American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-6, Issue-12, pp-29-34
www.ajer.org
Research Paper Open Access

Experimental Analysis on DieselEnginefueled with Nerium biodiesel oil and Diesel

S.D.Sekar[1], Dr S.Sekar[2], Dr T.N.Valarmathi[3], Dr T.Mothilal[4*]

[1](Department of Mechanical Engineering, R.M.K. Engineering College, Chennai, India.)
[2](Department of Mechanical Engineering, Velammal Engineering College, Chennai, India.)
[3](Department of Mechanical and production Engineering,Sathyabama University , Chennai, India)
[4*](Department of Mechanical Engineering, VelammalInstitute of technology , Chennai, India)

ABSTRACT:*Diesel engine plays a vital and indispensable role in today's life. At the same time, they contribute to atmospheric pollution substantially. This is a very tentative situation where both the environment comfort is inter-related. Development has been made for the usage of diesel engine in automobiles, as diesel engines are more efficient than gasoline engine but the unpleasant odour and emissions in the exhaust are the main drawbacks. Diesel is a fossil fuel which cannot be renewed so if the current scenario continues, there might come a day when there would be no more diesel left. Hence, this is the correct time to produce an alternate fuel which can perform well compared todiesel and can be used as a renewable resource. In the present work, bio mass derived Neriumoil is converted into bio-diesel and used as an alternative fuel for diesel. The testing is done by running a diesel engine with the bio diesel blended with base fuel in various proportions and the optimum blend ratio has been identified.*

Key Words:*Nerium oil, Bio-Diesel, Diesel Engine, Blended oil*

Date of Submission: 21-11-2017 Date of acceptance: 06-12-2017

I. INTRODUCTION

Crude oil is a smelly, yellow-to-black liquid and is usually found in underground areas called reservoirs. Scientist and engineers explore a chosen area by studying rock samples from the earth. Products from oil (petroleum products) help us do many things, it is used as fuel to automobiles, heat our homes and to make products like medicines and plastics. Even though petroleum products make life easier – finding, producing, moving, and using them can cause problems for our environment like air and water pollution. Over the years, new technologies and laws have helped to reduce problems related to petroleum products Bio-mass contains stored energy from the sun. Plants absorb sun's energy in the process through photosynthesis process. The chemical energy in plants gets passed on to animals and people eat them. Bio-mass is a renewable energy sources some examples for bio-mass fuels are wood, crops, manure and garbage. When burnt, the chemical energy in bio-mass is released as heat. Wood waste or garbage can burnt to produce steam to make electricity, or provide heat to industries and home. Burning bio-mass is not the only way to release its energy. Crops like corn and sugarcane are also fermented to produce fuel . Bio – diesel was produced from food products like vegetable oils and animal fats. Bio-mass fuels provide about 3% of energy used in the United States. People in the U.S.A are trying to develop ways to burn more bio-mass and less fossil fuels. Using bio-mass for energy can cut back on waste and support agriculture products grown in the United States. Bio-mass fuels also have a number of environmental benefits. At present time, virtually fuels derived from crude oil gasoline was supplied all over the world. Diesel and jet fuels are examples of transportation fuels that are produced from petroleum products. Petroleum products have become popular because of high energy density and their ease of handling. A high energy density means that onboard fuel storage is minimized and a vehicle can travel a long distance between refilling. Recently, rising oil prices and concerns over the environmental impacts of petroleum use have prompted research into alternative transportation fuels. The combustion of petroleum in motor vehicle results in emissions of gases associated with global warming, acid rain and urban air pollution. Many of the fuels being developed are derived from plant materials "bio-mass" or other forms of solar energy. All forms of solar energy are "renewable" and have no net emissions of greenhouse gases.

In the beginning of the third millennium, fuels derived from Biological components can be used successfully as an alternate fuel. This was done by Otto and A.V.RicardoBassoliCezare of Brazil. The Calorific Values of some vegetable oils are higher than Diesel. This data proves that fuels if derived from vegetable oils can be used successfully as an alternate for Diesel. Bio-Diesel has properties better than Diesel which can substantiate it to give better performance than Diesel.Transesterification process can be done successfully by methanol. Also, Ethanol can be used as a successful alternate for Methanol. Surgical spirit can be used fortransesterification processsuccessfully[1]. It was surveyed that Diesel would be depleted in another 40 years and the invention of an alternate fuel is the need of the hour. It also stated that the performance of an I.C. Engine was increased when Diesel was blended with alcohol. Vegetable oils have been found to be a potential alternative to diesel[2][3]. They have properties comparable to diesel and can be used to run a compression ignition engine with minor modifications.Neem oil up to 50%could be substituted for diesel for use in a diesel engine without any major operational difficulties[4].Experiment with methyl esters of Honge (HOME), Jatropha (JOME) and Sesame (SOME) in a single cylinder, four stroke, direct injection Compression Ignition (CI) engine was conducted and reported that the higher emission of CO, HC and smoke and lower NO as compared to that of diesel.[5].Biodiesel is recommend [6] as a substitute for petroleum diesel mainly because biodiesel is an oxygenated, renewable, biodegradable and environmentally friendly biofuel with similar flow and combustion properties and low emission profile. So, biodiesel is gaining more and more importance as an attractive fuel Alcohols blend with biodiesel was used and increase in brake thermal efficiency and reduction in CO, HC and NOxemissions was observed [7].It was observed that biodiesel could reduce CO, HC and PM emissions significantly with slightly increase in NO_Xemissions, compared with diesel[8]. Biodiesel is a nontoxic and biodegradable alternative fuel that is obtained from renewable sources Biodiesel is a primarily focused liquid alternative fuel for Compression Ignition (C.I) engines[9],[10]. Vegetable oils have comparable energy density, Cetane number, heat of vaporization and stoichiometric air–fuel ratio with that of the diesel fuel. Methyl, ethyl or butyl esters produced by esterification process of different kinds of vegetable oils, animal fats and algae are commonly referred as biodiesel [11] The performance and emission tests were carried on the compression ignition engine using blends (B20, B40,B60, B80 and B100) of Jatropha methyl esters (JME) and diesel by D. Kannan.et.al [12],they injected 5% of ethanol into the intake manifold by the port injection method with the assistance of a mechanical fuel injection pump. The ethanol injection assisted in getting an improved combustion process in diesel and JME blends as well.

1. Nerium oil extraction process

Bio diesel is obtained as the mono-alkyl esters of fatty acids derived from vegetable oils or animal fats. In simple terms, biodiesel is the product obtained when a vegetable oil or animal fat is chemically reacted with an alcohol to produce fatty acid alkyl esters. A catalyst such as sodium or potassium hydroxide is required is required to enhance the reaction quicker to produce bio diesel .Glycerol is produced as a co-product. The approximate proportions of the reaction are:

$$\text{1 litre of oil + 250 ml of Methanol} \longrightarrow \text{1litre of Biodiesel + Glycerol.}$$

Initially, Nerium oil was extracted from the nerium seeds by using Soxhlet apparatus. Then the Nerium oil is transesterified into biodiesel and is used as a fuel in a diesel engine. In the present work onelitre of Nerium oil with 0.25 litre of methanol produces one litre of Bio-Diesel and the remaining oil is converted into Glycerin which is a byproduct which when planned and transported correctly can be used in Soap Industry. Hence, it is extremely cost effective. Bio-diesel is an alternate fuel that requires no engine modifications and provides power similar to conventional diesel fuel. The Nerium Seed is shown in Fig.-1 TheNeruim oil is extracted from its seed with the following procedure. The seed is crushed initially, then the crushed seeds are placed into the main chamber of the soxhlet extractor.The Soxhlet extractor is placed onto a round bottom flask containing the extraction solvent (hexane). The Soxhlet is then equipped with a condensor. The solvent is heated to about 40-50 degree Celsius and the solvent vapour travels up a distillation arm condenses, and drips back down into the main chamber. The oil dissolves in the warm solvent and runs back to the distillation flask and this cycle is carried out for about 4-5 hours.

Fig 1. Picture of Nerium Seed

II. BIODIESEL PRODUCTION

Layout of biodiesel production is shown in Fig. 2.Production involves reaction process, separation process, washing with de-mineralized(DM) water, moisture removal process and contaminant removal process. The schematic diagram for the bio-diesel preparation procedure is shown in Fig.-2.

2.1 Physical properties of nerium oil

Kinematic viscosity @ 40 °C	-	4.2
Flash point	-	110°C
Cetane number	-	39
Calorific value	-	8750 Kcal/Kg

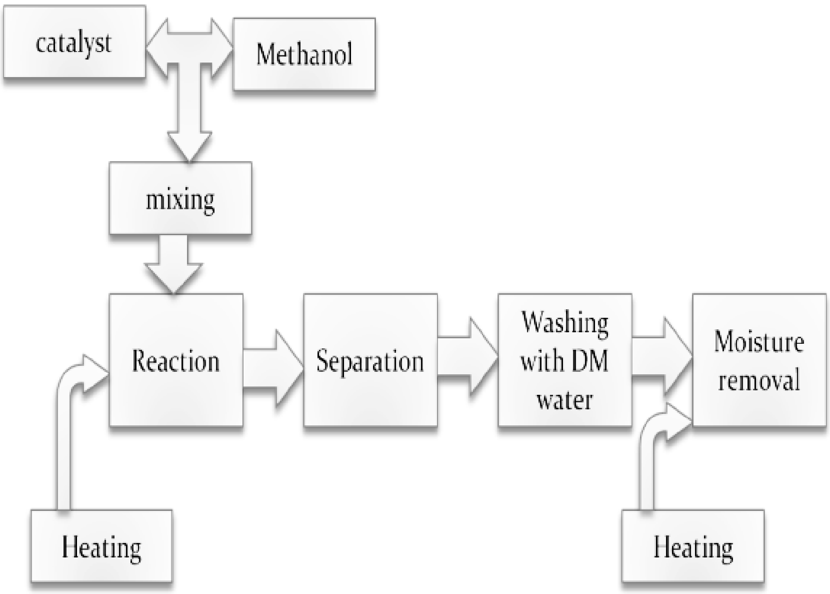


Fig 2. Layout of Bio-Diesel Preparation

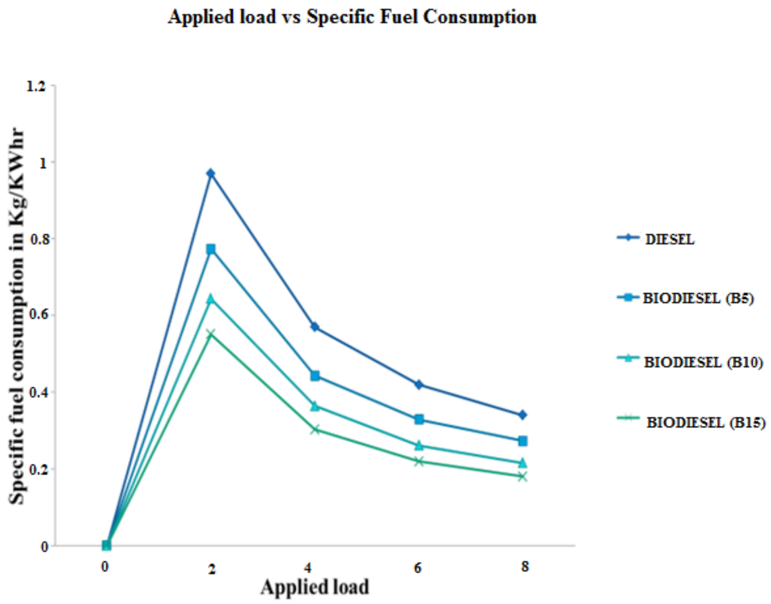
2.2 Engine specification

Make and Model	:	Kirloskar, AVl make
No of Cylinders	:	one
Bore	:	80 mm
Stroke	:	110mm
Swept Volume	:	553 cc
Clearance Volume	:	36.87 cc
Compression Ratio	:	16: 1
Rated Output	:	3.7 kW @ 1500 rpm
Rated Speed	:	1500 rpm
Combustion Fuel	:	High Speed Diesel
Lubricating Oil	:	SAE 40

III. EXPERIMENTATION AND RESULT ANALYSIS

3.1 Specific Fuel Consumption

Specific Fuel Consumption is the amount of fuel consumed in brake power per second of work. It is desirable that the Specific Fuel Consumption must be as low as possible. The effect of load on specific fuel consumption is shown in Fig.-3.The specific fuel consumption is an important parameter to evaluate engines performance and determine the fuel efficiency of an engine The variations of specific fuel consumption for different blend ratios (B5, B10, and B15) are shown in Fig. 3 and Fig. 4. From the above graphs, it is clear that the specific fuel consumption decreases with increase in blend ratio of biodiesel. One possible explanation for this reduction could be due to higher percentage of increase in brake power with load as compared to fuel consumption.



.

Fig 3. Plot for Specific fuel consumption Vs Applied load.

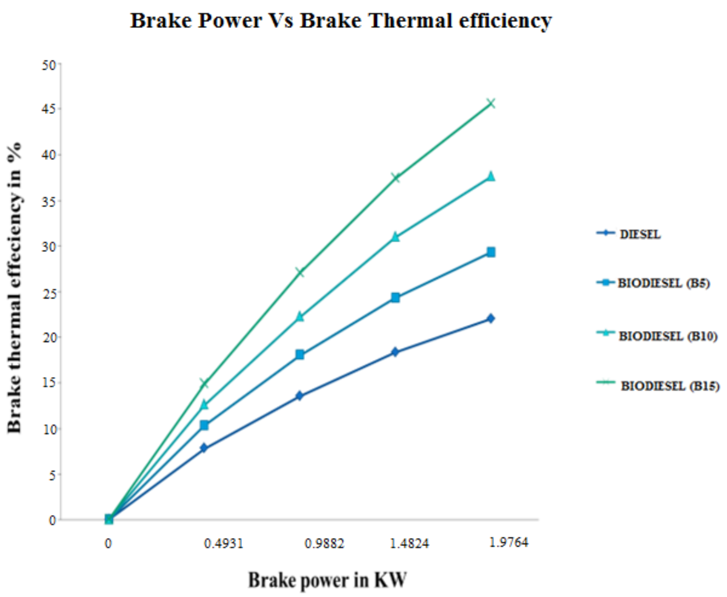


Fig 4. Plot of Brake thermal efficiency Vs Brake Power

Specific fuel consumption (Kg/KWhr) for B5, B10 and B15 were 0.0668, 0.1246 and 0.1601 respectively lower than diesel. This is desired as the amount of fuel consumed per brake power would be lower and this would increase the mileage of an engine.

3.2 Brake Thermal Efficiency

Brake Thermal Efficiency is the ratio between the brake power and heat supplied. The Brake Thermal Efficiency of the diesel is lesser than bio-diesel. The nature of change of brake thermal efficiency with respect to brake power is for various blend ratio isshown in Fig. 5.From the graph it is evident that the brake thermal efficiency has increased with increase in blend ratio of biodiesel. The brake thermal efficiency (in %) for B5, B10 and B15 are 8.28, 13.58 and 19.56 respectively higher than diesel. The brake thermal efficiency of biodiesel is higher than that of standard diesel especially at higher load. The possible reason for improved brake thermal efficiency may be more complete combustion.This proves that Bio-diesel provides better brake thermal efficiency than conventional diesel.

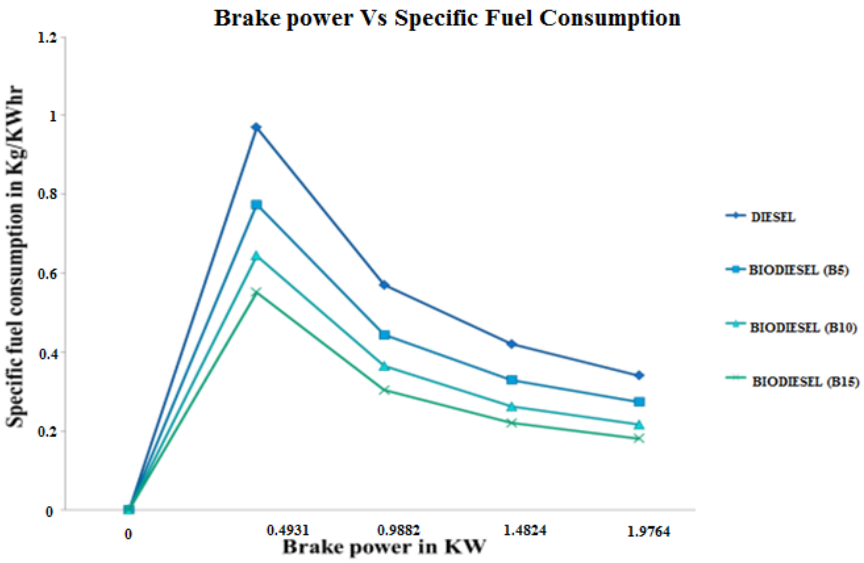


Fig 5. Plot of Specific fuel consumption Vs Brake Power

3.3Total Fuel Consumption

Total Fuel Consumption is the amount of fuel consumed in kg/hr. At the end of the experiment, it is evident that the same engine consumed less Biodiesel than Diesel. The variation of total fuel consumption for various blend ratios are shown in Fig. 6. From the graph it is evident that the total fuel consumption decreases with increase in blend ratio of biodiesel . The total fuel consumption (in Kg/hr) for B5, B10 and B15 were 0.13, 0.25, 0.3123 respectively lower than diesel.

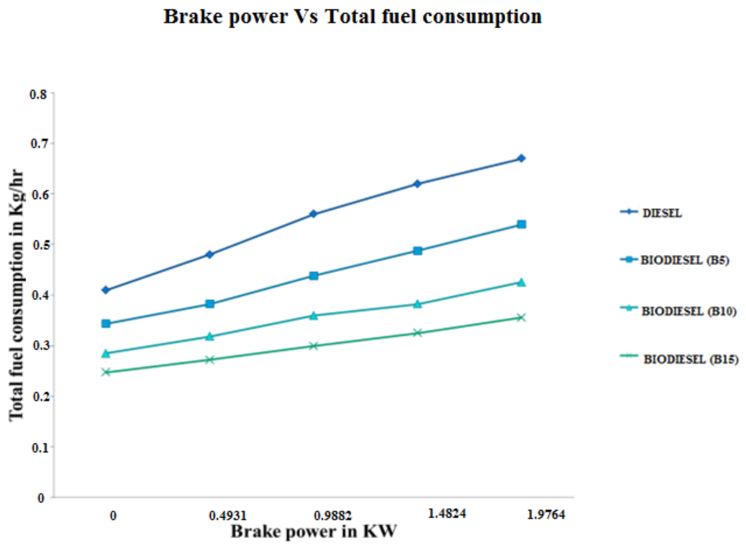


Fig 6. Plot of Total fuel consumption Vs Brake Power

IV. CONCLUSIONS

In the present work, Nerium oil had been extracted from Nerium seeds and is blended with diesel in various proportions such as B5, B10 and B15 and it was found that the performance of diesel engine had been increased. It has been found that the diesel blendedwith Nerium oil satisfies ASTM standards and Indian standards of biodiesel and hence biodiesel obtained from Nerium oil can be used as an alternate fuel for diesel engine. The work also states that biodiesel produces better brake power than conventional diesel. Also, the specific fuel consumption and total fuel consumption of biodiesel are slightly lower than Diesel. Brake Thermal Efficiency of biodiesel is very much higher than Diesel. As a conclusion, the performance of Biodiesel is higher than conventional diesel.

REFERENCES

[1] D.Kusdiana and S.Saka, Biodiesel fuel from rapeseed oil as prepared in supercritical methanol, Fuel 80, 2001,225-231.
[2] A.L.Hunke and N.J.Barsic, Performance and emission characteristic of a naturally aspirated diesel engine with vegetable oils (Part-2), SAE Paper, 810955, 1981.
[3] V.Gerhard, Performance of vegetable oils and their monoesters as a fuel for diesel engines, SAE paper, 831358, 1983.
[4] K.Pramanik, Properties and use of jatrophacurcas oil and diesel fuel blends in compression ignition engine. Renewable Energy, 28: 2003, 239-248.
[5] P.K Sahooand L.M. Das, Combustion analysis of Jatropha, Karanja and Polanga based biodiesel as fuel in a diesel engine. Fuel, 88, 2009, 994-999.
[6] S.A.Basha, K. R. Gopal, and S. Jebaraj, A Review on Biodiesel Production,Combustion, Emissions and Performance, Renewable and Sustainable Energy Reviews 13 (6–7), 2009,1628–1634.
[7] S.Sivalakshmi and T. Balusamy, Performance and Emission Characteristics of a Diesel Engine Fuelled by Neem Oil Blended with Alcohols, International Journal of Ambient Energy 32 (4): 170–178.
[8] A.L. Boehman, D. Morris, J. Szybist and E. Esen, The Impact of the Bulk Modulus of Diesel Fuels on Fuel Injection Timing, Energy & Fuels 18(6), 2004,1877–1882.
[9] A.Demirbas, Comparison of Transesterification Methods for Production of Biodiesel from Vegetable Oils and Fats.Energy Conversion and Management 49 (1), 2008,125–130.
[10] A.Demirbas, Progress and Recent Trends in Biodiesel Fuels, Energy Conversion and Management 50 (1), 2009.14–34.
[11] A.K Agarwal, Biofuels (alcohols and biodiesel) application as fuels for internal combustion engines, Progress in Energy and Combustion Science 33, 2007,233-271.
[12] D. Kannan, M. Nabi and J. Hustad, Influence of Ethanol Blend Addition on Compression Ignition Engine Performance and Emissions Operated with Diesel and JatrophaMethylEster.,SAE Technical Paper 20091808.

S.D.Sekar"Experimental Analysis on Diesel Engine fueled with Nerium biodiesel oil and Diesel." American Journal of Engineering Research (AJER), vol. 6, no. 12, 2017, pp. 29-34.