



An Experimental Investigation of Diesel Engine Using Biodiesel A Review

Sunny Tailor¹, Mayank Trivedi², Purvash Prajapati³, Hardipsinh Rana⁴,

Mr. Samik Bhatt⁵

¹Mechanical Engineering, S.R.I.C.T.

²Mechanical Engineering, S.R.I.C.T.

³Mechanical Engineering, S.R.I.C.T.

⁴Mechanical Engineering, S.R.I.C.T.

⁵Assisatant professor, Mechanical Engineering, S.R.I.C.T.

Abstract: *In present scenario the fossil fuel which we are using on diesel engine is going to be finish in near future. It also generates hazardous gases. This is harmful to the environment and human being. And transportation mainly depends on diesel engine. So if we change the fuel intake which is not harmful to the environment we can reduce the pollution. So in this paper we are using soybean oil mixed with diesel oil. This is to be used in various proportions 5%, 10%, 20%, 30%, 40%, and 50%.*

Key words: *Diesel engine, biodiesel, soybean, performance, emission.*

1. INTRODUCTION

Diesel engines are efficient power machinery for automotive applications due to their better fuel economy compared to gasoline engines. However, stringent emission regulations and future depletion of petroleum reserves force us to explore new technologies to develop alternative fuel as well as reduce pollutant emissions.

Biodiesel is produced by transesterification of oil, where one mole of oil is chemically reacted with three moles of an alcohol in presence of a catalyst. In this reversible reaction, the glycerol moiety of the triglyceride molecule is replaced with an alkali radical of the alcohol used, giving alkyl based monoesters.

Although biodiesel has many advantages when it comes to fuel properties, it still has several properties that need to be improved, such as its comparatively higher emission of nitrogen oxides. The purpose of this experimental study was to determine the effects of fuelling a diesel engine with soybean oil methyl ester and diesel fuel blends on performance and smoke density and NO_x emissions. Based on the trade-off relationship between NO_x and smoke density, the optimum blend ratio was determined.

1.1 Pollutants Of CI Engines:

- Sulfur Dioxides
- Particulate Matter
- Oxide of Nitrogen
- Carbon monoxide
- Unburned hydrocarbons

1.2 Harmful Effect By Pollutants

- Asthma
- Cardiovascular Disease
- Cancer

2. SUBMISSION OF TECHNICAL PAPER

1. Mukesh Singh and T. K Bhattacharya:- A study was conducted on fuel blends prepared using diesel and refined soybean oil combinations compatible with diesel fuel as used in CI engines. A stationary 3.73 kW Kirloskar make single cylinder compression ignition diesel engine having 27° BTDC (standard injection timing) was tested as per IS 10000 - 1980 on diesel and prepared diesel blends. The performance tests of the engine were carried on at no load, 25, 50, 75, 100 and 110 % brake load conditions and emission of CO, UBHC and NO_x was evaluated for each fuel blends. The emission of CO, UBHC, nitric oxide and nitrogen dioxide from the engine on diesel - refined soybean oil blends was in the range of 0.21 to 0.85%, 0.01 to 0.16%, 12.7 to 317 ppm and 3.8 to 41 ppm, respectively. The results indicated that the emission of CO and UBHC on the selected blends was found comparable but the NO_x level was found to be higher than the diesel. A blend having diesel - refined soybean oil mixed in 80:20 proportion replacing 20 percent diesel may be selected for fuel use in CI engines.

2. Charalampos Arapatsakos, Marianthi Moschou, Foteini Sakalid:- Hazardous pollutants that lead to atmospheric pollution have many sources and automobile's exhaust emission is one of these. Therefore, it needs to be taken into consideration seriously the replacement of fossil fuels with renewable fuels. This paper will examine the use of diesel-soy oil mixtures in diesel four-stroke engine. The mixtures that have been used are the following: diesel-5% soy oil, diesel-10% soy oil, diesel-20% soy oil, diesel-30% soy oil, diesel-40% soy oil, diesel-50% soy oil. For those mixtures and for every fuel temperature the gas emissions of carbon monoxide (CO), hydrocarbons (HC), nitrogen monoxide (NO) and smoke have been measured. CO, NO emission will be reduced and HC emission will be increase.

3. Jiantong Song, Jvbiao Yao, Jiangyi Lv and Chunhong Zhu:- the power and fuel economies performances of a diesel fueled with soybean biodiesel were investigated under different engine loads and speeds. Experimental results show that, compared with diesel fuel, with increase in the biodiesel in the blends, the brake power and torque and the brake specific energy consumption increase, the smoke density under free acceleration decreases except B10, the NO_x emissions increase. The trade-off relationship is clear between the NO_x and smoke density when the diesel engine fueled with different biodiesel percentage in the blends. From the trade-off relationship between NO_x and smoke density, the optimum blend ratio is B20 in the experimental study.

4. Prof. C. S. Koli , Arvind Pathak , Prof. Sanjay Bhatele:- In this work, Processed soya oil is blended with diesel in different proportions as B-10, B-20, B-30, B-40 and B-50. Thermodynamic analysis of 4stroke single cylinder diesel engine, By using different blends of diesel & soya oil has been carried out the effect of B-10,B-20,B-30,B-40,B-50 on the Brake Power, Thermal Efficiency, Brake Specific Fuel Consumption and Total Fuel Consumption has been absorbed and The experimental result shows that at B-40, the optimum BTE (12.09), maximum BP (1.221) and minimum BSFC (0.694).

5. Mohamed F. Al-Dawody and S.K. Bhatti:- Experiments were conducted with different compression ratios of 15, 16, 17.5 and 19 at various load conditions in terms of brake power at a constant speed of 1500 rpm. Three blends of soybean biodiesel (B20, B40 and B100) on volume basis have been tested and compared with respect to diesel fuel. It was observed that increasing the compression ratio from 15 to 19 produces lower smoke opacity, hydro carbon (HC) and carbon monoxide (CO) respectively. Oxides of nitrogen (NO_x) were found to be higher with higher compression ratio and higher substitution of SME. The best blend of SME was B20% SME which has less increase in the NO_x emissions as compared with B40% & B100% SME biodiesel.

6. R. Muneeswaran and M. R.Thansekhar:- Biodiesel is explored to be used in standard diesel engines and is thus distinct from the mineral oils. Biodiesel can be used alone, or blended with diesel in any proportions. The number of studies has shown significant increase in nitrogen oxides (NO_x) emissions in biodiesel fuelled diesel engine. The increase in NO_x , HC and CO emissions and solutions to this problem have been the subjects of research for considerable time It is difficult to control NO_x emissions. From the results, it is shown that B30 blend gives the better results for reduction in NO_x.

7. Dr. Hiregoudar Yerrenagoudaru, Manjunatha.k ,Shiva kumar.S, S.Veeresh kumar:- Generally CO, HC, NO_x, SO₂, particulate matters and smoke are treated as emissions from the exhaust gas of engines. Among these emissions, HC and CO are more toxic in nature which leads to air pollution. .Main aim of the project is to reduce emissions like HC, CO, CO₂, NO_x, SO_x from the exhaust gases of diesel engine. The result is HC, CO, CO₂ will be decrease and NO_x will be increase.

8. Abhishek Gaikwad , Abhay Singh , Avnish kumar , Amit Tiwari:- These investigations will examine the use of refined soybean oil blended with Pure Diesel in single cylinder, four stroke VCR diesel engine. For these mixtures the brake thermal efficiency (BTE), Specific Fuel Consumption (SFC) and operating Performance Characteristics are calculated at various loading conditions at constant speed without engine modification.CO and HC emission will be reduced and NO_x emission will be increase.

9. N. Ravi Kumar, Rajesh Guntur, and Y.M.C. Sekhar:- In this study Transesterification of soybean oil (TSO) (biodiesel) was carried out in the presence of NaOH as catalyst and the effect of the biodiesel was investigated on four stroke single cylinder slow speed diesel engine for both performance and emission characteristics in the range of no load to full load.The experimental results have showed that increase in brake thermal efficiency by 2.6 % and mechanical efficiency by 8.8 % with soybean Bio-diesel. Smoke is reduced by 75 % at part load and NO_x emissions are marginally increases at all loads with biodiesel operation.

10. Bjorn S. Santos,Sergio C. Capareda:- Engine power tests were conducted in accordance with SAE Standard Engine Power Test Code for diesel engines. Test fuels included Standard no. 2 diesel and four biofuels comprising 5%, 20%, 50% and 100% soybean oil biodiesel. Nitrogen oxides (NO_x), carbon monoxide (CO), and sulfur dioxide (SO₂) emissions were measured for all the test fuels using an Enerac™ model 3000E emissions analyzer. Based on the results of the experiments performed, the peak power produced using different blends of Soy bean oil biodiesel has no significant difference compared to that of the petroleum diesel. However, the brake-specific fuel consumption tends to increase as the percentage of biodiesel in a blend increases.

3. ILLUSTRATION OF FIGURES AND TABLES

3.1 Figure



FIG:-1 DIESEL ENGINE

3.2 Table

Table 1 – Engine specification

Power	10.4 Hp
Cooling	Water Cooled (Radial Cooled)
No. Of Cyl.	One
Fuel	High Speed Diesel
Type	Vertical ,4-Stroke, Compression Ignition
Injection	Direct By Multi-Hole Nozzle
Speed	1500 Rpm
Sp. Fuel Con.	250 G/K Wh
Fuel Tank	10 Liter
Rotation	Clockwise Looking At The Flywheel
Starting	Handle Start With Cranking
BORE (mm)	102.0
STROKE (mm)	115.0

Table 2 - Fuel Property

Property	Diesel	Soybean
Density	0.852	0.904
Viscosity (cSt)	1-3.7	29.37
Flash point temperature(°C)	60	310
Fire point(°C)	62	320
(Cetane/Octane) number	40-55	51
Calorific value(kj/kg)	44215	47300
Pour point	-8.1	-7

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