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Performance Control in a Diesel Engine with a Mixture of Biodiesel

1.Ajmeera Suresh*, 2.Mr.B.Pavannaik, 3.Dr.M.Janardhan*****

*M.Tech Student**Associate Professor***professor&Principal

Department of Mechanical Engg. Abdul Kalam Institute Of Technological Sciences, Kothagudem,Khammam (DT) -507120

ABSTARCT:

As is the case in this decade and focus below In the search for the best possible alternative fuels to compensate Energy demand and to replace fossil fuels, Biodiesel has been frequently discussed topic among Research has achieved so far. In this hour of need, when The world is suffering from problems associated with fossil fuels The depletion of reserves, and is trying to adapt alternative fuel, which is a more reliable source, and The achievement of the objectives of the time, leading to maintain the growth rate , Reduce pollution and meet stringent pollution standards The organization developed by the Boards of Pollution Control Worldwide. This paper deals with the comprehensive review Wheel biodiesel mixed with diesel using a diesel engine And the performance of the diesel engine in terms of Performance characteristics in terms of brake power, brake Thermal efficiency, fuel consumption, etc. break combustion characteristics and exhaust emissions Characteristics in terms of CO, HC, NOx, smoke opacity And particulate emissions, etc., in different loads The conditions and results quickly and mixtures of castor It is compared with that of diesel fuel. In addition to this cold The flow behavior of castor oil, additives and cold flow and its impact In engine performance at low temperature, and the need Modify engines using biodiesel fuel and Major Handling regarding the injection timing, injection Pressure variation access and optimize forecasting Performance diesel engine to produce different biodiesel The mixture also reviewed briefly. This study is an attempt to Shedding light on the distinctive characteristics of the wheel Biodiesel and biodiesel compared to other fuels from Renewable raw materials.

INTRODUCTION:

In recent years, there is a huge growth in the areas ofIndustrialization and urbanization, as

well as the disproportionate Growth in the automotive sector. Cars are part It is an integral part of human life, in recent decades, growth The automotive sector has achieved this increase Promote the growth of overexploitation of fuel oil and conventional diesel, which plays an important The role of economic growth of any country. World Facing the crisis of fossil fuels and environmental The deterioration in both time .Day after the current situation is Become worse than diesel fuel oil is high And continue to increase by 2% per year, reducing Down crude oil reserves. The main coal mines Energy source in India, while demand for gas oil The country met through the import of diesel from Petrol Gulf states. As a means of transport has an important The shareholders of the automotive industry are used worldwide. in India Approximately 70% of the automotive industry is based on diesel oil while 30% by compressed natural gas and liquefied petroleum gas are fulfilled and the like Gas. There is an urgent need to reduce imports of diesel in In order to save foreign exchange, but on the other hand It becomes very important to find out the best way possible Alternative energy that can replace the source oil and conventional diesel fuel. Much research has been done yet The date knowledge of an alternative source of energy It showed that the feed materials renewable energy in the form of Biodiesel through various sources such as Jatropha oil, Canola, peanut, sunflower and palm, cottonseed, pongamia, Sesame seeds, castor oil, rubber and others have proven to be a viable alternative renewable source because it promotes sustainable development Development. Some of these are edible oils and Associated with the high cost, from the point of view of economy The oil is edible can provide the best source of biodiesel Production. Ricin is an indigenous plant in India and It Contains 50% oil in the beans, and castor oil over 70% And in India, it contributes to the total production World production. The largest land available India itself a great advantage, since they can be placed under castor cultivation. The abundance of castor plants, Awareness among farmers for cultivation in India Castor oil has made the best source of Indian Circumstances. Castor oil is also good properties and preferably In other oils. Its characteristics are close to that of Diesel. From the point of view safety and storage castor Biodiesel is a good point and a spontaneous ignition as Compared to taking dieselEasy to transport safely. they have lessSuphur and content with the

environment. Castor biodiesel It is mixed in the mixture of different points on the basis of size With the diesel gives satisfactory performance using diesel Engine without any modification. But problems emissions of nitrogen oxides and related higher still associate that can be It can be solved using modern technologies such as exhaust gas Recycling adapters stimulus, delayed injection Timing, stepwise injection, exhaust catalyst and reducing Burning mixture by reduction of ignition delay, etc. Another problem often happens in the case of biodiesel BSFC has a top that can be reduced to Something by adjusting the engine in terms of development Injection timing and injection pressure differences.

The amendments become an injection pressure also useful It prevail fuel injection nozzle clogging, injector fouling And disintegration problems, especially at low temperatures. However, the use of additives in biodiesel cold flow It can serve the purpose of solving most problems Front because biodiesel fuel flow cold workability. The cold flow additives affect the cloud and pour points It provides a point of great advantage over low The temperature ranges. This is also useful with respect To provide the highest level of stability and makes the fuel mixture Castor maximum fuel more perfect season The time castor combination lends high

Liquidity. .

1.1 Biodiesel fuel: -

Biodiesel is fatty acid methyl esters Obtained through the conversion process Triglycerides and alcohol when heated in the presence of suitable catalyst such as NaOH or KOH for some The specified operating time. It is becoming triglycerides Methyl esters of fatty acids called as When the esterification and glycerol esters obtained As byproducts when Allow the mixture after the reaction To settle for separation. Through the process Esterification, castor oil can become biodiesel

LITERATURE REVIEW:

Literature [1] has showed researcher conducted an investigation using different blends of castor biodiesel as 25%,75% , pure diesel at 100% Exhaust Gas Recirculation(EGR) in order to find out the performance of diesel engine in terms of Brake Power, Brake Specific Fuel Consumption, Brake Mean Effective Pressure and Brake Thermal Efficiency and results are obtained showed the controlled emission and method proved very reliable in terms of fuel economy. Total fuel Consumption when tested against the Brake Power showed the Diesel has lower BSFC

as compared to both blends B25 &B75, while B25 has lower BSFC than B75 blend Brake Specific fuel Consumption when tested against Brake Mean Effective Pressure at 100% showed BSFC is higher forB75 blend as compared to B25&Diesel Brake Thermal Efficiency checked against the Brake Power showed that BTE for B25 was higher than diesel and B75 2.Another literature[2] in which performance test carried out with different Castor biodiesel blends B20, B40, B60,B80,B100 i.e neat biodiesel at different loading conditions 25%,50%,75%&100% loading at constant speed of 1500 rpm and for the specified time (20min) results obtained in terms of various performance parameters are – BSFC was checked against BMEP showed decrease in the BSFC with the increase in the BMEP at full loading conditions and it is noteworthy that BSFC increases with increase in biodiesel percentage in Diesel. Increase in load increases Exhaust Gas Temperature which reveals effective combustion i.e reduction in loss of exhaust energy. Blending percentage increases the exhaust gas temperature for all blend s under study but it can be seen that for B80 blend has less exhaust gas temperature at all loads. B60 blend showed less smoke opacity as compared to all other blends and B60 gave optimum performance. 3.literature[3] conducted using Castor biodiesel blend ,Canola oil &High Speed Diesel at different speeds and compared for the performance parameters Brake Power, Exhaust Gas Temperature and Torque rendered B.P of Diesel is higher than that of biodiesel blends B10CASTOR& B10CANOLA.but B10CASTOR has higher B.P than B10CANOLA as castor has higher calorific value than canola. HSD delivered the higher Torque during testing probably due to high calorific value of HSD than B10CASTOR& B10CANOLA.at starting the more Torque is required as the time passes Torque requirement reduces, thus gradual decrease can be seen after passage of time in the Torque values. Engine exhaust temperature was found less for HSD as compared to blends.B10CASTOR has exhaust temperature higher than B10CANOLA.this may be due to higher C.V & higher flash point of B10CASTOR also the biodiesel having higher oxygen content tends to burn at higher temperatures .It is also found that for maintaining torque and power output engine speed need to be higher and consequently it leads to increase in the amount of fuel injected to E 4. Literature [4] shows when Diesel engine performance evaluated at different loading conditions

ranging from no load to full load using blend of castor biodiesel such as B25,B50,B75,B100& pure diesel alone ,Brake Thermal Efficiency at different Brake powers shown that BTE for B25 blend exhibited the highest value at79.94% of total load as compared to diesel. The maximum BTE for B25 was 23.21% obtained at 4Kw against 24.3% for pure diesel. Brake Specific Fuel Consumption was lower than all other blends of the castor oil at different brake power and most significant values was obtained for B25 blend and has slightly lower value of BSFC. At maximum BTE load for B25, BSFC is found to be 0.342 Kg/Kw.hr as compared to 0.281 Kg/Kw.hr for Diesel. 5. The literature [5] showed that the blends of Castor oil, Ethanol &Diesel taken together as D85C15E15 & D90C10E20 had almost same Brake Thermal Efficiency to that of pure Diesel and increases with Brake Power up to 6.3Kw. 6.A Low Heat Rejection Diesel engine [6] in which the combustion performance was evaluated for castor biodiesel blends B25,B50,B75,B100 at different loads 1,2,3,4,5.2 at rated engine speed of 1500 rpm. Showed that the B25 blend of castor biodiesel can be substituted for the diesel in diesel engine without modifications still we can get the better performance and combustion characteristics with some modifications. Brake Thermal Efficiency of B25 blend was higher than normal diesel engine as compared to LHR engine at varied load condition because of increased combustion rate in LHR engine which ensures complete burning of fuel due to low heat rejection. In spite of this B25 has lower BTE than diesel due to large difference in Viscosity, Specific Gravity &Volatility. Mechanical efficiency was found to be increased up to B25 blend with increase in load whereas Brake Specific Fuel Consumption decreases with the increase in loads for different biodiesel blends in LHR engine. As SFC depends on the numerous factors like Volumetric Efficiency, Fuel injection, fuel density, viscosity and lower heating value etc. due to lower heating value of the biodiesel blends, more biodiesel is required to produce the same power as compared to diesel and hence the BSFC increases with the blending percentage. Mean Effective power of biodiesel blend is low due to low volatility and lower calorific value as compared to diesel and as the load increases the MEP increases. When Cylinder Pressure was evaluated at different Crank Angle to study the heat release, as burning rate during the premixed burning phase influences the cylinder pressure as it initiates

the better combustion and heat release ,Biodiesel blends brings the Peak pressure more closely to TDC due to higher burning rate in the early stage of combustion is higher in case of biodiesel. Castor biodiesel shows lower heat release rate during premixed burning phase as compared to diesel. 7.The literature [7]using Castor biodiesel blends B20, B40,B60 in diesel engine evaluated for its performance at various loading condition and at the rated engine speed showed that the Brake power developed by the engine at all the loads for all the tested blend was more or less same. Brake Power for the Castor biodiesel blends observed to be slightly higher as compared to the diesel. At 70% loading, BP for the Castor biodiesel 1.75% higher than that of diesel .For other blends the BP for the Castor is also observed to be at higher side. BSFC at 20% loading for all the blends of Castor was found to be lower and it increases with the loadings.B40shows the lower BSFC than that of the diesel whereas at 70% loading Diesel has lower SFC than any other blend. BTE of pure Castor biodiesel is more than that of the diesel, Castor bio fuel has more fuel consumption than diesel due to lower heating value .BP is same at all load.BTE for the blendsB20 to B60 is quite better as compared to Castor fuel only.BTE at above 60% loading is observed as quite high , this may be due to lower exhaust temperature as compare with diesel. Volumetric efficiency of pure biodiesel s greater than that of the diesel, this may be due to low exhaust gas temperature. Exhaust gas temperature increases with increase in the load on the engine however Castor biodiesel blends have lower EGT at higher loads than the diesel. 8. The test carried on the Thermal Barrier Coated diesel engine LHR engine[8] with Castor blends C20,C40,C60,C80,C100 at different loads and rated speed showed Air fuel ratio at different loading conditions is higher than C60&C100 for pure diesel and slightly equal to C20&C80 Castor blends. The BTE increases with the increase in the Injection pressure may be due to the

METHODOLOGY:

BIODIESEL

Biodiesel is a safe alternative fuel to replace traditional petroleum diesel. It has high-lubricity, is a clean-burning fuel and can be a fuel component for use in existing, unmodified diesel engines. This means that no retrofits are necessary when using biodiesel fuel in any diesel powered combustion engine. It is the only alternative

fuel that offers such convenience. Biodiesel acts like petroleum diesel, but produces less air pollution, comes from renewable sources, is biodegradable and is safer for the environment. Producing biodiesel fuels can help create local economic revitalization and local environmental benefits. Many groups interested in promoting the use of biodiesel already exist at the local, state and national level.

Biodiesel is designed for complete compatibility with petroleum diesel and can be blended in any ratio, from additive levels to 100 percent biodiesel. In the United States today, biodiesel is typically produced from soybean or rapeseed oil or can be reprocessed from waste cooking oils or animal fats such as waste fish oil. Because it is made of these easily obtainable plant-based materials, it is a completely renewable fuel source.

2.1.1 History of Bio Diesel

Use of Bio diesel in Diesel engines is not a new concept but century old. In fact Rudolf Diesel, the inventor of the Diesel Engine just used Peanut oil in his engine as early as1901. But later on the cheap availability of petroleum diesel completely replaced the use of vegetable oil. Today, since the availability is becoming scarce, it will be wise to go back to the traditional natural fuels like vegetable oil

Day-by-day the diesel oil is becoming costlier and dearer and within a few years it may not be available at all. Even now its availability is influenced by various extraneous factors like political situations, wars, terrorist activities etc. The worst affected are the developing countries like India, who do not have adequate resources of Petroleum products.

To-day we import 70% of our crude oil and in the coming years the requirement will increase greatly. Of all the petroleum products diesel oil is the maximum consumed oil constituting more than 40%.Diesel run vehicles are the backbone of Indian Economy and with the ever-increasing price of it our economy is severely strained. Further the ever-increasing use of Diesel oil is polluting the atmosphere greatly affecting the health of the people and also changing the climatic conditions of the whole world.

Hence it is high time the world develops an alternate fuel devoid of all the above problems. Bio diesel fits the slot perfectly to replace Petroleum diesel. Bio diesel is nothing but processed vegetable oil or animal fats. The vegetable oil can be

either edible or non-edible. Also used as cooking oil or fresh vegetable oil.

2.1.2 Definition

Biodiesel refers to a non-petroleum-based diesel fuel consisting of short chain alkyl (methyl or ethyl) esters, made by Transesterfication of vegetable oil or animal fat (tallow), which can be used (alone, or blended with conventional petro-diesel) in unmodified diesel-engine vehicles. Biodiesel is distinguished from the straight vegetable oil (SVO) (sometimes referred to as "waste vegetable oil", "WVO", "used vegetable oil", "UVO", "pure plant oil", "PPO") used (alone, or blended) as fuels in some converted diesel vehicles. "Biodiesel" is standardized as mono-alkyl ester.

2.1.3 Production of Bio Diesel

Bio diesel production is the process of making bio diesel, a liquid fuel source largely compatible with petroleum based furl. The following can be performed in a small home based bio diesel processor, or in large industrial facilities. The process is similar to either case.

1. Steps in the process
2. Production methods
3. Oil preparation
4. Base catalyzed Trans-Esterification of the bio liquid method

5 BENEFITS OF BIODIESEL:

The smartest technologies deliver benefits to multiple interests, including an improved economy, and a positive impact on the environment and governmental policies.

The role of the biodiesel industry is not to replace petroleum diesel, but to help create a balanced world energy policy. Biodiesel is one of several alternative fuels designed to extend the usefulness of petroleum, and the longevity and cleanliness of diesel engines.

The ultimate goal is to contribute to building a stronger, more self-sufficient community by way of a community-based biodiesel production model. A community-based biodiesel distribution program benefits local economies, from the farmers growing the feedstock to local businesses producing and distributing the fuel to the end consumer. The money stays in the community while reducing impact on the local environment and increasing energy security.

PROCEDURE AND SAMPLE CALCULATIONS

PROCEDURE

Procedure (single cylinder engine)

1. The engine is started and run for at least 15 minutes for warming up.

Motor for circulating the water is simultaneously started .Then, under no load condition, the time taken for the consumption of 10cc of fuel, the load applied, the speed and manometer readings are recorded.

2. The load is increased and allowed to run for 10 minutes. Then, the time taken for the consumption of 10cc of fuel, the load applied, the speed and manometer readings are recorded.

3. The load is further increased in approximately four equal steps up to the rated value and readings are noted as in earlier steps.

4. In addition, the temperature of cooling water at the inlet and outlet, temperature of exhaust gas and discharge of water are required at every load.

5. The engine is then stopped taking suitable precautions.

5.2 THE TEST SAMPLES ARE

1. B0(Pure Diesel)
2. B10 (10% Soya bean Oil and 90% Pure Diesel)
3. B20(20% mahua Oil and 80% Pure Diesel)
4. B30(30% Ethanol Oil and 70% Pure Diesel)

TESTING PROCEDURE

The testing procedure is carried by mixing the specimen samples with diesel in calculated proportions. The mixture of specimen sample and diesel is used in single cylinder diesel engine and several tests are conducted under controlled atmospheric conditions.

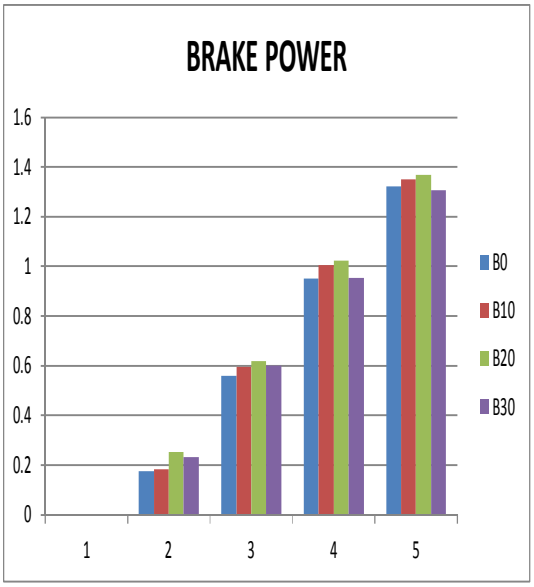
Step 1: Take bio diesel blend say ethanol B10, the composition contains 100 ml of ethanol and 900 ml of diesel, as ethanol is very dangerous proper atmospheric condition are to be maintain, water is used as the cooling agent in the experiment when the fuel is added to engine and cranking is done. Calculated proportions are taken and constant atmospheric conditions are maintained.

Step 2: load to be added to engine to engine and increased simultaneously with the help of the electrical loading and the mean difference of the two gauges are calculated to fine the exact torque applied on engine Loads are added in ascending order. The adding of load the rpm of the engine will be

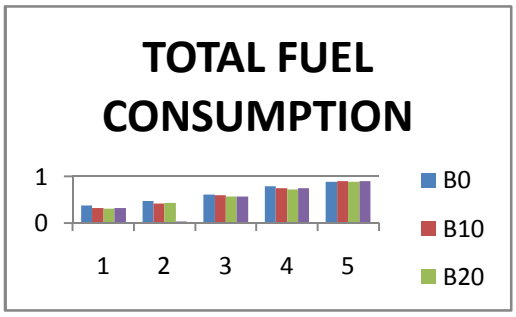
changing simultaneously that will be displayed on the digital meter. All this testing will give the performance of the fuel used in the engine and will be used in calculating to find the brake power and mechanical efficiency of the engine with using different types of test specimens.

RESULTS:

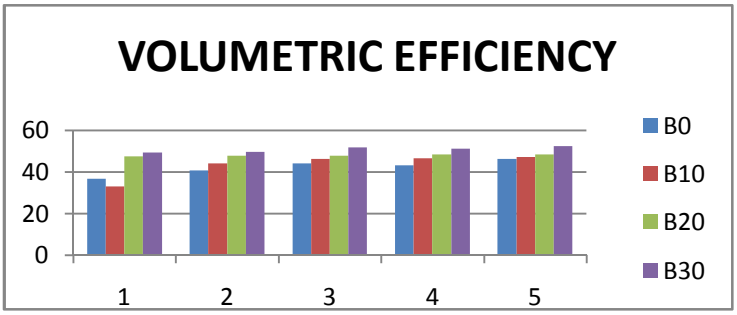
1.BRAKE POWER



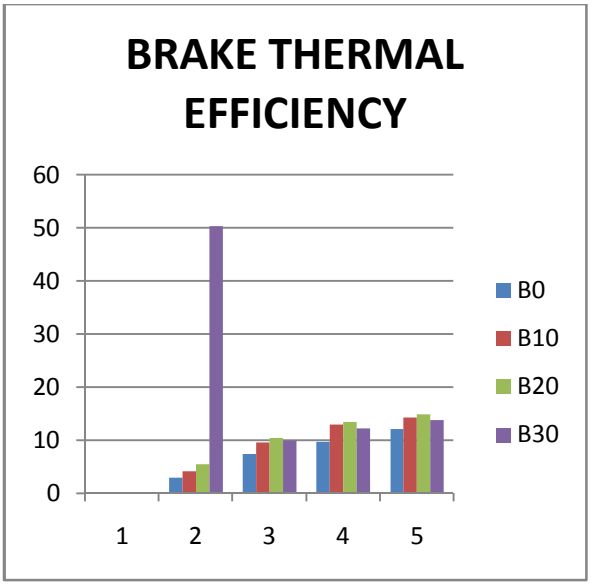
2.TOTAL FUEL CONSUMPTION



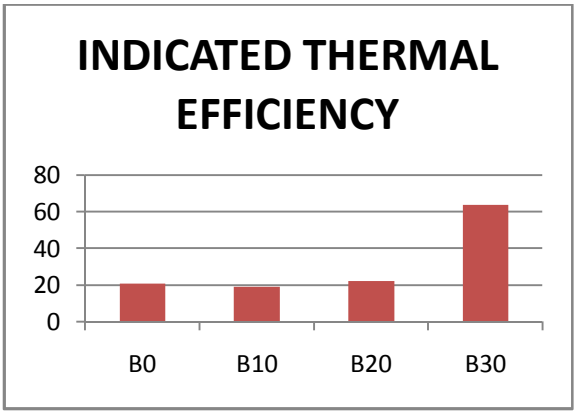
3.VOLUMETRIC EFFICIENCY



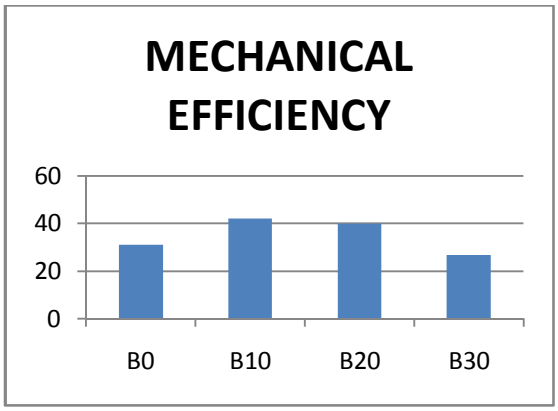
4.BRAKE THERMAL EFFICIENCY



5 INDICATED THERMAL EFFICIENCY



6. MECHANICAL EFFICIENCY



CONCLUSIONS

The experiments are conducted on the Single-cylinder 4 Stroke diesel engine with electrical loading test with pure diesel and blends of pure diesel and the following conclusions were made:

- Brake power is high for B30
- TFC is also high for B30
- Volumetric efficiency of all blends are nearer to diesel
- Brake thermal efficiency is high for pure diesel
- Indicated thermal efficiency is high for B30
- Mechanical efficiency is high for B10 and B20

REFERENCES [1] B. M. Jibhakate, S. D. Butley, "Experimental Investigation of Performance on Diesel Engine with Different Blends of Castor Oil at 100% EGR" IJSRD - International Journal for Scientific Research &Development| Vol. 2, Issue 12, 2015 | ISSN (online): 2321-0613 [2] Sumedh S. Ingle, Vilas M. Nandedkar, Madhav V Nagarhalli, "PREDICTION OF PERFORMANCE AND EMISSION OF CASTOR OIL BIODIESEL IN DIESEL ENGINE", International Journal of Mechanical and Production Engineering, ISSN: 2320-2092, Volume-1, Issue-1, July-2013,Prediction of Performance and Emission of Castor Oil Biodiesel in Diesel Engine [3] Mohammed HarunChakrabarti, Mehmood Ali, "PERFORMANCE OF COMPRESSION IGNITION ENGINE WITH INDIGENOUS CASTOR OIL BIO DIESEL IN PAKISTAN", NED UNIVERSITY JOURNAL OF RESEARCH, VOL VI, NO. 1, 2009 [4] R.Sattanathan, "Production of Biodiesel from Castor Oil with its Performance and Emission Test", International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438 Volume 4 Issue 1, January 2015 www.ijsr.net [5] S.Ganesan1, Dr.A.Elango, "Performance Analysis of CI Engine using blends ofCastor Oil and Ethanol", International Journal of Mining, Metallurgy & Mechanical

Engineering (IJMMME) Volume 1, Issue 1 (2013) ISSN 2320–4060 (Online) [6] Ravasab S Kumbar, Prakash S Patil, OmprakashHebbal, "EXPERIMENTAL INVESTIGATION OF PERFORMANCE AND COMBUSTION CHARACTERISTICS ON A SINGLE CYLINDER LHR ENGINE USING DIESEL AND CASTOR BIODIESEL", IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308 [7] M. M. KulkarniV.S.Dhumal , "Performance Characterization Of Single Cylinder DI Diesel Engine Fueled With Castor Biodiesel", International Journal of Engineering Research & Technology (IJERT) Vol. 1 Issue 10, December- 2012 [8] Maharaja Gasti, M. C. Navindgi, "Comparative Experimental Investigation Of Performance And Combustion Characteristics In A Single Cylinder Thermal Barrier Coated Diesel Engine Using Diesel And Castor Biodiesel", International Journal of Engineering Research & Technology (IJERT),Vol. 2 Issue 7, July – 2013 [9] K.B Yogeshwaran ,G. Raghu ,G. Naveenraj, " PERFORMANCE ANALYSIS OF DI DIESEL ENGINE USING DIESEL WITH CASTOR SEED OIL BLENDS" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) e- ISSN: 2278-1684, p-ISSN : 2320–334X PP 19-23 www.iosrjournals.org [10] JAYDEEP A. MEVADA, " The Effect of Ethanol and Biodiesel Blended Diesel Fuels on Performance from a Single Cylinder Direct Injection Engine ,International Journal of Research in Modern Engineering and Emerging Technology Vol. 1, Issue:1, January 2013 (IJRMEET) ISSN:XXXX-XXXX [11] Ch .S. Naga Prasad , K. Vijaya Kumar Reddy, B.S.P. Kumar, E. Ramjee, O.D. Hebbel and M.C. Nivendgi, "Performance and emission characteristics of a diesel engine with castor oil, Indian Journal of Science and Technology Vol.2 No.10 (Oct 2009) ISSN: 0974- 6846 [12]GauravDwivedi , Siddharth Jain , M.P. Sharma, "Diesel engine performance and emission analysis using biodiesel from various oil sources – Review, J. Mater. Environ. Sci. 4 (4) (2013) 434-447 Dwivedi et al. ISSN : 2028-2508 CODEN: JMESCN [13] Abdul Salam HamzaNaser, "Cetane Number Improver Added to Biodiesel-Diesel Blends Effects on Direct Injection Four Stroke Compression Ignition Engine Performance and Emissions ,Journal of Al Rafidain University College 287 ISSN (1681 – 6870) , Issue No. 35/2015