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Emission Analysis of a Single Cylinder Diesel Engine Using Diesel with Castor Biodiesel Blends

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Abstract: ***Automobiles are growing day by day it means usage of automotives are increasing, so usage of fuel also increasing. In this paper will be discuss the use of diesel with ethanol and castor seed oil blends in diesel four-stroke engine. This alternative fuel contains castor oil and ethanol so it increases the performance and reduces the emission compared to diesel. Ethanol is a good cooling agent due to blending of ethanol so the NO_x will be reduced. For those mixtures the gas emissions of NO_x, carbon monoxide (CO), carbon dioxide (CO2), hydrocarbons (HC), are being measured by the use of AVL smoke meter.The experimental investigation has been done on single cylinder CI Enginecoupled with an eddy current dynamometer, data acquisition system (Kirolskar high speed four stroke diesel engine with 3.2 KW, 1500rpm.) and the result has been recorded.***

Keywords—diesel, castor oil, ethanol, blends, CI Engine, performance analysis.

I. INTRODUCTION

Energy comes in a variety of renewable forms like wood, biomass, wind, sunlight. It also comes in the non-renewable form of fossil fuels- oil and coal and their use is a major source of pollution of land, sea and above all the air we breathe. Already castor oil was used as an alternative fuel after the esterification process was completed and experimental investigation has been carried out on single cylinder CI Engine and the results has been recorded. They observed lower HC and NO emissions. Brake thermal efficiency and exhaust gas temperature are less compared to diesel [1,6].In IC engine the addition of diethyl ether and ethanol on engine performance and emissions of a bio-diesel diesel blended fuel engine. It can be used in diesel engine without any modification [2,10]. Two centuries of unprecedented industrialization, driven mainly byfossil fuels, have changed the face of this planet.

The present civilization can't survive without motor cars and electricity. The increasing rate at which the changes in human lives are occurring has important consequences for the environment and carrying capacity of earth. The industrial revolution has brought greatly increased wealth to one quarter of the population and severe inequalities. Pollution and accelerating energy consumption has already affected equilibrium of earth's land masses, oceans and atmosphere. Particularly, important is the loss of biodiversity. Fortunately, the last 25 years has seen growing awareness of some of these consequences. Since the dawn of oil age man has burnt about 800 million barrels of petroleum.

About 71 barrels are burnt everyday throughout the world. And this consumption rate goes on increasing by 2% every year. The 2% doubles the quantity every 34 years. Somewhere between 1000 to 1600 billion barrels of fuel consumption are assumed to be in formation where economic recovery is possible. By 2010 the world would have consumed about one-half of the totalamounts that is technically and economically feasible to extract.

And at the current rate of consumption 1600 billion barrels would be depleted in 60 years. Hence use of castor biodiesel will increase the use of waste land and will generate rural employment [3]. Performance, emission and combustion characteristics of a variable compression ratio engine using methyl esters of waste cooking oil and diesel blends isslight increase in NOx emission, but it is still compare with that of standard diesel fuel and is also in the acceptable range[4,5]. It's high time to think about the alternative fuels. Castor methyl ester blends showed performance characteristics close to diesel. Therefore castor methyl ester blends can be used in CI engines in rural area for meeting energy requirement in various agricultural operations such as irrigation, threshing etc., [7]. Carbon nano particles addition with diesel increases SFC and peak pressure and decreases the CO emission compare to neat diesel [8]. Some other blends of castor oil experiments give some positive results and addition of three various oils like jatropha oil, palm oil and castor oil increases the yield and obviously give the same diesel emission level [9]. Every research is focusing the NOx and other emissions that the same way corn oil blended with Diesel used as an

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alternative fuel and the result is $CO_2$is increased gradually when the load is increased [16]. Everyone was tried to replace the diesel fuel. So, this is the time to think about Alternative fuels.

A. Experimental Setup and Procedure

The schematic diagram and photographic of the experimental setup are shown below.

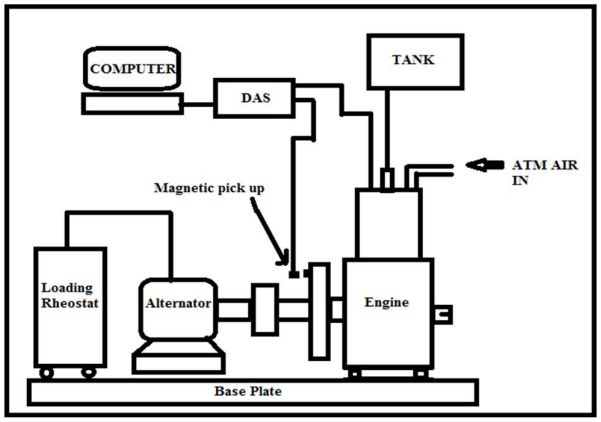

Fig 1 block diagram of experimental setup

A single cylinder, 4-stroke, water cooled, diesel engine coupled with electrical dynamometer as shown in figure 1 was used for the present work. The suction side of the test engine is attached with anti-pulsating drum to measure air inflow quantity. The inlet temperature of air is measured with inlet air thermometer. The exhaust side of the engine consisting of series of devices such as Exhaust Gas Thermometer (EGT), gas analyser probe and AVL smoke meter probe. A combustion analyser is also attached with the test rig to study the combustion behaviour of engine. The set-up also consists of fuel flow measuring device to measure the fuel consumption of the engine. The output side of the engine consists of an electrical dynamometer and followed by a loading rheostat. The output is measured in terms of watts using digital wattmeter mounted in the panel. An 8 bit Data Acquisition system (DAS) is also connected with test rig to acquire the combustion pressure and crank angle, pressure –volume, MFB and HRR data for a stipulated number of cycles.

Fig 2 experimental setup

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II. RESULTS AND DISCUSSION

The emission variation of the tested fuels with respect to BP in the speed of 1500 rpm is shown in figure 4. It observed that the fuel consumption for sample 2 gives lesser emission values with comparing to pure diesel.

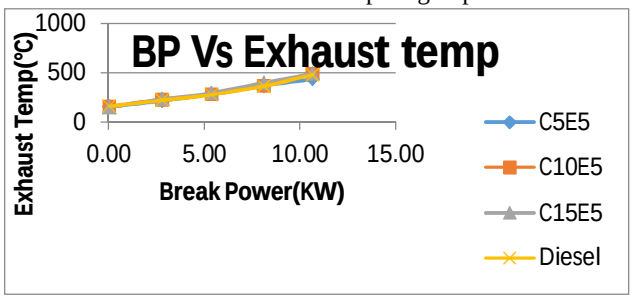

Fig 3 Graph of BP Vs ET Fig 3 shows the exhaust gas temperature for various blends and pure diesel.

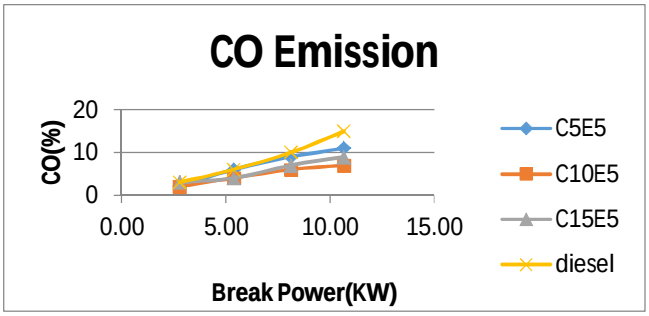

Fig 4 Graph of CO_2emission

Fig 4 shows the CO emission for various blends of castor biodiesel and pure diesel. From the above graph the 10% of castor biodiesel gives less CO emission compare to other blends.

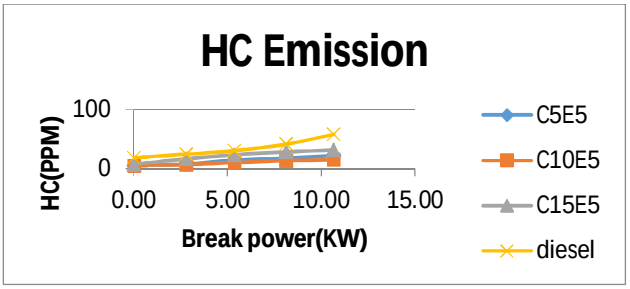

Fig 5 Graph of HC emission

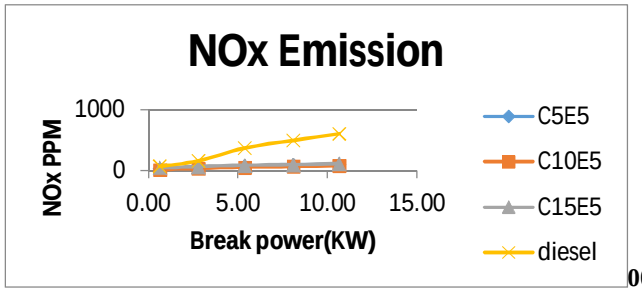

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Fig 6 Graph of NOx emission

Fig 5&6 shows the various HC and NOx emissions for various blends of fuels. From the above graphs 10% of biodiesel gives the less HC and NOx emissions for various load and speed.

III. CONCLUSION

The research aims to study the emission of castor oil blends with diesel fuel and find optimum blend to be used in the diesel engine. The Sample 2 have lower value of NO, Un burnt hydrocarbon than diesel. This is due to better combustion of fuel inside the cylinder than diesel. The Exhaust gas temp and emission for sample 2 is less comparing to sample 1, 3 and pure diesel. As the above graphs shows that sample 2 with 85% diesel, 15% biodiesel gives us optimum values of performance and emission characteristics comparing to sample 1,sample 3 and pure diesel.

Hence use of castor biodiesel will increase the use of waste land and generate rural employment. The local production of alternative fuel will save huge amount of foreign exchange. This capital when invested in our country will improve its financial structure.

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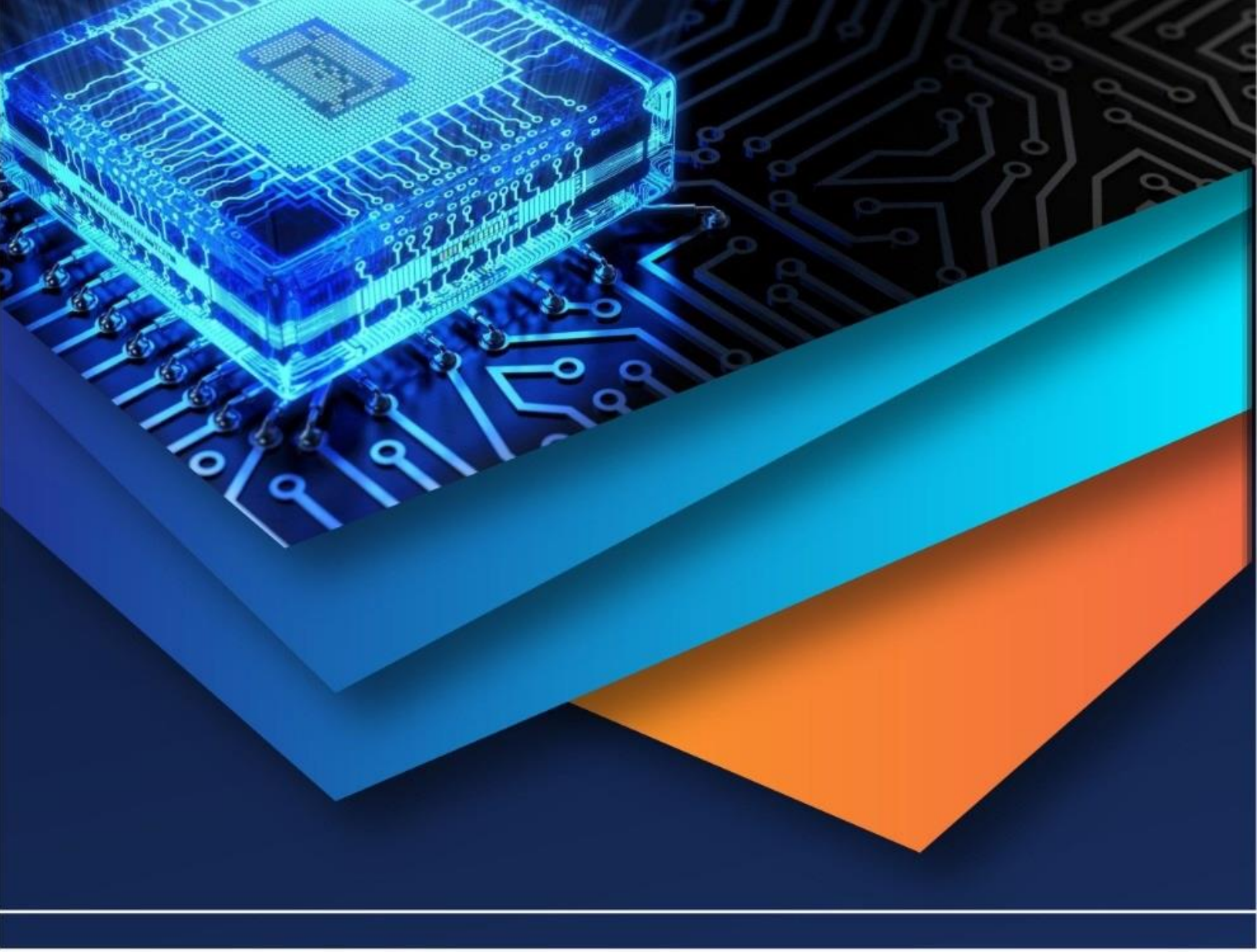

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