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Performance Analysis of Single Cylinder 4Stroke SI Engine Using Ethenol Blends

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ABSTRACT:

Ethanol which is one of the best alternative to fossils fuel as well as Environmentally cleaner, used with other blended fuel or in its own, in different proportions. this ethanol produce many ways like from sugarcane, agricultural waste, corn, etc. Ethanol is widely used as an alternative fuel or an effective additive of gasoline due to the advantage of its high octane number and its self-sustaining concept, which can be supplied regardless of the fossil fuel. As a result, vast study has been carried out to study its effects on engine performance an demission. in this experimental study ethanol- blends Gasoline in a different ratios and as a result shows that, carbon monoxide (co),emitted from exhaust of 4-stroke SI engine lower into environment. i.e. after blends Ethanol-Gasoline mixture emission of carbon monoxide (co) reduces. in this experimental studies Ethanol blends Gasoline have been used in 4-stroke single cylinder SI engine for performance and analysis under full load. In this experimental studies we can measure Torque, Break Power (BP),Break specific fuel consumption(BSFC), Break specific Energy consumption(BSEC),Thermal Efficiency, by using the experimental data. Today transport system is depends upon the fossil fuels specially liquid fuel which are depleting much faster rate than production. Consumption of the fuel is increasing day by day which is affecting the economy of our country. It fuel research is completely based on finding alternative fuel. In This paper the investigation main purpose is to evaluate the performance of the engine and decrease fuel consumption by using alternative fuel on combustion in four stroke SI engine. For this experimental investigation has been conducted on four stroke spark ignition engine, fuel-led with various bland of gasoline-ethanol. Experiment has been conducted ethanol-gasoline bland such as E0 (pure gasoline), E5(combination of gasoline 95% by volume, ethanol 5% by volume), E10(combination of gasoline 90% by volume, ethanol 10% by volume), E15(combination of gasoline 85% by volume, ethanol 15% by volume), E20(combination of gasoline 80% by volume, ethanol 20% by volume), E25(combination of gasoline 75% by volume, ethanol 25% by volume), E30(combination of gasoline 70% by volume, ethanol 30% by volume), E35(combination of gasoline 65% by volume, ethanol 35% by volume) and E40(combination of gasoline 90% by volume, ethanol 5% by volume), is used in the study and its effects on break power, specific fuel consumption, break thermal efficiency. In this research comprehensive review of various operating parameters use of ethanol-gasoline blends has been discussed.

Result obtain from the experimental tests has been discussed too. This work investigated ethanol-gasoline blending on the performance, emission of four stroke single cylinder SI (spark ignition) engine, air cooled engine having compression ratio 2.5 is used. The advantages of using ethanol as SI engine fuel include its greenness, renew-ability, higher availability and usability in near future, higher octane number, and biodegradability. Ethanol can be produced biologically from sugarcane, crop residues, cellulose, agricultural biomass, municipal waste etc.

KEYWORDS: SI engine, Ethanol, alternate fuel, petrol blend, gasoline, Performance.

INTRODUCTION

Increasing air pollution is one of the most important problems worldwide with exhaust emissions from motor vehicles playing a major role. Only changing the design of the engines is insufficient to cope with legal regulations, making it essential to work on alternative fuel technologies. The alternative fuel must be renewable as well as directly usable without major changes in the structure of the engine. Ethanol among the various alcohols is most suited fuel for SI engines, having reduction in CO, HC emissions and better anti-knock characteristics, allowing it to be used in higher compression ratio engines .The reduction of CO emission is apparently caused by the wide amiability and oxygenated characteristic of ethanol. Therefore it improves power output, efficiency and fuel economy. On the other hand, the auto-ignition temperature and ash point of ethanol are higher than those of gasoline, and the low Reid evaporation pressure which makes it safer for transportation and storage, and causing lower evaporative losses [2]. Latent heat of vaporization for ethanol is 3–5 times higher than petrol, thus accounting for lower intake manifold temperature and better volumetric efficiency. Further storage and dispensing for ethanol is similar to petrol since both are liquid fuels. In addition, for most unleaded gasoline, methyl tertiary butyl ether (MTBE) is a problem as it will contaminate groundwater and harm human health .Ethanol can be used to substitute MTBE in the future.

World population increasing day by day, that increased demand of vehicles and industries, which consume fossil fuel. Fossil fuel reserves are limited in nature and they are going to be depleted in next some decayed, if these limited reserves used to fulfill the demand of industries and transportation. The cost of petroleum products have increased dramatically due to this increased demand of petroleum products. Increased demand and cost of petroleum products increases the attention of researchers in this field of alternative fuels in recent years. Ethanol is good alternative fuel for spark ignition engines and reduces the hazardous emission products from the engine as compared to the conventional fuel, which makes ethanol eco-friendly.
Ethanol is an alcohol made through the fermentation of plant sugars from

agricultural crops and biomass resources. The most common agricultural crop utilized for ethanol production is corn. Only a portion of the feedstock is needed for ethanol production and the remainder can be used for animal feed, corn oil, or other products. Ethanol is a clear, colorless chemical compound made from the sugars found in crops such as corn, sugar beets and sugar cane. Ethanol is knows as most attractive alternative fuel because of its properties like high octane number and flame speed among all the alcohols. It can be produces from renewal energy resources like agriculture feedstock. Ethanol is good alternative fuel for spark ignition engines and reduces the hazardous emission products from the engine as compared to the conventional fuel, which makes ethanol eco-friendly.

Today the large amount of pollutants emitting out from the exhaust of the automotive vehicles run on fossil fuels are increasing and these pollutants are increasing as vehicles increasing day by day. In view of heavy consumption of gasoline due to transport, the search for alternative fuels has become compulsory. An important step in efforts to solve the problem is to replace fossil source energy with bio energy. In the transport sector this means blending bio fuel with petroleum based fuels for use with present vehicle fleets. Ethanol is considered to be one of the most promising alternative renewable fuels. The investigation main purpose is to evaluate the performance of the engine and decrease fuel consumption by using alternative fuel in four stroke SI engine. Ethanol blend has been introduced as a clean and green renewable alternative energy for SI engine. Ethanol has some advantages over gasoline, such as high octane number and flame speed, high latent heat of vaporization thereby higher volumetric efficiency. A varied mixture of ethanol and petrol are used depends of the country into Asian countries, such as Thailand (E10), Philippines (E5 and E10) and India (E5).

An Experimental setup has been developed with four stroke petrol engine, to study various fuel blended consist of petrol as primary fuel & ethanol as secondary fuel. In this experiment we mainly considered lower percentage blends to higher percentage blends. The main purpose of this project is found that carbon Monoxide (co) is reducing & checks the blended emission of ethanol blends used & Gasoline (Petrol) emission. As we know now a day's Gasoline fuel or crude oil is limited hence some alternate should obtained and by adding the ethanol into petrol (Gasoline) it provide good alternate fuel.

ethanol is not only renewable fuel but also colorless liquid with mild characteristics odors; ethanol can be produce from sugarcane, agricultural residues, woody bio-mass or waste. However, the simple process of chemically derived from ethylene or ethane. Ethanol is easily mixed other fuel like petrol or diesel and also it can be used as transportation fuel even in its original form. In the world now-a-days everyone looking forward for ethanol as not only renewable fuel but also it reduces carbon-monoxide (co) in the air and automatically it helps to reduces global warming.

If we add ethanol in gasoline fuel octane number increases in blended fuel and reducing carbon dioxide (co2) emission, by changing distillation temperature. Today

crude oil reserves are limited in nature and these are decrease day by day. So we need that future availability of energy and also reduce co2 emissions. In that way we need for utilization of regenerative fuels.
Use of ethanol as a fuel for SI engine. Same advantage over gasoline such as high latent heat of evaporation, better anti-knock characteristics and also improve thermal efficiency with increasing compression ratio. Ethanol reduces heating value as comparing with gasoline fuel. Because of ethanol contain oxygen in it as a result it is used as fuel in a SI engine.

Background of study

Today the petroleum stockpiles are limited and will ultimately run out. The ascension of population and urbanization makes the demand of energy is increasing daily. As the major typical energy sources like coal, petroleum, and fossil fuel square measure step by step depleted, biomass is rising collectively of the promising environmentally friendly renewable energy choices. Bio-fuel initiative has been backed by government policies within the search energy security through partly replacing the restricted fossil fuels and reducing threat to the surroundings from exhaust emissions and warming. The main fuel found to be associate progressively vital various to crude is bio-fuel. Bio-fuel conjointly produces less greenhouse gases like carbonic acid gas. Once either bio-fuel or crude oil is burned, the carbon content of the fuel returns to the atmosphere as carbonic acid gas.
Many researchers have according on ethanol-petrol blends engine performance and emissions characteristics. The advantages of bio fuels area unit the following: (a) they're simply offered from common biomass sources, (b) carbon oxide cycle happens in combustion, (c) they're terribly environmentally friendly, and (d) they're perishable and contribute to property (Bata et al., 2006). This experiments aims to study the run engine with different percentage of blending of gasoline and ethanol to reduce the exhaust emissions and also to increase efficiency of the engine.

METHOD

The project experiment was carried out on Single Cylinder 4-Stroke constant speed SI engine. It consists of following components:-
1. Fuel tank
2. Engine
3. Rope brake drum type dynamometer
4. Manual loading arrangement
5. AVL Five gas analyzer

Engine Specifications

- Maker- Grieves ltd.
- Type- Single Cylinder 4-Stroke SI engine
- Rated Power- 2.2 KW
- Rated RPM- 3000
- Stroke- 66.7 mm
- Bore- 70 mm
- Compression ratio- 4.7
- Capacity- 256 cc
    - Arm length- 0.1036 m

Initially the procedure of experiment starts with filling the fuel tank available then we start five gas analyzer, It takes half an hour to starts, after it starts, we starts generator with the help of rope at no load condition &

as soon as engine starts we supply the water to dynamometer for cooling purpose. The motor is provided with air fin for cooling so no need to supply water to motor.

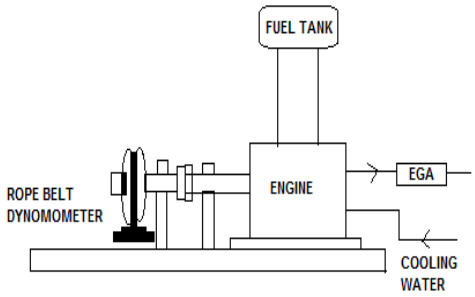

Fig 1. Single Cylinder 4-Stroke constant speed SI engine

We run the engine for few minutes before reading were taken to ensure stable operation. Once it is ensure the engine is running properly, we start taking readings. We measure the time required for 20ml of fuel with the help of stop watch & burette which is connect to the fuel tank, then we place knob inside the exhaust manifold & put it for a while until the stable reading of emission are shown by the analyzer and not down the reading Obtained. The reading obtained is time per 20ml of fuel consumed and emission of carbon monoxide, carbon dioxide, hydro carbon and nitrogen Oxide at no load condition. This procedure is repeated for different load. The load is carried out manually in the manner 1 kg, 2 kg, 3 kg, 4 kg and 5 kg. With these readings one type of fuel is completed.

Then you're off the engine after above set of readings are obtained for about 1 hour allowing it to cool for its proper functioning. Then repeating the procedure for another blended mixture and proper care was taken like mixing the ethanol and petrol, just before the experiment is carried out in order not to form much water to avoid corrosion problem. Each type of blend was used for reading in tree times, so as to minimize error, the procedure is carried out for the fuel E5, E10, E15, E20,E25 ,E50, E75. The reading obtained with the graph as shown in result and discussion in the next section.

By conducting the experiment on 4 stroke single cylinder SI engine in I.C Engine Lab of SRCEM B and more, following Conclusions have been drawn:-

- Brake specific fuel consumption decreases from blending E0 to E10, further increase in blend ratio, the BSFC increases. The minimum BSFC achieved at E10.
- Brake thermal efficiency increases from blending E0 to E10, further increase in blend ratio, the BTE decreases.

The maximum BTE achieved at E10. From the results, it can be concluded that ethanol blends are quite successful in replacing pure gasoline in four stroke spark ignition engine. Results clearly show that Brake thermal efficiency is increasing for a particular percentage of blending of alcohol. After a particular fixed percentage of blending the performance of SI engine decreases. The blending of ethanol in gasoline provides good combustion property. If we add alcohols after a particular percentage than it is incapable in proper combustion of fuel which results in lowering thermal efficiency. Performance of E10 shows better result within group of various blends of ethanol with gasoline. It shows least brake specific

fuel consumption and better engine performance. So from the result it is seen that E10 ethanol blended Gasoline is the best choice for use in the existing Spark Ignition Engines without any modification to increase Efficiency.

RESULTS AND DISCUSSIONS

The effect of ethanol–gasoline blends on the brake specific fuel consumption (BSFC) is shown in Figure 2. The BSFC initially increases up to E10 then gradually decreases for rest of the blends (up to E40). The effect of ethanol–gasoline blends on the fuel consumption is shown in Figure 3. The fuel consumption gradually decreases for all the blends (up to E40). The mechanical efficiency as shown in Figure 4 increases till E20 and then gradually decreases for other blends (up to E40) and the highest mechanical efficiency is recorded to be 92.77% for E20. The thermal efficiency is shown in Figure 5. It gradually increases for all the blends and the highest is recorded for the blend E40.

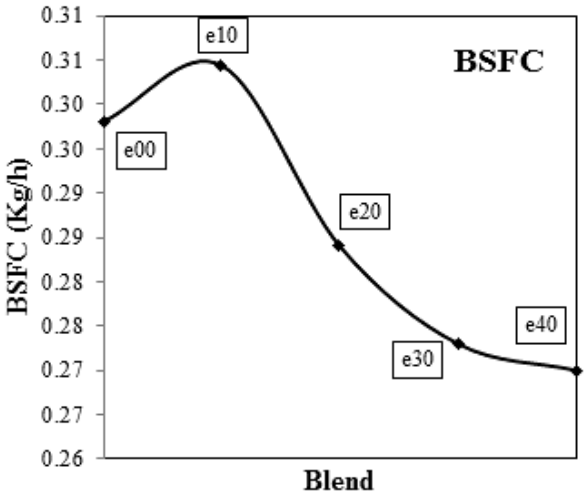

Fig. 2: BSFC for Ethanol and Load Conditions.

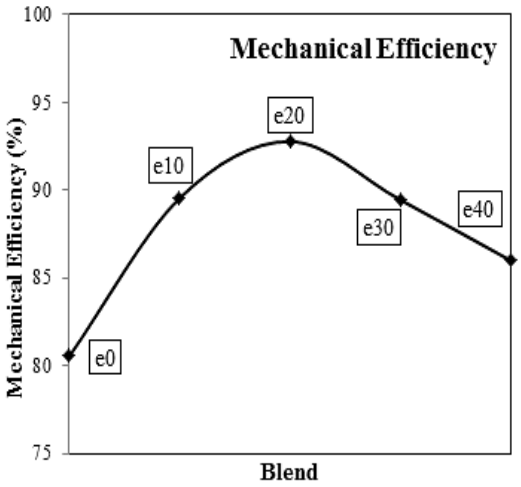

Fig. 3: Fuel Consumption for Ethanol and Load Conditions

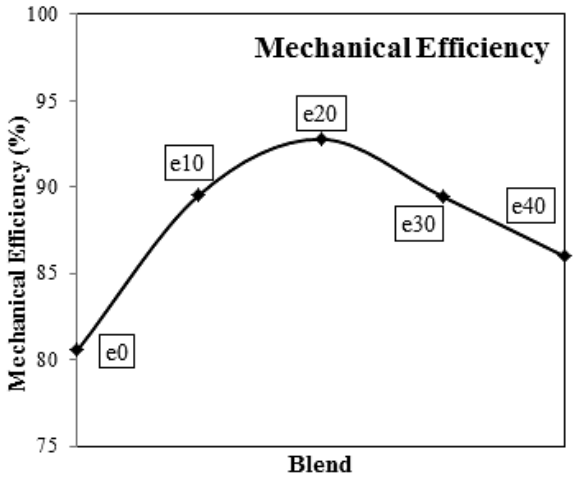

Fig. 4: Mechanical Efficiency for Ethanol and Load Conditions.

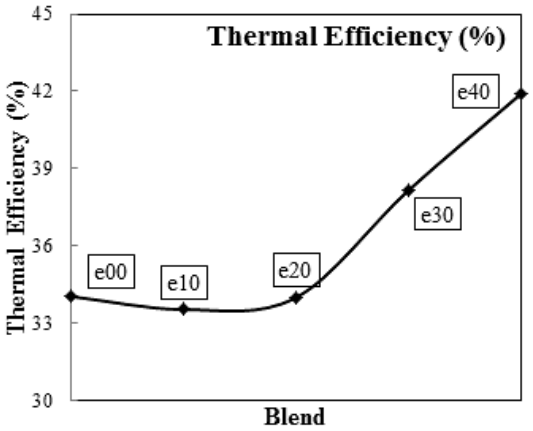

Fig. 5: Thermal Efficiency for Ethanol and Load Conditions.

CONCLUSION

The blended of ethanol is excellent alternative fuel also it is eco friendly and amount of emission is minimum. By adding blended mixture the efficiency increases or nearly equal, it will surely increase while we increase compression ratio. Ethanol blend in petrol then the percentage of carbon monoxide (CO) decreases. Mainly this study was carried out to study the performance of SI engine at lower percentage blends along with couple of higher percentage blends were tested. Using various percentage blends of ethanol the following main changes to engine performance of emission and comparison with petrol operated engine with increasing ethanol percentage emission of carbon monoxide decreases but CO2 increases because of the complete combustion, hence nitrogen oxide increases. As compare with petrol hydrocarbon emission into environment also increases but we can decrease quickly by increasing load.

In case of E10 break specific energy consumption (BSEC) is lower at initial loading and little bit increase by higher load. BSEC is of E15 and E5 almost same as petrol. E25 remaining higher and E15 and E75 remains slightly lower as compared with E25and E20 while we increasing break thermal efficiency of E10 and is equal to for E5 and E15. The efficiency of E25 was found to be lowest and for higher percentage it was lower. Thus efficiency increases with load increases.

From the above experiment it is clear that if we can optimized as E10 might be the best blame to be used in order to achieve good efficiency and minimum emission for lower compression ratio while engine is running at higher RPM at constant speed and intermediate percentage blending results in lower as in case of E25.

FUTURE SCOPE

· Analysis of composition of exhaust emission can be done.

· SI engine efficiency can be increase without any modification by using ethanol blended Gasoline.

· Combustion Analysis can also be done.

· It is not only the price reduction by ethanol blending that matters but also the millions of liters of petrol that we save for future.

The values of the exhaust gas temperature decrease so environment temperature can be reduced.

The engine performance and emission of a SI engine have been investigated by using ethanol petrol blended fuel and pure petrol. Experimental results indicated that when ethanol petrol lend is used, the engine power and fuel consumption of the engine slightly increase, CO emission decrease as a result of the leaning effect conditions and CO2 emission increase because of the improved combustion.

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