AN EXPERIMENTAL APPROACH TO IMPROVE PERFORMANCE CHARACTERISTICS OF C.I. ENGINE BY USING NANO PARTICLE IN BIODIESEL AS ADDITIVE

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ABSTRACT

Due to depletion of fossil fuel and enhancement with no. Of diesel vehicle, so development of alternate renewable fuel is very important. AS crude oil & petroleum products are difficult to find and also costly in terms of searching and producing. AS the development of fuel engines is improved vastly, but due to large amount of demand of fuel need to focus on it. Also it is required due to pollution occurred by exhaust of gasoline engines. The another reason is that the large amount of crude oil is important from those countries where these are found out in plenty amount. Biodiesel is first fuel which fulfil all the requirement needed for US Clean Air Act. It provides reduction in HC which remain unburnt , CO & particulate matter. It also remove amount of sulphur content. It is renewable, Biodegradable & toxic less, It is made chemically with the help of alcohol and vegetable oil with acid as catalyst.

Keywords— *Nano particle, Biodiesel, Diesel Engine, Efficiency;*

INTRODUCTION

Rudolf diesel invented the point of diesel engine, after 100 years, the experiment performed on peanut oil to search as an alternative fuel vegetable oil and due to depletion of fossil fuel and enhancement in the number of diesel vehicle, So development of alternative renewable fuel is very important. There are many biomass source exist which can be utilised as a source of energy for the development of agriculture, industrial and transport area due to high amount of energy demand. The requirement of diesel as a fuel is so high, even agriculture and industrial areas are so much dependent on it.

It is known that crude oil and petroleum product are in limited amount and very difficult to search and produce. As the development of fuel engines is improved, but due to large amount of demand of fuel need to focus on it. Also it is required due to pollution occurred because of exhaust of gasoline engines. As the report of NBA(National Biodiesel board), 0.5 million gallon selling of biodiesel was in 1999, the 2 million gallon in 2000, 5 million gallons in 2001, 15 million gallon in 2002 and forecasted 25 million gallon in 2003, 35 million gallons in 2006, It can be used as a fuel in diesel engines and no modification is necessary up to 20%. Biodiesel fulfils all the requirement of US clean air Act. It provides significant reduction of hydrocarbon which are unburnt, lower the CO and particulate matter. Biodiesel substantially lowers the solid carbon part of particulate matter. It lowers the CO_2 up to 78% on a life cycle basis.

Biodiesel are produced by Rapseed (UK), Sunflower (Italy), Soyabean (USA, Brazil) etc and non edible oil like Mahua, Jatropha, Pongamia in India. Approximate 100 biodiesel production plants are open in the world.

Biodiesel scenario in the World

School diesel buses are also main source for pollution which is responsible for health issues of children. By using biodiesel, these problems can be controlled. In 1991, the district school buses of Medford, New Jersey utilised biodiesel as a fuel. In 2002, Olympia and Illinois school district buses used biodiesel, also in Clark country, Nevada school district etc due to this, three big auto car companies developed new generation of vehicles. As the efficiency of diesel engine is 30% more than gasoline engines. So this concept is also applicable in case of power production or better fuel economy with respect to CO_2 emission. Currently Diesel engines are short, compact, smooth combustion and effective. That's why more attractive to auto manufacturers.

BIODIESELS

Biodiesel is fuel which is toxic less, degradable biologically and also renewable. It is produced from either edible or non edible vegetable oil or fats of animal. It is made by reacting chemically between alcohol and vegetable oil with the help of catalyst either base or acid. Biodiesel contains excellent lubricating properties. It does not contain any content of sulphur and 10% O_2 as a built in weight. It contains higher cetane no. than petrol or diesel. It is mainly made from renewable sources and it is clean burnt alternative fuel. It does not contain any petroleum content but it can be blended to make a blended fuel.

Pure biodiesel cannot be used with rubber because of property of solvent. It may destroy the gaskets and hoses of natural rubber. Up to 20% no modification is required. It is not require any special type of storage system for biodiesel, even it can be stored similarly to petroleum product as in the form of blend but it is harmful for rubber at more blended fuel. It contains lower offensive exhaust. It has very lower change in order of exhaust and even it smells like the fumes of French fries. It does not contain any problem of irritation of eye and it is more safer to use than other petroleum fuels. The flash point of biodiesel as a pure form is 260^0 compared to 125^0 Fahrenheit of no. 2 diesel type and also it reduces the amount of emission noticeably.

NANOFUELS

Due to adding nano particles in biodiesel, more surface area obtained with water and more reaction of decomposition of H_2 from H_2O.Alumina works in the form of catalyst. Nano metal oxides are considerable successful in lowering the emission of diesel engines. The blends of bio diesel successfully reduces the smoke and harmful exhaust gases and also increases the output energy as heat of combustion. For the reduction of emission of diesel nano metal oxides are very useful. The metal in this take participation in reaction with water to form hydroxyl radicals, by which soot oxidation is improved so reduces the temperature of oxidation.

As the powder of Aluminium is known as a n ingredient to form explosive but due to current technology it is possible to form nano size aluminium particles. The thermal behaviour like bizarre is shown due to stored internal energy. The agent which increases the property of combustion due to high rate of reaction is rudimentary aluminium.

LITERATURE REVIEW

1. Ghazali et al. [1].

It indicates that biodiesel could make utilized Likewise a supplanting from claiming diesel. In this test diethyl ether will be watched with b 30 and b 40 Likewise An 2% Also 6% on the foundation for volume done ASTM D7467 standard methods. Those test effects would compared with guidelines What's more Outcomes indicate that those best aspects might have been to B30DE6 the place the DEE serves clinched alongside decreasing viscosity, thickness Toward 3. 6% Also corrosive quality Eventually Tom's perusing 57% contrasted with palm biodiesel. For palm biodiesel there may be decrement for measure for vitality.

2. Behçet et al. [2].

He led tests on a four stroke, solitary cylinder, diesel motor with diesel Also distinctive blends for Biodiesel during fluctuating preheating temperature. The results for emanation test would watched. Those BSEC for Bldend 20 will be base with 600C preheating and the gas temperature for debilitate gas will be greatest the place Similarly as immaculate diesel need least smoke thickness.

3. Rodrigues, et al. [3].

They contemplated transesterfication about soybean oil with biodiesel Toward the utilization from claiming CaO strong build impetus. Those response instrument might have been examined and the differentiate effects of the molar proportion for methanol will oil, response temperature, impostor proportion about impetus on oil What's more water content were investigated. It indicates that those proportion for 12:1 from claiming methanol and oil, including 8% CaO Similarly as a catalyst, 650C temperature Also 2. 03% content about water is best for result, and the biodiesel yield surpassed 95% toward 3 h. Those impetus lifetime might have been longer over that about calcined K2CO3/c-Al2O3 Also KF/c- Al2O3 impetuses. CaO need property from claiming animation considerably after 20 rounds for cycle and the biodiesel yield then afterward 1. 5 h need not been influenced because of repeatness from claiming cycle.

4. Leung et al. [4].

It reviewed the distinctive technique for bringing down free greasy acids in the crude oil Furthermore refinement for rough biodiesel which need aid utilized within the business. They likewise demonstrated those new methodology for preparation about biodiesel. Those non reactant methanol is best for little time response. This methodology will be unabated should control waste cooking oil Also fat for creature.

5. Mekhilef et al. [5].

Biodiesel may be arranged from soyabean unrefined petroleum which might have been produced by a system for basic catalysed trasnesterfication. Those paramount properties of bio diesel might have been compared for a diesel and biodiesel both would utilized as fuel in layering ignition loop motor. It execution emanation and burning properties for motor were analysed. The burning phases for biodiesel may be comparable Actually prior burning occur In more level motor those top barrel weight Furthermore top rate about weight may be increment and the top heat is uprooted. Throughout pre blend burning period the place higher to biodiesel those rate for crest weight Also heat discharged may be least. Crest weight variety for barrel at secondary load motor is comparative the BSFC might have been easier for biodiesel. Its diminishment is destructive for debilitate gasses thereabouts it camwood make utilized Concerning illustration An alternauve fuel.

6. Kumar et al. [6].

For this, the PAHs , BaPeq, utilization about fuel, effectiveness from claiming vitality and Pm might have been watched with generator Likewise different sorts about fuel test : P0 , P10, P20, P30, P50, P75 Also P100. Those element for emanation increments as palm oil biodiesel rate expands. The content from claiming PM emanation lowers down with increments On substance from claiming palm oil. Palm oil biodiesel may be best biodiesel Furthermore it may be best for ci engines.

7. Atabani et al. [7].

They investigations those different analysis conveyed around bio diesel in the reality and their yield qualities. Jatropha curcas (Ratanjyot), Pongamia pinnata (Karanj), calophyllum inophyllum (Nagchampa), Hevca brasiliensis (Rubber) and so on are non eatable oil Eventually Tom's perusing which bio diesel may be produced. Biodiesel camwood make mix in whatever proportion for example, such that diesel and there will be no adjustment oblige dependent upon exactly mix rate.

8. Alkabbashi et al. [8].

They aggravated an arrangement on get raw petroleum based palm oil Toward esterification proesess. It will be conveyed crazy Eventually Tom's perusing Comprehending temperatue of 600C and period 60 minute, 10:1

proportion of methanol What's more oil Furthermore amount of impetus by 1. 4 (%wt). Those test led would as: thickness from claiming POB toward room temperature may be 0. 8498 kg L-1, surface pressure In stp for 26. 96 mn m-1, with Huh-Mason revision for 0. 1 Furthermore At last spare greasy liver rate of 0. 12% (equivalent with corrosive quality about 0. 26 mg KOH g-1).

OBJECTIVE 0F RESEARCH WORK

RESEARCH GAP

Based on the literature survey following research gap have been found out.

- A little work has been done with the blends of dual biodiesel (Hybrid biodiesel) for engine performance and emissions.
- No work has been done yet, by using nanoparticles in hybrid biodiesel as an alternative fuel for engine.

OBJECTIVE OF PRESENT WORK

Based on the research gap, the objective of the present work are as follows.

- Preparation of soybean oil and palm oil biodiesel and its different blends with diesel.
- Preparation of hybrid diesel biodiesel blend with addition of alumina nano particles.
- Experimental analysis of thermo physical properties of biodiesel blends and blends with nano fuel.
- Experimentation for performance evaluation and emissions effects of biodiesel blends and hybrid biodiesel blend with Al_2O_3 nano particles on diesel engine.

EXPERIMENTAL SETUP
BIODIESEL PREPARATION

Figure 3. 1 Preparation material for biodiesel.

200 ml for methanol might need been included should a measuring utencil with 3. 5 gm. Over potassium hydroxide (KOH). Potassium hydroxide might have been mixed completely methanol something like that that no un dissolved particles appear.

Aluminium Oxide Nanoparticles

Preparation method of nanofuel blends

Mix 4 might have been made Similarly as a base fuel will get ready Nanofuel. The greatest ability from claiming ultrasonicator will be 250 ml so for legitimate blending from claiming nanoparticles 200 ml might have been taken at one time. Consequently it took five turns on settle on you quit offering on that one litre about Nanofuel. 200 ml of mix might have been weighed utilizing precision weighing machine Likewise demonstrated clinched alongside fig. 3. 9 and. 8 gm. (. 5% Toward weight) aluminium oxide nanoparticles were included to it.

Figure 3.9 Preparation of .5 wt. % Al_2O_3 Nanofuel

1 ml from claiming compass 80 (. 5% v/v) ws measured utilizing infusion What's more might have been included to mix. This result might have been after that kept in ultrasonicator for 45 minutes toward 20 khz for fitting blending of nanoparticles clinched alongside biodiesel mix.
This procedure might have been repeater four All the more times to preparation of one litre about Nanofuel.

Figure 3.10 Prepared Al_2O_3 blended Nanofuel

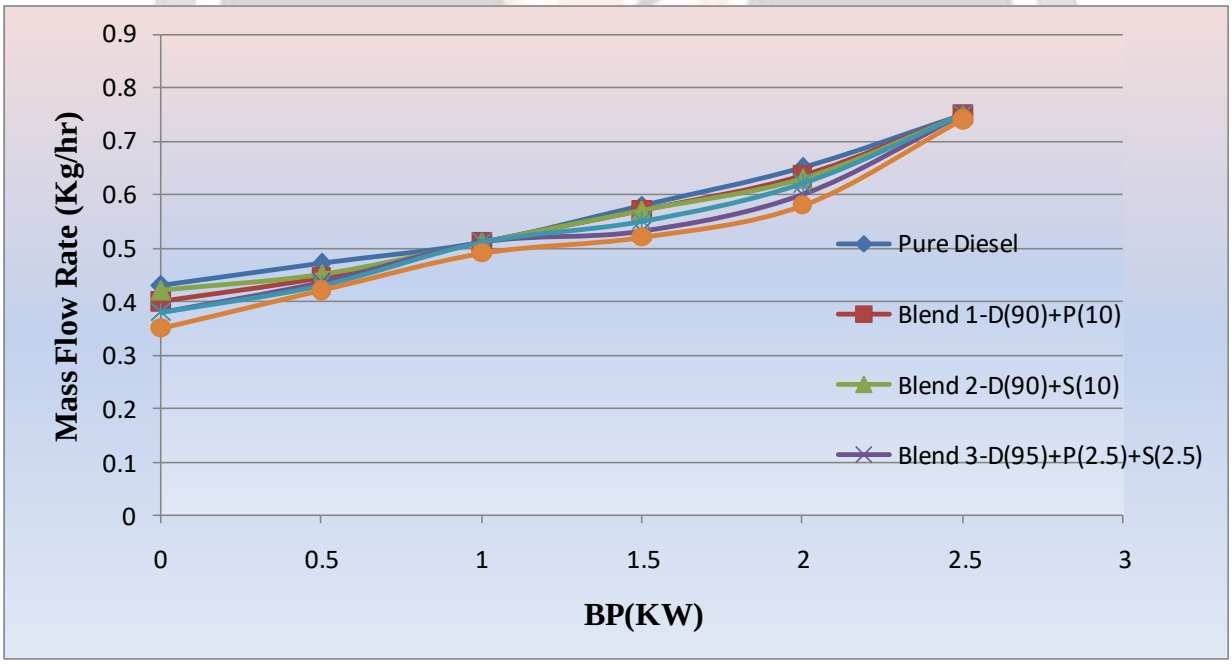
MEASUREMENT OF THERMO PHYSICAL PROPERTIES

The Engine elected for current experimentation is a computerized Kirloskar make CI Engine as shown in Fig. 3.11 with its properties specified in Table 3.3. This engine can go through higher pressures faced. Therefore, this engine is selected for carrying experiments.

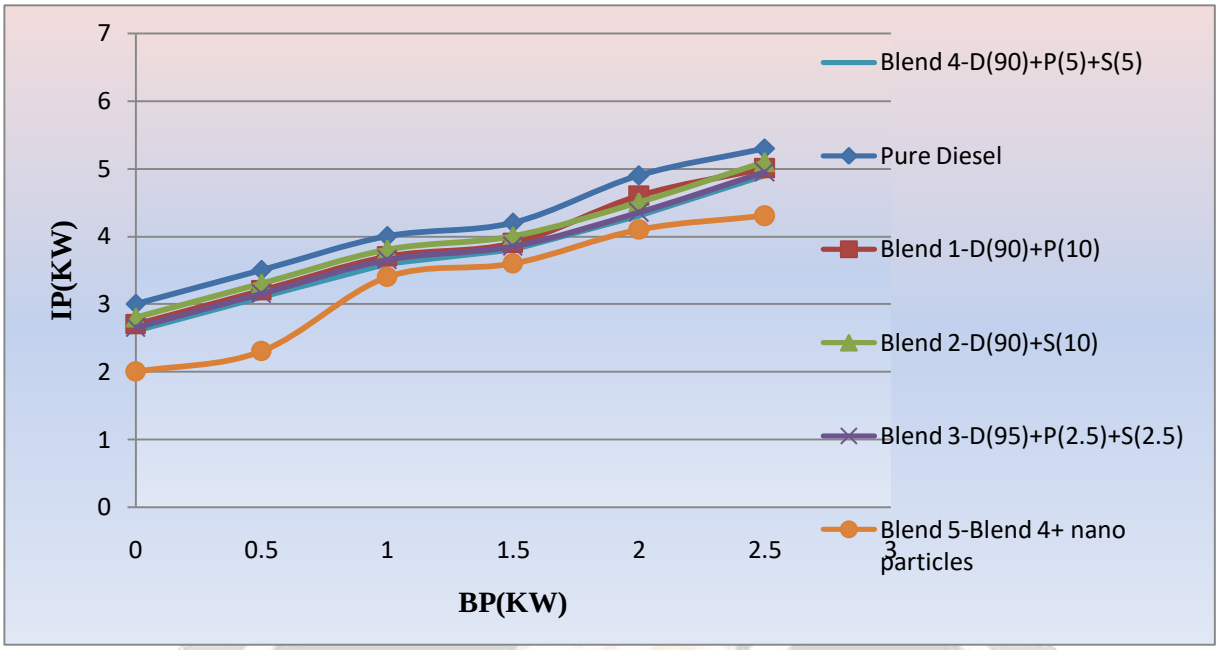
The Engine and DynamometerTable

Parameters	**Details**
Model type	Kirloskar, AV1
Engine type	Vertical, 4-stroke, single working high speed compression ignition diesel engine
No of cylinder	1
Rating at 1500 rpm	3.7KW
Base diameter	80mm
Strokelength	110mm
Cubic capacity	0.553 liters
Compression ratio	16.5:1
Rated speed	1500 rpm
Direction of rotation	Clockwise if looked from flywheel side

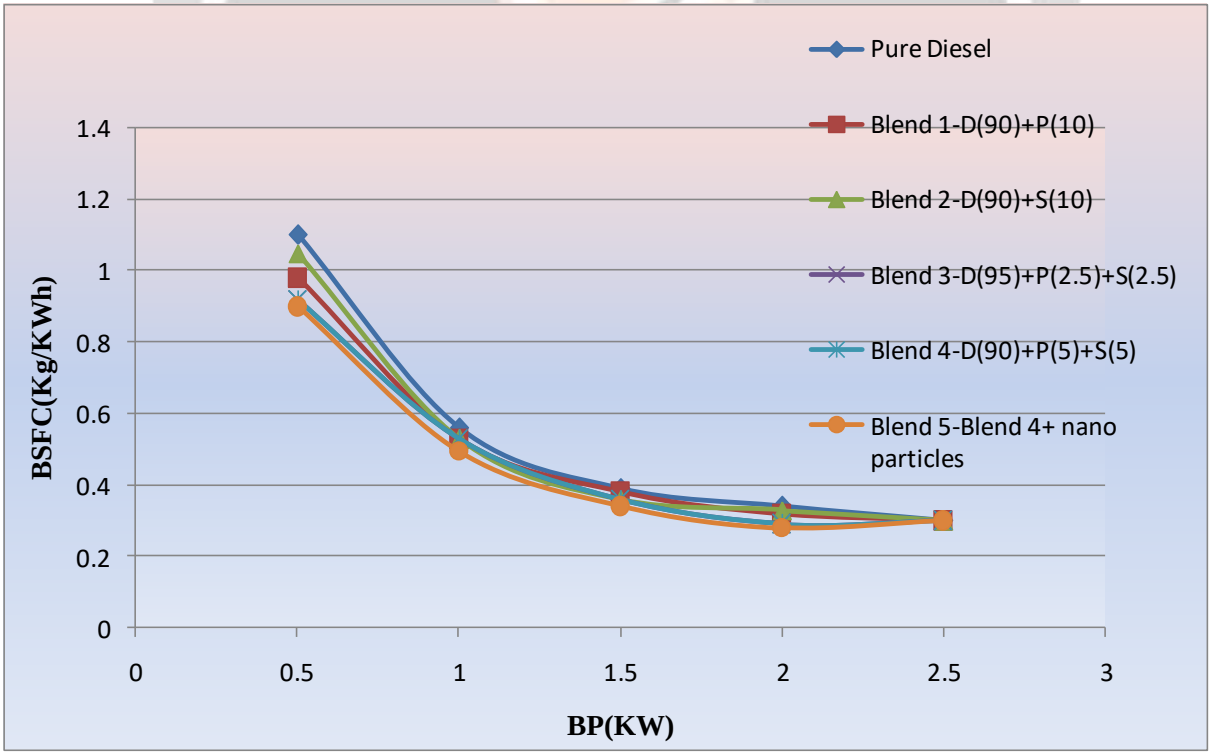
RESULTS AND DISCUSSIONS
PERFORMANCE ANALYSIS



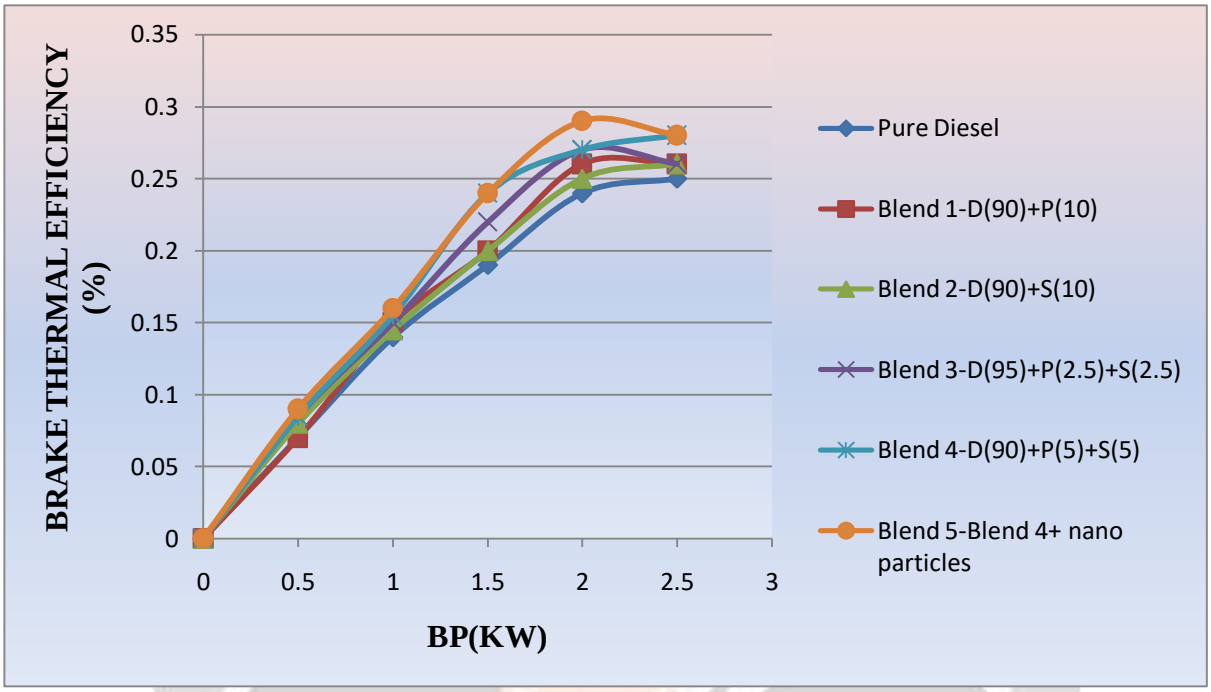
Variation of mass flow rate of fuel with brake power



Variation of indicated power with brake power



Variation of brake specific fuel consumption with brake power



Variation of brake thermal efficiency with brake power

CONCLUSIONS

The effects that went out about this experimentation are precise intriguing What's more news person On point of interest done past segment. A portion of the remarkable comes about need aid summarized underneath.

- impostor stream rate for biodiesel blends need aid discovered will be easier over that from claiming accepted fuel diesel Furthermore BSFC likewise takes after those same pattern. Then again to alumina nanoparticles included mixture biodiesel mix it is 3% under customary fuel.
- Concerning illustration the measure for biodiesel for blends expanded shown control diminished In same brake energy Also shown control will be least to alumina nanoparticles included mix.
- brake particular Vitality utilization declines for expanding break control. Biodiesel blends have indicated diminishment for brake particular Vitality utilization in examination will diesel. Nanofuel mix need demonstrated 7% diminishment contrasted with diesel.
- BTE Also mechanical effectiveness expanded with expansion of biodiesel and alumina nanoparticles. Alumina nanoparticles included mix need demonstrated 5% build to mechanical effectiveness contrasted with mix 4 Also 11% build in examination with routine fuel.
- Nanofuel mix need indicated 18% What's more 13% decrease for co What's more UBHC discharges over customary fuel diesel Also carbon dioxide emanations expanded marginally for expansion from claiming biodiesels What's more nanoparticles.

SCOPE OF FUTURE WORK

- other Nanoparticles, for example, CuO Might a chance to be utilized and impact of nanoparticle size on the execution from claiming fuel Might a chance to be perfomed.

- A percentage of the metal oxide nanoparticles need aid Additionally surface sensitive Along these lines erosive impact for metal oxide on motor What's more debilitate framework ought further bolstering be noted precisely.
- debilitate gas recirculation Might a chance to be used to further lessen discharges.
- other Biodiesels for example, mahua oil, coconut oil Also neem oil Might a chance to be utilized

REFERENCES

1. Ghazali, W.N.M.W.; Mamat, R.; Masjuki, H.H.; Najafi, G. Effects of biodiesel from different feedstocks on engine performance and emissions: A review. Renew. Sustain. Energy Rev. 2015, 51, 585–602.

2. Behçet, R.; Oktay, H.; Çakmak, A.; Aydin, H. Comparison of exhaust emissions of biodiesel-diesel fuel blends produced from animal fats. Renew. Sustain. Energy Rev. 2015, 46, 157–165. [CrossRef]

3. Rodrigues, M.C.; Guarieiro, L.L.N.; Cardoso, M.P.; Carvalho, L.S.; da Rocha, G.O.; de Andrade, J.B. Acetaldehyde and formaldehyde concentrations from sites impacted by heavy-duty diesel vehicles and their correlation with the fuel composition: Diesel and diesel/biodiesel blends. Fuel 2012, 92, 258–263. [CrossRef]

4. Leung, M.K.; Tan, K.T.; Lee, K.T.; Mohamed, A.R. Malaysian palm oil: Surviving the food versus fuel dispute for a sustainable future. Renew. Sustain. Energy Rev. 2009, 13, 1456–1464. [CrossRef]

5. Mekhilef, S.; Siga, S.; Saidur, R. A review on palm oil biodiesel as a source of renewable fuel. Renew. Sustain.Energy Rev. 2011, 15, 1937–1949. [CrossRef]

6. Kumar, N.; Chauhan, S.R. Performance and emission characteristics of biodiesel from different origins: A review. Renew. Sustain. Energy Rev. 2013, 21, 633–658. [CrossRef]

7. Atabani, A.E.; Silitonga, A.S.; Badruddin, I.A.; Mahlia, T.M.I.; Masjuki, H.H.; Mekhilef, S. A comprehensive review on biodiesel as an alternative energy resource and its characteristics. Renew. Sustain. Energy Rev. 2012, 16, 2070–2093. [CrossRef]

8. Bioenergy Biodiesel; Michigan State University: Trowbridge Rd East Lansing, MI, USA, 2014.

9. NBB Benefits of Biodiesel; National Biodiesel Board: Jefferson City, MO, USA, 2009.

10. Imtenan, S.; Masjuki, H.H.; Varman, M.; Kalam, M.A.; Arbab, M.I.; Sajjad, H.; Ashrafur Rahman, S.M. Impact of oxygenated additives to palm and jatropha biodiesel blends in the context of performance and emissions characteristics of a light-duty diesel engine. Energy Convers. Manag. 2014, 83, 149–158. [CrossRef]

11. Devaraj, J.; Robinson, Y.; Ganapathi, P. Experimental investigation of performance, emission and combustion characteristics of waste plastic pyrolysis oil blended with diethyl ether used as fuel for diesel engine. Energy 2015, 85, 304–309. [CrossRef]

12. Moon, G.; Lee, Y.; Choi, K.; Jeong, D. Emission characteristics of diesel, gas to liquid, and biodiesel-blended fuels in a diesel engine for passenger cars. Fuel 2010, 89, 3840–3846. [CrossRef]

13. Qi, D.H.; Chen, H.; Geng, L.M.; Bian, Y.Z. Effect of diethyl ether and ethanol additives on the combustion and emission characteristics of biodiesel-diesel blended fuel engine. Renew. Energy 2011, 36, 1252–1258.[CrossRef]

14. Rakopoulos, D.C.; Rakopoulos, C.D.; Giakoumis, E.G.; Papagiannakis, R.G.; Kyritsis, D.C. Influence of properties of various common bio-fuels on the combustion and emission characteristics of high-speed DI (direct

injection) diesel engine: Vegetable oil, bio-diesel, ethanol, n-butanol, diethyl ether. Energy 2014, 73,354–366. [CrossRef]

15. Rashedul, H.K.; Masjuki, H.H.; Kalam, M.A.; Ashraful, A.M.; Ashrafur Rahman, S.M.; Shahir, S.A. The effect of additives on properties, performance and emission of biodiesel fuelled compression ignition engine. Energy Convers. Manag. 2014, 88, 348–364. [CrossRef]14149 Energies 2015, 8, 14136–14150