PERFORMANCE AND EMISSION CHARACTERISTICS OF WASTE FISH OIL WITH DI-METHYL CARBONATE AS AN ADDITIVE

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Abstract:

This project mainly focuses on proposing the usage of Biodiesel in place of diesel as it is becoming costly, not renewable and also Emissions are high which are hazardous to environment. To prepare biodiesel we have various ways one of that is using waste fish oil with an additive. The additive we are using in this project is DIMETHYL CARBONATE as it gives better performance and less emissions from engine.NO_X. Diesel fuels emit significant quantities of CO, CO_2 and These emissions are hazardous in nature and likely to cause Global warming. Biodiesel can reduce net CO_2 emissions, compared with petroleum diesel fuel.In the present work it is proposed to carryout testing of performance and emissions characteristics of waste fish oil which is blended with diesel in different proportions with and without Di methyl Carbonate fuel additive. The experiments will be carried out on a single cylinder four stroke water cooled diesel engine. Finally the performance and emissions such as NO_X, CO and CO_2 will be compared.

KEY WORDS: Biodiesel, waste fish oil, Dim ethyl Carbonate, diesel engine, Performance, Emissions

INTRODUCTION

Biodiesel is the process of producing fuel from vegetable oil and fatty oils, through the chemical reactions of transesterification and esterification process. This involves vegetable or animal fats and oils being reacted with short-chain alcohols (typically methanol or ethanol. The alcohols used should be of low molecular weight. Ethanol is the most used because of its low cost, however, greater conversions into biodiesel can be reached using methanol. Although the transesterification reaction can be catalyzed by either acids or bases, the base-catalyzed reaction is more common. This path has lower reaction times and catalyst cost than those acid catalysis. However, alkaline catalysis has the disadvantage of high sensitivity to both water and free fatty acids present in the oils.

Purna C. Mishra The demand for consumption of petroleum products increased with vehicles population.For addressing the present problem we discussed alternate fuel. Moreover, the alternate fuel must be produced in such a manner that it can be used directly in present engines without much engine modifications. Edible and non-edible oils are the main source for alternate fuel. In this paper we have discussed the performance characteristics of a diesel engine fuelled with waste fish oil using additive. Due to high viscosity and low volatility of non-edible oils their prolonged use is not advisable. These problems can be minimised by the transesterification process which is a reaction of triglyceride and alcohol in presence of a catalyst to produce mono alkyl ester which is known as biodiesel and glycerol .The biodiesel was blended with additive in various proportions to prepare a number of test fuels which are tested on a diesel engine to studyvarious parameters like carbon residue, fire point, flash point, viscosity, pour point,

cloud point, cetane index etc. and compare those with that of diesel . The result shows biodiesel with 10% additive (Dimethyl carbonate) is best suited for diesel engine.

S. Savariraj Biodiesel has become one of the most versatile alternative fuel options for diesel engine applications. The recent biodiesel research in India receives its attention towards fish-oil based biodiesel. In the present work, biodiesel derived from the fish-oil extracted from fish species was used as fuel in diesel engine to investigate its performance, combustion and emission characteristics. The various blends of fish-oil biodiesel with diesel, B25, B50, B75, B100 were used in the experiments and the results indicate that brake specific fuel consumption and brake thermal efficiency were higher with B100 fuel than that of diesel. The combustion analysis shows that the peak cylinder pressures of B25, B50, B75 and B100 are lower than that of the diesel and the starts of combustion timing was taken place at earlier crank angle degrees for fish-oil biodiesels. The exhaust gas temperatures of B100 were lower than that of diesel at the different loads. At full load, B100 fuel produced higher smoke, NOx , CO and HC emissions of 34.95%, 1.65%, 14.6%, and 1.8% respectively with reference to diesel fuel.

V.Bhojwanib The steep rise of demand of petroleum based fuel is because of rapid and fast industrialization of automotive sector. There are limited reserves for petroleum based fuels. These limited reserves are located in the certain regions of the world. Therefore the countries those are not having the sufficient stock of petroleum based fuel, are facing the problems of increase cost of fuel which mainly due to the cost involved in the import of the petroleum based fuel. Hence it is required to find out and investigate the other resources of the alternative fuels, which can be produced from nearby and locally available sources such as Alcohol, Biodiesel, Vegetable oil etc. Methyl or ethyl esters of fatty acids produced from vegetable oil or an animal fat is called biodiesel. Non edible oil or animal fats are the main recourses for production of biodiesel such as Jatropha, Palm, Marine fish oil, Soybean, Cottonseed etc. Biodiesel blends are prepared in any proportion with diesel to use in a conventional diesel engine. By using biodiesel in an engine there is a significant reduction in the harmful pollutants in the environment. This paper reviews the production, properties, performance and emission analysis of different feedstock of blends of biodiesel and experimental work carried out in the various parts of the world.

MATERIALS AND METHODS

The alternative fuel considered for this work is waste fish oil, which is a color of brown liquid with a distinct taste and odor. The locally produced waste fish oil are shown in below . For this research work locally produced oil is used as shown below

Transesterification:

Transesterification is reaction of oil (triglyceride)with primary alcohol to form ester and glycerol. The oil was stirred and heated up to 60ºc at which mixture of alcohol 10% and 0.5% NaOH added and reaction continued for 90 minute. After the methyl Easter formation is completed, heating is discontinued and the production has been shifted to cool and frozen. The two layers were clearly observed when allowed to settle for 24 hours to separate the patrol. The upper layer biodiesel and the diminisher dense layer are called glycerin. After glycerin and biodiesel phases are separated. The biodiesel was washed with

distilledwater.

ENGINE SET UP:


Fig:complete external engine set up

KIRLOSKAR single cylinder water cooled variable compression diesel engine equipped with EGR is used for the experimental tests. Eddy current dynamometer is used to apply loads on the engine. Eddy current dynamometer is attached to the flywheel to apply loads on the engine. An injection pressure of 200bar is maintained to inject the fuel. The cylinder pressure is measured by the piezo-sensor fitted on the engine cylinder head and crank angle encoded fitted on the fly wheel. The standard engine has a provision of injection point variation 0 to25^{o}BTDC. The emissions HC, CO, CO_2, UBHC and NOX are measured by using AVL-DIGAS 444 fire gas analyzer. The opacity of the smoke is measured by AVL smoke meter.

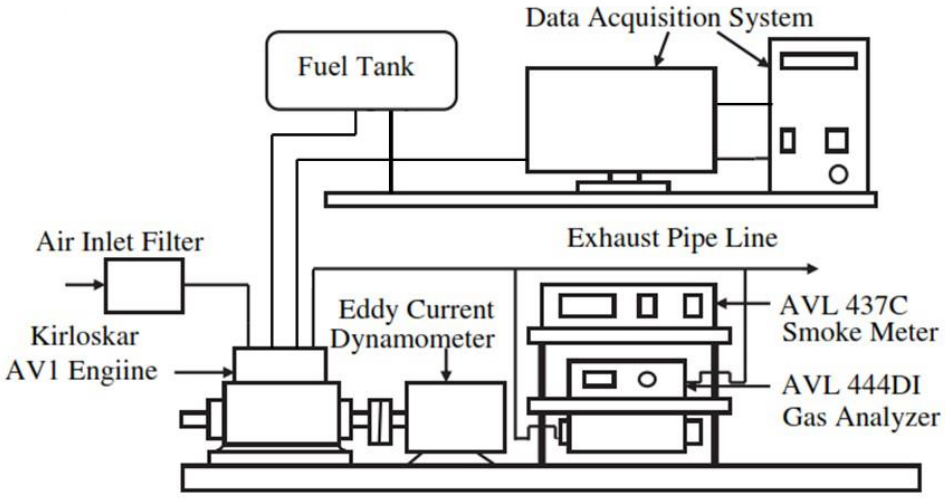

Fig. Schematic diagram of experimental set up

TEST METHOD:

Experiment has been conducted with diesel and waste fish biodiesel. The tests are carried out in VCR Engine. In first stage the experimental investigation is done to get base line parameters by using standard diesel. In second stage of investigation the waste fish biodiesel blends are used i.e.B10-D90, B15-D85, and B20-D80 as a fuel in the engine.The cooling of the engine is accomplished by circulating water through the jackets of the cylinder head and the engine block. In the experimental investigations, different instruments are used for the measurement of different parameters.

The major gaseous emissions measured in the current study are HC, CO, CO_2, O_2 and NO_x. Possibly, the reason for the occurrence of these emissions are general and depends up on the type of fuel being used, engine operating and design condition, engine loading condition.

RESULT AND DISCUSSIONS:

PERFORMANCE ANALYSIS WITHOUT ADDITIVE

PERFORMANCE ANALYSIS:

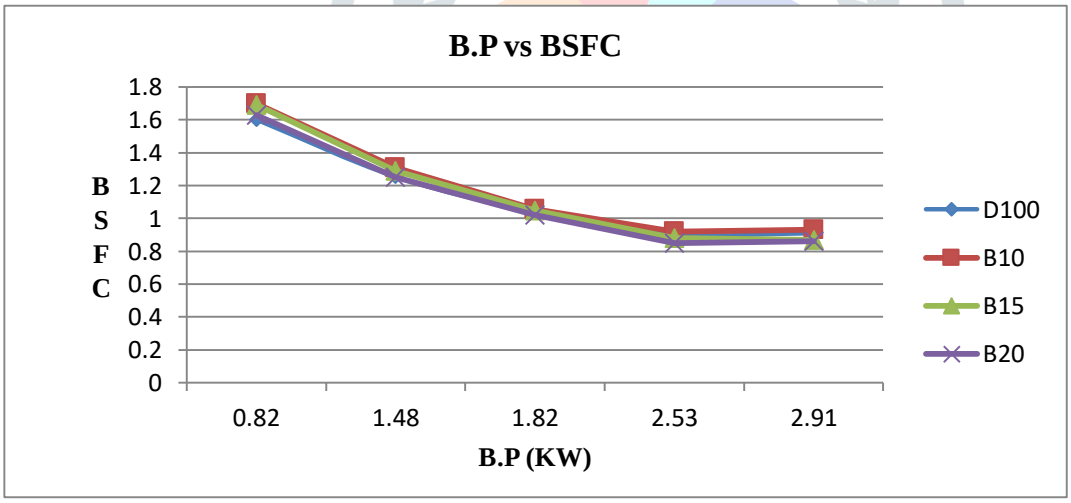

Fig: Variation of BSFC with Brake power

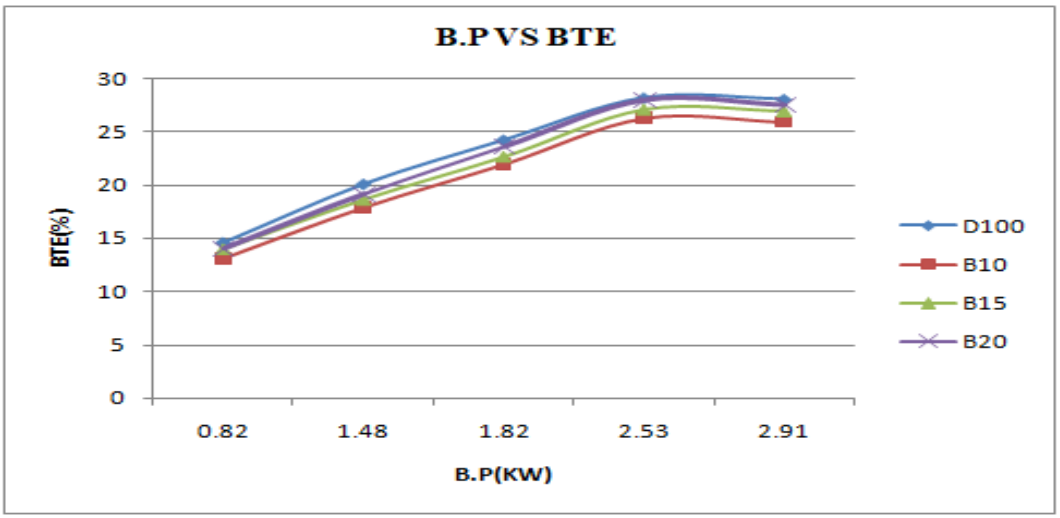

Fig: Variation of ηBTE with Brake power

EMISSION ANALYSIS WITHOUT ADDITIVE

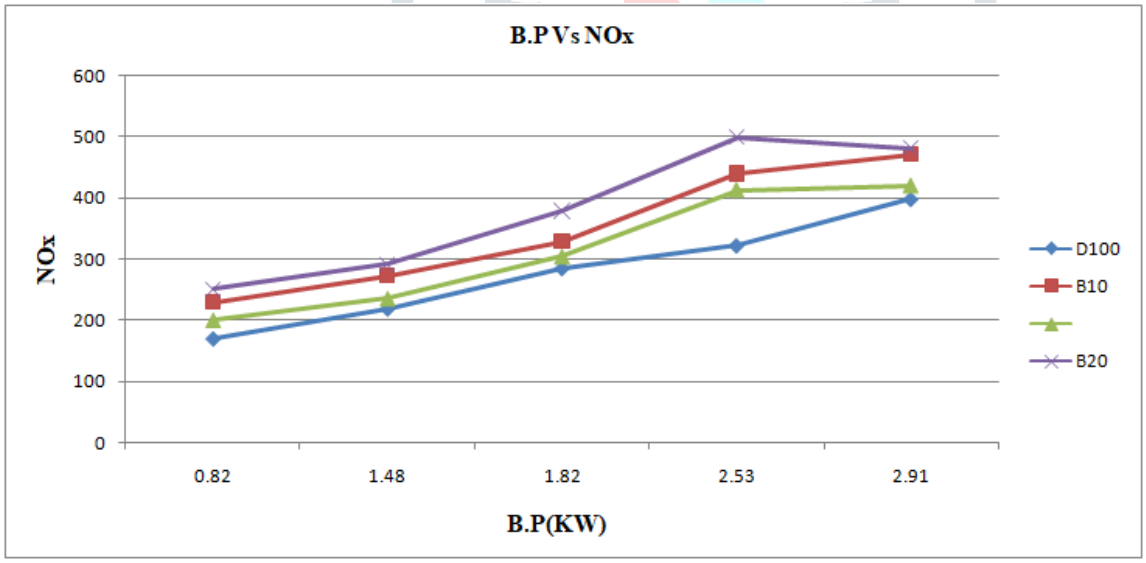

Fig: The above graph shows that while increasing the brake power automatically the NOx will be increases.

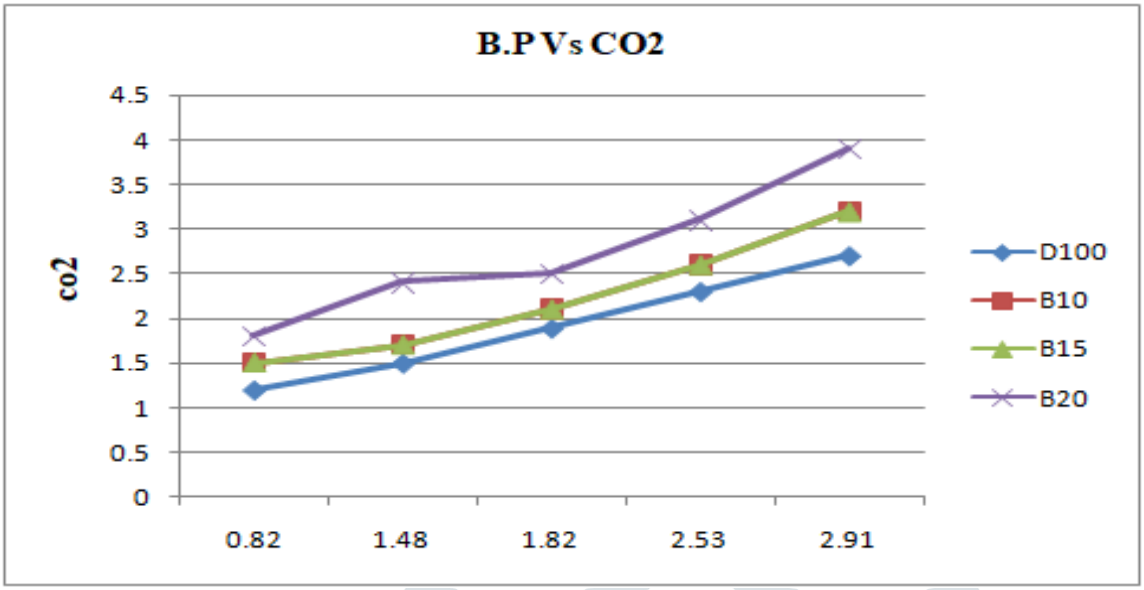

Fig: The above graph shows that while increasing the brake power automatically CO_2 will increases.

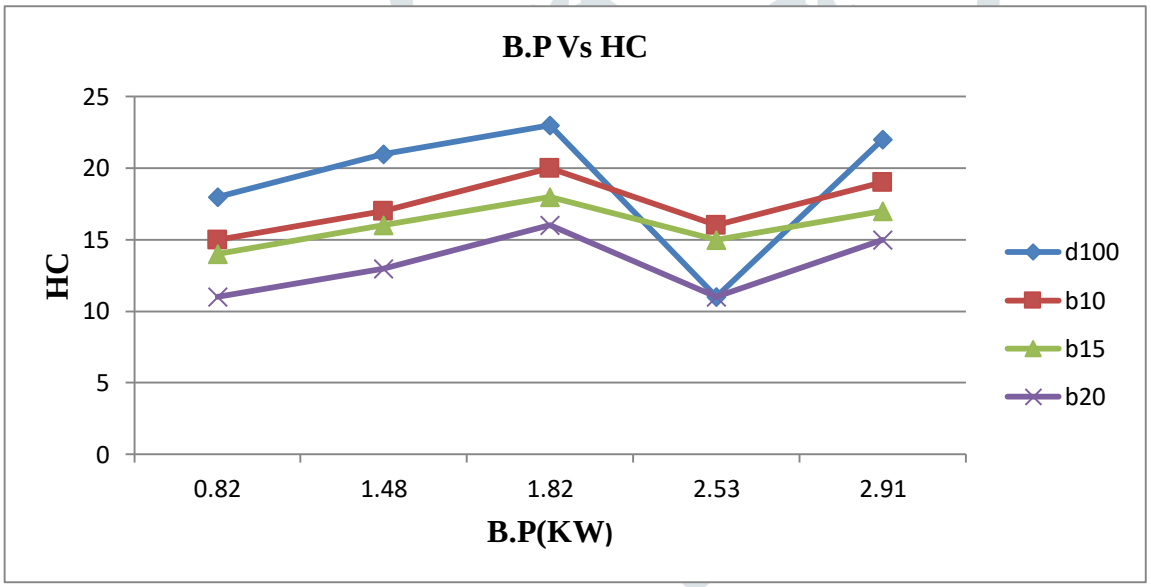

Fig: The above graph is drawn for HC and B.P in that while increasing the B.P, HC emissions are gradually increases for some point and it decreases and again goes on increasing.

ADDITIVE:

For using of additive to these three blends (i.e,B10,B15,B20) the performances and emissions are changed up to some extent. This change is more in B20 blend and the graphs can be shown in below.

PERFORMANCE ANALYSIS WITH ADDITIVE

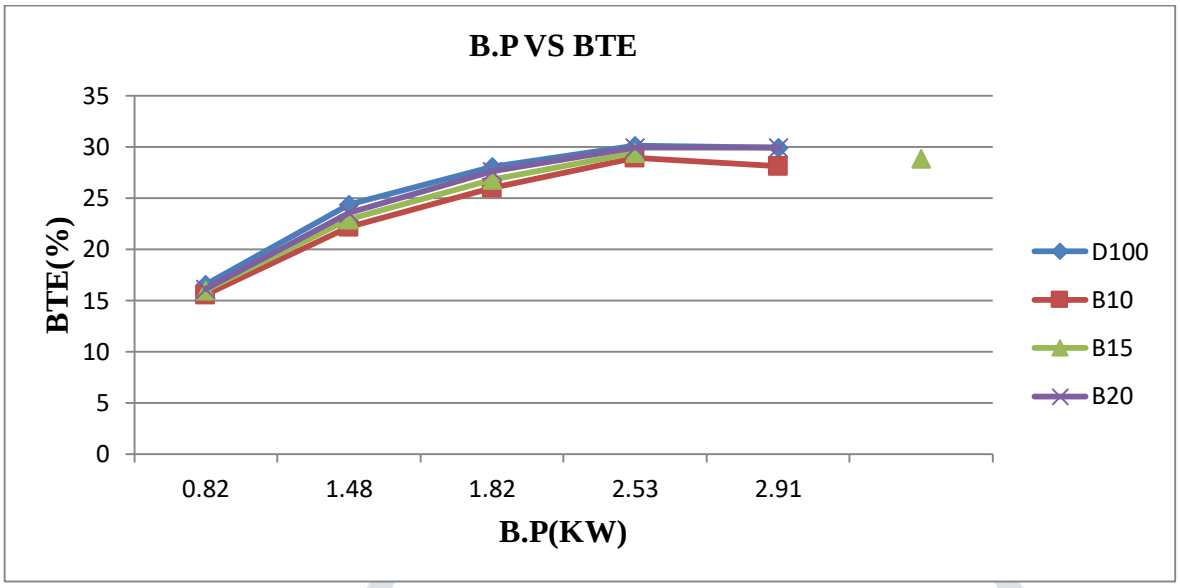

Fig: The above graph is drawn between B.P and BTE in which the performance of Brake thermal efficiency is increases compared to normal blend(without using additive).

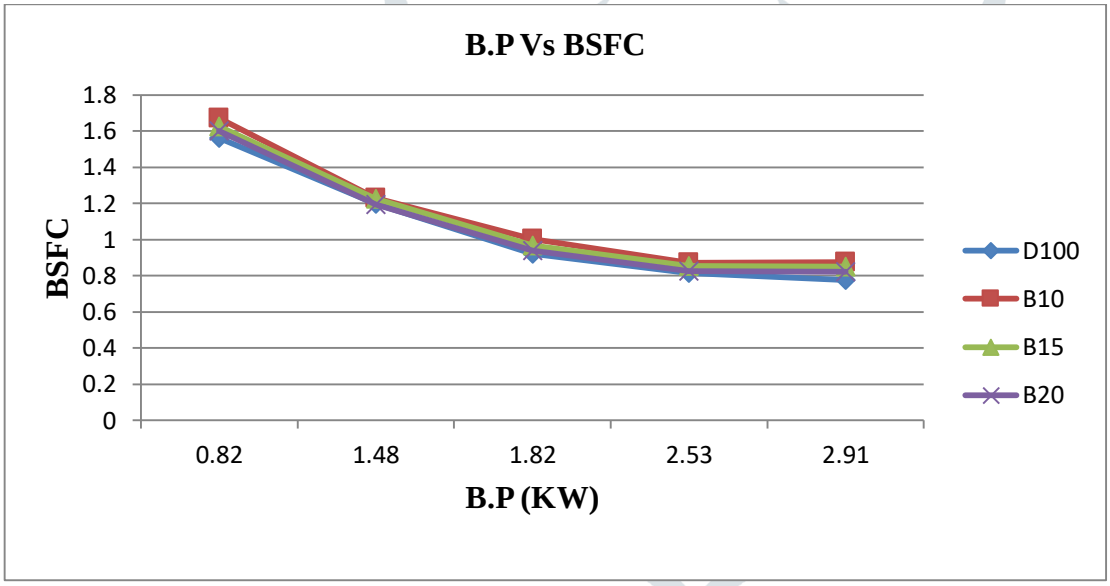

Fig: The above graph is drawn between B.P and BSFC in which the BSFC is decreases while increasing the B.P.

EMISSION ANALYSIS WITH ADDITIVE

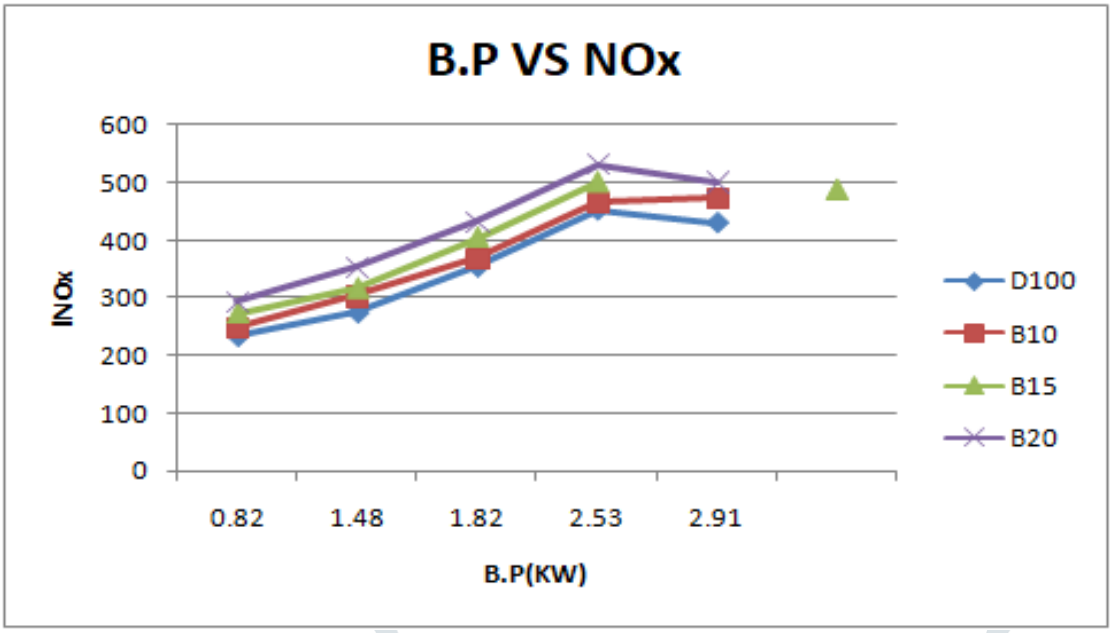

Fig: Variation of NOx with Brake power for various EGR percentages

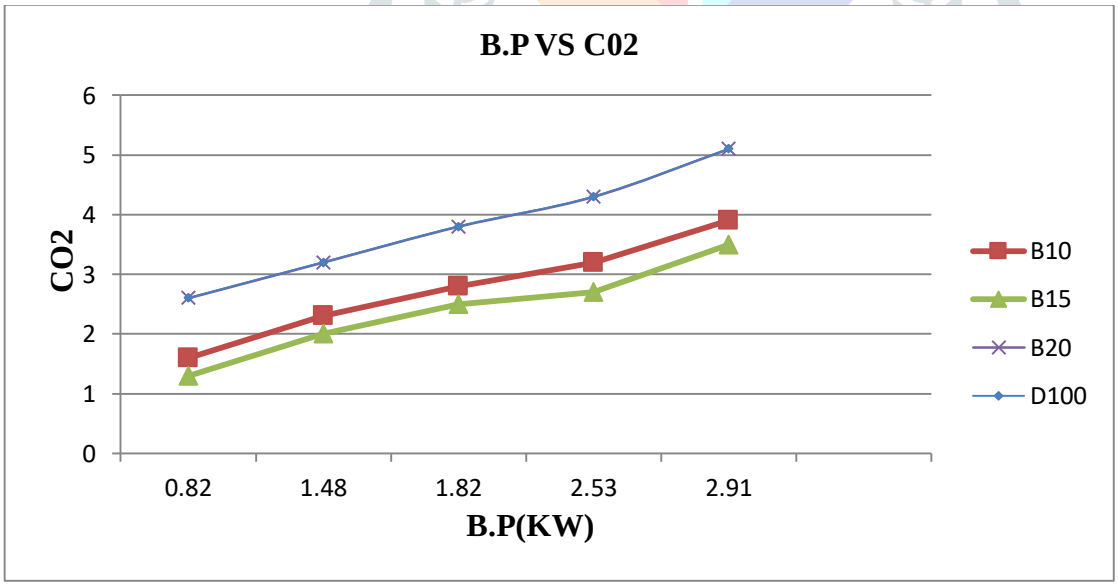

Fig: Variation of CO_2 with Brake power

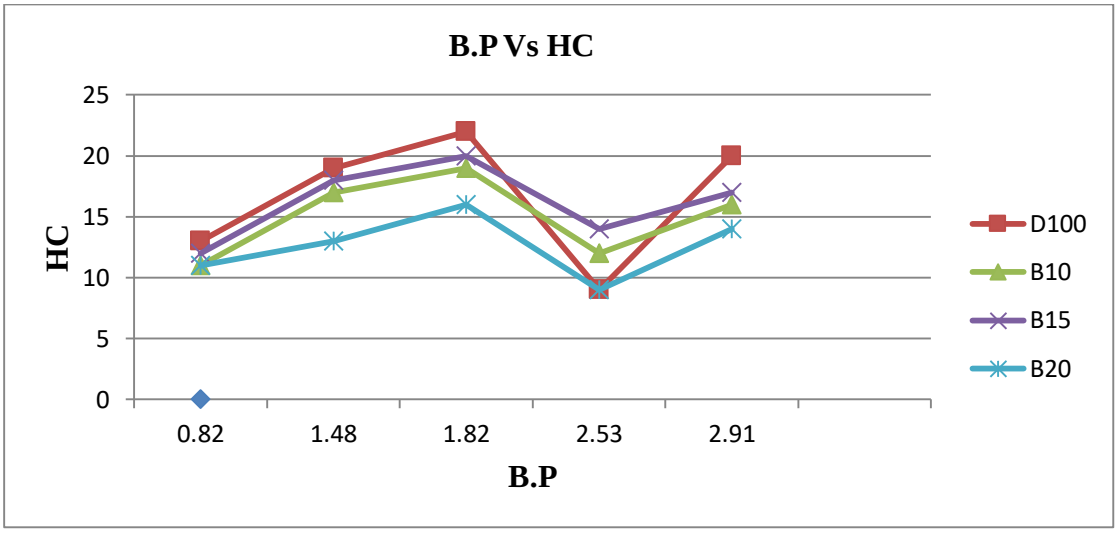

Fig: Variation of HC with Brake power

CONCLUSION

The engine runs in diesel fuel mode, and a combination of Waste fish oil & additive These experiment was performed by using three different blends ofB10,B15 and B20. The following results were obtained. The performances of Brake thermal efficiency is increases compared to normal diesel For the usage of blends B20 it gives better performance results compared to all and also it decreases the emissions. The emission HC also decreases for increasing the Brake Power a part for usage of 5% additive to B20.

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