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Experimental studies on Optimizing the compression Ratio in a Direct Injection Diesel Engine Running on Rice bran Bio- diesel

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Abstract

During recent decades, considerable efforts have been expended world-wide to reduce dependency on petroleum fuels for power generation and transportation by suitable alternative fuels that are environmental friendly. In this respect, vegetable oils are a promising alternative to diesel fuel. The performance, emission and combustion characteristics of a single cylinder four stroke variable compression ration multi fuel engine when fuelled with Bio-Diesel and its various percentage of blends with diesel will be investigated and compared with standard diesel. In order to find out optimum compression ratio, and significance of improving performance of the engine, tests will be conducted on a single cylinder four stroke variable compression ratio diesel engine. In the present paper an attempt is made to apply the impact of Variable Compression Ratio (VCR) concept. The VCR is achieved by varying clearance volume, and this is primarily by altering the volume of the auxiliary combustion chamber and effective length of the connecting rod. The major contribution of present work is to optimize the C.R running on various blends of Rice bran bio-diesel

Keywords: Petroleum fuels, Alternative Fuels Combustion, Compression ratio, clearance volume.

1.0 INTRODUCTION

As seen from the availability of non renewable sources of energy, it has been concluded that the above source of energy namely petroleum products is very fast depleting and unless some alternative source of energy is available, it becomes impossible to meet out the future energy crisis. This has lead to the search of new source of unconventional source of energy. However petroleum source of energy remains the primary source. However to reduce the load on the petroleum and diesel

fuels, blends of diesel or with other fatty and vegetables oils are the present trends. It has been observed that certain seed oils like neem,karanja,jatropa, ziziphus jubiba oil, tamunu oil etc exhibit combustion properties very similar to petroleum and diesel oils. Hence in the present work an attempt is made to use rice bran bio- diesel. The need for above work is due to the mismatch between energy available and energy requirements in the area of petroleum products . Biodiesel is defind as fuel comprised of mono alkylesters of long chain fatty acids derived from vegetable or fatty acids. Bio diesel fuel is a clean burning alternative fuel that comes from 100% renewable sources. Bio diesel fuel is made through a prosess called tranasesterification compared to other ordernative fuels, biodesel fuels have a number of advantages . It offers no health emission gasess. Many researchers conducted work on CI engines by using bio fuels or bio desel made out of many vegetables seed oils. The engines performs was studied using above bio diesels with out major modifications of engine parameters. The bio fuel preparation by esterification prosess is suitable for bio fuel preparation.Insted of using pure bio disel inside the engine, blending of bio fuel with diesel avoids major modification of engine settings. Hence in the present work a particular seed oil namely Rice bran oil is chosen and bio diesel of different percent blends with diesel are prepared. Load test is carried out with varying compression ration and results are analyzed for optimum compression ratio.

2.0 LITERATURE RIVIEW

Recent research paper were reviewed to arrive at the latest results on today technology and need for studying the compression ratio and for bio fuel blends. The literature review is presented below

Pavanendra Kumar, et al [1], did extensive work on the analysis of performance of diesel engines by varying the compression ratio using different fuels, their experimental set up consisted of suitable diesel engine to be used with a provision for varying the compression ratio. they have analyzed the experimental results and concluded that, in general the brake thermal efficiency increases with the increase in load, further the specific fuel consumption decreases with increase in load. Sanjay Patil [2], Conducted experiments on effect of varying compression ratio on the performance of CI engine with bio diesel blends. They concluded that, in the present energy Scenario efforts must be made on use of bio diesel in compression Ignition engine with suitable modification to improve the performance of the engine. They determined the optimum operating parameters by using the experimental setup through computer simulation technique. Navaneeth Krishana, et al [3], did extensive work on finding out the performance of combustion and emission characteristics of variable compression ratio engines fueled with bio diesels. Their work related to estimating the performance of a single cylinder four stroke variable compression ratio multi fuel engine fueled with different blends of bio diesel starting from 10% to 60% bio diesel with a fixed compression ratio of 19 . They concluded that considerable improvement in the performance parameters was observed. Yoggesh Tamboil, et al [4], conducted test for VCR engines using various blends of Neem oil. Bio diesel production is a valuable process and requires a carefull study of optimization process because of its renewable nature .According to them these blends have to be used as environment friendly alternative fuel for diesel engine. Bio diesel is nothing but fuels derived from renewable biological recourses used in diesel engines. They concluded that the

heat release in exhaust is reduced. Rupesh L. Rant etal [5], Made emission analysis of bio diesel blends on variable compression ratio engines. Their experimental tests consisted of a variable compression ratio engine, eddy current dynamometer for loading, fuel supply system for bio diesel, water cooling system, lubrication system various sensors and instruments, , computerized integration, online measurement of load fuel flow, exhaust emission instruments etc. They have used blends of jatropa bio diesel up to 40% blend as a bio diesel. The VCR used where 14,15,16,17,and 18. They worked on an over load of 125%. They concluded that hydrocarbon emission decreases with increase of compression ratio. Same is the case with CO. Hani Chotai [6], worked on effect varying compression ratio on performance & emissions of bio diesel engine fueled with bio diesel. They concluded that the SFC decreases with increase of Break Power. Further the effect of increase on load with SFC is marginal.
K. Manikanta et al [7]. Did extensive experimental work on performance analysis of VCR engine using Diesel . They concluded that the effect of compression ratio on SFC is negligible. It was found by then that with respect to break power the optimum compression ratio was found to be 17, where as with respect to Break thermal efficiency and SFC, the optimum compression ratio was found to be 18.

3.0 ISSUES AND CHALLANGES RELATED TO PRESENT WORK

A. The major challenge the present work is to choose the working parameters like BP, η B.Th, SFC to be optimized.

B. The blends have to be prepared by well mixing for sufficient long time, otherwise the results may be misleading

C. Environmental friendly seed oils must be chosen for bio diesel blend preparation in order that they do not pollute pollute the atmosphere

D. Careful consideration must be given for calculating the volume of the combustion chamber for arriving at VCR

4.0 SCOPE AND OBJECTIVES OF PRESENT WORK

The scope of present work is to conduct experiments with suitable seed oil diesel blend with the objective of optimizing the compression ratio for improved BP, η B.Th ,SFC.

5.0 FORMULATION OF PROBLEM

In view of anticipated future energy crises, lot of research must be undertaken for alternative fuels through bio diesel blends and optimizing the various parameters for maximum BP, η B.Th, SFC. Hence the present problem is formatted for optimizing CR in diesel engine using alternative fuels.

6.0 PRESENT WORK

The present work is split in to the following modules.

A. Choosing the diesel engine and the bio diesel under study for experimental investigation. The physical and chemical properties of the bio diesel are to be noted down.

B. Choosing the parameters like compression ratio for conducting experiments along with the blend percentages.

C. Arrangements to be made for measuring the BP, η B.Th ,SFC .etc of the engine.

D. Identification and selection of suitable instrumentation for conducting the experimental work.

7.0 EXPERIMENTAL WORK

For the experimental work Rice bran oil which contains 5-15% of oil is chosen for bio diesel preparation in steps of 5%. If the study is limited to 15% blend, major modification in the engine need not be made. The standard test rig for conducting the load test is made use of in the experimental setup to find out the BP, η B.Th, SFC . For convenience eddy current dynamometer which can offer loading upto 15kg is used for loading the engine to find the η B.Th, SFC at different CR .

8.0 RESULTS AND DISCUSSION

Various graphs were drawn using the experimentally observed values and are presented through figures 1 to 15 and shown below

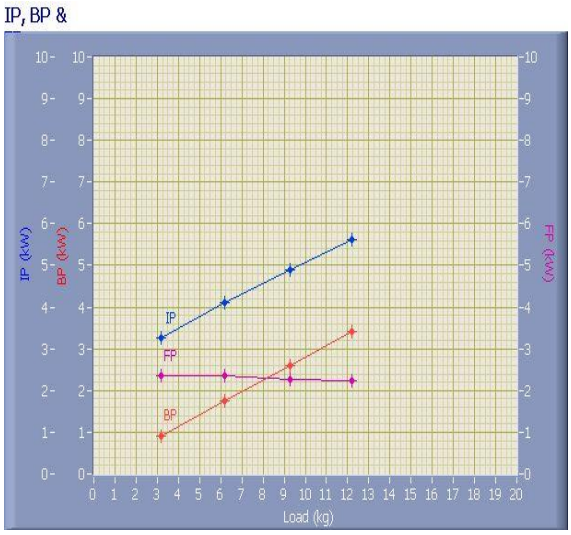

Fig.1 BP etc vs load for 5%blend with CR 16.

Fig.2, η B.Th vs CR for 5%blend with CR 16.

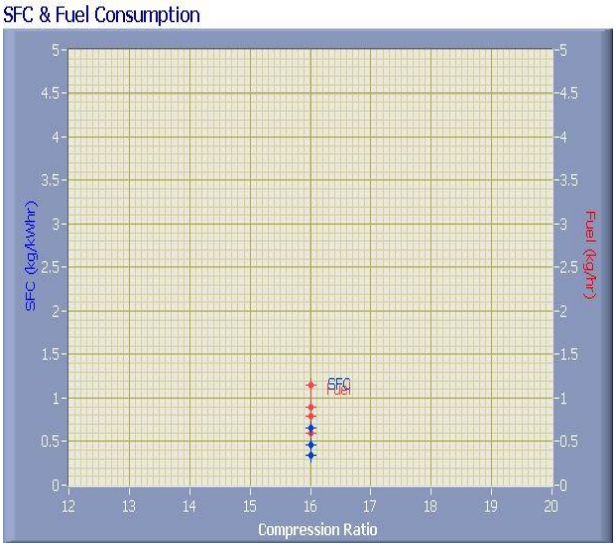

Fig.3,SFC vs CR for 5%blend with CR 16.

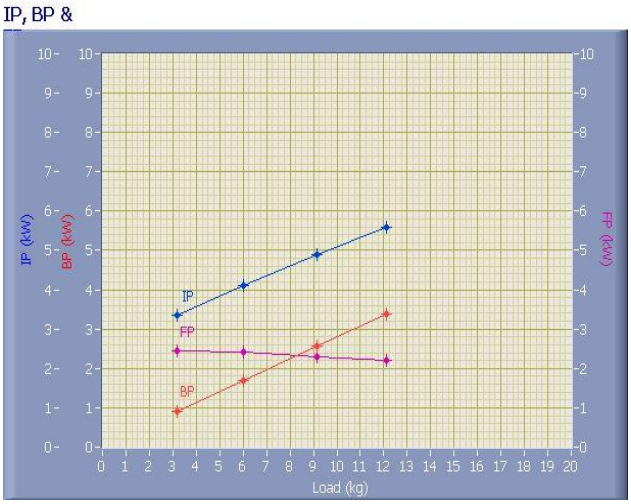

Fig.4, BP etc vs load for 5%blend with CR 18

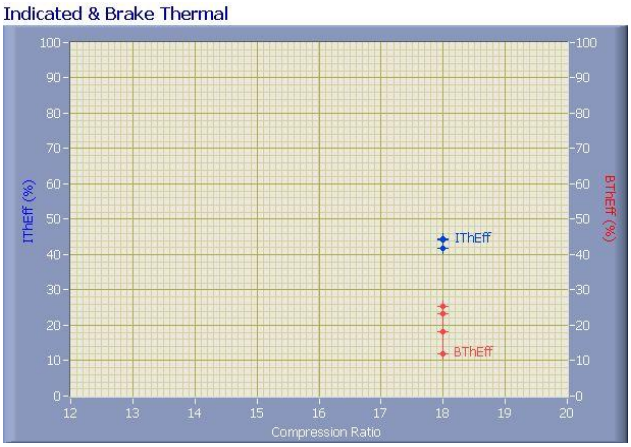

Fig.5, η B.Th vs CR for 5%blend with CR 18

Fig.6,SFC vs CR for 5%blend with CR 18.

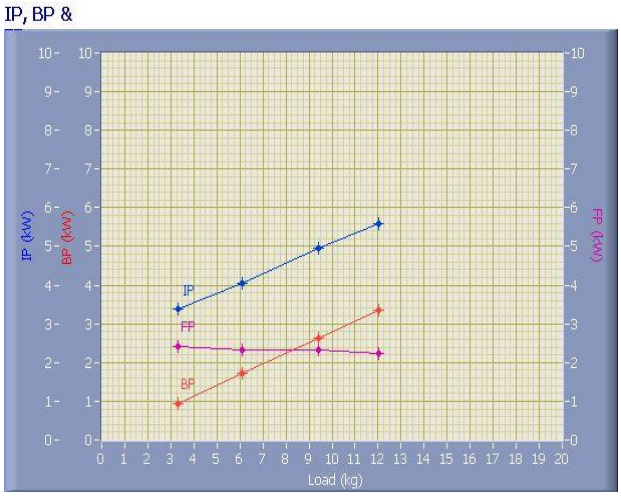

Fig.7, BP etc vs load for 10%blend with CR 16.

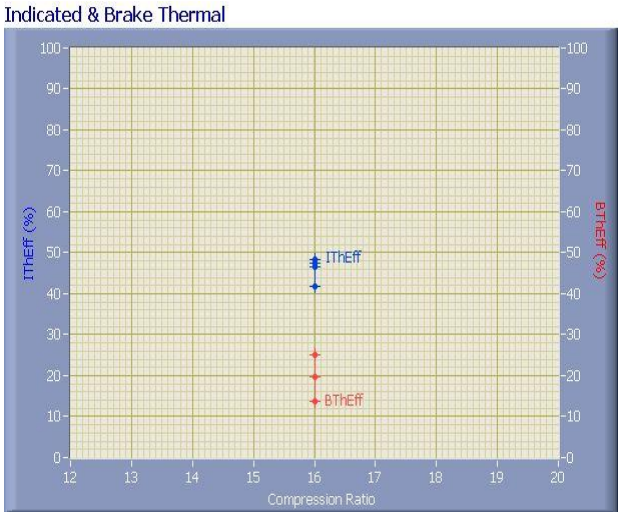

Fig.8, η B.Th vs CR for 10%blend with CR 16.

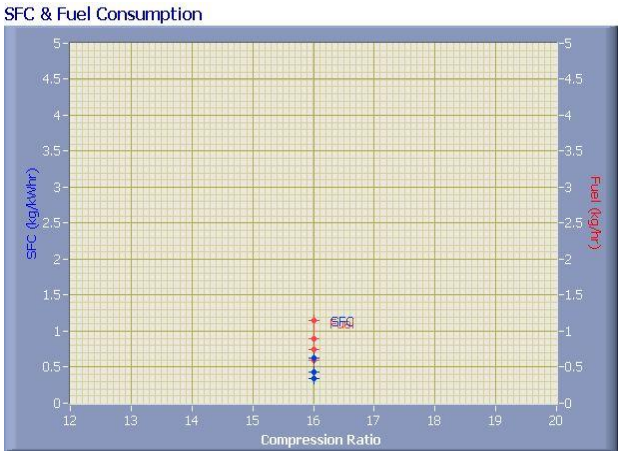

Fig.9,SFC vs CR for 10%blend with CR 16.

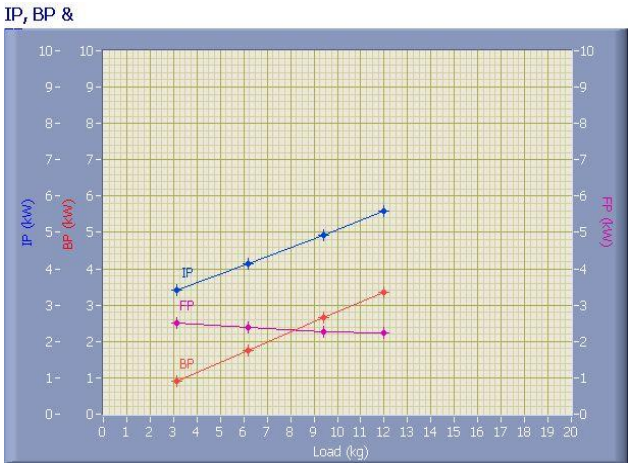

Fig.10, BP etc vs load for 10%blend with CR 18

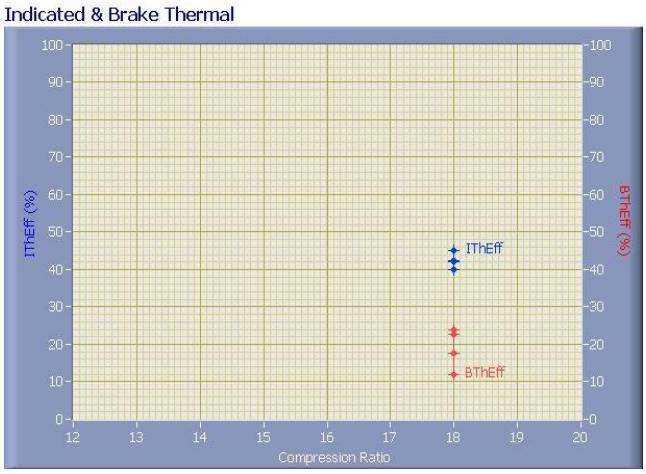

Fig.11, η B.Th vs CR for 10%blend with CR 18

Fig.12,SFC vs CR for 10%blend with CR 18.

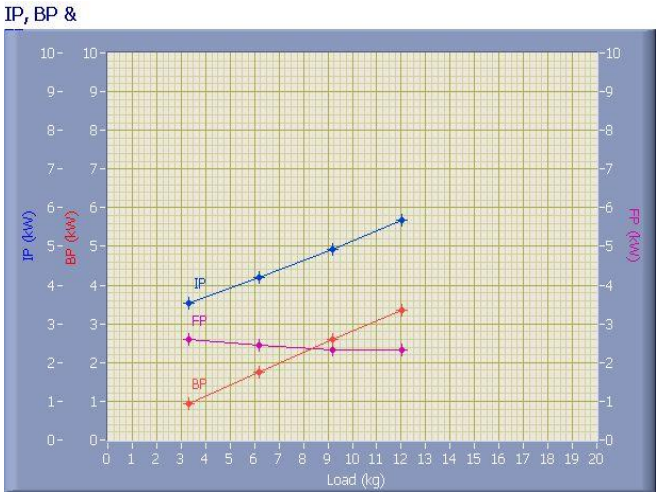

Fig.13, BP etc vs load for 15%blend with CR 18

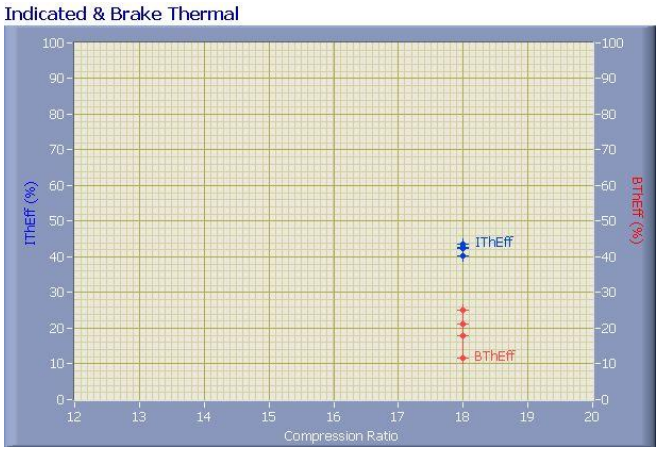

Fig.14, η B.Th vs CR for 15%blend with CR 18

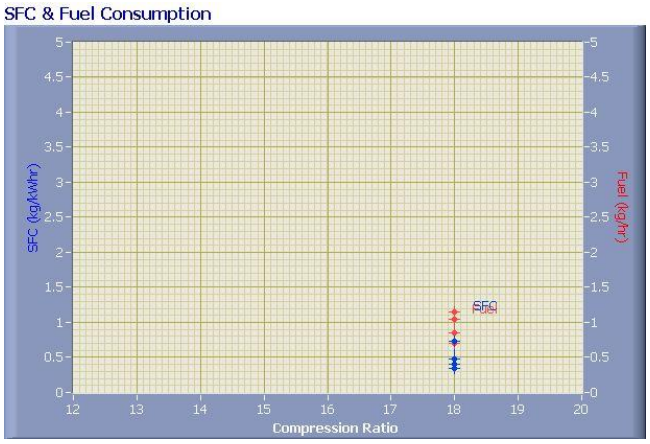

Fig.15,SFC vs CR for 15%blend with CR 18.

9.0 Conclusions

The major contribution of present work is optimizing the important parameter CR running with various blends of rice bran bio- fuels .In general the η B.Th is increased by about 8%(CR-18and blend 5%) and the SFC is decreased by about 12%(CR18and blend 5%).Hence it has been concluded that a CR of 18 and a blend of 5% the optimum values for η B.Th and SFC are achieved.

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