Experimental Analysis of Comparative Performance on Operating Diesel Engine with Multi-Cylinder System using Alternative Fuel Such As Methanol, Petrol and Karanja Oil Blends"------A Review

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Abstract

To prevent over emission & global warming (prevent also greenhouse generation & pollution) through vehicles with powered engine and we talk specially diesel engine with multi-cylinder system (such as more than one cylinder system) or four stroke multi-cylinder .In diesel engine high performance than petrol engine due heavy transportation purpose and heavy league system for long distance traveling and high revenue generation on it. In diesel engine with multi-cylinder system, problems are vapour lock, knocking of fuel, proper atomization, scavenge and need high performance etc. If such problems have to remove so that engine efficiency will improve that's what vehicle powered with engine may run smoothly with low emission and high fuel efficiency and low cost. Due to that reason will search for blend for diesel fuel; so we looked for methanol, petrol and karanja oil as blend of diesel fuel as proper proportion is required engine point of view. Here main blend is Karanja oil as abstracts from vegetable oil as non-edible. The mixing of petrol and methanol is to reduce viscosity with karanja oil. So mainly karanja oil is mixing with diesel fuel but to reduce viscosity level as vegetable oil to use as fuel mixing with methanol and petrol by process of distillation or new technique of chemical process. The aim is to do experimental analysis for performance of a diesel engine fuel with blend of karanja oil ;as composition of 2.0 vol%, 6.0 vol%, 8.0 vol% and 12 vol% blends with methanol , petrol and to improve it chemical behavior so that both the agents taken as equally proportions in karanja oil make as fuel. Therefore we see improve in calorific value for high performance of methanol, petrol and karanja oil blend of diesel engine. We see in result of better engine performance as in term of Indicated power more efficient as earlier as 10% of engine performance so improved in brake power that's what engine get excellent efficiency as in Mechanical, volumetric and thermal.

Keywords- Alternative Fuel Performance, IC Engine with Blend Fuel

I. INTRODUCTION

Transport and industry emissions are the largest and fastest rising source of greenhouse gases and account for around 25% of all CO_2 emissions. Since 1970, total CO_2 emissions have fallen by 22% with significant falls in emissions from power stations and industry, but those from road transport increased by 92%. Finding a cleaner alternative to conventional fuels would help contribute to the achievement of its Kyoto targets. The government is also keen to reduce dependence on oil, given the vulnerability of supplies from politically unstable regions.

International scientists are clear that all countries will have to cut greenhouse gas emissions, particularly carbon dioxide, in order to prevent the harmful effects to climate change. The current view is that this should be done through a series of economic, political and social incentives that will lead to a significant reduction in emissions of atmospheric carbon, and move society towards a sustainable low carbon economy.

Generally speaking there are three categories of fuels that represent options to the traditional road fuels, petrol and diesel:

- Ultra-low sulphur versions of both petrol and diesel that may be used in existing engines, and which are commonly available.
- Bio-diesel and road fuel gases (liquefied petroleum gas and compressed natural gas) that may be used in adapted vehicles or those specifically designed for their consumption.
- Alternative fuels that still require further research and development before being available for widespread use: bio-Methanol and bio-gas in the medium term; in the longer term, Methanol and hydrogen.

By using the vegetable oil the following advantages are pointed out:

1) The biological cycle is closed because the oil plant absorbs carbon from oxygen during growth and then burns into CO_2.

2) The energy balance of vegetable oil is positive, i.e. solar power stored in vegetable oil is more than the energy required to produce it.
3) Vegetable oil fuels burden the environment with fewer climatic effecting pollutants,
4) Rapeseed plant reduces nitrogen loss and is considered to improve soil and set aside land because of their intense root system and better nutrients.
5) Bio diesel is an excellent fuel exhaust gas value is clearly reduced.
6) Because of lack of sulphur highly effective waste gas catalyst with a long life span should be used. The oxygen content enables to build a highly effective values.
7) Using a filling up with bio diesel reduces damages to soil and water.
8) Compared to fossil fuels bio diesel makes small difference to climate gases, and in addition the fossil fuels needed in agriculture production release large quantity of nitrogen dioxide.

II. INTRODUCTION OF KARNAJA OIL (HONGE OIL)

Karanja Oil (Hange oil) derived from the Milletiapinnate, which is native to India. Milletiapinnata is a species of tree in the pea family. Febaceae native in tropical and temperate Asia including parts of India, China, Japan, Malaysia, Australia and Pacific islands. A honge tree that grows to about 15-25 meters (15-80ft) in height with a large canopy which spreads equally wide, it may be deciduous for short periods. The leaves are a soft, shiny burgundy in early summer and mature to a glossy, deep green as the season progresses. Flowering starts in general after 3-4 years. Cropping of pods and single almond sized seeds can occur by 4-6 years. Small clusters of white, purple, and pink flowers blossom on their branches throughout the year, maturing into brown seed pods. The Honge oil is bitter, red-brown, thick, non-drying and non-edible.

III. CONTENT OF KARANJA OIL

Table 1: Karanja oil contains following acids

Fatty Acid	*Molecular formula*	*Percentage*	*Structure*
Palmitic acid	$C_{16}H_{32}O_2$	*11.65*	$CH_3(CH_2)_{14}COOH$
Steatic acid	$C_{18}H_{36}O_2$	*7.0*	$CH_3(CH_2)_{16}COOH$
Oleic acid	$C_{18}H_{34}O_2$	*51.59*	$CH_3(CH_2)_{14}(CH=CH)COOH$
Linoleic acid	$C_{18}H_{32}O_2$	*16.64*	$CH_3(CH_2)_{12}(CH=CH)2COOH$
Eicosanoic acid	$C_{20}H_{40}O_2$	*1.35*	$CH_3(CH_2)_{18}COOH$
Dosocasnoic acid	$C_{22}H_{44}O_2$	*4.45*	$CH_3(CH_2)_{20}COOH$
Tetracosanoic acid	$C_{24}H_{48}O_2$	*1.09*	$CH_3(CH_2)_{22}COOH$
Residual		*6.83*	

Fig.1: Tree of Karanja and seeds of Karanja

Fig. 2: Seed of karanja oil

Fig. 3: Karanja oil

IV. LITERATURE REVIEW

Experimental Investigation of Comparative Performance of 4-Stroke 4-Cylinder C.I. Engine Operating On Methanol, Petrol (Jitendra Singh Dangi*, Vinay Yadav, 2015)) [9]

Direct-injection stationary diesel engine was operated under steady state at different engine loads to investigate the performance, of Karanja oil blends vis-à-vis base line diesel. Fuel consumption and thermal efficiency are relatively inferior for all Karanja oil blends compared to diesel. HC emissions were lower for Karanja oil blends than diesel for the whole engine operating range across all blend concentrations. CO and NO emissions were slightly higher for higher Karanja oil blends. Smoke capacity was lower for lower Karanja oil blends compared to diesel. In summary, Karanja oil's higher concentration blends are not suitable as alternate fuels in unmodified diesel engines. Injection timing optimization with unheated blends and pre heating the Karanja oil may be potentially techno economically feasible methods to use Karanja oil in diesel engines. However, lower concentration blends (up to 10% volume) can be readily used as alternate fuels to augment diesel supplies.

An investigation of using biodiesel/marine diesel blends on the performance of a stationary diesel engine (S. Kalligeros, 2002)[8]. This paper represents Vegetable oils are produced from numerous oil seed crops. While all vegetable oils have high-energy content, most require some processing to assure safe use in internal combustion engines. Some of these oils already have been evaluated as substitutes for diesel fuels. With the exception of rape seed oil which is the principal raw material for biodiesel fatty acid methyl esters, sun7ower oil, corn oil and olive oil, which are abundant in Southern Europe, along with some wastes, such as used frying oils, appear to be attractive candidates for biodiesel production. In this paper, fuel consumption and exhaust emissions measurements from a single cylinder, stationary diesel engine are described. The engine was fueled with pure marine diesel fuel and blends containing two types of biodiesel, at proportions up to 50%. The two types of biodiesel appeared to have equal performance, and irrespective of the raw material used for their production, their addition to the marine diesel fuel improved the particulate matter, unburned hydrocarbons, nitrogen oxide and carbon monoxide emissions.

Comparative environmental behavior of bus engine operating on blends of diesel fuel with four straight vegetable oils of Greek origin: Sunflower, cottonseed, corn and olive (D.C. Rakopoulos, 2011) [5]. Accoding to this paper An experimental study is conducted to evaluate the use of sunflower, cottonseed, corn and olive straight vegetable oils (SVO) of Greek origin, in blends with diesel fuel at proportions of 10 vol.% and 20 vol.%, in a fully instrumented, six-cylinder, turbocharged and after-cooled, heavy duty (HD), direct injection (DI), 'Mercedes-Benz',mini-bus engine installed at the authors' laboratory. The series of tests are conducted using each of the above blends, with the engine working at two speeds and three loads. Fuel consump- tion, exhaust smokiness and exhaust regulated gas emissions such as nitrogen oxides (NOx), carbon mon- oxide (CO) and total unburned hydrocarbons (HC) are measured. With reference to the corresponding neat diesel fuel operation, the vegetable oil blends show reduction of emitted smoke with slight increase of NOx and effectively unaffected thermal efficiency. Theoretical aspects of diesel engine combustion, combined with the very widely differing physical and chemical properties of the vegetable oils against those for the diesel fuel, aid to the correct interpretation of the observed engine behavior.

As a Substitute for Diesel (Ashish R. Thakre 2000) [7].This paper represents the diesel engine is a major contributor to air pollution especially within cities and along urban traffic routes. Therefore it has become very essential to develop the technology of IC engines, which will reduce the consumption of petroleum fuels and exhaust gas emissions. In fact, agricultural and transport sectors are almost diesel dependent. The various alternative fuel options researched for diesel are mainly biogas, producer gas, ethanol, methanol and vegetable oils. Out of all these, vegetable oils offer an advantage because of its comparable fuel Properties with diesel and can be substituted between 20%-100% depending upon its processing. But as India still imports huge quantity of edible oils, therefore, the use of non-edible oils of minor oilseeds like Karanj oil has been tested as a diesel fuel extender. The various fuel blends of karanj oil were tested on different engine loads to evaluate its properties, effect of engine load on brake energy consumption (BSFC), effect of engine load on brake thermal efficiency (BTE), effect of exhaust emission, costing. The work in this paper highlights a developed methodology for generating the electricity by the use of raw material such as karanj oil. The work proposed the use of karanj oil-non edible oil derived from leguminous trees, which grows wild even under the inhospitable agro climate and soil conditions. Study and observation of this work indicates the periodic scarcity and increasing

cost of such petro based products, difficulties of transportation to remote areas. Attempts have made in the past to find alternative sources of fuel/energy from renewable resources such as organic oils and starches of this kerosene and diesel are the most important especially in the context of domestic water supply, irrigation pump sets and lighting. To overcome all the problems this paper proposed karanj oil as a substitute for diesel. The outcome after using of karanj oil as a substitute for diesel was that smoke was clear, impact of diesel is reduces, employment increases and also our country will be developed and self-dependent.

V. PROBLEM FORMULATION

Efforts are under way in many countries, including India, to search for suitable alternative diesel fuels that are environment friendly. The need to search for those fuels arises mainly from the standpoint of preserving the global environment and the concern about long term supplies of conventional hydrocarbon based diesel fuels.

The increased demand of petroleum derived fuel as blends as well as their resulting environmental concerns provides the incentives for the development of alternate fuels from renewable resources. Biodiesel derived from animal fat and vegetable oils can be used as diesel fuel substitute. The critical problem was to reduce air pollution, radiation and increase efficiency of the engine with distilled blend with required composition of Karanja oil with diesel. That go with experimental set-up or experimental results.

VI. OBJECTIVE OF PRESENT WORK

The main objective of this work is to obtain a feasible solution to reduce fuel consumption. As w Karanja oil use for blending with petrol and Mthanol in diesel as distillation composition as per required experimental set-up with various efficiency calculation. The testing of this blend fuel is carried out on a 4- stroke with multi-cylinder say here four cylinder but go for more than that diesel engine.

To Investigate the Performance Characteristics as experimentally , so that we observe such as Mechanical Efficiency and Load, Brake Specific Fuel Consumption, Air Fuel Ratio and Load , Volumetric Efficiency and Brake Power , Brake Specific Fuel and Brake Thermal Efficiency.

VII. CONCLUSION

Based on the Experimental results following conclusion can be drawn:

1) Karanja oil can be one of alternate fuel for diesel engine. This has characteristics very close to diesel. It is miscible with diesel fuel in any proportion and can be used as diesel fuel extender.
2) India is Agriculture based country; large portion of our waste and unfertile land can be used for Karanja plantation so that large production of Karanja oil can be used for blend for diesel, will act as a future fuel.
3) On comparing the physical and chemical properties of Karanja oil are quite similar to diesel. However its viscosity is higher by 14 times as compared to diesel.
4) Mixing of petrol and Methanol can reduce the viscosity of Karanja oil to a substantial level and allow it to be used in diesel engine.
5) Calorific value of Karanja oil is found to be low by 8% due to different in chemical composition and difference of carbon-hydrogen contents
6) Above results indicate that Karanja oil can be used as a one of the alternate fuel for diesel engine, which is cheap, easily produced and etherified, easily blended with diesel in wide range of proportion, satisfactorily performance and low emission.

REFERENCE

[1] Paul Bellaby," Uncertainties and risks in transitions to sustainable energy and the part 'trust' might play in managing them: a comparison with the current pension crisis", Renewable and Sustainable Energy , (2010),pp- 3100-3107
[2] Deepak Agarwal, Avinash kumar " performance and emissions characteristics of jatropha oil (preheated and blends) in a direct injection compression ignition engine", Applied Thermal Engineering, (2007),pp- 2314-2323
[3] John Sheffield,"The role of energy efficiency and renewable energies in the future world energy" PII: S0960-148 (1996),pp- 00084-5
[4] John Sheffield,"The role of energy efficiency and renewable energies in the future world energy", PII: S0960-148 (1996),pp- 00084-5
[5] D.C. Rakopoulos, C.D. Rakopoulos, E.G. Giakoumis, A.M. Dimaratos, M.A. Founti "Comparative environmental behavior of bus engine operating on blends of diesel fuel with four straight vegetable oils of Greek origin: Sunflower, cottonseed, and olive" Elsevier,vol: 90(2011),pp- 3439-3446 .
[6] Avinash Kumar Agarwal K. Rajamanoharan, "Experimental investigations of performance and emissions of Karanja oil and its blends in a single cylinder agricultural diesel engine" Elsevier (Applied energy), vol: 86, (2009), pp- 106-112.
[7] Ashish, R. Thakre,"As a Substitute for Diesel "ijrd, vol: 4, issue: 4, (2000).
[8] R.Shanmugasundaram, Culex quinquefasciatus, Aedes aegypti and Anopheles stephensi. "Larvicidal activity of neem and karanja oil cakes against mosquito vectors",IJERST, 2008,vol: 29,pp- 43-45.
[9] Jitendra Singh Dangi*, Vinay Yadav "Experimental Investigation of Comparative Performance Of 4-Stroke 4-Cylinder C.I. Engine Operating On Methanol, Petrol, IJESRT, vol: 7, 2015, ISSN-2277-9655.