International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 03 | Mar 2020 www.irjet.net p-ISSN: 2395-0072

Performance Analysis of 4 Stroke 4 Cylinder SI Engine using Blends of Ethanol

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Abstract - *In this work the performance of 4 stroke 4 cylinder petrol engine was investigated with the blends of ethanol. Due to constrain in ethanol blend usability the investigation was kept for 10%, 20%, 80%. The present papers aim is to discuss performance parameter like efficiency, brake power, indicated power which were tested on Ambassador Car engine with the help of PLC and SCADA for various load. Performance analysis shows increase in break power, thermal efficiency and also slightly change in specific fuel consumption. It conclude that pure ethanol when blended with normal fuel can effectively serve as an alternative for powering the cars*

Key Words: Ethanol, Engine speed, Brake power, Thermal efficiency

1. INTRODUCTION

The design and generative of given setup and experimented data assortment and examine unit of measurement evenly important for any experimental analysis. For the success of experiment rig development depends on correct planning, choice and selection of correct of equipment and activity instruments and talent in fabrication. Further, knowledge assortment throughout experimentation depends on the exactitude and accuracy of the observations. The analysis and interpretation of the obtained results fully depends on the right subject understanding and therefore the co-relation with the established results printed in literature. The principles and methodologies that are used throughout the course of many experimental investigations within the gasoline engine take a look at rig. With the current level of technological goals throughout the planet, once different fuel could be a search, efforts are created to introduce vaporize fuel further as ethyl alcohol as ethyl alcohol is employed either in neat kind or in mixing or as bio-fuel obtained from fermentation method. The instruments fitted to the take a look at rig area unit properly mark to attenuate the potential errors throughout experimentation. A 4-stroke, four-cylinder gasoline engine is chosen for the current study. In our take a look at rig we tend to used Ambassador four strokes four cylinders gasoline engine, that having scoop. 5Hp @ 5000 revolutions per minute, scoop torsion 65 N-m @ 1500 revolutions per minute, there are a unit 04 Cylinder during this engine, Displacement 1489 cc, Bore 79.

By varied the movement speed of a four-stroke SI engine with blends of 10% and 20% and evaluated its performance characteristics. A discount in exhaust gas emissions with a rise in brake thermal potency was discovered throughout that the 10% mix was complete to be the foremost effective despite the slight a single cylinder four stroke SI engine victimization grain alcohol blends in steps of 20% up to 80% whereas varied the compression magnitude relation between 7.1 and 9.1 and The use of spark-ignition ICEs with grain alcohol blends leads to improved engine performance through multiplied brake power and thermal potency. Therefore on comparison of the characteristic and performance of si engine by ethanol blends as fuel at variable operational conditions

Table 1: Characteristics of the engine

S/N	Parameter	Data
1	Bore X Stroke	79.00x89.00 mm
2	No Of Cylinders	4
3	Cylinder Displacement	1489 cc
4	Compression Ratio	8:3:1
5	Max Power	72.5 hp
6	Max Torque	65 n-m
7	Bore/Stroke Ratio	0.88
8	Cooling	Water cooled
9	Ignition	Battery

1.1 METHODS AND MATERIAL

The Test Engine Specifications the engine used for this investigation is an Ambassador (CLASSIC 1500 DSL1489) spark ignition engine whose main characteristics are contained Table 1. In Table 2, the ratios of the ethanol blended fuels and in Table 3 physiochemical properties of the fuel is given

Table -1: Ratios of the ethanol blend

S/No	Mixtures	Ratio of Ethanol to Gasoline	
		Blend (%)	Petrol (%)
1	E 10	10	90
2	E 20	20	80
3	E 80	80	20

Table 3: properties of the Investigated blendS

S/NO	PROPERTY	INVESTIGATED BLENDS		
		E10	E20	E85
1	Density (kg/dm3)	0.7280	0.7895	0.7895
2	Stoichiometric air/fuel ratio	13.857	13.661	9.951
3	Lower heating value (KJ/Kg)	41890	40260	29605
4	Research Octane Number	96.6	98.2	109.6
5	Motor Octane Number	85.7	87.4	89.9

1.2 NDICATED MEAN EFFECTIVE PRESSURE (P_{mi})

$$IP = \frac{P_{mi}LAN}{60} \times N_{CYL} \times n$$

P_{mi} =

Where,

L =Stroke length

A =Cross section area

N =Speed in RPM

N_{CYL}=Number of cylinders

n $= \frac{1}{2}$ For four strokes

1.3 BRAKE MEAN EFFICTIVE PRESSURE

$$BP = \frac{P_{mb}LAN}{60} \times N_{CYL} \times n$$

Where,

L = Stroke length

A = Cross section area

N = Speed in RPM

N_{CYL} = Number of cylinders

n $= \frac{1}{2}$ For four strokes

T = torque in (N-m)

1.3 INDICATED THERMAL EFFICIENCY

$$\eta_{bth} = \frac{BP}{m_f \times CV}$$

Where,

BP = Brake power

m_f = mass flow rate of fuel

CV = calorific value

1.4 RELATIVE EFFICIENCY

$$\eta_{relBP} = \frac{\eta_{bth}}{\eta_{air\ std}}$$

Where,

$\eta_{air\ std}$ = air standard efficiency

1.5 MECHANICAL EFFICIENCY

$$\eta_{mech} = \frac{BP}{IP}$$

1.6 BRAKE SPECIFIC FUEL CONSUMPTION

$$BSFC = \frac{M_f \times 3600}{BP}$$

1.6 INDICATED SPECIFIC FUEL CONSUMPTION

$$ISFC = \frac{M_f \times 3600}{IP}$$

2. RESULT AND DISCUSSION

Fig.1 represents the pattern of the fuel flow for the various classes of ethyl alcohol blends below investigation.

The curves are selected as, F10, F20, F80 and F100 like the various types blends E10, E20, E80 supported its ration to the baseline fuel.

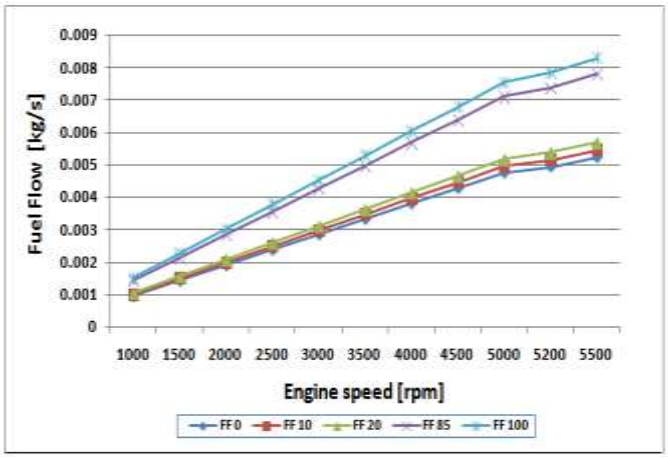

Figure 1: Analysis of the Fuel flow for the different blends

Fig.2 represent BP vs. efficiency

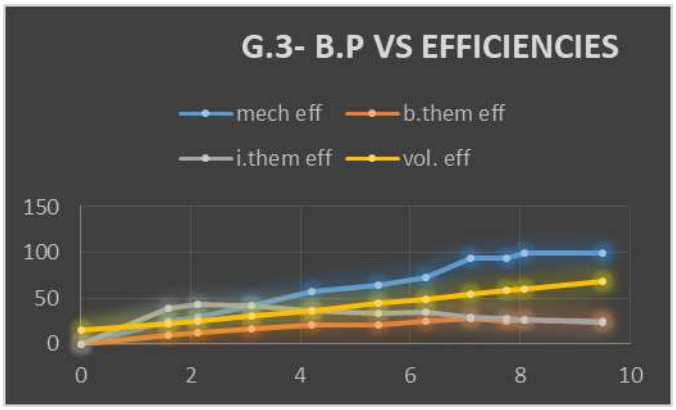

Figure 2: Analysis of BP vs efficiency for different blends

Fig 3: represent the difference of thermal efficiency for all blends such as E10, E20, E80.

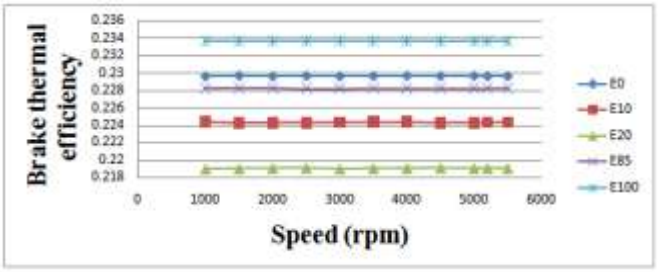

Figure 3: Difference of the Brake Thermal Efficiency for all blends

Fig 4: represent BP vs. ISFC and BSFC in which we conclude that the brake power shows slightly increased with relative to the blends used

Figure 4: Analysis B.P VS ISFC and BSFC

Fig 5: Represent the IP, BP and therefore the FP accumulated with increase in speed and naturally, the worth of the IP was found to be beyond that of the brake power taking as a significant issue the role of the friction absorbed through the friction power FP

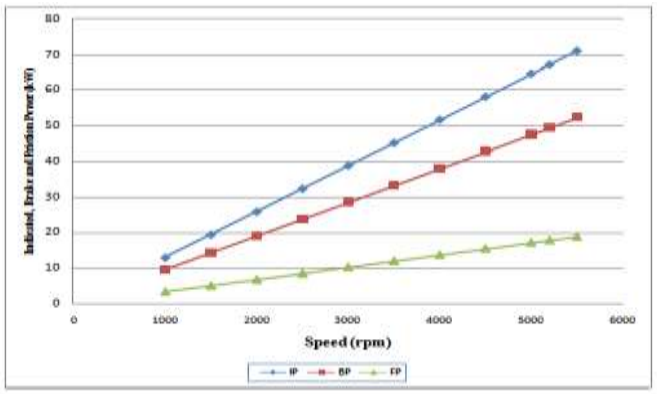

Figure 5: Analysis of the relationship between the Indicate Power, Friction Power and the Brake Power

3. CONCLUSIONS

Although gasoline blends is known to be the standard fuel that has powering of spark-ignition engines, this analysis has evaluated the behavior of a SI engine once powered by ethanol

Throughout this study, it's find out that blending of blends contains an inclination of ascend the running worth for the cars looking on the grade of blending.

This could conjointly depend upon the supply of refined fermentation alcohol in industrial quantities enough to favorably contend with existing stock of PMS.

The worth's of each indicated and brake thermal efficiencies are found to be slightly higher as a result of the low heat of combustion value of blends compared

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