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Performance and Emission Analysis of 4 Stroke Compression Ignition Engine Using Turmeric Leaf Oil as a Fuel

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Abstract
The Economy of nation is mainly dependent on the fuel price. All the product prices add the transportation cost and which is directly related to fuel price. The Fuel is limited on the earth which restricts the use of the fuel. Combustion of fuel results in the emission of carbon dioxide (CO_2) and other harmful pollutants. This results in increasing the global CO_2 level and global warming. This paper leads to the idea of using turmeric leaf oil on single cylinder, 4 stroke, water cooled, direct injection diesel engine such that it reduces the demand of the petroleum products that is going to be extinct in near future. It includes about the emissions of harmful gases that can be reduced by the use of turmeric leaf oil with their different blend with diesel. In this paper an experimental investigation is done to examine the performance and emission of turmeric leaf oil with their different blend (B10, B20, B30) with diesel fuel and it is compared with diesel fuel. Different performance parameter like break specific fuel consumption, break power, break thermal efficiency etc of C I engine are observed and compared with diesel engine performance parameter with the same.

Keywords: Turmeric leaf oil, performance, emission, Diesel engine.

1. Introduction
Petroleum resources are finite and almost 90% of energy needs of the world are provided by fossil fuels which are depleting at an alarming rate. In recent years, the consumption of petroleum products in India has been increased significantly. As far as India is concerned the need to search an alternative fuels argent to meet the demand for transportation, agricultural sector. Apart from the depleting resources, of petroleum, another important aspect of their use is in the alarming rise of pollutants like Carbon-monoxide (CO), Hydrocarbons (HC), Oxide of nitrogen (NOx), carbon dioxide (CO_2) etc. by automobiles and industries which have tremendous effect on human life and vegetation. Researcher all over world, for reason mention above, have focus their attention in conservation of petroleum product and look for development of various alternative fuels including renewable and blending of renewable and non-renewable resources. Turmeric is used as condiment, dye, drug and cosmetic in addition to its use in religious ceremonies. India is a leading producer and exporter of turmeric in the world. Turmeric is mainly grown in Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal, Gujarat, Meghalaya, and Maharashtra, Assam. In today's India, turmeric is still added to nearly every dish be it meat or vegetables. Turmeric has been used in Indian Systems of Medicine for a long time. It has been known as poor man's saffron because it offers a less expensive alternative yellow coloring Turmeric is known worldwide for its multipurpose use in medicine, cosmetics, food flavoring and textile industries. The rhizomes of turmeric are used in many ways but the leaves of the turmeric are having no use so far. Oil from turmeric leaf is extracted by hydro distillation. Fresh leaves were collected, cleaned and cut into small pieces. Leaves were kept metal net of the distillation unit below which sufficient quantity of water was charge as extracting solvent. The water was heated at about 100oC and the generated steam was passed under pressure through the leaves. The extracted oil along with steam was condensed & collected in the receiver. The mixture was cooled & allowed to stand for some time to separate the oil & water layer. After complete separation of layers, the oil was separated.

2. Objective of the work
Conventional energy sources such as oil, coal, natural gas have limited reserves that are expected not to last for an extended period. World primary demand is projected to increase by 1.7% per year from 2007 to 2030, from just over 12,000 million tons of oil equivalent to16800

million tones overall increase of 40%. As world reserves of fossil fuels & raw material are limited. It has stimulated active research interest in non petroleum & non polluting fuels. Diesel engines are the major source of power generation & transportation hence diesel is being used extensively but due to gradual impact of environmental pollution there is an urgent need for suitable alternate fuels for use in diesel engine without any modification. There are different types of vegetable oil & biodiesel have been tested in diesel engines its reducing characteristic for green house gas emissions. Its help on reducing a country's reliance on crude oil imports its supportive characteristic on agriculture by providing a new market for domestic crops, also its effective lubricating property that eliminates the need of any lubricate additive & its wide acceptance by vehicle manufacturers can be listed as the most important advantages of bio-diesel fuel. There are more than 350 oil bearing crops identified, among which only Jatropha, ongamia, sunflower, cottonseed, rapeseed, neem oil & peanut oil are considered as potential alternative fuels for diesel engines. The present study aims to investigate the use of turmeric leaf oil blend with diesel as an alternate fuel for compression ignition diesel engine.

Table 1: Properties of Diesel and Turmeric Leaf Oil

Sr. no	Parameter	Diesel	Turmeric Leaf Oil
1	Calorific kj/kg Value,	41000	42310
2	Density, kg/m^3	850	883
3	Dynamic Viscosity, Cps	4.95	6.10
4	Fire Point ˚c	107	130
5	Flash Point ˚c	80	110
6	Pour Point ˚c	-23	<-20

3. Experimental Setup

A Single cylinder, 4-four-stroke, water cooled diesel engine is used for evaluation of the performance and emission characteristics of turmeric leaf oil blending with diesel, which is used as alternative fuel for diesel engine. The performance of diesel fuel and turmeric leaf oil blending at different loading condition were evaluated. The exhaust gas coming out from the engine is first passed to the calorimeter and then to the exhaust gas analyzer. The diesel engine having Bore 87mm and stroke 110mm.The engine works at a compression ratio of 16:1. A U-tube manometer is used to measure mass of air intake, fuel consumption of engine measure manually with burette, Exhaust gas calorimeter is used to measure exhaust gas mass flow rate. An electric dynamometer is used. Load on the engine is given with help of load bank.

Fig 1: Kirloskar Single cylinder diesel engine

Table 2: Engine Specifications

Sr. No.	Specification	Value
1	Maximum Engine Output	3.7 kw
2	Maximum Engine Speed	1500 rpm
3	Bore x Stroke	87 x 110 mm
4	Compression Ratio	16:1

4. Results and Discussion

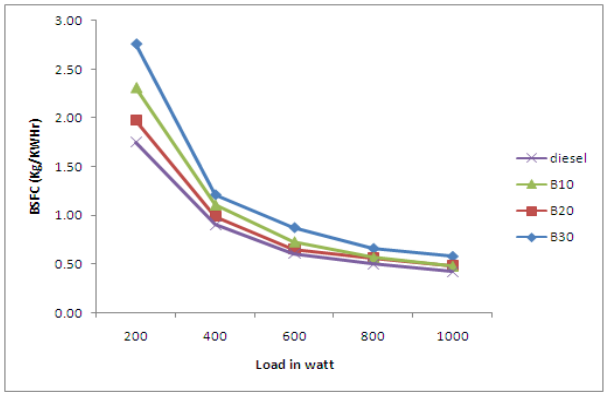

Fig 2: Load Vs Break specific fuel consumption

Fig shows it was observed that BSFC of diesel and various blends of turmeric leaf oil, decreases with increases in load, and it is lower for diesel as compare to blend of turmeric leaf oil.

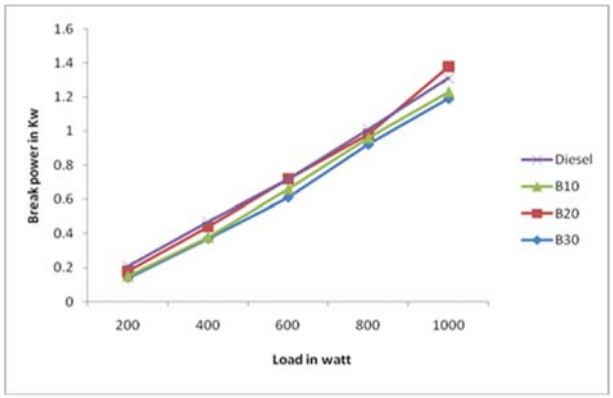

Fig 3: load Vs break power (kw)

Fig shows Load increases break power also increases, break power is slightly less than that of diesel.

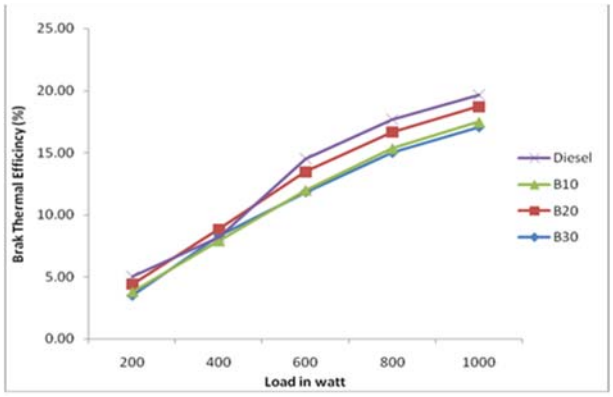

Fig 4: Load Vs Break Thermal Efficiency (%)

Fig shows break thermal Efficiency Increases with increases in load. Higher value of BTE is 20.83%

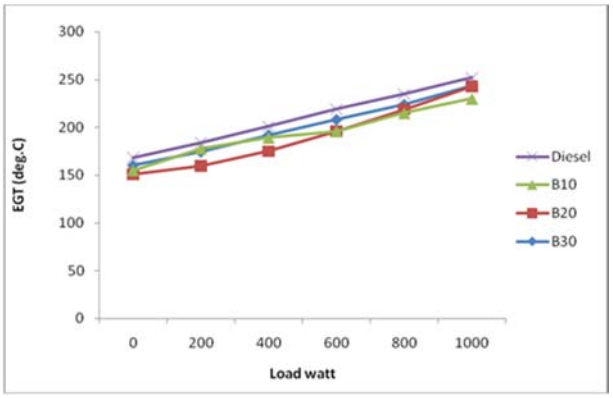

Fig 5: Effect of varying load on Exhaust Gas Temperature

Fig shows exhaust gas temperature of diesel fuel is more for lower load. In case of blends of oil, exhaust gas temperatures are less as compare to the diesel fuel. Therefore Exhaust Gas Temperature can be reduced by using blends.

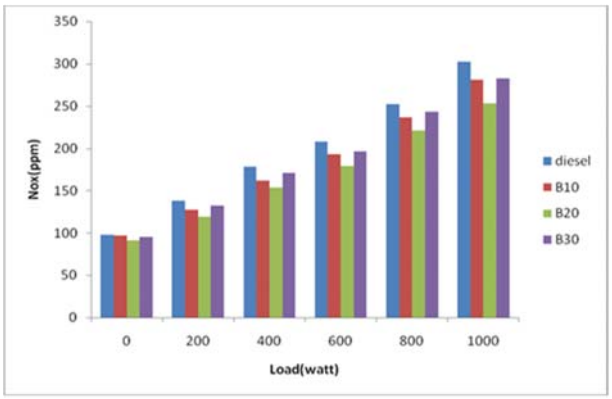

Fig 6: Variation of NOx Vs Load

Fig shows NOx emission increases with increasing load. For all blends of turmeric leaf oil NOx emission is less than diesel. Blend B10 & B20 shows less emission as compare to diesel.

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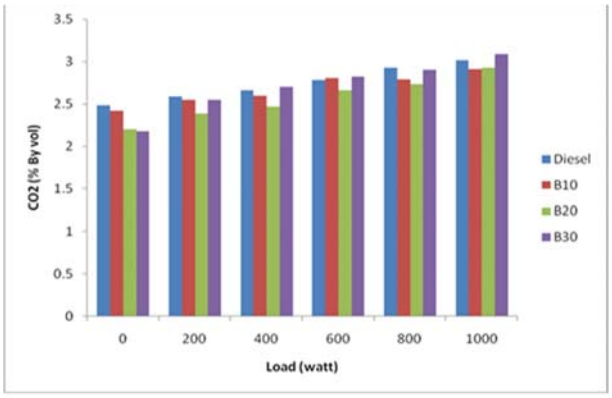

Fig 7: Variation of CO_2 Vs Load

Fig shows CO2 emission increases with increasing load. For blend B10 & B20 shows less emission as compare to diesel.

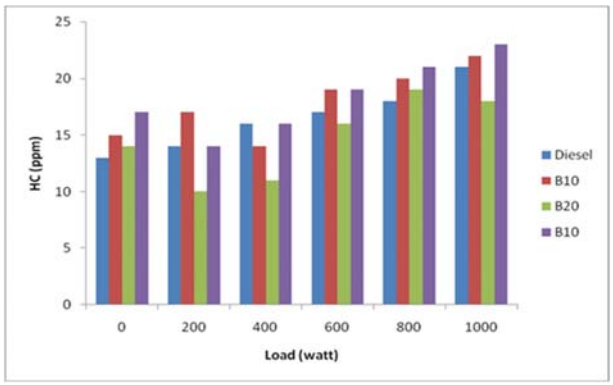

Fig 8: Variation of HC Vs Load

Fig shows Hydrocarbon emission increase in load increases for all loads. Hydrocarbon emission for blend is higher than diesel. For blend B10 & B30 have higher HC emission as compare to diesel

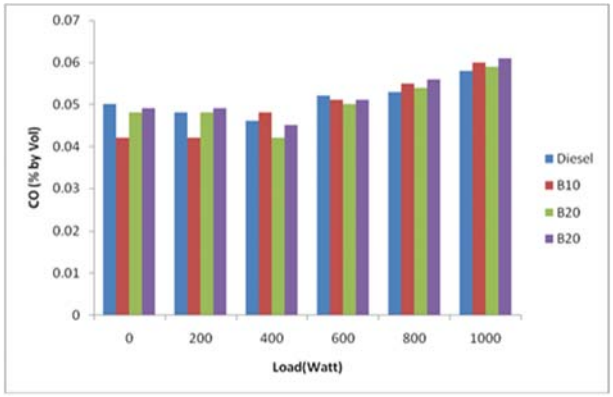

Fig 9: Variation of CO Vs Load

Fig shows that from load 0 watt to 400 watt CO emission decreases foe diesel and all blends of turmeric leaf oil. For further load 600 watt to 1000 watt CO emission for all blend and diesel increases. For high load Co emission is high foe blend as compare to diesel.

5. Conclusions

1. The flash and fire points of turmeric leaf oil was quite high than diesel, therefore it is safe handle. The cloud point, pour point and density of turmeric leaf oil is quite high than diesel.
2. The density of turmeric leaf oil can be compensated as it reduces as the temperature reduces. Because of higher cloud and pour point, turmeric leaf oil is not suitable as a diesel fuel in cold climatic condition.
3. The break power of engine slightly decreases as compare to diesel when blends of turmeric leaf oil are used. The break thermal efficiency for diesel is higher than as compare to all blends of turmeric leaf oil.
4. The NOx and CO_2 increases with increase in load and for all blends of turmeric leaf oil emission was less as compare to diesel. The hydrocarbon emission also increases with increase in load & it was higher for blends as compare to diesel.

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7. References

1. R. Senthilkumar', K. Ramadoss M. Prabu, Emission and performance characteristics of single cylinder diesel engine fuelled with neem biodiesel, IEEE-International Conference On Advances In Engineering, Science And Management (lCAESM -2012) March 30, 31, 2012
2. Nilesh janardhan mundle, preliminary photochemical Evaluation of the oil Extracted from Leaves of Curcuma longa L. and its application as biofuel, Int.J.Pharma.Phytopharmacol.Res.2011,1(2):73-77
3. G. H. Kawade, S. T. Satpute, Jatropa Biodiesel Blending with Diesel Fuel Suitable for Diesel Engine, 978-1-4673-6150-7/13/$31.00 ©2013 IEEE
4. WANG Yan-yao, SHANG Shu-qi, Study on the Use of Alternative Fuel Made from Waste Vegetable Oil in the Diesel Engine, 978-1-4244-9577-1/11/$26.00 ©2011 IEEE.
5. Pravin A. Madane, Dr. Prof. Ashok T. Pise" Sandesh Chougule, Properties of Biofuel and their Diesel Blends as a Fuel for c.l. Engines, IEEE-International Conference On Advances In Engineering, Science And Management (lCAESM -2012) March 3 0, 3 1, 2012
6. Guo Hejun Zhang Zhili Jiang Bing Huang Xianxiang,, Development of a New Palm Oil Monoester Used as a Clean Alternative Diesel Engine Fuel.
7. Dr. K. Rajagopal, S.Naga Sarada, K.Kalyani Radha,, Alternative Fuels for a Single Cylinder Direct Injection Diesel Engine, 978-0-7695-3267-7/08 $25.00 © 2008 IEEEDOI 10.1109/ICETET.2008.261
8. K R Patil, Prof. P.M.Khanwalkar, development of HCNG blended fuel
9. Engine with control of NOx emission, Second International Conference on Emerging Trends in Engineering and Technology, ICETET-09