iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** IX **Month of publication:** September 2017

DOI: http://doi.org/10.22214/ijraset.2017.9086

International Journal for ReseaArch in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

Performance Analysis of Four Stroke Compression Ignition Engine Using Biodiesel Blended Diesel

Shree Dewangan[1], Saurabh Kumar[2]
[1]*(MTech, Thermal engineering scholar, Mechanical engineering department, Raipur institute of technology, Raipur, India)*
[2]*(Assistant Professor, Mechanical engineering department, Raipur institute of technology, Raipur, India)*

Abstract: With increase in demand of alternative fuel to conserve non-renewable source of fuel a research has been carried out to reduce the diesel usage by adding biodiesel which increase thermal efficiency of the engine. This research shows that use of increase in brake thermal efficiency has been obtained in one litre of solution with biodiesel blended diesel gives maximum efficiency. Regression analysis also has been carried out to find out correct amount of biodiesel which can be used for blending in petrodiesel.
Keywords: Petrodiesel, biodiesel, brake thermal efficiency, fuel consumption, brake power

I. INTRODUCTION

India is very big vast and developing country. Population is also growing day by day as a result of this many people are using diesel vehicle on daily basis. More than 50% of vehicle is passenger vehicle or utility vehicle [1] and as above mentioned vehicles are compression ignition engine system diesel is main fuel and we all know that diesel has been produce from non-renewable source of energy. Non-renewable sources of energy are very limited and it is very necessary to conserve it so alternative fuel is required. Second reason for searching alternative fuel is that by using diesel as a fuel environment is affecting badly. According to a report pollution level in India is increasing by percent every due to use of compression ignition engine vehicles or diesel vehicles. Biodiesel can use as alternative fuel in place of diesel or by mixing with diesel. It fulfil both requirement of alternative fuel as we can conserve non-renewable source and by using biodiesel level of pollution will also decrease this is due to process of preparation of biodiesel [2]. Biodiesel is prepared from natural plant namely palm and Jatropha. In this research Jatropha plant is used for preparation of biodiesel [3].

Figure 1 Bio-diesel plant

Figure 1 is the biodiesel plant situated in campus of Raipur institute of technology. Biodiesel was taken from this plant. Jatorpha plant is used for making biodiesel. Calorific value of biodiesel is less than petro diesel but economically bio diesel costs cheaper than petro diesel. This research tells the optimum diesel and biodiesel ratio by regression analysis by comparing B15 B20 and B25.

International Journal for ResearchArch in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

II. EXPERIMENTAL SETUP

Experimental setup consists of four stroke single cylinder C.I. engine having speed of 1500RPM. Bore and stroke of engine are 85mm and 110mm respectively. Cooling system of engine is water cooled and loading device is hydraulic dynamometer with weighing attachment. Figure 2 shows the schematic arrangement of compression ignition engine.

Table 1 Fuel specification

S.No.	Fuel	Notation	C.V.	Density
1.	Diesel	K1	42360	742.100
2.	B15	K2	41800	773.284
3.	B20	K3	41700	783.294
4.	B25	K4	41600	769.538

Where C.V. is calorific value of fuel in kJ/kg and density in kg/m^3.

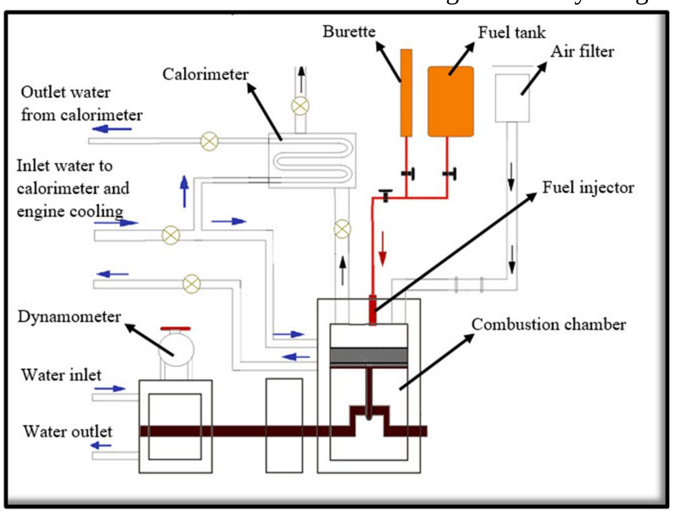


Figure 2 Schematic diagram of compression ignition engine.

III. METHODOLOGY

First of all three different fuels has been made K2, K3 and K4. K2 consist of 15% of biodiesel and 85% of diesel in one litre of solution. K3 consist of 20% of biodiesel and 80% of diesel in one litre of solution. K4 consist of 25% biodiesel and 75% diesel in one litre of solution. The performance of these three different type of solution is compared with fuel K1 that is diesel.

Plug in the switch of thermocouple and start it which shows temperature T_1, T2, T3, T_4 and T_5 indicates the reading of temperature of water inlet to engine and calorimeter, temperature of water exit from calorimeter, temperature of water exit from cooling jacket, exhaust gas temperature before calorimeter, temperature of exhaust gas from engine after calorimeter respectively.

Pour the diesel into the engine set the dynamometer to 0kg load and note down the fuel consume within 5 minute also note down all temperature. Time taken for water outlet from cooling jacket and water outlet from calorimeter has been also recorded. Repeat this process for fuel K2, K3 and K4.

Pre-test has been done for engine parameters to check the condition of the engine. Pre-test is required in every experiment as it gives the conditions of the setup. In this regard some experimental parameters have been found which are as follows:

Table 2 Range of parameter in the experiment

S.No	Parameters	Minimum Limit	Maximum Limit
1	Mass flow rate of fuel	0.6189 kg/hr	0.642955 kg/hr
2	Load	0 kg(no load)	4kg
3	Brake Power	0 kW	2.05017 kW
4	B.S.F.C.	0.3161 kg/kWhr	1.222 kg/kWhr
5	B.T.E.	0%	26.884%

IV. RESULTS AND DISCUSSION

A. Result In Tables

TABLE 3 PERFORMANCE VALUES OF K1

Load (W)	BP (kW)	m_f (kg/hr)	BSFC (kg/kW-h)	BTE (%)
0	0	0.61891	-	0
1	0.5084	0.62158	1.222446	6.9521
2	1.0169	0.62336	0.612975	13.864
3	1.5254	0.62959	0.412736	20.590
4	2.0338	0.64295	0.31612	26.884

TABLE 4 PERFORMANCE VALUES OF K2

Load (kg)	BP (kW)	m_f (kg/hr)	BSFC (kg/kW-h)	BTE (%)
0	0	0.4129	-	0
1	0.5084	0.4185	0.823056	10.4639
2	1.0162	0.4259	0.419107	20.5495
3	1.5233	0.4287	0.281419	30.6036
4	2.0298	0.4370	0.215319	39.9984

TABLE 5 PERFORMANCE VALUES OF K3

Load (kg)	BP (kW)	m_f (kg/hr)	BSFC (kg/kW-h)	BTE (%)
0	0	0.3618	-	0
1	0.5149	0.3712	0.72105	11.9729
2	1.0284	0.4135	0.40213	21.4685
3	1.5406	0.4276	0.27759	31.1
4	2.0501	0.4399	0.21457	40.235

TABLE 6 PERFORMANCE VALUES OF K4

Load (kg)	BP (kW)	m_f (kg/hr)	BSFC (kg/kW-h)	BTE (%)
0	0	0.4368	-	0
1	0.5135	0.4387	0.854299	10.129
2	1.0264	0.4243	0.413463	20.930
3	1.5376	0.4454	0.289683	29.873
4	2.0488	0.4473	0.218339	39.634

International Journal for ReseaArch in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

B. Graphical Analysiz

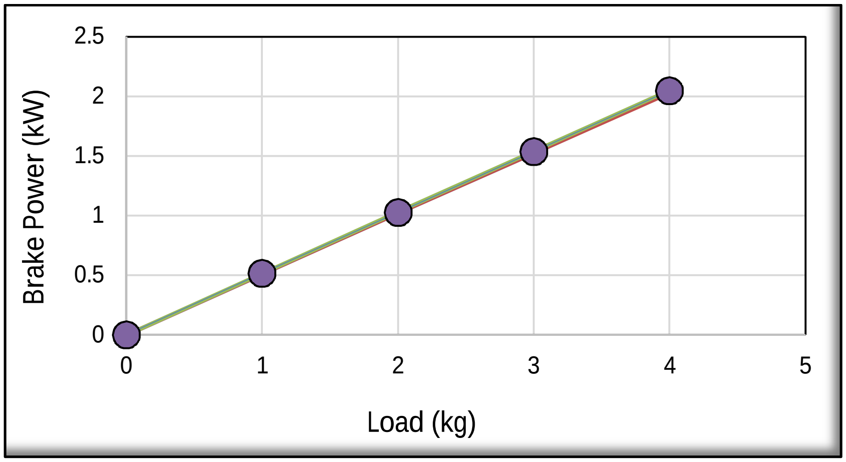


Figure 2 Graph between Brake power and load for all fuels

From above figure it is clearly visible that load is directly proportional to brake power. As we increase load brake power will also increase. In all cases for fuel K1 to K4. Negligible fluctuations were obtained between fuels that is due to change in engine speed but individually the variation between brake power and load is constant.

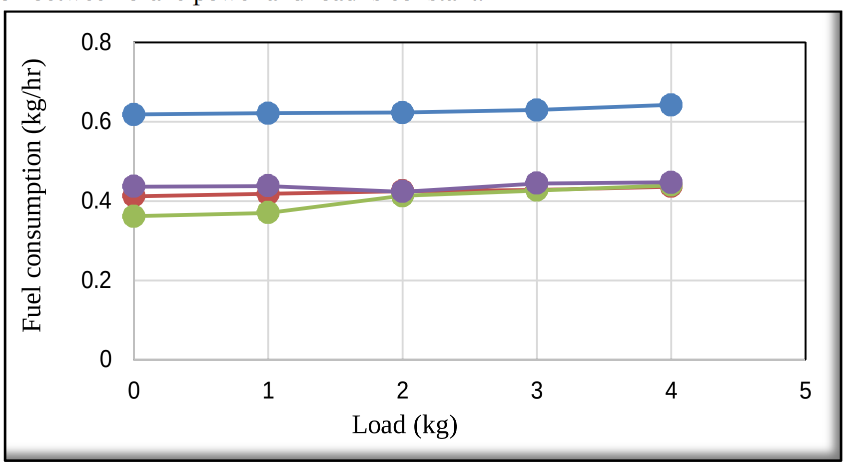


Figure 3 Variation between fuel consumption and load

From figure 3 it can be seen that as load increases from 0kg to 4kg fuel consumption also increases this due to requirement of fuel increases as we increases the load. If at some load consumption of fuel decreases that is due to engine fluctuation at 3kg load.

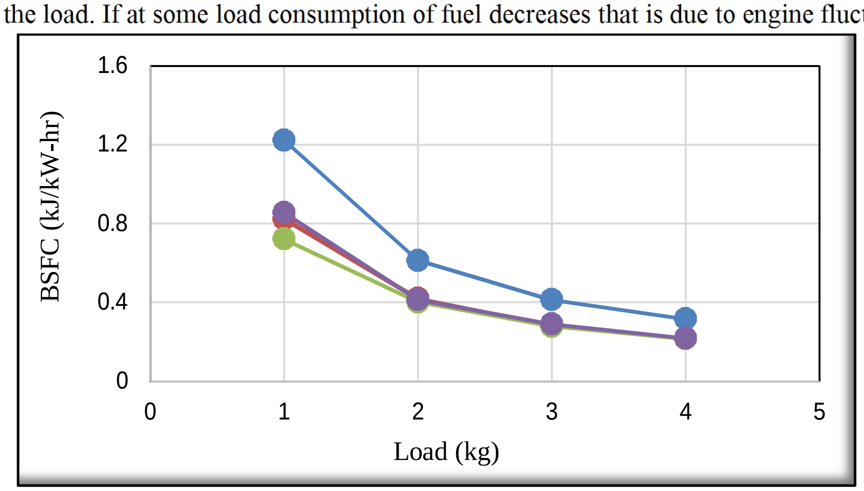


Figure 4 Variation between BSFC and load

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

From figure 4 it be seen that as load increases from 0kg to 4kg load value of brake specific fuel consumption decreases. This is due to reason that at high speed process of combustion improved due to high cylinder temperature which improve fuel atomization and also improve fuel mixing process.

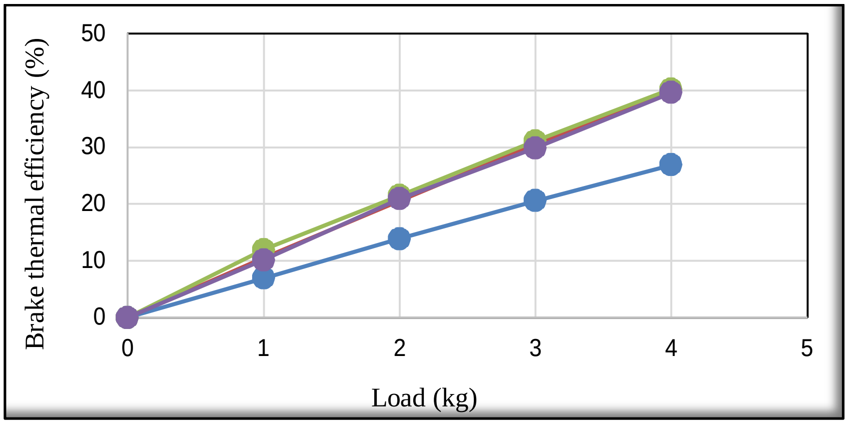


Figure 5 Variation between Brake thermal efficiency and load

From figure 5 it can be seen that as load increases brake thermal efficiency also increases. This is due to ratio of friction to brake power goes down.

V. REGRESSION ANALYSIS

Regression analysis is a statistical technique for investigating and modelling the relationship between variables. Application of regression analysis is numerous and occurs in every field, including engineering and many other fields. Using regression analysis, the brake thermal efficiency has been related with percentage of biodiesel in diesel by volume. From figure 4.5 result shows the following polynomial equation of curve of best fit

$\eta = 0.001C^3 - 0.0758C^2 + 1.79C + 26.884$

Where C is concentration of nanoparticle

The above model has value of R^2 as 1 so it is 100 % fit.

For, Maximum brake thermal efficiency

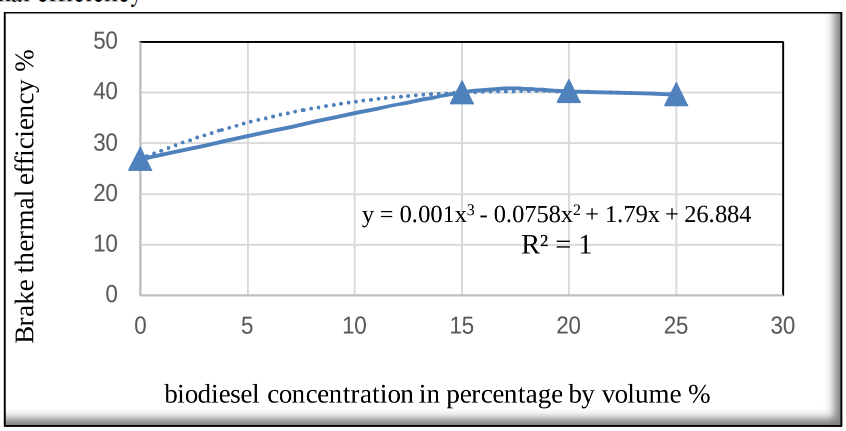


Figure No. 6 Variation in Brake thermal efficiency with biodiesel concentration in percentage volume

$$\frac{d^2\eta}{dC^2} = 0$$

or, $0.003C^2 - 0.1516C + 1.79 = 0$

therefore on solving we get,

$C_1 = 31.7271$

$C_2 = 18.8061$

Again differentiating

$$\frac{d^2\eta}{dC^2} = 0$$

or, $0.006C - 0.1516 = 0$

$$\frac{d^2\eta}{dC^2} \text{ at } C_1 = 0.03876$$

$$\frac{d^2\eta}{dC^2} \text{ at } C_2 = -0.0387634$$

So the biodiesel concentration in percentage with water by volume which will give maximum efficiency is 18.8061%.

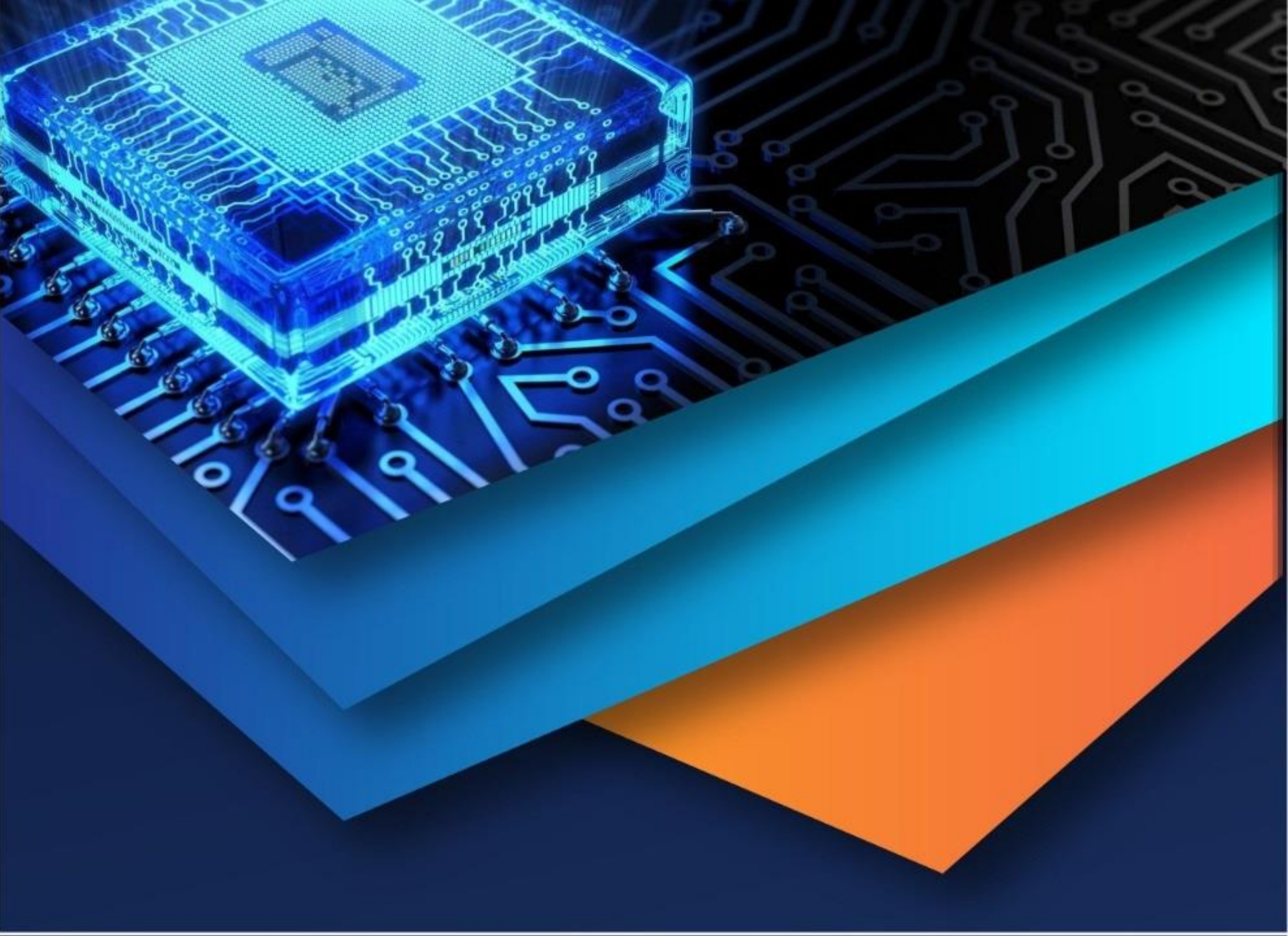
VI. CONCLUSION

From the above result it can be concluded that

A. B15 gives 39.99% thermal efficiency.
B. B20 gives 40.23% thermal efficiency.
C. B25 gives 39.63% thermal efficiency.
D. So best performance we will get is from B20 that is 80% diesel and 20% biodiesel.
E. By regression analysis it has been found that best result we will get from 18.80% biodiesel in one liter of solution.
F. In compare to diesel B20 gives 33.18% better performance.

REFERENCE

[1] P. Doval, "50% of passenger cars now sold run on diesel," Times of India, 2012. [Online]. Available: http://timesofindia.indiatimes.com/business/india-business/50-of-passenger-cars-now-sold-run-on-diesel/articleshow/12408287.cms. [Accessed: 26-Mar-2012].
[2] S. nehar A. Kumar, "Biodiesel: As an alternative fuel," in Environmental protection, 1st ed., Daya Publishing House, 2007, pp. 32–37.
[3] M. BinLiang, HoufangLu., YingyingLiu., HuiZhou., YingYang., "Production of biodiesel from Jatropha curcas L. oil," Comput. Chem. Eng., vol. 33, no. 5, pp. 1091–1096, 2008.
[4] A hull, I Golubkov, B Kronberg, J Van Stam, "No Title," Int. J. Engine Res., vol. 7, no. 1, pp. 51–63, 2006.
[5] Ayush Kumar Raghuvanshi, C P Singh, "Extraction of biodiesel from Jatropha oil and performance study of diesel engine with biodiesel fuels," Int. J. Sci. Res. Publ., vol. 4, no. 10, pp. 1–4, 2014
[6] S. A. Monisha J, Harish A, Sushma R, Krishna Murthy T P, Blessy Mathew, "Biodiesel: A Review," Int. J. Eng. Res. Appl., vol. 3, no. 6, pp. 902–912, 2013.
[7] Wail M Adailesh, Khaled S Alqdah, "Performance of Diesel Engine Fuelled by a Biodiesel Extracted From A Waste Cocking Oil," Energy Procedia, vol. 18, pp. 1317–1334, 2012.
[8] K Srithar, K Arun Balasubramanian, V Pavendan, B Ashok Kumar, "Experimental investigations on mixing of two biodiesels blended with diesel as alternative fuel for diesel engines," J. King Saud Univ. – Eng. Sci., vol. 29, pp. 50–56, 2014.
[9] Jayashri N Nair, J Deepthi, K Siva kalyan, "Study of biodiesel blends and emission characteristics of biodiesel," Int. J. Innov. Res. Sci. Eng Technol., vol. 2, no. 8, pp. 3710–3715, 2013.



10.22214/IJRASET

INDEX COPERNICUS
45.98

IMPACT FACTOR:
7.129

TOGETHER WE REACH THE GOAL
IMPACT FACTOR:
7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY