A REVIEW ON PERFORMANCE AND EMISSIONS ANALYSIS OF DIESEL BLENDED WITH BIODIESEL ADDED WITH NANO PARTICLES IN VARIABLE COPMPRESSION RATIO COMPRESSION IGNITION ENGINE

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Abstract

This review work presents the investigation of performance and emission characteristics of a compression ignition direct injection engine, when fueled with biofuel. Pure diesel and blends of biofuel are compared in its 6%, 12%, 18%, 24%, 30% and 36% blends (on a volume basis). The effects of load on brake power, brake thermal efficiency, brake mean effective pressure and specific fuel consumption and emission characteristics as carbon monoxide, carbon dioxide, hidrocarbons and nitrogen oxides has been investigated and presented.
Keywords: Nahar, Biodiesel, Performance characteristics, Emission Characteristics.

1. Introduction

The requirements for the alternative fuel sources include being environmentally friendly, economically feasible and renewable, while being compatible with present day diesel engine infrastructure [1]. In the context of diesel engines, biodiesel found as the front runner for main stream adoption. This has led to various experimental studies of to improve biodiesel usage in diesel engines, such as improving cold flow properties [2], additives [3] and preheating [4]. Many researcher has worked with biofuel by considering alternative fuel. An

 ISBN : 978-93-87793-50-7

experimental study was conducted to determine the feasibility of using flash pyrolysis oil of wood in diesel power plants [5]. Biodiesel extracted fomJatropha oil was investigated for emission characterstics analysis on a single cylinder VCR engine with various loads and blends. Blends (biodiesel + diesel) of JB00, JB10, JB20, JB30, and JB100 were prepared at 40°C. The emission parameters, such as nitrogen oxides (NO_x), carbon monoxide (CO), and hydrocarbon (HC), were studied and compared to diesel fuel. Results showed that, among the blends prepared from methyl ester of Jatropha, JB30 shows reduction in emissions [6]. Experiments were carried out with common karanja derived biodiesel. Both commonly agreed on reduction of HC emission, with contradictory results reported for $NO_x$and CO emissions [7-8]. This research work reports on the use of nahar oil, as a potential source of biodiesel.

2. Process Parameters

The transesterification is an extensive, most promising and convenient method for reduction of density and viscosity of the biofuels. However, this process adds extra cost of processing because of the transesterification reaction involving process heat inputs and chemicals [9-13]. In this process, Nahar Oil is heated up to 65°C in a round bottom flask. KOH used up to 30g and methanol is dissolved in solution. Solution is poured into round bottom flask while stirring the mixture continuously. The mixture is maintained at 65°C for 3 hours and then allowed to settle under gravity in a separating funnel. Out of two layers formed, lower layer is of glycerol and upper layer is of biofuel. The lower layer is separated out and ester is mixed with 10% (by volume) hot water and shaken properly and again allowed to settle down for 24 hours. Water containing KOH in the lower layer of the separating funnel is removed. The remaining moisture from the purified ester is removed using crystals of silica gel. The ester is then blended with diesel oil in various concentrations for preparing biodiesel blends, which are subsequently used in engine tests. The blends is referred as B06 (B06 blend is 06 % biodiesel and 92 % diesel oil), B12, B18, B24, B30 and B36.

2.1 Engine Setup

The engine was run till the steady state is reached. Then the engine was loaded in steps of 0 kg, 3 kg, 6 kg, 9 kg, 12 kg and 15 kg load at constant compression ratio of 17. Experiment is carried out initially using neat diesel fuel to generate the base line data. After recording the base line data, tests are carried out using B00, B06, B12, B18, B24, B30 and B36 biodiesel blends. The engine tests are conducted at various loads and the parameters related to performance and emission characteristics are recorded.

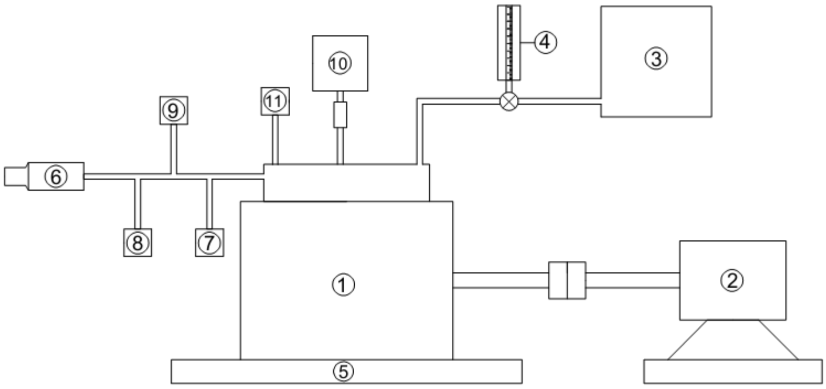

Fig. 01 Engine set up

1. Test engine, 2. Dynamometer, 3.Fuel tank, 4.Fuel burette, 5. Test bed, 6. Silencer, 7. Smoke meter, 8. HC / CO / NO_x / CO_2 / O_2nnalyzer, 9. Exhaust temperature sensor, 10. Air flow meter, 11. Stop watch

2.2 Specification of Engine Setup

Detaıled specification of test setup is discussed at below table.

Table 2: Engine Specification

Sr. No.	Description	Specification
1	Make	Rocket Engineering Model
2	Bore	80 mm
3	Stroke	110 mm
4	Swept Volume	553 mm
5	RPM	1500
6	Brake Horse Power	5 HP
7	Fuel Oil	High Speed Diesel

8	Coefficient of Discharge	0.65
9	Water Flow Transmitter	0 to 10 lit./min.
10	Air Flow Transmitter	0 to 250 wc
11	Piezo Sensor	0 to 5000 psi with low noise cable
12	Software	Labview

In the recent years, serious efforts have been made by several researchers to use different sources of energy as fuel in existing diesel engines. The use of straight vegetable oils is restricted by some unfavorable physical properties, particularly their viscosity. Due to higher viscosity, the straight vegetable oil causes poor fuel atomization, incomplete combustion and carbon deposition on the injector and valve seats resulting in serious engine fouling. It has been reported that when direct injection engines are run with neat vegetable oil as fuel, injectors get choked up after few hours and lead to poor fuel atomization, less efficient combustion and dilution of lubricating oil by partially burnt vegetable oil

A Prabhu et al.investigated the performance, combustion and emission characteristics of a single cylinder direct injection (DI) diesel engine with three fuel series: biodiesel–diesel (B20), biodiesel–diesel–nanoparticles (B20A30C30) and biodiesel–nanoparticles (B100A30C30). The nanoparticles such as Alumina (Al_2O_3) and Cerium oxide (CeO_2) of each 30 ppm are mixed with the fuel blends by means of an ultrasonicator, to attain uniform suspension. The brake thermal efficiency of the engine for the nanoparticles dispersed test fuel (B20A30C30) significantly improved by 12%, succeeded by 30% reduction in NO emission, 60% reduction in carbon monoxide emission, 44% reduction in hydrocarbon emission and 38% reduction in smoke emission, compared to that of B100. [14]

ChiranjieevaRaoSeela et al. investigational research is carried out to found the performance and emission characteristics of a DI diesel engine with Cerium Oxide Nanoparticles additives in diesel and biodiesel blends. Mahua methyl ester was produced by transesterification and blended with diesel. Cerium Oxide Nanoparticles of 50 and 100 ppm in proportion is subjected to high speed mechanical agitation followed by ultra-sonication. The experimentations was conducted on a single cylinder DI diesel engine at a constant speed of 1500 rpm using different cerium oxide (CeO2)-blended biodiesel fuel (B20 + 50 ppm, B20 + 100 ppm, B50 + 50 ppm and B50 + 100 ppm) and the outcomes were compared with those of neat diesel and Mahua biodiesel blend (B20 and B50). [15]Qibai Wu et al. investigated the effects on engine performance and exhaust emissions using carbon coated aluminium (Al@C) nanoparticles as additives in palm oil methyl ester biodiesel. The nanoparticles were blended with the biodiesel fuel in the mass fractions of 30 ppm under ultrasonic mixing. A series of experimental tests have been conducted using a heavy-duty diesel engine test bench provided by Cummins. The results show clearly that adding Al@C nanoparticles can reduce brake specific fuel consumption (BSFC) remarkably with average of 10%. NOx and CO emission reduce significantly in nanoparticles fuel blends cases at about 12% and 9% respectively, comparing with neat biodiesel. [16]

Shivaramakrishna et al. proposed that, performance and emission of a single cylinder four stroke variable compression multi fuel engines when fueled with 20%, 25% and 30% of Karanja blended with diesel are investigated and compared with standard diesel. Experiment has been conducted at compression ratios of 15:1, 16:1, 17:1, and 18:1. The impact of compression ratio on fuel consumption, brake thermal efficiency and exhaust gas emissions has been investigated and presented. Experimental analysis on the performance of biodiesel over diesel was evaluated by response surface methodology to find out the optimized working condition. The overall optimum is found to be 25% biodiesel–diesel blended with a compression ratio of 18. [17]A Prabhu et al. found that to evaluate the effect of nano particles such as Alumina (Al2O3) and Cerium oxide(CeO2) as additives in Jatropha biodiesel, an experimental investigation is carried out to study the performance and emission characteristics in a single cylinder, four stroke DI diesel engine. Alumina and Cerium oxide nano particles are added with Jatropha biodiesel at mixed proportions forming 10, 30 and 60 parts per million. Significant improvement in the brake thermal efficiency near to that of neat diesel is observed for the nano particle blended test fuels along with the reduction of nitric oxide, carbon monoxide, unburned hydrocarbon and smoke emission by 13 %, 60 %, 33 % and 32 % respectively. [18]

Abbas AlliTaghipoorBafghi et al. suggest that investigation is carried out to establish the performance characteristics of a compression ignition engine while using cerium oxide nanoparticles as additive in neat diesel and diesel-biodiesel blends. In the first phase of the experiments, stability of neat diesel and diesel-biodiesel fuel blends with the addition of cerium oxide nanoparticles is analyzed. Afterseries of experiments, it is found that the blends subjected to high speed blending followed by ultrasonic bath stabilization improves the stability. In the second phase, performance characteristics are studied using the stable fuel blends in a single cylinder four stroke engine coupled with an electrical dynamometer and a data acquisition system. The tests revealed that cerium oxide nanoparticles can be used as additive in diesel and diesel-biodiesel blends to improve complete combustion of the fuel significantly. [19]K. NanthaGopal et al. proposed that biodiesel produced from Pongamia oil has been considered as promising option for diesel engines because of its environmental friendliness. In this work, bio-diesel from Pongamia oil is prepared (PME 100), tested on a diesel engine for different blends such as PME 20, PME 40, PME 60 and PME 80. Comparison is made with diesel operation. Parameters such as brake thermal efficiency, brake specific fuel consumption, carbon monoxide, unburned hydrocarbons, smoke and NOx emissions are evaluated. Even though the performance reduces slightly when the engine is fueled with biodiesel, significant changes in the combustion parameters observed in case of biodiesel blends are significant to note. On the other hand, reduction in CO, HC and smoke is observed. Study reveals the effect of bio-diesel on a DI engine when compared to diesel and evolves conclusions with respect to performance and emissions. [20]

Puneet Sharma et al. said that, increased population has resulted in extra use of conventional sources of fuels due to which there is risk of extinction of fossil fuels' resources especially petroleum diesel. Higher viscosity is a major issue while using vegetable oil directly in engine which can be removed by converting it into biodiesel by the process of transesterification. Various fuel properties like calorific value, flash point and cetane value of biodiesel and biodiesel–diesel blends of different proportions were evaluated and found to be comparable with petroleum diesel. The result of investigation shows that Brake Specific Fuel Consumption (BSFC) for two different samples of B10 blend of eucalyptus biodiesel is 2.34% and 2.93% lower than that for diesel. Brake Thermal Efficiency (BTE) for B10 blends

was found to be 0.52% and 0.94% lower than that for diesel. Emission characteristics show that Smoke Opacity improves for both samples, smoke is found to be 64.5% and 62.5% cleaner than that of diesel. [21]S. Nagaraja et al. found that, the performance and emission characteristics of a direct injection variable compression ratio engine when fueled with pre-heated palm oil and its 5%, 10%, 15%, 20% blends with diesel (on a volume basis) are investigated and compared with standard diesel. The suitability of raw palm oil using pre-heated in the temperature range of 90º C as a fuel has been presented in this study. Experiments were conducted at constant speed of 1500 rpm, full load and at compression ratios of 16:1, 17:1, 18:1, 19:1 and 20:1. The effects of compression ratio on brake power, mechanical efficiency, indicated mean effective pressure and emission characteristics has been investigated and presented. The blend O20 is found to give maximum mechanical efficiency at higher compression ratio and it is 14.6% higher than diesel. Also the brake power of blend O20 is found to be 6% higher than standard diesel at higher compression ratio and indicated mean effective pressure of blend O20 is found to be lower than diesel at higher compression ratio. Exhaust gas temperature is low for all the blends compared to diesel. [22]
C. Srinidhi et al. performed an experiment analysis of performance parameter such as brake power, break specific fuel consumption, brake thermal efficiency and Exhaust Gas temperature and emission characteristics (NOx, HC, CO. etc.) is obtained for various bio diesel and diesel blends and compared with ordinary diesel at various loads on a modified variable compression ratio CI engine. The results of the investigation shows that the performance and emission characteristics of the engine fuelled with Honne oil methyl ester – diesel blends is comparable to the ordinary diesel. [23]M. Habibullah et al. found that biodiesel is a renewable and sustainable alternative fossil fuel that is derived from vegetable oils and animal fats. This study investigates the production, characterization, and effect of biodiesel blends from two prominent feed stocks, namely, palm and coconut (PB30 and CB30), on engines. PB15CB15 improves brake torque and power output while reducing BSFC and NOx emissions when compared withCB30. Meanwhile, compared with PB30, PB15CB15 reduces CO and HC emissions while improving brake thermal efficiency. The experimental analysis reveals that the combined blend of palm and coconut oil shows superior performance and emission over individual coconut and palm biodiesel blends. [24]

 ISBN : 978-93-87793-50-7

S. Imtenan et al. found that recent years, palm and jatropha biodiesels have been considered as potential renewable energy sources in Malaysia. Therefore, this experimental investigation was conducted to improve the blend of these two biodiesels (20% biodiesel blend, named P20 and J20, respectively) with the help of oxygenated additives. The comparative improvement of P20 and J20 blends with ethanol, n-butanol, or diethyl ether as additives was evaluated in terms of performance and emissions characteristics of a four-stroke single cylinder diesel engine. The final blend consisted of 80% diesel, 15% biodiesel, and 5% additive. Tests were conducted at different speeds (1200–2400 rpm) at constant full load conditions. Use of additives significantly improved brake power and brake thermal efficiency (BTE). [25]

G. Sakthiveletal.proposed that the thirst for fuel is steadily increasing as technology continues to open new areas of exploration. At the same time, the indiscriminate extraction of fossil fuels also may result in extinction of petroleum deposits in foreseeable future. Along with this, pollutant emission from diesel engines causes major impacts on ecological systems. In order to overcome the above problems associated with the use of petroleum derived fuels, a suitable source of biodiesel should be used to replace conventional diesel fuel. Hence, in this work, feasibility of using biodiesel prepared from fish oil was investigated. Various properties such as viscosity, density, calorific value, flash point and cetane value of biodiesel and biodiesel–diesel blends of different proportions were investigated. Later, experimental tests were carried out to evaluate the performance, emission and combustion characteristics of a single cylinder, constant speed, direct injection diesel engine using biodiesel–diesel blends, under variable load conditions. [26]V. Arul MozhiSelvan et al. investigated, the performance, combustion and emission characteristics of a variable compression ratio engine using Cerium Oxide Nanoparticles and Carbon Nanotubes as fuel-borne nanoparticles additives in Diesterol (diesel–biodiesel–ethanol) blends. As Diesel and Ethanol are immiscible, Castor oil biodiesel is used as an additive which acts as a bridging agent to prevent the phase separation. The addition of CERIA and CNT in Diesterol blend increases the cylinder gas pressure when comparing with the neat Diesterol blends. The Cerium Oxide Nanoparticles act as an oxygen donating catalyst which provides oxygen for the oxidation of carbon monoxide and absorbs oxygen for the reduction of nitrogen oxides. The combined effect of CERIA and CNT as fuel-borne nanoparticles additives in the Diesterol fuel blend

 ISBN : 978-93-87793-50-7

contributes for the cleaner combustion and significantly reduces the harmful exhaust gas emissions. [27]

K. NanthaGopal et al.produced biodiesel from pongamia oil has been considered as promising option for diesel engines because of its environmental friendliness. In this work, bio-diesel from pongamia oil is prepared (PME 100), tested on a diesel engine for different blends such as PME 20, PME 40, PME 60 and PME 80. Comparison is made with diesel operation. Parameters such as brake thermal efficiency, brake specific fuel consumption, carbon monoxide, unburned hydrocarbons, smoke and NOx emissions are evaluated. Even though the performance reduces slightly when the engine is fueled with biodiesel, significant changes in the combustion parameters observed in case of biodiesel blends are significant to note. On the other hand, reduction in CO, HC and smoke is observed. Study reveals the effect of bio-diesel on a DI engine when compared to diesel and evolvesconclusions with respect to performance and emissions. [28]PuneetVermaetal.conclude that, environmental concerns and energy crisis of the world has led to the search of viable alternatives to conventional sources of fuel. FAME (Fatty Acid Methyl Ester) is environment friendly, alternative, and nontoxic, safe, biodegradable has a high flash point and is also termed as Bio-Diesel. It is commonly produced by the process transesterification. For its production, establishment of suitable process, selection of proper feedstock and reaction parameters is of utmost importance in present scenario. This paper is an attempt to investigate diesel engine performance with cotton seed biodiesel. A higher BTE was found with the preheated with B20, B40 and B60 that 3.74%, 10.46%, 3.27% at full load more than that for diesel. Smoke was reduced with considerable factor when quantity of biodiesel is increased in pure diesel. [29]

Selvaganapthy et al. concluded that the ignition delay reduced, peak pressure and heat release rate increased due the presence of particles. The reasons for the same are explained above under each chapter. Due to these observation, and we found that the brake thermal efficiency increased minutely. As a drawback, it was also found that the emissions NOx, increased. It was found the mixing of nano particles with diesel to be innovative and it has a lot of promise for the future. Looking into the future, we can also try Different nano particles in same composition and weight can be used and the results can be analyzed. [30]

J. SadhikBasha et al. conclude that the present study reports the results of Alumina and CNT (carbon nanotube) nanoparticles blended biodiesel fuel on the performance, emission, and combustion characteristics of a diesel engine. The biodiesel is produced from the raw jatropha oil by standard transesterification process, and subsequently, the nanoparticles such as Alumina, CNT, and Alumina–CNT are blended with the biodiesel fuel in the mass fractions of 25 and 50 ppm with the aid of an ultrasonicator. The characterization studies of the nanoparticles such as TEM and XRD are carried out to analyze their morphology. [31]

K. Fangsuwannarak et al. performed a comparative study of biodiesel properties and engine performance efficiency with the addition of TiO2 nanoparticles were conducted initially. The basic properties of the base fuel and the modified fuel formed by dispersing the catalyst TiO2 nanoparticles by ultrasonic are measured using ASTM standard test methods. The various palm oil fractions of 2%, 10%, 20%, 30%, 40%, 50% and 100% in the rest of ordinary diesel fuel are denoted as B2, B10, B20, B30, B40, B50, and B100, respectively, which are in the fuel standard. A chassis dynamometer used under the simulation of road load conditions with eddy current brake was used to measure engine brake power, engine torque, wheel power, and specific fuel consumption (SFC). Exhaust emission values were measured directly by sampling from exhaust pipe with a probe of the analyzers. [32]Kumar D. and Ali A. carried out the preparation of potassium ion impregnated calcium oxide in nanocatalyst for transesterification of a variety of triglycerides. In order to establish the effect of Kþ impregnation on catalyst structure, particle size, surface morphology, and basic strength, the characterized by powder X- ray diffraction, scanning electron and transmission electron microscopic, BET surface area measurement, and Hammett indicator. The catalyst prepared by impregnating a mass fraction of 3.5% Kþ in CaO was found to exist as w40 nm sized particles. [33]Wail M. Adaileh et al. conclude that in this study, the combustion characteristics and emissions of compression ignition diesel engine were measured using a biodiesel as an alternative fuel. The tests were performed in Chemical and Mechanical Engineering department laboratories at steady state conditions for a four stroke single cylinder diesel engine loaded at variable engine speed between 1200-2600 rpm. The experimental results compared with standard diesel show that biodiesel provided significant reductions in CO, and unburned HC, but the NOx was increased. [34]

Syed AmeerBasha et al. conclude that effect of different catalysts and additives on biodiesel production, performance, combustion and emission characteristics. This study is based on the reports of about 60 scientists who published their findings between 1998 and 2010. It was reported that base catalyst produced more biodiesel compared to acid type catalysts. There was not much variation in engine performance with the use of catalyst. Combustion characteristics were improved with the use of additives. [35]J SadikBasha et al. (carreid experimental investigation is carried out to establish the performance,emission, and combustion characteristics of a diesel engine using carbon nanotubes (CNT) blended water–diesel emulsion fuels. The investigation is carried out in three phases using an experimental set-up consisting of a single-cylinder diesel engine coupled with an electrical loading device, an AVL Di-gas analyser, an AVL smoke meter, and a data-acquisition system comprising a Kistler piezoelectric pressure transducer and a crank angle encoder: using neat diesel in the first phase, water–diesel emulsion fuel in the second phase, and CNT blended water–diesel emulsion fuels in the third phase. [36]

A.S. Silitonga et al proposed that, energy is fundamental to the quality of life in the earth. Meeting the growing demand for energy sustainably is one of the major challenges of the 21st century. Indonesia is a developing country and the world's fourth most populous nation. Total annual energy consumption increased from 300,147 GWh in 1980, 625,500 GWh in 1990, 1,123,928 in 2000 and to 1,490,892 in 2009 at an average annual increase of 2.9%. Presently, fossil-fuel-based energies are the major sources of energy in Indonesia. During the last 12 years, Indonesia has recorded the most severe reduction in fossil fuel supplies in the entire Asia-Pacific region. [37]May Ying Koh et al. found, the demand for petroleum has risen rapidly due to increasing industrialization and modernization of the world. This economic development has led to a huge demand for energy, where the major part of that energy is derived from fossil sources such as petroleum, coal and natural gas. However, the limited reserve of fossil fuel has drawn the attention of many researchers to look for alternative fuels which can be produced from renewable feedstock. Biodiesel has become more attractive because of its environmental benefits and it is obtained from renewable resources. [38]

B. K. Venkanna et al. found an alternative fuel that can be used as diesel engine fuel. Literature pertaining to use of vegetable oil in diesel engine with kerosene and dimethyl carbonate (DMC) is scarce. Experiments have been conducted when fuelled with H20 (20%H + 80%D), HK (20%H + 40%K + 40%D) and HKD5 (20%H + 40%K + 35D + 5%DMC) to HKD15 in steps of 5% DMC keeping H and K percentages constant. The emissions (CO, HC and smoke density (SD)) of fuel blend HKD15 are found to be lowest, with SD dropping significantly. The NOx level is slightly higher with HKD5 to HKD15 as compared to ND. The brake thermal efficiency of HKD5 to HKD15 is same and it is higher than that of ND. There is a good trade off between NOx and SD. Peak cylinder pressure and premixed combustion phase increases as DMC content increase.[39]Prafulla Patil et al. performed the experiments of reaction kinetics of transesterification of Camelina sativa oil using metal oxide catalysts under the conventional heating and the microwave-heating conditions were investigated. The transesterification reaction rates and the fatty acid methyl ester (FAME) conversion rates were determined using heterogeneous metal oxide catalysts, i.e., BaO, CaO, MgO and SrO and two different heating methods. It was observed during the kinetic studies in this work that the BaO and SrO catalysts generated higher FAME yields than the CaO and MgO catalysts. [40]

Siddharth Jain et al. found that, the increasing industrialization and modernization of the world has to a steep rise for the demand of petroleum products. Economic development in developing countries has led to huge increase in the energy demand. In India, the energy demand is increasing at a rate of 6.5% per annum. The crude oil demand of the country is met by import of about 80%. Thus the energy security has become a key issue for the nation as a whole. Petroleum-based fuels are limited. Biodiesel, an ecofriendly and renewable fuel substitute for diesel has been getting the attention of researchers/scientists of all over the world. [41]

D.H. Qi et al. found that biodiesel is an alternative diesel fuel that can be produced from different kinds of vegetable oils. It is an oxygenated, non-toxic, sulphur-free, biodegradable, and renewable fuel and can be used in diesel engines without significant modification. However, the performance, emissions and combustion characteristics will be different for the same biodiesel used in different types of engine. In this study, the biodiesel produced from soybean crude oil was prepared by a method of alkaline-catalyzed transesterification .[42]

Nagarhalli M. V et al investigate that experimental for to analyze the emission and performance characteristics of a single cylinder 3.67 kW, compression ignition engine fuelled with mineral diesel and diesel-biodiesel blends at an injection pressure of 200 bar. The performance parameters evaluated were break thermal efficiency, break specific energy consumption (BSEC) and the emissions measured were carbon monoxide (CO), carbon dioxide (CO2), hydrocarbon (HC), and oxides of nitrogen (NOx). [43]

SadhikBasha et al. carried out experimental investigations in a single cylinder, four stroke, naturally aspirated, air cooled, constant speed, direct injection diesel engine by using Carbon Nanotubes (CNT) dispersed at 25, 50 and 100 ppm separately in Jatropha biodiesel by using surfactants Span 80 and Tween 80 as a bridging medium for the preparation of Jatropha emulsion test fuel. Based on the results, they found enhanced brake thermal efficiency percentage of 15% with significant NO reduction percentage of 29%.[44] Shivakumar et al. found one of the significant route to tackle the problem of increasing prices and the pollution problems of petroleum fuels is by the use of vegetable oil fuels known as biodiesels. Performance studies were conducted on a single cylinder fourstroke water-cooled compression ignition engine connected to an eddy current dynamometer. Experiments were conducted for different percentage of blends of Honge oil with diesel at various compression ratios. Experimental investigation on the Performance parameters and Exhaust emissions from the engine were done. Artificial Neural Networks (ANNs) were used to predict the Engine performance and emission characteristics of the engine. [45]Boz N. et al demonstrated calcination of KF-impregnated nanoparticles of g-Al2O3 and used as heterogeneous catalysts for the transesterification of vegetable oil with methanol for the synthesis of biodiesel. The ratio of KF to nano-g-Al2O3, calcination temperature, molar ratio of methanol/oil, transesterification reaction temperature and time, and the concentration of the catalyst were used as the parameters. [46]

Md. NurunNabi et al.found that, biodiesel (BD) from non-edible renewable karanja (PongamiaPinnata) oil, determination of BD properties and influence of BD on engine performance and emissions. It has been found that cultivating of karanja plant in such unused land; Bangladesh can reduce DF import by 28%. Karanja methyl ester (KME), which is termed as BD, has been produced by well-known transesterification process. [47]

Marian Verziu et al.obtained biodiesel from rapeseed oil and sunflower oil using different nanocrystallineMgO catalysts in nano sheets form, which were prepared by conventional and aero gel method. Working under microwave conditions with these systems led to higher conversions and selectivity when preparing methyl esters, as compared to autoclave or ultrasound conditions. MgO can be used effectively as a heterogeneous catalyst for biodiesel transesterification. The exposed facet of the MgO has an important influence on activity and selectivity. [48]ZaferUtlu et al. conclude that, usage of methyl ester obtained from waste frying oil (WFO) is examined as an experimental material. A reactor was designed and installed for production of methyl ester from this kind of oil. Physical and chemical properties of methyl ester were determined in the laboratory. Gathered results were compared with No. 2 diesel fuel. Engine tests results obtained with the aim of comparison from the measures of torque, power; specific fuel consumptions are nearly the same. [49]

Bora et al. performed an experimental analysis with Nahar biodiesel and he concluded that existing diesel engine can be operated with NOME blends (up to 30%) with diesel with almost comparable performance as that of neat diesel. Undesirable combustion symptoms of neat vegetable oils in diesel engine can be got rid of by way of transesterification. A blend [30% (by vol) of NOME and 70% of neat diesel] can be effectively used in existing diesel engines without any engine hardware modification. Lianyuan Wang et al determined that nano-MgO has higher catalytic activity in the supercritical/subcritical temperatures. At the stirring rate of 1000 rpm with 3 wt % nano-MgO, the transesterification reaction was completed and more than 99 % yield were obtained within reaction time of 10 min under 533ºK temperature and at high pressure of 28.7 MPa, with the methano/oil molar rate of 36:1. The higher reaction rate with nano-MgO was mainly attributed to the lower activation energy (75.94 kJ/mol) and the higher stirring. [50]Michael J. Haas concluded semirefined and refined vegetable oils are the predominant feedstocks for the production of biodiesel. However, their relatively high costs render the resulting fuels unable to compete with petroleum-derived fuel. We have investigated the production of fatty acid methyl esters (FAME; biodiesel) from soapstock (SS), a byproduct of edible oil refining that is substantially less expensive than edible-grade refined oils. This resulted in an acid oil with a free fatty acid (FFA) content greater than 90%. [51]M.Canakci et al. conclude that, biodiesel is currently expensive but would be more cost effective if it could be produced from low–cost oils (restaurant waste, frying oils, animal fats). These low–cost feedstocks are more challenging to process because they contain high levels of free fatty acids. A process for converting these feedstocks to fuel–grade biodiesel has been developed and described previously. The objective of this study was to investigate the effect of the biodiesel produced from high free fatty acid feedstocks on engine performance and emissions. The neat fuels and their 20% blends with No. 2 diesel fuel were studied mat steady–state engine operating conditions in a four–cylinder turbocharged diesel engine. [52]

3. Conclusions

The present review has demonstrated the extensive research effort. It identifies a number of areas that performance and emissions analysis of Bio Diesel.From an engineering perspective, there is a need to investigate the occurrence and significance of flaws in emissions analysis of Bio Diesel.

- Biodiesel by adding Nano particle as agent at the time of triesterification will reduce the emission.
- Analysis of the engine performance with biodiesel produced by using Nano particle as a agent.
- Analysis of emission characteristics of diesel engines fuelled with biodiesel produced by using Nano particle as catalyst
- At constant compression ratio and constant engine RPM by varying load is found superior blend in comparison with Diesel (B00) and other Blends.
- Percentage Improvement in results of nanoparticales in comparison with Bio diesel in performance characteristics BP, BMEP, BTHE and BSFC.
- Percentage decrement in results of addition of nano particle in comparison with bio diesel in performance characteristics CO, HC, CO_2

- The NOx emission for entire range of fuel is higher as blends of biodiesel increases this is due to high viscosity is observed at all blends of biodiesel.
- Nahar biodiesel could be used as an alternative fuel in compression ignition engine without any engine modifications.

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