficiency ,BSFC,mech effi, brake power. The emission is reduced by increasing blending ratio. It having higher CO2 emision. CR 20:1 gives optimum result during high load.

5. CONCLUSION

From this paper it is concluded that preheating technique is effective to increase the efficiency and reduce the co and hc emission. By varying compression ratio, desire output can be . no work is done on the combine effect of preheating on vcr engine. So it is require to work on the combine effect of preheating technique and variable compression ratio on the performance of compression ignition engine.

6. REFERENCES

[1]. V. Gnanamoorthi, G. Devaradjane, "Effect of compression ratio on the performance, combustion and emission of DI diesel engine fueled with ethanol-Diesel blend" Journal of the Energy Institute(2014), p:1-8.

[2]. D.T. Hountalas, G.C. Mavropoulos, G. Kourbetis, "Experimental investigation to develop a methodology for estimating the compression condition of DI Diesel engines " Energy Conversion and Management 47 (2006) 1–18.

[3]. O. Laguitton, C. Crua, T. Cowell, M.R. Heikal, M.R. Gold, "The effect of compression ratio on exhaust emissions from a PCCI diesel engine", Energy Conversion and Management 48 (2007) 2918–2924.

[4]. Mao-Bin Liu, Bang-Quan He, Hua Zhao, "Effect of air dilution and effective compression ratio on the combustion characteristics of a HCCI (homogeneous charge compression ignition) engine fuelled with n-butanol", Energy (2015)1-8.

[5]. Cenk Sayin, Mustafa Kemal Balki, "Effect of compression ratio on the emission, performance and combustion characteristics of a gasoline engine fuelled with iso-butanol/gasoline blends" energy (2015) 1-6.

[6]. Biplab K. Debnath, Niranjan Sahoo, Ujjwal K. Saha, "Thermodynamic analysis of a variable compression ratio diesel engine running with palm oil methyl ester", Energy Conversion and Management 65 (2013) 147–154.

[7]. Mustafa Kemal Balki, Cenk Sayin, "The effect of compression ratio on the performance, emissions and combustion of an SI (spark ignition) engine fueled with pure ethanol, methanol and unleaded gasoline", Energy xxx (2014) 1-8

[8]. Deepak Agarwal, Avinash Kumar Agarwal, "Performance and emissions characteristics of Jatropha oil (preheated and blends) in a direct injection compression ignition engine", Applied Thermal Engineering 27 (2007) 2314–2323.

[9]. S. Bari, T.H. Lim, C.W. Yu, "Effects of preheating of crude palm oil (CPO) on injection system, performance and emission of a diesel engine", Renewable Energy 27 (2002) 339–351

[10]. Bhupendra Singh Chauhan , Naveen Kumar , Yong Du Jun , Kum Bae Lee," Performance and emission study of preheated Jatropha oil on medium capacity diesel engine", Energy 35 (2010) 2484e2492 42

[11]. Sagar Pramodrao Kadu, Rajendra H. Sarda, "Experimental Investigations on the Use of Preheated Neat Karanja Oil as Fuel in a Compression Ignition Engine", World Academy of Science, Engineering and Technology Vol:4 2010-12-24

[12]. Hanbey Hazar, Hüseyin Aydin, "Performance and emission evaluation of a CI engine fueled with preheated raw rapeseed oil (RRO)–diesel blends", Applied Energy 87 (2010) 786–790

[13]. A.K. Hossain, P.A. Davies, "Performance, emission and combustion characteristics of an indirect injection (IDI) multi-cylinder compression ignition (CI) engine operating on neat jatropha and karanj oils preheated by jacket water", biomass and bioenergy 46 (2012) 332-342
[14]. M.A. Kalam, H.H. Masjuki, "Emissions and deposit characteristics of a small diesel engine when operated on preheated crude palm oil", Biomass and Bioenergy 27 (2004) 289–297
[15]. Murat Karabektas, Gokhan Ergen, Murat Hosoz , "The effects of preheated cottonseed oil methyl ester on the performance and exhaust emissions of a diesel engine", Applied Thermal Engineering 28 (2008) 2136–2143
[16]. O.M.I. Nwafor, 'The effect of elevated fuel inlet temperature on performance of diesel engine running on neat vegetable oil at constant speed conditions", Renewable Energy 28 (2003) 171–181
[17]. Can Cinar , Ahmet Uyumaz, Hamit Solmaz, Fatih Sahin, Seyfi Polat, Emre Yilmaz, " Effects of intake air temperature on combustion, performance and emission characteristics of a HCCI engine fueled with the blends of 20% n-heptane and 80% isooctane fuels", Fuel Processing Technology 130 (2015) 275–281
[18]. M. Pugazhvadivua,*, K. Jeyachandran, "Investigations on the performance and exhaust emissions of a diesel engine using preheated waste frying oil as fuel", Renewable Energy 30 (2005) 2189–2202
[19]. M. Senthil Kumar, A. Kerihuel, J. Bellettre, M. Tazerout, "Experimental investigations on the use of preheated animal fat as fuel in a compression ignition engine", Renewable Energy 30 (2005) 1443–1456
[20]. S. Nagarajaa, K. Sooryaprakashb, R. Sudhakaran, "Investigate the Effect of Compression Ratio over the Performance and Emission Characteristics of Variable Compression Ratio Engine Fueled with Preheated Palm Oil - Diesel Blends", Procedia Earth and Planetary Science 11 (2015) 393 – 401