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"Experimental Investigation of the Suitability of Orange Peel Oil as a Blend with Cotton Seed Oil as Alternate Fuel for Diesel Engines: A Review"

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Abstract: As a renewable, sustainable and alternative fuel for compression ignition engines, biodiesel instead ofdiesel has been increasingly fueled to study its effects on engine performances and emissions in therecent 10 years. But these studies have been rarely reviewed to favor understanding and popularizationfor biodiesel so far. In this work, reports about biodiesel engine performances and emissions, published byhighly rated journals in scientific indexes, were cited preferentially since 2000 year. From these reports,the effect of biodiesel on engine power, economy, durability and emissions including regulated andnon-regulated emissions, and the corresponding effect factors are surveyed and analyzed in detail. Theuse of biodiesel leads to the substantial reduction in PM, HC and CO emissions accompanying with theimperceptible power loss, the increase in fuel consumption and the increase in NOx emission on conventionaldiesel engines with no or fewer modification. And it favors to reduce carbon deposit and wear ofthe key engine parts. Therefore, the blends of biodiesel with small content in place of petroleum dieselcan help in controlling air pollution and easing the pressure on scarce resources without significantlysacrificing engine power and economy. However, many further researches about optimization and modificationon engine, low temperature performances of engine, new instrumentation and methodology formeasurements, etc., should be performed when petroleum diesel is substituted completely by biodiesel.

Keywords: Biofuel,Performance,Emissions,alternative fuel

I. INTRODUCTION

Diesel engine will be the major power source for automobiles in the twenty-first century. To reduce emissions and solve the energy crisis, designing diesel engines with low emission and less energy consumption has always be an objective for researchers across the globe. However, with the development of new technologies, today's diesel engines have better emission characteristics and the less energy consumption compared with its predecessor. But, there is still lot to do on diesel engines aimed to achieve our goal of clean and effective diesel engine. Accordingly, research on a clean burning fuel instead of conventional fuel is advisable, which could not only decrease exhaust gas to a great extent, but, also provide more options of energy sources. The use of alternative fuels for internal combustion engines has attracted a great deal of attention due to fossil fuel crisis and also GHG impact. Alternative fuels should be easily available, environment friendly, and techno-economically competitive. Successful alternative fuel should fulfill environmental and energy security needs without sacrificing engine operating performance. Renewable resources offer the opportunity to tap local resources and reduce dependency on fossil energy resources. Most biodiesel oils, particularly of the nonedible type can be used as fuel in diesel engines. One of the promising alternative fuels considered for diesel engine is biodiesel.

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Biodiesel fuels are renewable, as the carbon released by the burning of biodiesel fuel is used when the oil crops undergo photosynthesis. Biodiesel also offers the advantage of being able to readily use in existing diesel engines without engine modifications. The alkyl monoester of fatty acids as bio-diesel which was obtained from renewable oil and fats materials by transesterification reaction is a good alternative. Biodiesel can be obtained from raw vegetable oil by transesterification with methanol or ethanol after chemical reactions. Vegetable oils present a very promising alternative to diesel oil since they are renewable and have similar properties as of diesel. Many researchers have studied the use of vegetable oils in diesel engines. This recommends the intensive studies on the use of alternative fuels especially renewable ones like vegetable oils and alcohols. Biodiesels such as Jatropha, Karanja, Sunflower and cottonseed are some of the popular biodiesels currently considered as substitute for diesel.

When biodiesel is used as a substitute for diesel, it is highly essential to understand the parameters that affect the combustion phenomenon which will in turn have direct impact on thermal efficiency and emission. In the present energy scenario lot of efforts is being focused on improving the thermal efficiency of IC engines with reduction in emissions. The problem of increasing demand for high brake power and the fast depletion of the fuels demand severe controls on power and a high level of fuel economy.

II.LITERATURE REVIEW

A number of researchers have experimentally investigated the combustion, performance and emission characteristics of vegetable oils and their esters in diesel engines.

S.Kirankumar [1]They conducted experiment on the four stroke single cylinder water cooled diesel engine at constant speed (1500 rpm) with varying loads by using cotton seed oil blends of C10, C20 and C30 by varying the injection pressures from 165 bar to 210 bar. The performance characteristics like brake thermal efficiency, brake specific fuel consumption and exhaust gas temperatures were investigated. Based on investigations, a comparison was drawn on engine performance with pure diesel operation and with different blends.TheirExperimental results demonstrated that at 195 bar fuel injection pressure, the performance characteristics were observed better with blends when compared to the pure diesel operation. Maximum brake thermal efficiency observed was 34.01% with 30% blend at an injection pressure of 195 bar and lower specific fuel consumption observed was 0.258 kg/kw-hr with 30% blend at an injection pressure of 195bar.

R. Senthil Kumar and R. Manimaran[2] Theyconducted performance test on horizontal single cylinder variable speed Greaves engine with various blends of cottonseed oil (B5, B10, B15, B20, B40 & B100) and compared the performance of cottonseed oil with diesel. Based on the their observations of this experiment,Theyconcluded that TFC and SFC were found to be the function of load and brake power. The performance test done on various blends of biodiesel showed that its characteristics followed the same trend as that of the bio-diesel. The emission test conducted showed that emission levels for biodiesel were lower than diesel. On comparing the performance test graphs of B5, B10, B15, B20, B40,They concluded that TFC and SFC of B100 and B40 is very high compared to that of diesel . So the usage of these blends will be uneconomic but the TFC and SFC of B20 remains very stable on various loading conditions.

M. Martin and D. Prithviraj[3] in their experimental investigation, the viscosity of cottonseed oil (CSO), which is considered a potential alternate fuel, was reduced by blending it in different proportions with diesel, and its viscosity at various temperatures was analyzed and used as a fuel in a compression ignition (CI) engine. Performance, combustion and emission parameters at various loads were calculated using a single cylinder CI engine and compared with neat diesel and cottonseed oil. A remarkable improvement in the performance of the engine is noticed as the viscosity of the oil is reduced. Brake thermal and volumetric efficiencies of the engine increased with a significant reduction in the exhaust gas temperature. Reductions in smoke, CO and HC emissions are also noticed.Their results show that a blend containing 60% of cottonseed oil with diesel, which is heated to a temperature of 70°C, can be used as an alternate fuel without any engine modification.

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K.Dilip Kumar and P.Ravindra Kumar[4]Theycarried outan experimental investigations on C.I.engine with Bio Diesel blends of cotton seed Methyl Esters and Neem Oil Methyl Esters. The engine used for their experiment was single cylinder Four Stroke water cooled, constant speed diesel engine with cotton seed Methyl ester (CSOME) and Neem oil methyl ester (NOME) which were derived through transesterification process and parameters of transesterification were optimized. The blends of various proportions of the CSOME & NOME with diesel were prepared, analyzed and compared with diesel fuel, and comparison was made to suggest the better option among the bio diesel. Various Tests have been carried out to examine properties, performance of different blends (C05, C10, C15, and C20) of CSOME and NOME in comparison to diesel. From their experimental Results it was indicated that C20 have closer performance to diesel. However, its diesel blends showed reasonable efficiencies.They were also observed that cotton seed methyl ester gives better performance compared to Neem methyl esters and also the emissions and smoke for these diesel blends were less as compare to the pure diesel.

A.V. Krishna Reddy *et al.*[5]Theyconducted experiments on 5.2 BHP single cylinder four stroke water-cooled variable compression diesel engine. Methyl ester of cottonseed oil is blended with the commercially available Xtramile diesel. Cottonseed oil methyl ester (CSOME) is blended in four different compositions from 10% to 40% in steps of 10 vol%.They use these four blends and Xtramile diesel brake thermal efficiency (BTE) and brake specific fuel consumption (BSFC) were determined at 17.5 compression ratio. They concluded that Properties of the 10% and 20% blends of CSOME are nearer to the diesel fuel. The performance of the cottonseed oil methyl ester fuelled engine is comparable with diesel engine. Engine could be run without any difficulty using cottonseed oil methyl ester blends. These blends of cottonseed oil can be recommended for present diesel engines without any modification.Thus the above investigations of their experiment suggest that esterified vegetable oils can be effectively employed in emergency as a suitable alternative fuel in existing diesel engine.

M. Harinarh Reddy *et al.*[6]Theyinvestigated the performance of a diesel engine using diesel fuel and cottonseed oil (CSO) biodiesel in terms of brake thermal efficiency and indicated thermal efficiency for conventional diesel, cottonseed oil, as well as for Jatropha oil. A Single Cylinder, 4-stroke vertical, water-cooled, self-governed diesel engine developing 5 HP at 1500 rpm engine was selected for the testing with diesel fuel and neat bio-dieselat full load conditions. The evaluation of theoretical data of their experiment showed that the brake thermal efficiency and indicated thermal efficiency of CSO biodiesel was slightly higher than that of diesel fuel and Jatropha oil. Their study reveals that the use of cottonseed oil biodiesel improves the performance parameters of CI engine compared to conventional diesel fuel.

Shyam Kumar Ranganathan*et al.*[7]Theyinvestigated the comparative performance of single cylinder diesel engine with direct use of cotton seed oil methyl ester and preheated condition at variable temperature such as 50, 70 and 90°C.The properties such as viscosity, flash point, pour point were experimentally measured of COME, thus obtained are comparable with ASM biodiesel standards. The COME has been tested in single cylinder four stroke diesel engine coupled with rope brake dynamometer. Theycarried out experiment for varying load at constant speed. Their results revealed that preheating COME up to 90°C at higher load lead to increase in brake thermal efficiency is 2 % as compared to diesel fuel and brake specific fuel consumption increases at higher load as compared to diesel fuel. There was no significant change found in brake power where as exhaust gas temperature of all preheated biodiesel COME was high and break specific energy consumption required to preheat COME was high as compared to diesel.

S.NagaSarada*et al.* (2010)[8]They conducted test with cotton seed oil and diesel. To improve the combustion characteristics of cotton seed oil in an unmodified engine, effect of increase in injection pressure was studied.The injection pressure was increased from 180 bar to 240 bar (in steps of 15 bar). The investigation of their experiment revealed that the optimum pressure for cottonseed oil as 210 bar and comparison of the performance of the engine was studied in terms of brake specific fuel consumption, brake thermal efficiency, indicated thermal efficiency, mechanical efficiency and exhaust emissions. Increased injection pressure has a significant effect on enhancing engine performance and lowering emissions. Increase in the injection pressure from 180 bar to 240 bar with cotton seed oil as fuel lead to: Quieter operation of the engine was observed when cotton seed oil was used as fuel. Performance of engine with cotton seed oil as fuel was better at an IP of 210 bar. An increase in the Brake thermal efficiency from 25.02% to 28.02% was observed with increase in

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injection pressure from 180bar to 210 bar; due to better atomization and improved combustion of the fuel lowering of the HC emissions from 1720 ppm to 1480 ppm.According to their investigation the Performance of engine with cotton seed oil as fuel at an IP of 210 bar was approximately similar to the operation of engine with diesel.

m. senthilkumar (2001)[9] They used orange peel oil as the inducted fuel and Jatropha oil, methyl ester of Jatropha oil and diesel as pilot fuels. With admission of orange peel oil in the dual fuel operation, there is an appreciable increase in brake thermal efficiency. Orange peel oil induction drastically reduced smoke to 3BSU with Jatropha oil and 2.8BSU with methyl ester of Jatropha oil as pilot fuels.

III.CONCLUSION

Based on the observations of this experiment, it can be concluded that,The performance test done on various blends of biodiesel shows that its characteristics follow the same trend as that of the bio-diesel. The emission test conducted shows that emission levels for biodiesel are lower than diesel.Fromthe performance test graphs of blends of biodieselwith diesel we can compare the various characteristics of fuel and engine.Thus the usage orange peel oil and cottonseed oil blend will be more optimum compared to diesel. On comparing the efficiency graphs of various blends with diesel we determine that efficiency for various loading conditions.

IV.FUTURE SCOPE

1] To establish an experimental setup for analyzing overall performance of C.I. engine using diesel and biodiesel blends.
2] To study effect of operating parameters like speed and load using diesel and biodiesel blends on thermal efficiency, brake specific fuel consumption and emission behavior of C.I. engine.
3] To develop mathematical model for thermal efficiency of C.I. engine with biodiesel blends and validate model with experimental results.

REFERENCES

1] S.Kirankumar, "Experimental Investigation on Performance, Combustion Characteristics of Diesel Engine by Using Cotton Seed Oil", International Journal of Engineering Trends and Technology (IJETT) – Volume 5 number 1 - Nov 2013, pp. 47-53.
2] R. Senthil Kumar and R.Manimaran, "Performance and emission characteristics on 4-stroke single cylinder C. I. Engine using cottonseed bio fuels",Asian Journal of Engineering Research, ISSN-2319–2100, Vol. I, Issue II, Jan.-March.2013
3] M. Martin and D. Prithviraj, "Performance of Pre-heated Cottonseed Oil and Diesel Fuel Blends in a Compression Ignition Engine", Jordan Journal of Mechanical and Industrial Engineering,Volume 5, Number 3, June 2011 ISSN 1995-6665 Pages 235-240
4] K. Dilip Kumar and P. Ravindra Kumar, "Experimental Investigation of Cotton Seed Oil and Neem Methyl Esters as Biodiesel on CI Engine", International Journal of Modern Engineering Research (IJMER), ISSN: 2249-6645, Vol.2, Issue.4, July-Aug 2012, pp.1741-1746
5] A. V. Krishna Reddy, M. Shiva Shankar and K. Apparao, "Experimental Determination Of Brake Thermal Efficiency And Brake Specific Fuel Consumption Of diesel engine fuelled with biodiesel", International Journal of Engineering and Technology Vol.2 (5), 2010, pp. 305-309
6] M.Harinathareddy, DrP.Nageswara Reddy and Dr.K.Vijayakumarreddy, "Experimental Investigation of Compressed Ignition Engine Using Cotton Seed Oil Methyl Ester as Alternative Fuel", International Journal of Engineering and Science ISBN: 2319-6483, ISSN: 2278-4721, Vol. 2, Issue 1 (January 2013), pp. 06-10.
7] ShyamKumarRanganathan,AnilGandamwad&MayurBawankure,"Performance evaluation of C.I. engine with cottonseed oil", International Journal of Instrumentation, Control and Automation (IJICA) ISSN: 2231-1890, Vol-1 Iss-3, 4, 2012, pp. 23-27.
8] S. Naga Sarada, M.Shailaja, A.V. Sita Rama Raju1and K. KalyaniRadha, "Optimization of injection pressure for a compression ignition engine with cotton seed oil as an alternate fuel", International Journal of Engineering, Science and Technology, Vol. 2, No. 6, 2010, pp. 142-149
9] V. Ganeshan, "Internal Combustion Engines", 2nd edition, Mc Graw- Hill Publishing Company, NY, 2003.