Performance and emission testing in CI engine using tri fuel

Prof. Dharmendra J. Patel [1], Singh Sachin kumar [2]

[1] *Asst. Pro., Department of Mechanical Engineering, government engineering college bhuj, gujrat,india*
[2] *M.E student, Department of Mechanical Engineering, government engineering college bhuj, gujrat,india*

ABSTRACT

Pollution from the petroleum oil increases day by day in terms of CO2, CO, NOX, PM and many other gases and particles. Price difference and economy leads people toward the use of alternative fuels. To overcome this problem Tri-fuel is the best suitable fuel for the IC engine because of its clean emission characteristics. It is found that power produced by the Tri-fuelled engine is more and lower NOx emissions compare to Gasoline engine because of the high volumetric efficiency, high compression ratio.

Keyword *Diesel , Jatropha , Lpg, Tri Fuels, CI Engine, Emission, Performance*

1. INTRODUCTION

The use of fossil fuel is increasing drastically due to its consumption in all consumer activities. The high utility of fossil fuel depleted its existence, degraded the environment and led to reduction in underground carbon resources. Hence the search for alternative fuels is paying attention for making, sustainable development, energy conservation, efficiency and environmental preservation, has become highly pronounced now a days. The worldwide reduction of underground carbon resources can be substituted by the bio-fuels. The SI and CI engines are the major contributors of the GHG. The main researchers around the world are finding the alternate fuel that should have the least impact on the environmental degradation. Rudolf Diesel patented an engine design for used dual fuel system. The present fuel system involves the adaptation of Rudolf with diesel as a single fuel. The emission of NOX is unavoidable in fuel combustion systems. An attempt has been made to develop a tri fuel system without additives in conventional C.I engines to achieve biofuel and to reduce emission of Pollutants.

2. NEED OF THE EXPERIMENT

Amidst ever drop off fuel resources and constantly increasing air pollution, the fundamental sustainability of present energy system has been put into question. The present reserve of Petroleum products is slowly empty out, widening the gap between global energy supply and energy consumption. As per 2009, energy used on a global scale is about 152.3 Terawatt-Hour, which is about 39% higher than that of 1990. further, in order to meet the stringent EURO VI standards, automobile maker are compelled to try out emission, more precisely NO_x and smoke reducing alternatives like LPG, Jatropha etc. As a result a lot of the research studies are now oriented toward finding a cleaner burning fuel with satisfactory combustion and performance signatures

I am doing level best to develop a tri fuel system in conventional C.I. engine to increasing the performance and to reduce emission of pollutants.

Finally I have decided to use following fuel as a tri-fuel in engine to increase the performance and reducing the emission of an engine

1) DIESEL

2) JATROPHA

3) LPG

2.1. OBJECTIVE OF EXPERIMENT

- ✓ Modification of a single cylinder diesel engine in to tri- fuelled C.I engine has been performed with the intention of reducing harmful emission.
- ✓ Much lower particulate matter (PM),
- ✓ Lower gaseous pollutants like CO_2, HC, CO, NOx,
- ✓ Lower the smoke emission level,
- ✓ Lower engine operating noise,
- ✓ To carry out emission and performance tests of single cylinder C.I engine and compare with modified single cylinder tri-fuelled C.I engine.

2.2 Experimental Work and Methodology

A Single Cylinder, diesel engine is used for the purpose of experimentation. The engine is then coupled to a rope brake dynamometer. Inlet manifold is connected with air box which is also attached with U-tube manometer. Fuel supply to the engine is from the tank via burette in case of diesel +Jetropha and from Rota meter in case of LPG cylinder. Rota meter is used to measure the fuel consumption of LPG.
Necessary provisions are made to measure the flow rates of fuel, air flow to the engine cylinder, rpm of dynamometer, and applying load on drum with help of belt and weight scale, inlet air, inlet gas and exhaust gas temp. Gas analyzer used to measure exhaust gas parameters. Thus, after developing the Experimental Test Set-up, the experimental work carried out in the following steps:

- ➢ Development of test ring for four stroke single cylinder diesel engine.
- ➢ Engine is to be run for 20 minutes before each sets of reading were taken to get stabilization.
- ➢ Set the load on the dynamometer via weight scale.
- ➢ The engine speed was kept constant for the each set of reading .
- ➢ The engine was tested at the speed of 1400 rpm. The load on the engine varied from no load to10 kg. performance emission parameters was measured.

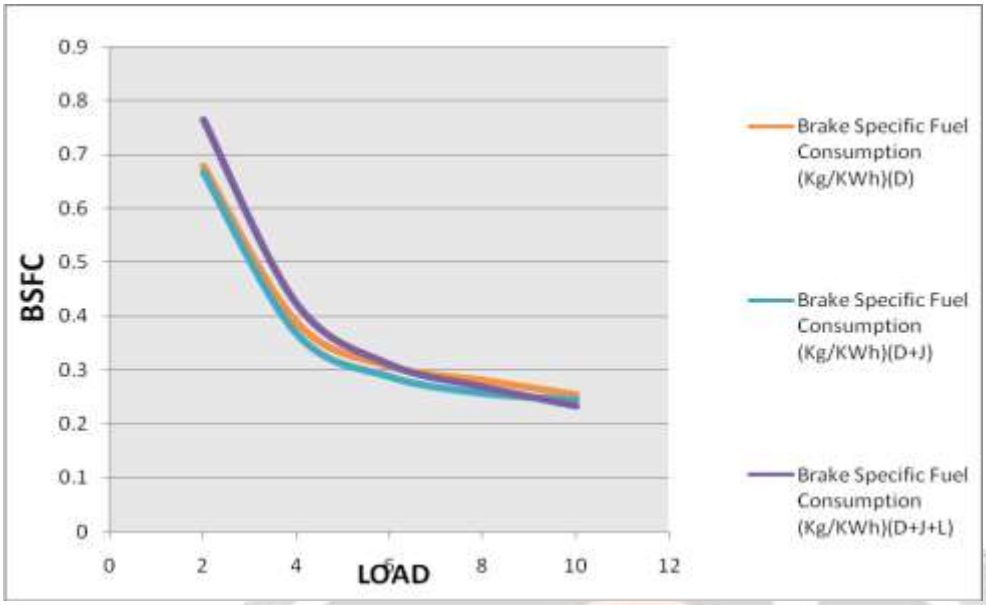
2.3 MODIFICATION OF DIESEL ENGINE INTO TRI-FUEL C.I ENGINE

- ✓ Adopted for supply of LPG-Air mixture.
- ✓ Installing gas adapter in series with air inlet manifold.
- ✓ Heating solder to heat inlet manifold up to 100 ^{o}C.
- ✓ LPG conversion kit.

3. EFFECT ON PERFORMANCE AND EXHAUST EMISSIONS

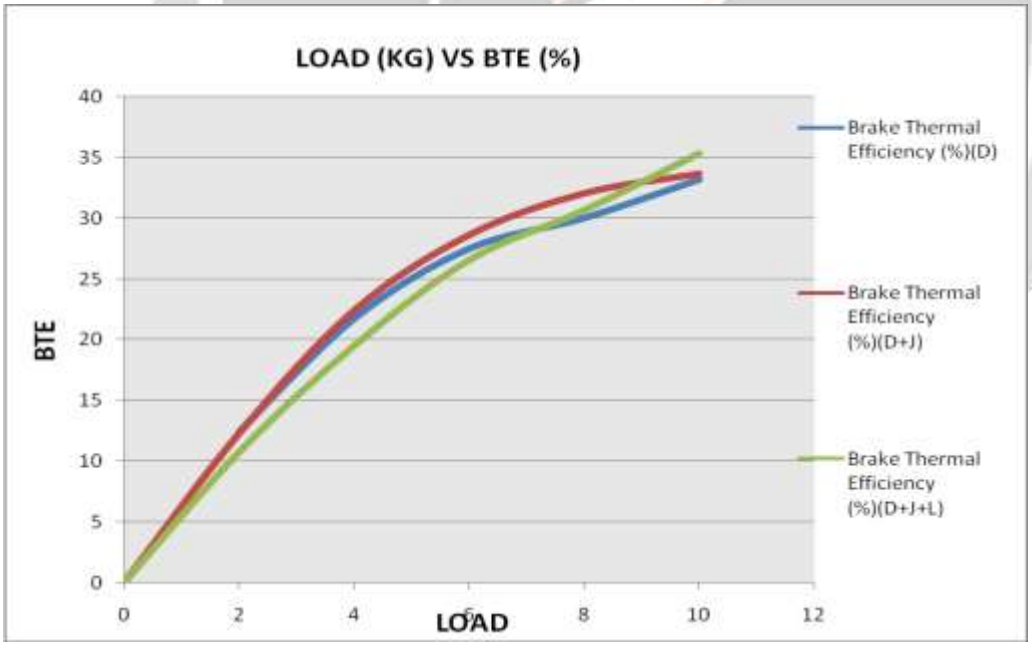
3.1. Engine performance parameters

(A) Brake specific fuel consumption.



Diesel + Jatropha + LPG has highest bsfc as compared to diesel, diesel + Jatropha for load up to 4 kg. After that it is decreasing slightly. Maximum BSFC of tri fuel is 0.764 at 2 kg load and minimum at 10 kg load is 0.234

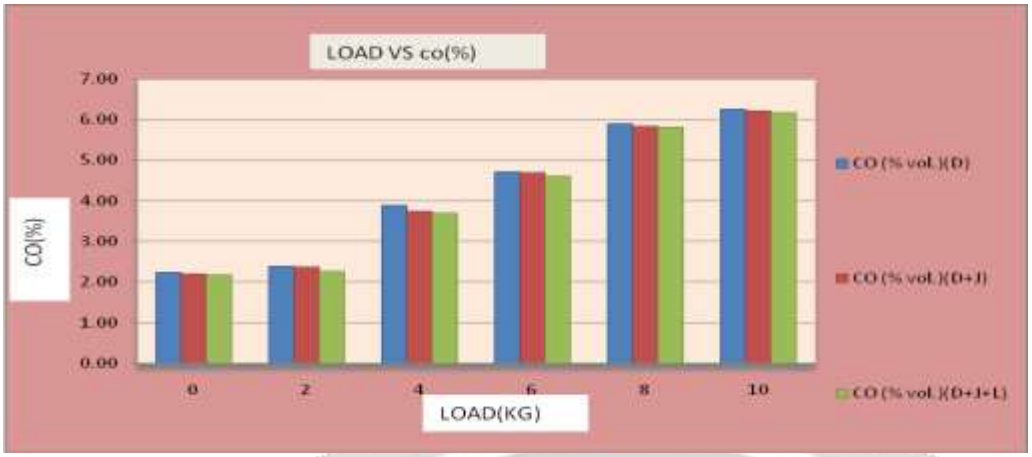
(B) Brake thermal efficiency



The brake thermal efficiency increases with increasing load and speed on the engine. It was maximum at 10 kg load. From figure it is clear that brake thermal efficiency is increase with increasing load for all the fuels but it is maximum for the tri fuels at max load which is equal to 35.33%

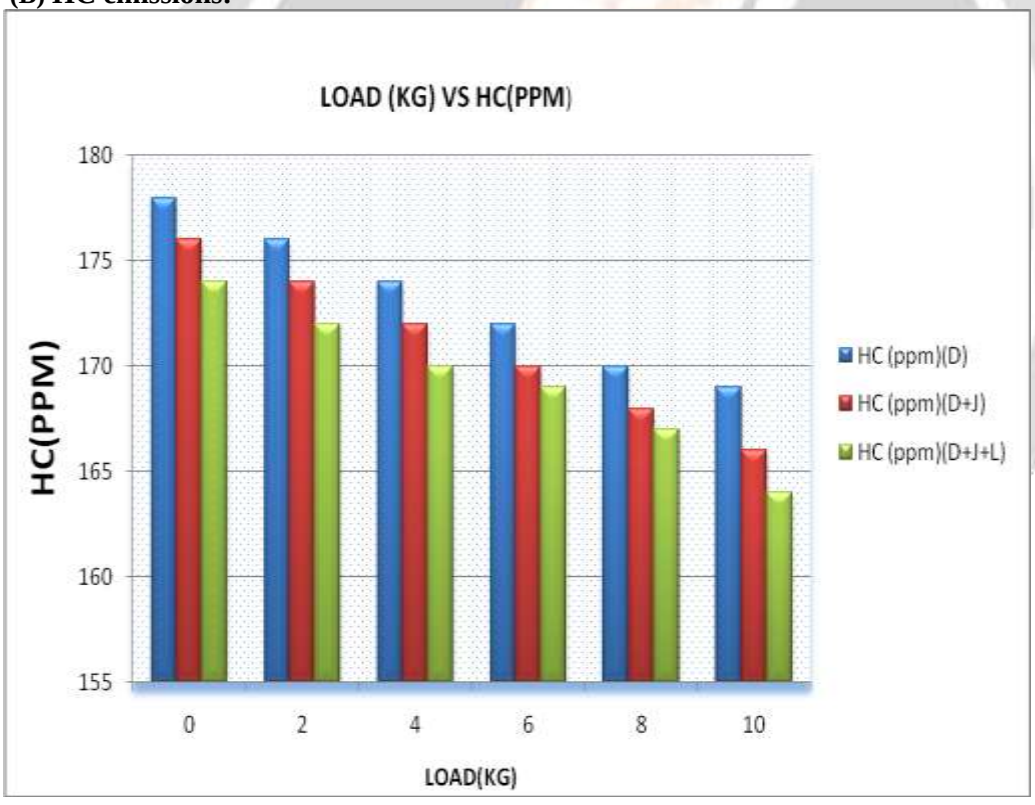
3.2 Engine emission parameters

(A) CO emissions



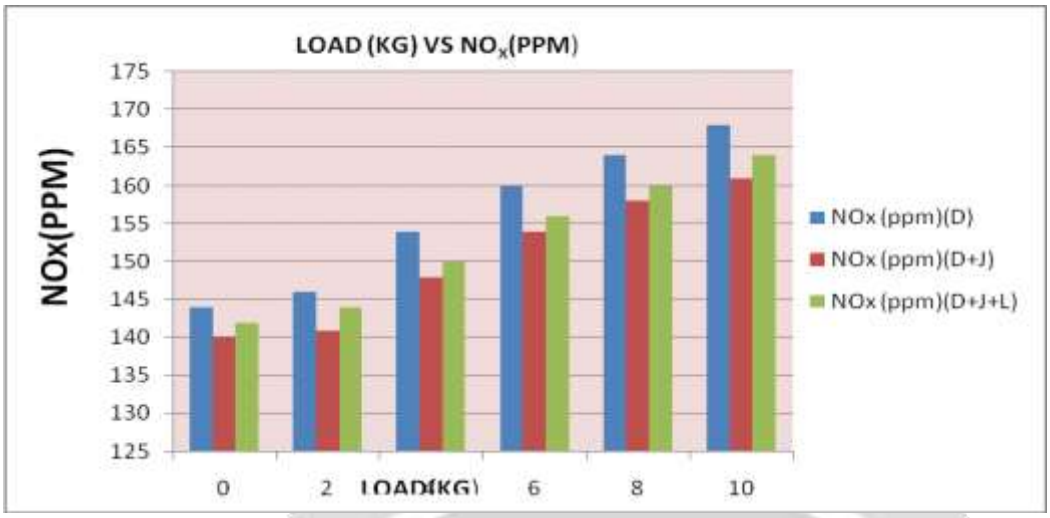
the variation in CO emissions with load.CO emission is increase as load on engine increase at all speed. CO emission decreases as blending increase. Value of CO for tri fuel blend is 6.18 for tri fuel.

(B) HC emissions:



The result shows that, as blending increase, HC emission was continuously decreased As compare to diesel fuel, HC emission from blends fuels was drastically decreased due to proper mixing of fuels and air, high rate of burning characteristics of blends air mixture reduce the time of combustion duration which lead to complete combustion and reduce unburned hydrocarbon in emission

(C) NOx emissions



The result shows that, as blending increases, NO_X emission was continuously decreased at all load. As compared to diesel fuel, NO_X emission from blends fuels was less.

4. CONCLUSIONS

In this research ,diesel engine has been converted into Tri fuel engine to minimize the exhaust gas emissions and increase engine performance. For increasing performance of the Tri-fuel engine, the effect of various percentages of fuel blending has been studied. Various performance parameters and engine exhaust emissions has been measured. Research work has been carried out at different rpms with varying load conditions.

- Diesel + Jatropha + LPG has highest bsfc as compared to diesel, diesel + Jatropha for load up to 4 kg.
- The brake thermal efficiency increases with increasing load and speed on the engine.
- CO emission decreases as blending increase.
- NO_X emission was continuously decreased at all load. As compared to diesel fuel, NO_X emission from blends fuels was less.

6. REFERENCES

[1] D.Kumaran, M.Rajendran, P.A.Jeeva, S.Karthikeyan present on "Formulation Of Novel Bio Based Tri Fuel For I.C. Engines"2004

[2] Suraj Bhan Singh, Atul Dhar, Avinash Kumar Agarwal presented on Technical feasibility study of bio diesel Diesel blends for powering medium-duty transportation spark ignition engine 2010

[3] Vikas Rai. Ritesh Kumar Ranjan. Performance Optimization of single Cylinder Four Stroke S.I. Engine using Tri-Fuel Blending -An Experimental Investigation may 2015

[4] Simona Silvia Merola*, Cinzia Tornatore, Luca Marchitto, Gerardo Valentino and Felice Esposito Corcione Experimental investigations of butanol-gasoline blends effects on the combustion process in a SI engine 2008

[5] Gvidonas Labeckas , Stasys Slavinskas Study of exhaust emissions of direct injection diesel engine operating on ethanol, petrol and rapeseed oil blends 2013

[6] Samuel Rodman Oprešnik , Tine Seljak , Franc˘išek Bizjan , Tomaz˘ Katrašnik present on "Exhaust emissions and fuel consumption of a triple-fuel spark-ignition engine powered passenger car" 2011

[7] Abhishek Paul , Probir Kumar Bose, Raj Sekhar Panua , Rahul Banerjee presen on An experimental investigation of performance-emission trade off of a CI engine fueled by diesel compressed natural gas (CNG) combination and diesel ethanol blends with CNG enrichment 2011

[8] An experimental investigation on hydrogen as a dual fuel for diesel engine system with exhaust gas recirculation technique N. Saravanan, G. Nagarajan, K.M. Kalaiselvan, C. Dhanasekaran 16 March 2007

[9] Hüseyin Aydin a,*, Cumali _Ilkılıç b Effect of ethanol blending with biodiesel on engine performance and exhaust emissions in a CI engine ISSN: 0974-2115 june 2010