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STUDY ON MEXICANA BIODIESEL & ITS BLENDS ON SINGLE CYLINDER C I ENGINE. – A REVIEW

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ABSTRACT

This report explores the feasibility of biodiesel production from a weed plant *Argemone Mexicana* seed oil and an efficient catalyst crystalline manganese carbonate. To the best of the authors' knowledge, this is the first study making use of pure, crystalline, ash colored manganese carbonate as a heterogeneous catalyst for the production of methyl esters as fuel from *Argemone Mexicana* seed oil. The optimum process conditions for the conversion of *Argemone Mexicana* oil to its methyl ester by transesterification required 1% manganese carbonate as catalyst with alcohol to oil ratio 5:1 at 600C to yield biodiesel of 99.99% purity.

Keywords: *biodiesel, Mexicana, transesterification, biodiesel, diesel, blends.*

I. INTRODUCTION

The vegetable oil was used as a fuel around 100 years ago by the inventor of diesel engine Rudolph Diesel. Rudolph Diesel used peanut oil in his CI engine. After exploration of fossil fuels they were continued to be major conventional energy source. The fossil fuel demand is continuously increasing world over resulting in rapid depletion of fossil fuel deposits. In several studies, it has been experimentally investigated that the human health hazards are associated with exposure to diesel exhaust emissions. Therefore, limited fossil fuels and intensified environment pollution, it has become a global issue to develop such clean fuel, which is technically feasible, domestically available and environmentally acceptable.

The selection of biodiesel is mainly because of an oxygenated, renewable, biodegradable and environmental friendly with similar flow performance and low emission profile. It is also due to the attractive characteristics of biodiesel which are higher cetane number, absence of Sulphur and aromatic compounds, excellent lubricity etc. The use of vegetable oils directly in an engine is considered impractical because these oils contain free fatty acids (FFA), phospholipids, sterols and other impurities. This vegetable oil is converted into biodiesel by the process of esterification. Esterification is a reaction involving FFA and alcohol which yields fatty acid alkyl ester and water.

This paper investigates the production and properties of *Argemone Mexicana* biodiesel and their comparison with diesel fuel. The use of *Argemone Mexicana* as a engine fuel has a potential to reduce exhaust emission since Mexicana oil has less than half of carbon dioxide emission than customary diesel. Experimental tests are conducted on the single cylinder four stroke compression ignition engine. The performance of the engine using blends of *Argemone Mexicana*biodiesel were evaluated and compared with the performance obtained with diesel. The main purpose of the present study is to determine the suitability of using MB6, MB12, MB18, MB24, MB30 and MB36 on CI engine without any major hardware modification and to compare the results of these blend fuels with diesel fuel. And performance of engine was recorded at 0%, 20%, 40% 60%, 80%, 100% and overload conditions. The significant performance parameters of C.I. engine were selected as Specific fuel consumption, brake power, brake thermal efficiency, mechanical efficiency, indicated power and torque

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II. LITERATURE REVIEW

[1] Optimization of Bio-Oil extraction process from Beauty Leaf (Calophyllum inophyllum) Oil seed as second generation bio diesel source, Jahirul M.I. Brown J.R, ETAL.
Beauty Leaf (Calophyllum inophyllum) oil seed is a potential source of non-edible vegetable oil, for its future production of bio-diesel because of its ability to grow in wide range of climatic conditions, easy cultivation, high fruit production range and high oil content in the seed. Chemical extraction was found to be very effective method for oil extraction because of its consistency in performance and high oil production rate. Chemical Extraction using Hexane as a solvent was found to be very effective but due to lack of availability of hexane and lack of hexane recovery system it was not possible to take full advantage of the effectiveness of the product.

[2]. Study on Emissions of a DI Diesel Engine Fueled withPistacia Chinensis Bunge Seed Biodiesel-Diesel Blends, Ma Zhihao, ETAL

This paper deals with the emissions of an YTR3105 direct injection diesel engine fuelled with pistacia chinensisbunge seed biodiesel-diesel blends. The results of the study show that CO, HC and exhaust smoke emissions decreasewith the increase of the proportions of biodiesel in the blends. The NOx emissions are reduced as the engineoperating with B10 and B20, but slightly increased with B30. HC emissions and exhaust smoke of the engine fueled with biodiesel-diesel blends are lower than that. Over the load range NOx emissions of B10 and B20are slightly lower than that of diesel, and B30 is almost equivalent to diesel. Exhaust smoke decreaseswith the increasing the proportions of biodiesel fuel in the blends.

[3]. Experimental investigations of ignition delay period and performance of a diesel engine operated with Jatropha oil biodiesel, Mohammed EL-Kasaby, ETAL.

Jatropha-curcas as a non-edible methyl ester biodiesel fuel source is used to run single cylinder, variable compression ratio, and four-stroke diesel engine. Combustion characteristics as well as engine performance are measured for different biodiesel– diesel blends. It has been shown that B50 (50% of biodiesel in a mixture of biodiesel and diesel fuel) gives the highest peak pressure at 1750rpm, while B10 gives the highest peak pressure at low speed, 1000rpm.B50 shows upper brake torque, while B0 shows the highest volumetric efficiency.B50 shows also, the highest BSFC by about(12.5–25%) compared with diesel fuel. B10 gives the highest brake thermal efficiency.B50 to B30 show nearly the lowest CO concentration, besides CO concentration is the highest at both idle and high running speeds. Exhaust temperature and NOx are maximum for B50.Delayperiodis measured and correlated for different blends. Peak pressure of B50 is higher at low and high engine speed, while that of B10 and B20 are optimum at economic engine speed (medium speed). Higher percentage of NOx in case of biodiesel compared with that of diesel is attributed to the higher combustion temperature of oxygenated biodiesel resulted from advanced injection.

[4]. An Experimental Evaluation of Performance and Emission Characteristics for Modified Diesel Engine Using Mixed Biofuel, Yogendra Rathore, ETAL..

To reduce emissions produced by on-road vehicles. Biodiesel is a renewable fuel that has been shown to reduce many exhaust emissions, except oxides of nitrogen (NOx), in diesel engine cars. This is of special concern in inner urban areas that are subject to strict environmental regulations, such as EURO norms. Also, the use of pure biodiesel (B100) is inhibited because of its higher NOx emissions compared to petroleum diesel fuel. It is observed that for the biodiesel blends of 10% and 20% the density, fire point, flash point and calorific value were very close to that of diesel, which makes them suitable for using them as an alternative for diesel. The mixed Karanja and Coconut shows higher biodiesel yield of 72.5%.The mixed biodiesel blend B10 shows the higher brake thermal efficiency which is slightly less than that of diesel. The specific fuel consumption of mixed biodiesel blends B10 and B20 shows value closer to diesel. Mixed Karanja and Coconut biodiesel blends B10 and B20 can be used as alternative fuel in diesel engine.

[5]. Effect of pongamia biodiesel on emission and combustion characteristics of DI compressionignition engine, K. Nantha Gopal, ETAL.

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. Diesel engine performance, emission and combustion characteristics are analyzed for all blends of PME 20, PME 40, PME 60. PME 80 and PME 100 fuels and compared with petroleum diesel. All the performance and emission results are presented and discussed in this section.

[6]. Experimental Studies on the Combustion Characteristics and Performance of A Direct Injection Diesel Engine Fueled with Rice-Bran Oil Derived Biodiesel Diesel Blends, K. Ashok, ETAL.

Biodiesel is an oxygenated, sulfur-free, biodegradable, non-toxic, and environmentally friendly alternative diesel fuel. It is consisting of the alkyl monoesters of fatty acids from vegetable oils or animal fats. Biodiesel can be derived from renewable resources, such as vegetable oils, animal fats, and waste restaurant greases. The performance and emission parameters for different blends were better compared with diesel. From these findings, it is concluded that rice-bran biodiesel could be safely blended with diesel up to 20% without significantly affecting the engine performance (SFC, EGT) and emissions (CO, HC and NOx) and thus could be a suitable alternative fuel for diesel engines. The study suggests that excess oxygen contents of biodiesel play a key role in engine performance and biodiesel is proved to be a potential fuel for complete or partially replacement of diesel fuel.

[7]. Experimental Investigation on Performance, Emission and Combustion Characteristics of Single Cylinder LHR Diesel Engine using Tobacco Seed Biodiesel. Basavaraja. K.T, ETAL.

In this present investigation tobacco oil biodiesel, a non-edible oil biodiesel is selected for the test on diesel engine and its suitability as alternative fuel is examined. The blends are prepared in 10/90%, 20/80%, 30/70% and 100/0% on volume basis, then analyzed and compared with diesel. Further blends are heated and effect of viscosity on temperature is studied. The performance and emission characteristics of blends are evaluated at variable loads of 0.1, 1.04, 2, 3.02, 4.01, 4.85kW at constant rated speed of 1500 rpm and the results are compared with diesel. Dilution of tobacco biodiesel reduces the viscosity considerably. The blends containing 90% 80% and 70%of diesel has viscosity 4.13 cSt, 4.22 cSt, 4.28 cSt and4.69 cSt which is very close to viscosity of diesel 4.1 cStat 40℃and does not require any heating prior to injection into the combustion chamber. Blends containing 0% of diesel required preheating up to 80℃.Performance and emission characteristics of 90% (B10) and 80% (B20) are better than the other blends followed by 70% blend. The maximum efficiency of 90%and 80%blend is well comparable with diesel. However unburned HC emissions are increased up to 4.1kW load by 10%, 18.5%, 37.14% and 45% for 90%, 80%, 70% and 0%blends but HC is reduced by 16%, 18% and 24% for the blends B10, B20 and B30 respectively compared with diesel at full load condition. CO emission, CO2emissions reduced 1.9%, 7.7%, 9.7% and 12.1% for the blends B10, B20and B30 respectively when compared with diesel. 3.7%, 7%, 10.9% and 13.14% decrease in the NOx emission for the blends B10, B20 and B30 respectively when compared with diesel.

[8]. Production of Biodiesel from Hybrid Oil (Dairy Waste Scum and Karanja) and Characterization and Study of Its Performance on Diesel Engine, Sushma.S, ETAL

Depletion of petroleum derived fuel and environmental concern has promoted to look over the bio fuel asan alternative fuel source. But a complete substitution of petro-diesel by bio fuel is impossible with the use of edible and non-edible oil; hence, in the present study dairy waste scum oil and karanja oil (in equal quantities) is used to produce hybrid oil biodiesel by trans-esterification process using sodium hydroxide as catalyst. The Brake thermal efficiency of diesel fuel is increased about 1.44% when compared to that of neat biodiesel at 100% load [Fig.2]. The Brakethermal efficiency of B10 is very close to that of diesel fuel at full load condition. By increasing the load of the engine, the brake thermal efficiency also increases for all the tested fuel types.

[9]. Synthesis of biodiesel from Jatropha curcas oil using waste eggshell and study of its fuel properties, Supriya B. Chavan, ETAL.

High purity calcium oxide (CaO) was prepared from eggshell and used as a catalyst for the production of biodiesel. Non-edible oil, Jatropha curcas was used as a feedstock for the synthesis of biodiesel. High purity calcium oxide (CaO) was obtained when the eggshell was subjected to calcination at 900 _C for_2.5 h. Reusability of the catalyst was observed and the catalyst worked efficiently up to six times without significant loss of activity. Physical and chemical properties of biodiesel such as density, kinematic viscosity, cloud point, etc. were studied. A CaO catalyst, obtained by calcination (900 _C for 2.5 h) of eggshells had better activity in the transesterification of Jatropha oil for biodiesel production.

[10]. Effect of coconut biodiesel blended fuels on engine performance and emission characteristics, A.M. Liaquat*, H.H. Masjuki, ETAL.

Alternative fuels have received much attention due to the depletion of world petroleum reserves and increased environmental concerns. Thus processed form of vegetable oil (Biodiesel) offers attractive alternative fuels to compression ignition engines. A total of three fuel samples, such as DF (100% diesel fuel), CB5 (5% coconut biodiesel and 95% DF), and CB15 (15% CB and 85% DF) respectively are used. As results of investigations, there has been a decrease in torque and brake power, while increase in specific fuel consumption has been observed for biodiesel blended fuels over the entire speed range compared to net diesel fuel.Conclusion is indicating that CB5 and CB15 can be used in diesel engines without any engine modifications and have beneficial effects both in terms of emission reductions and alternative petroleum diesel fuel. In comparison with the diesel fuel, biodiesel blends produced lower sound levels due to many factors including increase in oxygen content, reduction in the ignition delay, higher viscosity, lubricity, etc.

[11]. Production of Palm fatty acid distillate biodiesel and effects of its blends on performance of single cylinder diesel engine, Ameya Vilas Malvadea, ETAL.

Fossil fuels are commonly used fuel for automobiles. The reserve stock and exhaust gas emission of fossil fuel cause a serious problem. So there is a need of an alternative ecofriendly fuel. Biodiesel is a renewable fuel produced from plant and animal material by esterification. Esterification is an acid catalyzed reaction that converts free fatty acid (FFA) of oil into triglycerides. Transesterification is base catalyzed reaction they converts triglycerides into mono alkyl esters. The Palm fatty acid distillate biodiesel could be easily used as an alternative fuel to diesel engine. Esterification and transesterification using H2SO4 as acid catalyst and NaOH as base catalyst can reduce FFA about 60% to less than 0.5%. Also the reaction time of 60 min and temperature about 65°C make a simplified production system.

III. CONCLUSION

- In this review paper,study of number of research papers on plant oil has been carried out; wherein we come to know that a very less amount of research work been carried out over *Argemone Mexicana*, for preparation of biodiesel.
- So further work can be continued with given work plan and preparation of biodiesel, using plant oil from the *Argemone Mexicana* plant and further testing and evaluation of the data after it.
- Further plotting and representation of the data using statistical analysis can be done to ensure further understanding.

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