A Literature Review of Performance Enhancement And Emission Reduction of a Single Cylinder CI Engine using Tri Fuels

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Abstract

Amidst ever decreasing 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 dying out, widening the gap between global energy supply and energy consumption. As per 2008, energy used on a global scale is about 142.3 Terawatt-Hour, which is about 39% higher than that of 1990.I am attempting to develop a tri fuel system without additives 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 engine1) DIESEL 2) JATROPHA 3) LPG

Keywords- Compression-Ignition (Diesel) Engine, C.I. engine

I. INTRODUCTION

Diesel engine plays a dominant role in the field of power, propulsion and energy. The diesel engine is a type of internal combustion engine; more specifically it is a compression ignition engine, in which the fuel injected by fuel injection system is ignited solely by the high temperature created by compression of the air during the compression stroke.
The engine operates on the diesel cycle. The working of the cycle is as follows:

A. Sub point of Topic

Author can write there abbreviation and their work which is related to them work. These all word should be in 10mm size. You Compression-ignition (C.I.) engines burn fuel oil which is injected into the combustion chamber when the air charge is fully compressed. Burning occurs when the compression temperature of the air is high enough to spontaneously ignite the finely atomized liquid fuel. In other words, burning is initiated by the self-generated heat of compression. Just like the four-stroke-cycle petrol engine, the C.I. engine completes one cycle of events in two crankshaft revolutions or four piston strokes. The four phases of these strokes are:

B. Basic operation of CI engine

1) Intake stroke
2) Compression stroke
3) Power stroke
4) Exhaust stroke

Table 1: Properties Diesel Jatropha &LPG

Fuel Property	*LPG*	*Jatropha*	*Diesel Fuel*
Formula	C_3H_8/C_4H_{10}	_	C_8 *to* C_{25}
Molecular weight	*44.09*	*900(approx.)*	*200(approx.)*
Density (kg/L,15ºC)	*0.50*	*0.93292(gm/cc)*	*0.83-0.85*
Specif gravity (15ºC)	*0.5*	*0.87-0.89*	*0.81-0.89*

Freezing point, ºC	*-187*	*-60*	*-40 to -1*
Boiling point, ºC	*-42*	*124*	*188-343*
Vapor pressure, kPa (38ºC)	*1303*	*<1.2*	*<1*
Specific heat, kJ/kg-K	*2.48*	*1.5*	*1.8*
Viscosity, mPs-S (20ºC)	*0.102*	*13.88*	*2.6-4.1*
Latent Heat of Vaporization, kJ/kg	*426*	*248*	*233*
Lower Heating Value, kJ/kg	*46500*	*43250*	*42600*
Flash point, ºC	*-104*	*168*	*74*
Auto ignition temperature ºC	*457*	*318*	*316*
Stoichiometric Air-Fuel Ratio,	*15.7*	*16*	*15*
Octane number			
Research	*112*		*-*
Motor	*97*		*-*
Cetane number	*-*	*38.00*	*40-55*

II. LITERATURE REVIEW

A. *"Experimental Investigation of Diesel Engine Using Blends of Jatropha Methyl Ester as Alternative Fuel" by "Dr.R.Suresh ", "Suresh Raddy", "K.V.Yathish"*

This project is aimed at biodiesel production of Jatropha cruces oil using calcium oxide catalyst (CaO) as heterogeneous solid metal oxide catalyst by base catalyzed trans esterification process and the study of the fuel properties like density, viscosity, flash point, calorific value, copper strip corrosion etc. with varying blends of Jatropha methyl ester. A single cylinder, four stroke, direct-injection, water cooled diesel engine tests will be carried out with the aim of obtaining comparative measures of performance and exhaust emissions characteristics of blends of Jatropha methyl ester.

The results are analyzed to optimize best operating conditions for maximum performance and minimum emissions. In the past years due to industrial revolution & increased human activities and depleting reserves of fossil fuels, there is urgent need for exploring alternative to fossil fuels. The vegetables oils cannot be used directly in diesel engines as alternative fuel because of high viscosity of vegetable oils leads to problem in pumping and spray characteristics. The inefficient mixing of vegetable oils with air contributes to incomplete combustion. The best way to use vegetable oils as fuel in diesel engines is to convert it into biodiesel.

B. *"Characterization of Processed Jatropha Oil for use as Engine Fuel" by "Anil Kumar Dubey", "R.M. Sarviya", "A. Rehman"*

Out of various no edible oil resources, Jatropha curcas oil is considered as a promising alternate fuel for CI engines. The present study describes the process used for production of degummed Jatropha oil (DGJO) and Jatropha methyl ester (JBD) The important fuel properties of DGJO and JBD were determined and compared with fossil diesel and Jatropha oil. The degumming and Trans esterification process has reduced the viscosity by 19.8% and 74.8% respectively. The heating of degummed oil at70 ^{0}C reduce the viscosity by 6.8 times when compared with viscosity at 10^{0}C. Further the degummed oil at 70 0C becomes viscous at par with fossil diesel, hence could be used directly in IC engines.

The increasing concern on environmental protection and the stringent exhaust gas regulation has made the attention on use of vegetable oil as alternate fuel for engines. The use of vegetable oil in compression ignition engine is as old as diesel engine itself. In Rudolph Diesel's preface to his 1912 patent he wrote that the "Use of vegetable oil for engine fuel may seem insignificant today but such oil may became in coarse of time ,as important as petroleum" (Vasudevan, 2005). Vegetable oils have the greatest promise to be used as alternate fuels for diesel engines due to a very significant fact that they are renewable energy sources and could emit substantially less greenhouse gases (Pugazhvadivu, 2005). The Cetane number and calorific values of vegetable oil are close to petro diesel hence could be directly used in compression ignition engines. The Vegetable oils develop the increasing concern on environmental protection and the stringent exhaust gas regulation has made the attention on use of vegetable oil as alternate fuel for engines. The use of vegetable oil in compression ignition engine is as old as diesel engine itself.

C. *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 Abhishek Paul, Probir Kumar Bose, Raj Sekhar Panua, Rahul Banerjee*

In order to comply with the ever-stringent emission norms throughout the world and crunch in petroleum reserves, the modern day automobile industry is compelled to hunt for new and alternative means of fuel sources to keep the wheels spinning globally. Paradoxical objectives of attaining simultaneous reduction in emission along with high performance has provided with a few alternatives. The present study deals with one such approach in which the potential of diesel ethanol blending and subsequent CNG (compressed natural gas) enrichment have been investigated. The study starts with a miscibility test of ethanol in diesel,

which paves the way for an experimental comparison between performance and emission characteristics of Diesel Ethanol blends, Diesel CNG combinations and Diesel Ethanol blends with CNG enrichment. The results indicates that diesel ethanol blend D95E5 (95% diesel 5% ethanol) with low CNG enrichment produces a better performance-emission characteristics as compared to base diesel operation as well as diesel ethanol blend operation. Results also portrayed ethanol's potential in reducing NOx emission, BSEC and smoke opacity.

D. "Experimental Investigation on Performance Characteristics of Diesel Engine Operated on Jatropha Biodiesel with LPG Jet Induction" by "Adithya Murali", "Jaseel K.P", "Taju Antony A.T", "Viswajith. D",

Environmental degradation and depleting oil reserves are matters of great concern round the globe. The fact that a few nations together produce the bulk of petroleum has led to high price fluctuation and uncertainties in supply for the consuming nations. Developing countries like India depend heavily on oil import. Diesel being the main transport fuel in India, finding a suitable alternative to diesel is an urgent need. Jatropha Curcas is a renewable non-edible plant that grows in arid and semi-arid regions of the country on degraded soils having low fertility and moisture. Jatropha based bio-diesel (JBD)is a non-edible, renewable fuel suitable for diesel engines and is one of the most promising alternatives to the use of conventional diesel which can be used in the existing diesel engines without any modification or with minor structural changes. Researchers are being carried out to reduce emission rates and these researches would be explored till reducing the exhaust emissions up to zero level. The present investigation explores with a series of experiments towards effective combustion of air, LPG and Jatropha mixture wherein the LPG jet is inducted through air inlet to form a homogeneous mixture, and novel methods for improving efficiency such as fuel magnetization and preheating are employed.

Changes in the performance of the engine and emission levels compared with conventional diesel fuel are noted.

From all the above results and discussions, we arrive at a few conclusions, summarized in these following points:

- It was discovered that the induction of LPG jet into the inlet manifold had predominant influence on the engine's performance.
- The thermal efficiency increases when the LPG jet is injected intothe inlet manifold. At average brake power values, the thermal efficiency increases by about 10% when a 12 cc/s LP jet is injected into the engine's inlet manifold
- Considerable changes were not noted in the torque and brake mean effective pressure readings.
- The fuel consumption was reduced by about 30% in case of the 12 cc/s LPG jet induction; by about 15% in case of the 8 cc/s LPG jet induction. The case of the 4 cc/s LPG jet induction, however, did not show considerable changes.
- It was observed that fuel magnetization is not as effective in case of Jatropha biodiesel as petro- diesel. The relative ineffectiveness may be attributed to the difference in chemical structures of the fuel molecules.
- It was also observe during the experiments that there was an increase in visible emissions when the Jatropha biodiesel was used without preheating.

III. SUMMARY OF LITERATURE REVIEWED

1) The results suggest that ABE solutions, an intermediate product during ABE fermentation, are a very promising alternative fuel to be directly used in diesel engines.
2) The Experimentation thus revealed the potential of LPG enrichment of petrol as an efficient instrument to overcome the inherent paradox of simultaneously reducing emissions and without much penalization of performance characteristics in conventional petrol engine.
3) The engine thermal efficiency and exhaust gas temperature produced by the LPG burning is always higher as compared with that of the petrol/diesel.
4) Brake thermal efficiency for LPG-Ethanol blend is good compared to gasoline.20% Ethanol blend with LPG gives 5.23% more efficiency than 10% Ethanol blend with LPG.
5) Using LPG-Ethanol blends exhaust gas temperature is more compared to Gasoline at all loading conditions[9]

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