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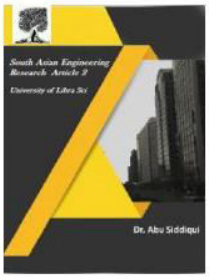

"PERFORMANCE INVESTIGATION ON KARANJA, NEEM AND MAHUA BIODIESEL COMBINE WITH DIESEL INSIDE SINGLE CYLINDER IC ENGINE"

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ABSTRACT

*I*n the current years, vehicle people improved extremely which increase the require of fossil fuel. The accessibility of crude oil supply decrease constantly, these reason make the researchers to stumble on new renewable alternative fuel particularly biofuels. Some of the vegetable plant life like karanja, neem, and mahua, rapeseed, jatropha, soabean , etc. were previously originate as victorious production of biodiesel. But the troubles in these sources were the land availability. Still, it has been reported that the use of biodiesel significantly reduced emission and increase the performance of the engine. The most hopeful technique for the production of biodiesel is transesterification process .Now-a-days researchers have reported the opportunity for the production of biodiesel . In the present study, karanja, neem and mahua biodiesel blend with diesel ratio of (10%), (20%) and (30%)is blends with diesel are used in the IC engine.

***Key Words*:** Transestrification1, IC Engine2, Karanja,Neem and Mahua Biodiesel3,

1. INTRODUCTION

The resources of petroleum as fuel are dwindling day by day and increasing demand of fuels, as well as increasingly stringent regulations, pose a challenge to science and technology. With the commercialization of bio-energy, it has provided an effective way to figurant against the problem of petroleum scarce and the influence on environment. India is one of the greatest rising countries with a steady profitable growth, which multiply the require for moving in many folds. Fuel expenditure is directly balanced to this demand. India depends generally on import fuel owing to need of fossil fuel assets and it has a great blow on wealth. In Indian scenario, the data available from auto fuel consumption reveals that in the year 2017-18, 12.85 million metric tonnes (MMT) petrol and 66.91 MMT of diesel were consumed with a crude oil import amounting to rupees 3,88,044 corers. Biodiesel is a promising alternative for our diesel needs.

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India ranks 6th in terms of consumption of energy i.e. 3.5% of the total world's commercial energy.

2. Research Methodology

2.1 Equipment and Technique

Base on the accessibility of karanja, neem and mahua biodiesel combine with diesel, the property like calorific value, kinematic viscosity, flash point and fire point, karanja, neem and mahua biodiesel mix together with diesel is probable in the table 3.1,3.2, and 3.3 preferred for biodiesel grounding and investigational examination. a variety of mixture combinations of multi-blend biodiesel i.e. KF-1 (karanja fuel 10%, diesel 90% by volume), KF-2 (karanja fuel 20%, diesel 80% by volume), KF-3 (karanja fuel 30%, diesel 70% by volume) are prepared as shown in table 2.1

Table 2.1 Arrangements of flue sample of multi-blend biodiesel along with diesel

Preparation of flue samples of multi-blend biodiesel along with diesel		
S No.	Fuel samples	KBD + Pure diesel = Quantity obtained
1.	KF-1	100ml + 900ml = 1-litre
2.	KF-2	200ml + 800ml = 1-litre
3.	KF-3	300ml + 700ml = 1-litre

Table 2.2 Arrangements of flue sample of multi-blend biodiesel along with diesel

Preparation of flue samples of multi-blend biodiesel along with diesel		
S No.	Fuel samples	NBD + Pure diesel = Quantity obtaine
1.	NF-1	100ml + 900ml = 1-litre
2.	NF-2	200ml + 800ml = 1-litre
3.	NF-3	300ml + 700ml = 1-litre

Table 2.3 Arrangements of flue sample of multi-blend biodiesel along with diesel

Preparation of flue samples of multi-blend biodiesel along with diesel		
S No.	Fuel samples	MBD + Pure diesel = Quantity obtained
1.	MF-1	100ml + 900ml = 1-litre
2.	MF-2	200ml + 800ml = 1-litre
3.	MF-3	300ml + 700ml = 1-litre

2.2 Catalytic Pyrolysis

Transesterification: is a large amount universally used and significant method to decrease the viscosity of vegetable oil. In this procedure triglyceride react through three molecules of alcohol in the occurrence of a catalyst produce a mixture of fatty acids, alkyl ester and glycerol. The progression of elimination of all the glycerol and the fatty acids as of the vegetable oil in the presence of a catalyst is called esterification. This esterifies vegetable oil is called bio-diesel. Biodiesel property are related to diesel fuel. It is renewable, non-toxic, bio-degradable and surroundings pleasant transportation fuel. After esterification of the vegetable oil its density, viscosity, cetane number, calorific value, atomization and vaporization rate, molecular weight, and fuel spray penetration distance are improved more. So these enhanced property give superior performance in CI engine.

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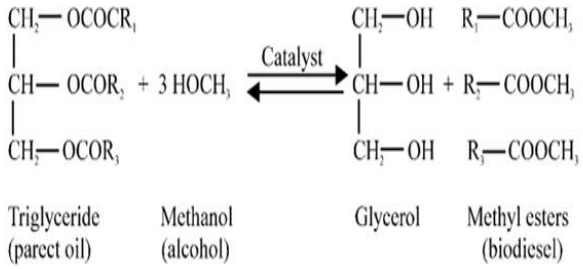

Fig 2.1 Transesterification equation

Physical and chemical property be additional enhanced inside esterified vegetable oil since esterified vegetable oil contain added cetane number than diesel fuel. This parameter brings good combustion characteristics in vegetable oil esters. So un burnt hydrocarbon level is decreased in the exhaust. It results in lower generation of hydrocarbon and carbon monoxide in the exhaust than diesel fuel. The vegetable oil esters have more oxygen and lower calorific value than diesel. So, it improves the combustion process and generate lower nitric oxide development in the exhaust than diesel fuel.

Fig 2.1 Photograph of experimentation I.C engine set-up

3. RESULTS AND DISCUSSION

3.1Introduction

The investigational outcome obtain from the test conceded out on engine performance accessible in this division. These contain results at regular speeds with different loads for the dissimilar fuels i.e. standard diesel fuel and the three multi-blend biodiesel products. The outcomes are discussed from the point of view of by multi-blend biodiesel (karanja, neem and mahua) as an another fuel for compression ignition engines.

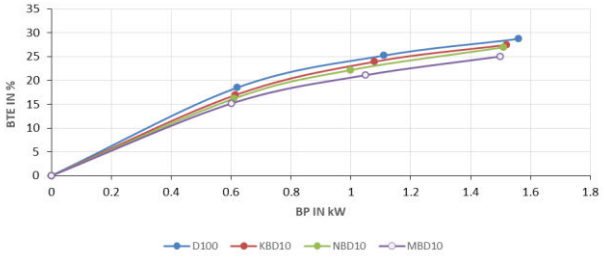

Chart1 deviation of brake thermal efficiency among esteem to brake power

Chart1 show the deviation of brake thermal efficiency with brake power for a variety of multi-blends biodiesel (karanja, neem and mahua) are KBD-10, NBD-10, MBD-10 alongside with pure diesel correspondingly. Brake thermal efficiency is increasing with increasing brake power for all multi-blends of biodiesel (karanja, neem and mahua) and diesel. It could be due to diminution in heat loss and enhance in power with enhance in load. At rated power of 1.52 kW approximately all the multi-blends have close to efficiency to diesel in which KBD-10 have highest thermal efficiency (27.47%) as compare to diesel (28.71%). It may be because of the existence of oxygen in biodiesel which enhance the combustion as

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compare to diesel and biodiesel is more lubricant than diesel that

Provides additional lubrication. Multi-blends of biodiesel (karanja, neem and mahua) have higher viscosity, density and lower calorific value than diesel.

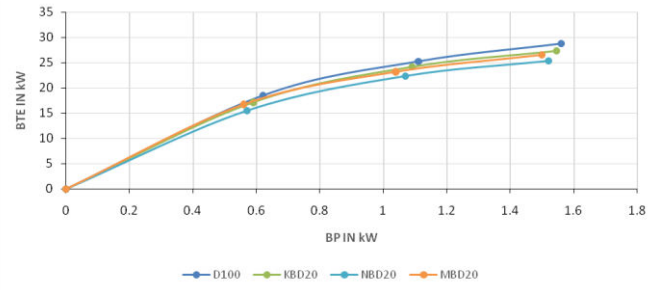

Chart2 deviation of brake thermal efficiency among esteem to brake power.

For a variety of multi-blends biodiesel (karanja, neem and mahua) are KBD-20, NBD-20, MBD-20 along among pure diesel correspondingly. Brake thermal efficiency is growing with growing brake power used for all multi-blends of biodiesel (karanja, neem and mahua) and diesel. It might be due to decrease in heat loss and enhance in power with enhance in load

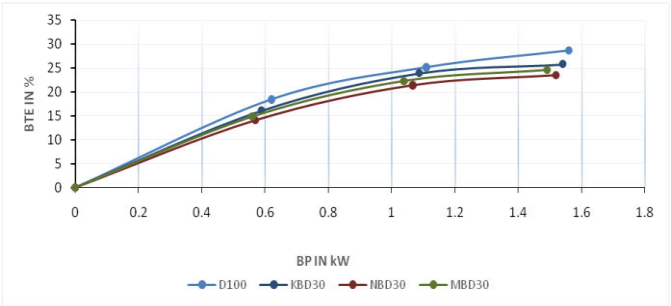

Chart3 deviation of brake thermal efficiency among esteem to brake power

At rated power of 1.545 kW almost all the multi-blends have near efficiency to diesel in which KBD-20 and contain highest thermal efficiency (27.30%) as compare to diesel (28.71%). Multi-blends of biodiesel contain superior viscosity, density and lesser calorific value than diesel. Chart 3 shows the deviation of brake thermal efficiency among brake power for a variety of multi-blends biodiesel (karanja, neem and mahua) are KBD-30, NBD-30, MBD-30 along among pure diesel correspondingly. Brake thermal efficiency is growing with growing brake power for all multi-blends of biodiesel (karanja, neem and mahua) and diesel.

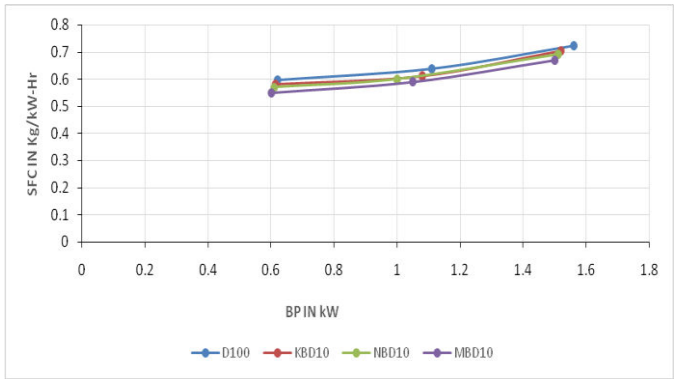

Chart4 deviation of specific fuel consumption among esteem to brake power

The deviation in SFC (specific fuel consumption) among brake power for a variety of multi-blends biodiesel (karanja, neem and mahua) are KBD-10, NBD-10, and MBD-10along through pure diesel as shown in Fig. 4the specific fuel spending while using multi-blend biodiesel is predictable to enhance as compare to the utilization of diesel fuel. SFC decreased sharply with enhance in load for all fuel samples.

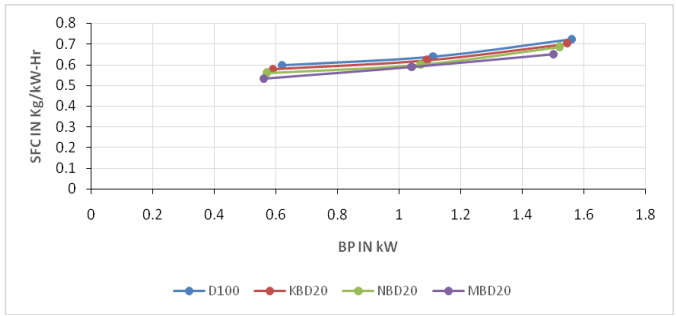

Chart5 deviation of specific fuel consumption among esteem to brake power

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The deviation in SFC (specific fuel consumption) with brake power for a variety of multi-blends biodiesel (karanja, neem and mahua) be KBD-20, NBD-20, and MBD-20 along among pure diesel as shown in chart 5 the specific fuel utilization when using multi-blend biodiesel is predictable to raise as compare to the utilization of diesel fuel. SFC decrease piercingly with enhance in load for all fuel samples. The major cause for this may be that the percent enhance in fuel necessary to control the engine is less than the percent enhance in brake power due to comparatively less portion of the heat sufferers at higher loads. As the SFC is calculated on weight basis, so superior densities resulted in superior values of SFC.Maximum SFC is obtained in KBD-20 (0.701) at 1.545 kW.

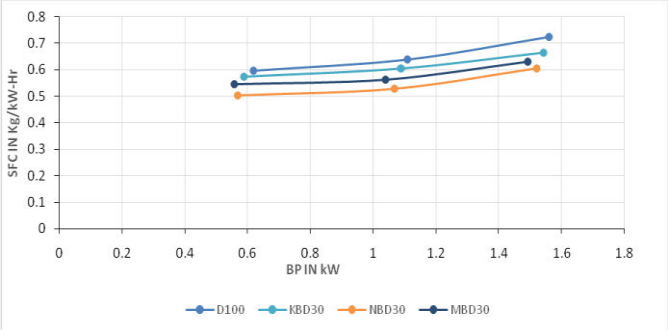

Chart6 deviation of specific fuel consumption among esteem to brake power

The variation in SFC (specific fuel consumption) with brake power for various multi-blends biodiesel (karanja, neem and mahua) are KBD-30, NBD-30,and MBD-30 along with pure diesel as shown in chart 6 the specific fuel consumption when using multi-blend biodiesel is expected to increase as compared to the consumption of diesel fuel. SFC decreased sharply with increase in load for all fuel samples The main reason for this may be that the percent increase in fuel required to operate the engine is less than the percent increase in brake power due to relatively less portion of the heat losses at higher loads. As the SFC is calculated on weight basis, so higher densities resulted in higher values of SFC. greatest SFC is obtain in KBD-30 (0.665) at 1.541 kW.

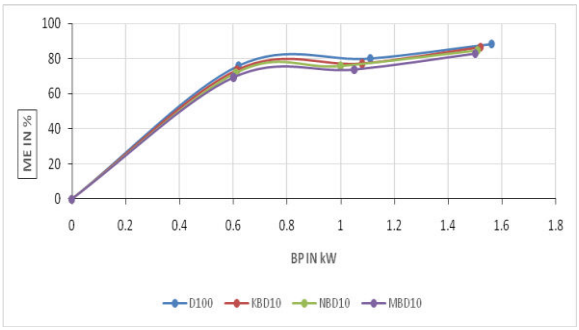

Chart7 deviation of mechanical efficiency among esteem to brake power

The deviation of mechanical efficiency with brake power for pure diesel and multi-blend biodiesel (karanja, neem and mahua) are shown in chart 7 the mechanical efficiency of pure diesel is slightly superior to the multi-blend biodiesel. In this case the pure diesel and KBD-10, NBD-10 and MBD-10 be approximately closer to each other. From the graph it is evident that as the percentage of multi-blend bio diesel increase in diesel the mechanical efficiency go on lessening. The mechanical efficiency of the engine is highest at 1.520 kW pure diesel compare to other multi-blend biodiesel. This happens due to lower calorific value and higher viscosity of multi-blend biodiesel compare to pure diesel

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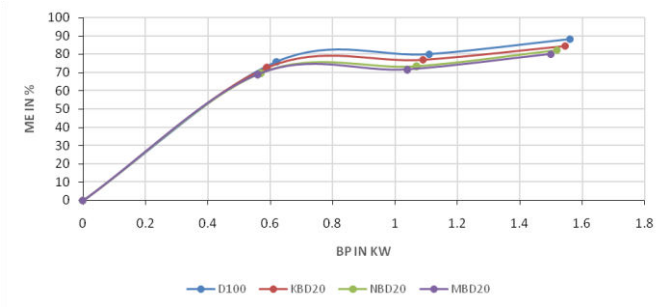

Chart8 deviation of mechanical efficiency among esteem to brake power

The deviation of mechanical efficiency with brake power for pure diesel and multi-blend biodiesel (karanja, neem and mahua) are shown in chart 8 the mechanical efficiency of pure diesel is to some extent superior to the multi-blend biodiesel. In this case the pure diesel and KBD-20, NBD-20 and MBD-20 are approximately closer to each other. From the graph it is marked that as the proportion of multi-blend biodiesel increase in diesel the mechanical efficiency goes on lessening. The mechanical efficiency of the engine is highest at 1.545 kW pure diesel compare to other multi-blend biodiesel. This happen due to poorer calorific value and superior viscosity of multi-blend biodiesel compare to pure diesel.

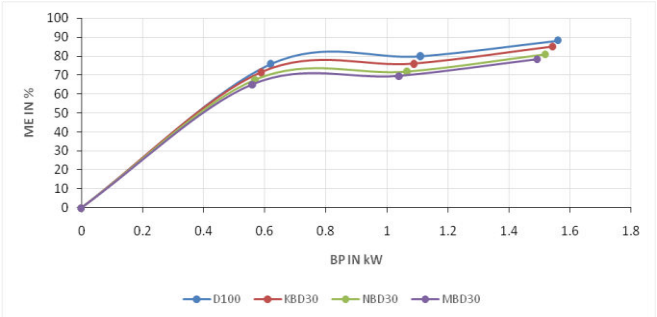

Chart9 deviation of mechanical efficiency among esteem to brake power

The deviation of mechanical efficiency with brake power for pure diesel and multi-blend biodiesel (karanja, neem and mahua) are shown in chart 9 the mechanical efficiency of pure diesel is to some extent superior to the multi-blend biodiesel. In this case the pure diesel and KBD-30, NBD-30 and MBD-30 are approximately closer to both others. From the graph it is evident that as the percentage of multi-blend biodiesel increase in diesel the mechanical efficiency goes on lessening. The mechanical efficiency of the engine is highest at 1.541 kW pure diesel compare to other multi-blend biodiesel. This happen due to lesser calorific value and superior viscosity of multi-blend biodiesel compare to pure diesel.

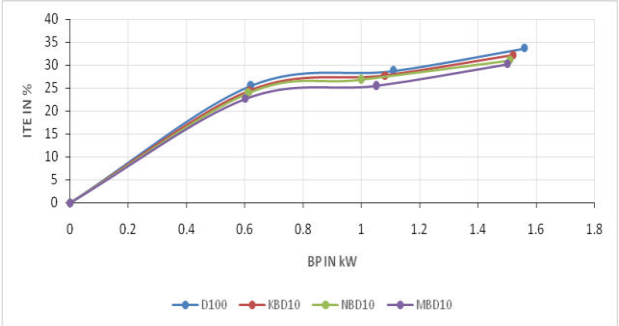

Chart10 deviation of indicated thermal efficiency among esteem to brake power

Chart10 shows deviation of indicated thermal efficiency with esteem to brake power. From the graph it observed that the indicated thermal efficiency is highest at initial brake power in the series of 0-1.52 kW brake power. Pure diesel has superior indicated thermal efficiency compared with all multi-blend biodiesel. This is due to superior calorific value of diesel with lesser viscosity. Maximum indicated thermal efficiency is obtained that 32.21% at 1.52kW

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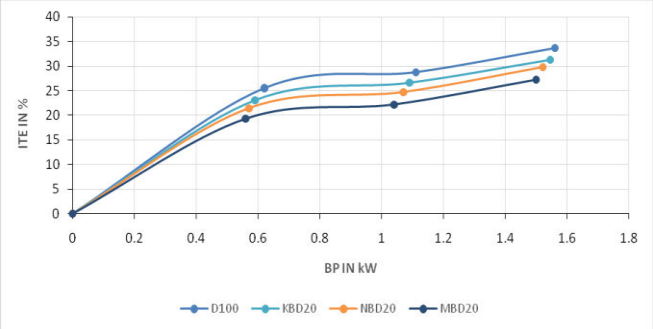

Chart11 deviation of indicated thermal efficiency among esteem to brake power

Chart11 shows deviation of indicated thermal efficiency with respect to brake power. as of the graph it pragmatic that the indicated thermal efficiency is highest at starting brake power in the range of 0-1.545 kW brake power. Pure diesel has superior indicated thermal efficiency compare among all multi-blend biodiesel. This is due to superior calorific value of diesel with lesser viscosity. Maximum indicated thermal efficiency is obtained that 31.26% at 1.545 kW

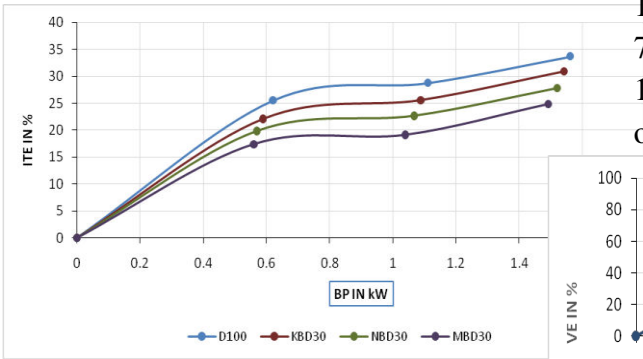

Chart12 deviation of indicated thermal efficiency among esteem to brake power

Chart12 shows deviation of indicated thermal efficiency among respect to brake power. as of the graph it pragmatic that the indicated thermal efficiency is highest at starting brake power in the range of 0-1.541 kW brake power. Pure diesel has superior indicated thermal efficiency compared among all multi-blend biodiesel. This is due to superior calorific value of diesel with lesser viscosity. Maximum indicated thermal efficiency is obtained that 30.93% at 1.541kW

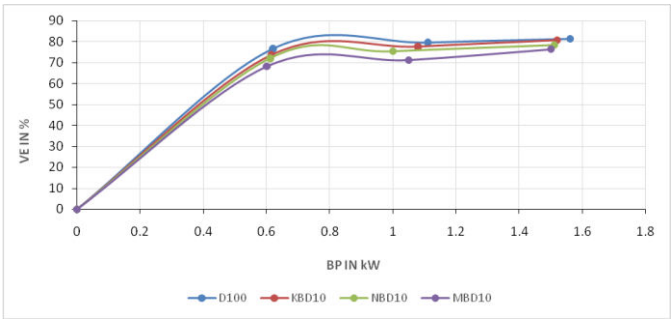

Chart13 deviation of volumetric efficiency among esteem to brake power.

From the chart 13 it observed that the volumetric efficiency is a little deviation in the average brake power and approximately constant. There is no a large amount deviation in the pure diesel compare to multi-blend biodiesel. From the graph pure KBD-10 have smallest amount it pragmatic that 73.52%,77.5% and 80.57% at 0.615 kW, 1.08kWand 1.52 kW. This is due to presence of oxygen during the combustion.

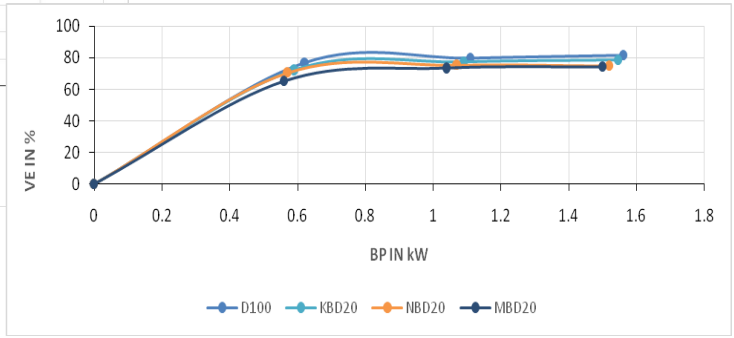

Chart13 deviation of volumetric efficiency among esteem to brake power.

There is no a large amount deviation in the pure diesel compared to multi-blend biodiesel. From the graph pure KBD-20

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having smallest amount it observed that 72.18%,77.13% and 78.41% at 0.590 kW, 1.09 kWand 1.545 kW.This is due to presence of oxygen during the combustion. From the chart it observed that the volumetric efficiency is slightly variation in the average brake power and almost constant

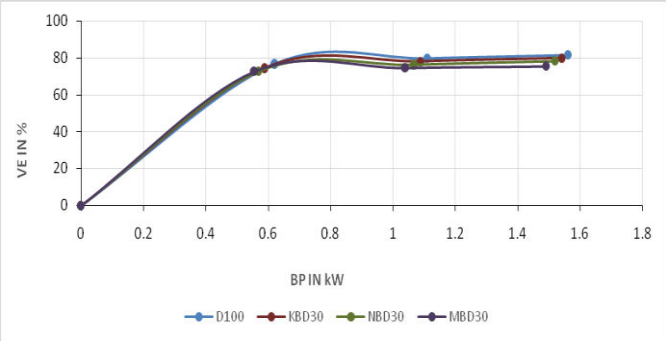

Chart14 deviation of volumetric efficiency among esteem to brake power..

There is no a large amount deviation in the pure diesel compared to multi-blend biodiesel. From the graph pure KBD-30 have smallest amount it observed that 61.578%,67.65% and 67% at 0.589 kW, 1.088 Kw and 1.541 kW. This is due to presence of oxygen throughout the combustion.

CONCLUSIONS

Use of a multi-blend biodiesel is measured as a new feasible source of alternative fuel for diesel engine. No complexity was faced at the occasion of preliminary the engine and the engine run efficiently at continuous engine speed of 1500 RPM. Based on the investigational work with multi-blend biodiesel, at utmost load, the following conclusions are drawn. The performance parameter like brake thermal efficiency, brake specific fuel consumption, brake specific energy consumption, torque have similar result at wide range of power output.

- The brake thermal efficiency of KBD-30 has highest 26.02% compare to pure diesel 18.71% at 1.5 kW brake power due to the occurrence of oxygen in the molecular constitution of multi-blend biodiesel intensify the complete combustion phenomenon.
- The mechanical efficiency of pure diesel is to some extent superior than the multi-blend biodiesel at 1.5 kW brake power due to lesser calorific value of multi-blend biodiesel.
- The indicated thermal efficiency contain greatest at average brake power in the range of 0.5-1.5 kW. Pure diesel has higher indicated thermal efficiency compared by means of further multi-blend biodiesel.
- The volumetric efficiency is somewhat decrease in the average brake power and approximately steady. There is no to a great extent deviation in the pure diesel compare to multi-blend biodiesel.
- Highest specific fuel consumption is obtain in NBD-30 (0.903) compare to pure diesel at 1.5 kW brake power.

REFERENCES

1. DivyaBajpai., Tyagi.V.K. (2006) Biodiesel: source, production composition, properties and its benefits. *Jounal of oleo science*, 55(10): 487-502.
2. GuoqingGuan, KatsukiKusakabe, Nozomi Sakurai, Kimiko Moriyama, (2009) Transesterification of vegetable oil to biodiesel fuel using

acid catalysts in the presence of dimethyl ether. *Fuel*, 88: 81-86.

3. TitipongIssariyakul (2011) Development of Biodiesel Production Processes.
    a. From Various Vegetable Oils
4. Dr. K.VIJAYA KUMAR REDDY (2010) Experimental investigation on performance and emission characteristics of diesel engine using bio-diesel as an alternate fuel.
5. V.DhanaRaju, P.Ravindra Kumar, "Experimental investigation of linseed and neem methyl esters as biodiesel on CI engine",International Journal of Engineering Science and Technology (IJEST), Vol. 4 No.06 June 2012.
6. AshishJawalkar, KalyanMahantesh, "Performance and Emission Characteristics of Mahua and Linseed Biodiesel Operated at Varying Injection Pressures on CI Engine", International Journal of Modern Engineering Research (IJMER),Vol.2, Issue.3, May-June 2012.
7. IlkerTurgutYilmal, MetinGumus, Mehmet Akcay, Thermal Barrier Coatings For diesel Engines.International scientific conference 19-20 November 2010, Gabravo Turkey.
8. RajendraPrasath, B., P. Tamilporai ,P. and Mohd.Shabir, F., "Analysis of combustion, performance and emission characteristics of low heat rejection engine using bio-diesel" International Journal of Thermal Sciences , Volume-49, pp: 2483-2490, 2010.
9. Naveen. P, C.R. Rajashekhar, C. Umashankar&VinayakaRajashekhar Kiragi " Effect of Titanium Oxide Coating on Performance Characteristics of Bio-Diesel (Honge) Fuelled C.I.Engine" International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.4, July-Aug 2012 pp-2825-2828 ISSN: 2249-6645
10. Sudheer B.P.K, Murthy V.S.S, KalyaniK.radha, Anjaneyaprasad.B, Ramjee. E, nagaprasad CH.S, K.V.K. reddy and Rajagopal.K "PERFORMANCE EVALUATION OF A LOW HEAT REJECTION CI ENGINE USING VEGETABLE OILS" International J.ofMulti.displ.Research&Advcs in Engg. (IJMRAE), ISSN 0975-7074, Vol.1, No. I,November 2009, pp 53-70 performance.
11. P. Lawrence, P. Koshy Mathews and B. DeepanrajExperimental Investigation on Performance and Emission Characteristics of Low Heat Rejection Diesel Engine with Ethanol as Fuel, American Journal of Applied Sciences 8 (4): 348-354, 2011 ISSN 1546-9239 © 2010 Science Publications.
12. IlkerTurgutYilmal, MetinGumus, Mehmet Akcay, Thermal Barrier Coatings For diesel Engines.International scientific conference 19-20 November 2010, Gabravo Turkey.

13. GauravDwivedi, Siddharth Jain, Mahendra Pal Sharma, "PONGAMIA AS A SOURCE OF BIODIESEL IN INDIA" Received May 19, 2011; revised June 2, 2011, accepted June 9, 2011.
14. Elango T.And Senthilkumar T. Effect Of Methyl Esters Of Neem And Diesel Oil Blends On The Combustion And Emission Characteristics Of A C.I. Engine. Arpn Journal Of Engineering And Applied Sciences, Issn 1819-6608, Vol. 5, No. 10, October 2010