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Performance and Emission Test of Diesel (100%) and Biodiesel (neem30,40,50%) in CI Engine

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Abstract - Biodiesel production is a valuable process which needs a continued study and optimization process because of environmentally advantageous attributes and its renewable nature. in India neem tree is a widely grown crop, termed as divine tree due to its wide relevance in many areas of study. the present study is intended to consider aspects related to the feasibility of the production of biodiesel from neem oil. the objective of this study was to investigate the effect of the bio diesel produced from high free fatty acid feed stock on engine performance and emission. biodiesel performance and testing is done in CI engine, neem oil was extracted from neem seeds by solvent extraction and transesterification. in this work the biodiesel blends of proportion B30,B40,and B5 was compared with the 100% diesel in single cylinder 4 stroke water cooled CI engine with the compression ratio of 16 and found that the biodiesel B40 is having higher mechanical efficiency compared to the remaining blends and also 100% diesel and brake thermal efficiency is higher than the pure 100% diesel.

Key Words: Diesel, Biodiesel, Neem oil, Transesterification, Performance, Emission Characteristics

1. INTRODUCTION

It is not a new idea to use biodiesel in engine as alternative fuel it was first used by Rudolph diesel at Paris exposition of 1900[1], Crude oil prices have been increasing rapidly which increases the burden on foreign exchange reserves of importing countries like India, It has severe effect on the economy of oil importing countries, efforts are going all over the world to find alternative automotive fuel due to increase in the demand for petroleum products global warming due to emission of harmful gases, degradation of air quality and fast depletion of supply of fossil fuel noticeable research work has been made to use methyl ester(bio-diesel) in the place of conventional diesel oil. it has received attention all over the world as an alternative fuel to diesel oil because it has produced from renewable sources such as straight vegetable oil and fried animal fats and oil also a waste cooking oil and fried oil[2], it is eco friendly in nature and referred as green energy source[3,4,5], biodiesel is a renewable diesel fuel substitute that can be made by chemically combining and natural oil or fat with an alcohol such as methanol or ethanol, methanol has been the most commonly used alcohol in commercial production of biodiesel[6], A number of methods are currently available and have been adopted for the production of biodiesel. There are four primary ways to produce biodiesel. pyrolysis, micro-emulsification, dilution and Transesterification[7], Neem is a tree in the family 'Maliaceae' which grows various parts in India it's scientific name 'Azadirachta indicia'. the ever green tree is large, reaching 12 to 18 meters in height with a girth of up to 1.8 to 2.4 meters. the seeds have 40% oil which has high potential for the production of biodiesel. it has a higher molecular weight, viscosity, density, and flash point than diesel fuel neem oil is generally light to dark brown and has a strong odour that is said to combine the odours of peanut and garlic[8]

2. Material and Methodology

A. oil extraction

The sample is extracted from solvent extraction of the neem seed, fruit,

Cleaning of neem oil: the first step in obtaining oil from neem for bio diesel to remove the seed coat and husk in a process referred to as de hulling. In developing countries, had objects are used to crack the shell are popular once the nets cracked, the oil bearing seeds are cleaned and dried. Seed cleaning involves the removal of the seed coat and the separation of the chaff. Seed drying can be done by placing the seed under the sun or by heating carefully on the fire for a short while. Once this is done, the next step is to begin crucial extraction process.

Transesterification: this is most commonly used process in production of bio diesel. It is most commonly used and important method to reduce the viscosity of vegetable oils. In this process triglyceride reacts with three molecules of alcohol in the presence of a catalyst producing a mixture of fatty acids, alkyl ester and glycerol. The process of removal of all the glycerol and the fatty acids from the vegetable oil in the presence of a catalyst is called esterification. The bellow fig shows transesterification process

2.1 B. Properties of biodiesel

Prop.	Diesel	B30	B40	B50
Flash point(c)	57	35	33	58
Fire point(c)	63	39	37	60
Density(kg/m)	830	826.8	837.6	848.4
Viscosity(Cst)	4.3	4.34	4.38	4.4
CV(kJ/kg)	45700	44860	44020	43170

2.2 experimental setup

fig2. Engine setup

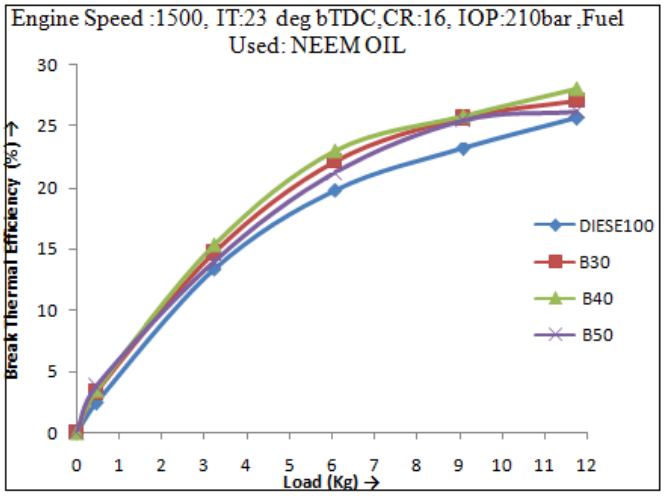
Table -1: engine specification

product	VCR Engine test setup 1cylinder 4 stroke, diesel(comp)
Engine	Make kirloskar, type 1 cylinder 4 stroke diesel, water cooled power 3.5kw at 1500 rpm, stroke 110mm, and bore 87.5mm. 661cc, CR17.5, modified to VCR engine CR 12 to 18. with electric start arrangement, battery and charger
Dynamometer	Type eddy current, water cooled
Load sensor	Load cell, type strain gauge, range 050kg
Compression ratio	16:1

3.Result and discussion

Comparison of biodiesel

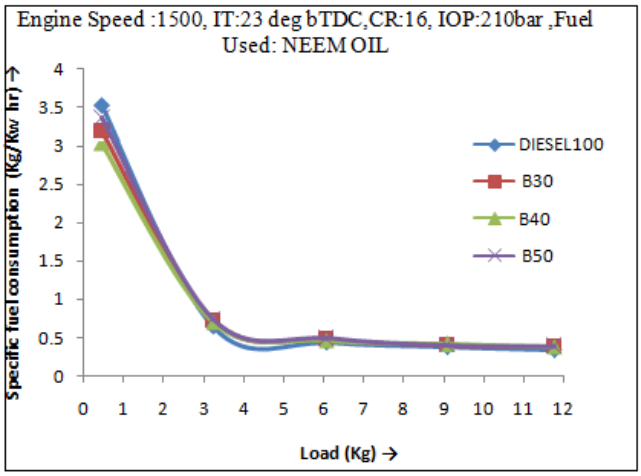
3.1 LOAD VS BRAKE THERMAL EFFICIENCY



RESULT: As the load increases the brake thermal efficiency for both diesel and biodiesel blends increases linearly and the biodiesel B40 gives best performance compare to the pure diesel

DISCUSSION: The maximum thermal efficiency of B40 is 2.01% higher than that of diesel.

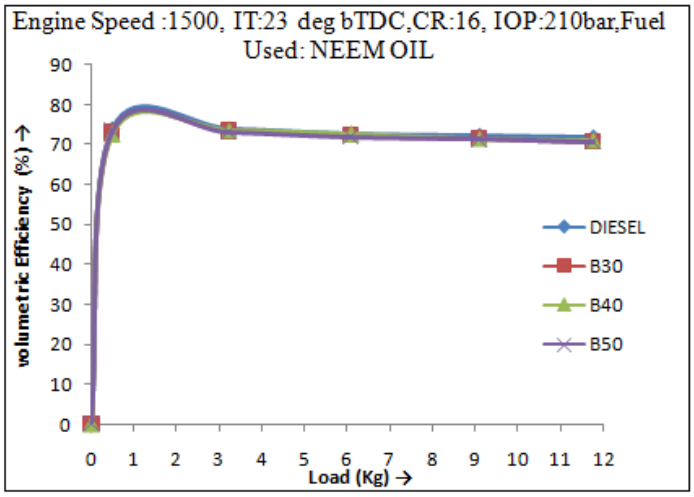
3.2 LOAD VS SPECIFIC FUEL CONSUMTION



RESULT: As the load increases the specific fuel consumption for both diesel and biodiesel decreases suddenly up to 6kg load and further it reduces steadily at higher load.

DISCUSSION: The main reason for this could be that the part load efficiency of any engine is lower than full load. fuel consumption to produce unit power decreases due to reduction of energy losses.

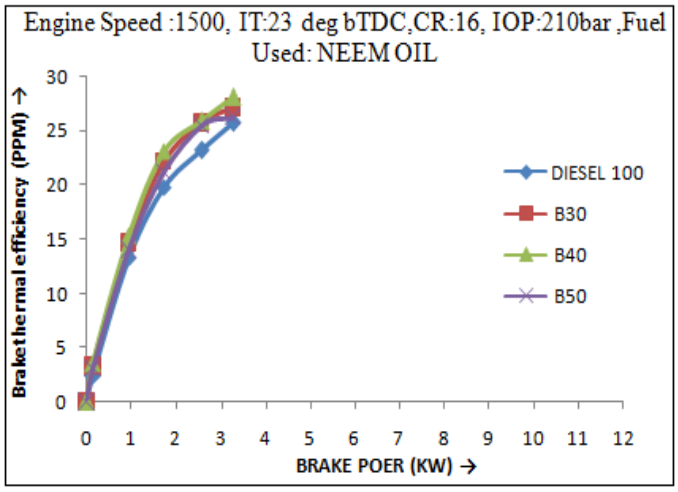
3.3 LOAD VS VOLUMETRIC EFFICIENCY



RESULT: From graph diesel has higher volumetric efficiency compare to the biodiesel blends and we can say that the volumetric efficiency is maximum at lower load.

DISCUSSION: So volumetric efficiency is just a measure of how good the engine is at sucking in air, and anything that reduces the flow of air into the engine will lower the volumetric efficiency. normally an engine's volumetric efficiency increases with load hits a maximum, then sharply falls.

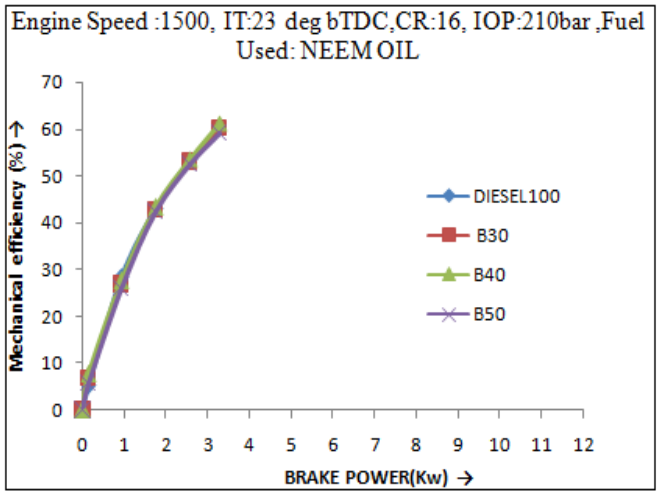
3.4 BRAKE POWER VS BRAKE THERMAL EFFICIENCY



RESULT: from the graph we can see that as the brake power increases the brake thermal efficiency for both diesel biodiesel blend amongst the blends B30,B40,and B50, the brake thermal efficiency for B40 is appears to be comparatively more than other blends.

DISCUSSION: the brake thermal efficiency of the blend B40 is higher than diesel at brake power of 2KW. and this may attribute to better spray characteristics of B40 blend fuel in the combustion chamber which leads to effective utilization of air resulting in more complete combustion.

3.5 BRAKE POWER VS MECHANICAL EFFICIENCY



RESULT: The mechanical efficiency increases as the brake power increase for both pure diesel and biodiesel

DISCUSSION: All the blend produces output nearly same as that of 100% diesel but with difference in brake power.

4. CONCLUSION

1) Performance, combustion characteristics of biodiesel is well compared with the diesel, the maximum brake thermal efficiency of B30,B40,B5 and diesel are respectively 27.12,28.04, 26.20 and 25.68

2) The brake thermal efficiency for the blend B40 is more as compared to remaining blends and diesel i.e.28.04%

3) The performance is slightly reduced while brake specific fuel consumption is increased when using biodiesel.

4) From the graph BP VS MECH Eff the bio diesel blend B40 having highest mechanical efficiency than the diesel and the remaining blends

5) The best blending ratio is 60% diesel and 40% biodiesel I.e.B40 biodiesel which gives the best performance which is closer to diesel fuel

6) Taking analysis of all the above graphs we are finding that the biodiesel (neem oil) is best alternative fuel for CI engine, by comparing biodiesel performance and combustion characteristic we are conclude that biodiesel blends will give a best performance with compare to Diesel

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