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An Experimental Study on Performance of Sugarcane Bioethanol blend on VCR Engine.

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ABSTRACT — *Biofuels are a wide range of fuels which are in some way derives from biomass. Biofuels are gaining increased public and scientific attention, driven by factored such as oil price spikes, the need for increased energies securities and concern over greenhouse gas emissions from fossil fuels. Biofuels have become particularly appealing to developing countries because of their potentially to stimulate economic development in rural area and eradicate poverty through the recreates of employment opportunities and increased incomes in agricultural sectors.*

Key words: Biofuel, Biomass, Green House Gas, Fossil Fuels

I. Introduction

The fossil fuel is the most efficient and useful in all the sector of modern-day living. Fuel is playing a majority roles in developing countries particularly in transporters, Industrial sectors, Agriculture and consumes farm. India is one of the fastest-growing economist in the world and will continue to enjoy the demographic dividend for a few decade. Energetic is a critical inputs towards raising the standard of living of citizens. The energetic strategic of the country aims to charts the way forward to meet the Government's recent ambitious announcements in the energetic domains such as electrification of all census villages by 2019, 24X7 electricity, 175GW of renewable energetic capacities by 2022 and reduction in energetic emission intensifies by 33% - 35% by 2030[2]. Fossil fuels will continue to occupations a signify share in the energetic basket. However, conventionally or fossil fuel resourceful are limited, non-renewable sourcing are to be extracting. The crude oil price has been fluctuation in the world market. Such fluctuate are training various economist the world over, particularly those of the developing countries. The road transporters sectors accounts for 6.7% of India's Gross domestically Product (GDP). Currently, diesel alone meets an overestimate 72% of transport fuel demand followed by petrol at 23% and balance by other fuels such as CNG, LPG, etc. for which the demand has been steadily rising. Provision overestimates have indicator that crude oil requiring for indigenous consume of petroleum products in financially Year 2017-2018 is about 210 MMT. It was founded that the ethanol generates from sugarcane and crop residue gives additional incomes to the farmer and also helps the environments & safe disposed of farm stubble. Hence ethanol is a promising biofuel that can be blended with petrol to operate the sprayers and leads to reduce environmentally pollution. In India, Bioethanol can be produced from multiple sourcing like sugar-containing materials, starch containing materials, celluloses and lignocelluloses material including petrochemical routed. However, the present policies of Ethanol Blended Petrol (EBP) Programme allows bioethanol to be procured from non-food feedstock like molasses, celluloses and lignocelluloses material including petrochemical routed. Currently, ethanol for EBP programme is coming from molasses routed as a by-product of the sugar industry. At the present levels of cane and sugar production about 350MMT and 26-28 MMT per annum respectively, the maximized quantity of molasses unavailable is about 13MMT, which is sufficiency to produce about 300 crore litres of alcohol/ethanol. One MMT of Sugar sacrificed can produce 60 crore litres of ethanol. Ethanol will also be allowed to be produced directly from sugarcane juice to increase the blending percentages. The goals of the National Biofuel policies – 2018 is to enable the available of biofuels in the market thereby increasing its blending percentages. Currently, the ethanol blending percentages in petrol is 2%, an indicate targets of 20% blending of ethanol in petrol is proposed by 2030

II. Literature Review

A.F Kheiralla [1] have reported on ethanol-gasoline blends that engine performance and emissions characteristics founded little difference in power performance, specifics fuel

consumption, and thermal efficiency between engines fueled with gasoline or a gasoline blend of 15% ethanol (E15). The gasoline fuel replacement is regulators by the amount of ethanol in the blend. However, problems arise, due to the presence of water in the blend because commercially unavailable ethanol is seldom founded in an anhydrous state. The commonly unavailable ethanol grading contain between 10% and 20% water. Typical local distillation conversion fermented sugar molasses to 190-proof or industrial ethanol, containing 5% water, and removable the remaining water requiring special measures at an added cost. Thus, there would be an economists incentives if the spark ignition engine could be run on industrial ethanol instead of anhydrous ethanol. Vladan Micic and Milovan Jotanovic [7] have addressed that most promising biofuels are bioethanol. Ethanol has many favorable properties. For example, the octane number of ethanol is higher than the octane number of conventionally petrol. The octane number influences the anti-knocking property of the fuel. A high octane number stands for an anti-knocking fuel. Knocking describes uncontrolled combustion which puts heavy mechanical and thermal loads on the engine. Dr. Shrishail Kakkeri [3]. have reported that all alcohols have the ability to absorb water. Condensation of water in the fuel system is absorbed and does not have the opportunity to collect and freeze. Since ethanol blends contain at least 10 percentages ethanol, they are able to absorb water and eliminated the need for adding a gas-line antifreeze in winter.

III. Methodology

Biofuel is the environmentalists friendly and renewable sourced of alternatives fuel which is mainly produced from animal fats tallow, lard, white or yellow grease, poultry fats, or fish oils; recycled greases used cooking and frying oils; and most commonly, plant oils from soybeans, corn, rapeseed, sunflowers, and cottonseeds, etc. To use this biofuel in diesel engine there is no need for engine modifications as well. In general, the term biofuel is used to represent all the liquid and gaseous transport fuels derives predominating from biomass. Biofuels conversions system is one of the important steps in the whole biofuel production chain. factored such as high yields and low energies consumed are important to consider in promotions the future competitiveness of biofuels to fossil fuels in the market Biofuels can be derives from any biological carbon into biofuel via different production pathways to produce sourced, but photosynthetic plants are the most biodiesel, ethanol, butanol, methane, or other fuels; all are commonly used feedstock. Biofuels are categorizing as the subject of ongoing researches. Technologies to produce into the first- generations biofuel and advanced biofuel second-first- generations fuels are maturing but some feedstock's are generations, third- generations, etc. Currently, biodiesel and bioethanol are the two most promising biofuel being projecting to replace convenes fossil fuels in transport.

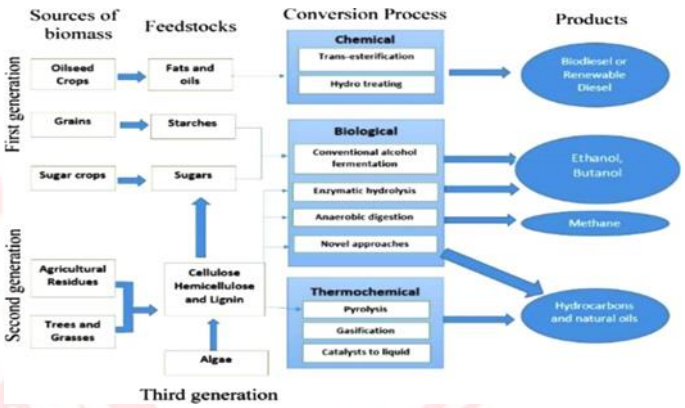

Fig 1. Classification of Bioethanol

Ethanol is a high octane; water-free alcohol produced from the fermentation of sugar or conversion starch. It is used as a blending ingredient in gasoline or as a raw material to produce high-octane fuel-ether additives. Ethanol is made from grains mainly corn or other renewable agricultural or forestry products such as wood, brewery waste, potatoes, cheese whey, paper waste, beets, or vegetable waste.

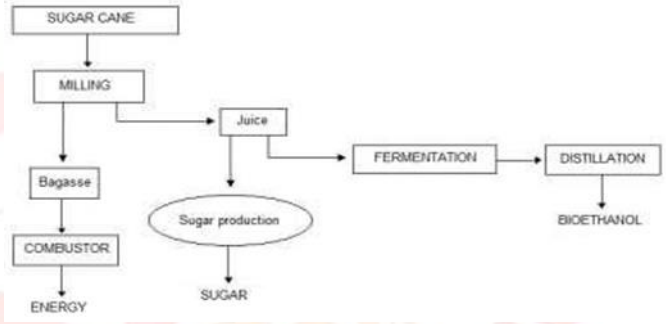

Fig 2. Production of Bioethanol

This gives an account of the advantages of ethanol blending in convene petrol like another substituted such as ethanol. Ethanol's vapour pressure is lower than that of petrol, resulting in lower evaporative emissions while its flammability is also much lower than that of petrol, reducing the risk of vehicle catching fire. In addition, there is no gum formation associated with ethanol, and anti-oxidants and detergent additives are not requirements. Ethanol blending in petrol is an effective way of increasing domesticate petrol unavailable and for that, all-round efforts need to be made to increase ethanol production Bio-fuels have caught globalization attention in the last decades. They are renewable liquid fuels made from biological raw materials and have proved to be good substituting for petroleum in the transporter sectors. Being environmentalist friendly, biofuels like ethanol and bio-diesel can help us to conformists to stricter emission

norm. Globalization, several policy have given a fillip to bio-fuel production, leading to an increase in ethanol and bio-diesel outputs.

IV. Research Gap

RG-1: invariable Compression ratios VCR engine is relatively a new conceptualize, which is still in its nascent phasing. In the past, several methodical have been proposed to accommodating the conceptualize of VCR engines. Some of them concentrates on changing the cylinder head and piston geometries, and a few others variable the arrangement of the crankshaft and connecting rod of the cylinder. Some of the methodical in the literature include the movable cylinder block, use of eccentric bearings for crankshaft and connecting rod and use of adjustable lever rod between the crankshaft and connecting rod. In this study we are achievable various compression ratios using the handwheel which operates the screw holding the auxiliary piston is provided with holes circumferentially along with the locking plate. The bolts used for locking the movement of the screw are loosened and the handwheel is operated. A scale with the compression ratios directly marked is provided for indicative compression ratios.

RG-2: In the past, research have tried to disestablishing the relationship between the engine and its operating conditions such as load, power and torque outputs. Apart from these characteristic parameter, it was unfounded that the use of alternatively fuels with better octane rating would improve efficiency and emissions. It was reported that better blending capabilities and anti-knock characteristics of alcohols make it a viable alternative fuel for internal Combustion Engine. In this work, we are concentration on biofuel blend as an unanticipated fuel for convene fossil fuels and validate its suitability for IC engines.

RG-3: In the literature, a lot has been discussed on the effect of invariable compression ratios and use of alternatively fuels for Compression Ignition engine but a comprehensively study of the same seems to be lacking. Hence, in the present work, a single cylinder invariable compression ratios internal Combustion Engine was tested with a biofuel blend and its performance parameter were compared at different compression ratios.

V. Working Procedure

The Test Rig consists of Four-Stroke Petrol Engine (Air Cooled) to be tested for performance is coupled to Alternator. To facilitate the change in compression ratio, an auxiliary head-piston assembly above the main head has been provided. The auxiliary piston is operated up-down by hand wheel-screw rod assembly to fix the required compression ratio. When the piston is in the bottom most position, the compression ratio is at its maximum value, and in the top most position it is at minimum value of 2. The charge from this initial volume of clearance is determined by the displacement of the piston and thus used for calculation of the compression ratio.

The hand wheel which operates the screw holding the auxiliary piston is provided with holes circumferentially along the locking plate. The bolts used for locking the movement of screw are loosened and the hand wheel is operated. A scale with the compression ratio directly marked is provided for indicating this. After adjusting to the required compression ratio, all the bolts are tightened well before conducting experiment. The rate of fuel Consumption is measured by using Volumetric Pipette. Air Flow is measured by Manometer, connected to air box.

A. SET UP

The preliminary set up is described as follows.

- The Rate of Fuel consumption is measured by using Volumetric Pipette.
- Air Flow is measured by Manometer, connected to Air Box.
- The different mechanical loading is achieved by loading the engine through Alternator and Torque controller synchronized with weighing balance.
- The engine speed is measured by electronic digital meter.
- Temperature at air inlet, engine exhaust gas, engine water inlet and outlet are measured by electronic digital temperature indicator with thermocouple.
- Water flow is measured by water flow meter or Rotameter.

B. PROCEDURE

- Release the locking bolt of the auxiliary piston screw rod assembly.
- Rotate the hand wheel and bring the indicator to the required compression ratio.
- Lock the screw rod assembly before conducting the experiment for the compression ratio selected.
- Open the 3- way cock, such that fuel flows into the engine.
- Supply the cooling water to the engine head.
- Start the engine and allow it to run on load condition for few minutes.
- Apply the load on the engine by operating the Torque controller which is synchronized with Alternator.
- Allow the engine to run at this load for few minutes and note the following readings.
  - ✓ Engine Speed
  - ✓ Energy meter

- ✓ Manometer
- ✓ Time for 50CC of fuel consumption.
- ✓ Various Temperature Readings.

- ➢ Repeat the above mentioned procedure at different loading conditions.
- ➢ Stop the engine after removing load on the engine.
- ➢ Change the compression ratio and repeat the above procedure.

VI. Results And Discussion

The VCR Petrol Engine is operated for different Compression ratio by following the working procedure mentioned in the previous section. In this work we have attempted for Compression Ratio 4, 4.3, 4.67, 5 and 5.5. The results are tabulated in this section.

The SFC v/s BP graph for Compression Ratio 4 and 4.67 are accordance with SFC increases with increase in BP, but there is slight variation is observed in Compression Ratio 5.5 for E10 blend
The plotted graph depicts that Compression Ratio for 5.5 is showing variation in the graph. Hence the Compression Ratio 4 and 4.67 satisfies with the standard condition

SFC decreases with increase in brake power, Hence E7.5 is the optimum blend for the SI Engine. The BSFC v/s CR graph for E 7.5 blend is in accordance with BSFC decreases with increase in Compression Ratio

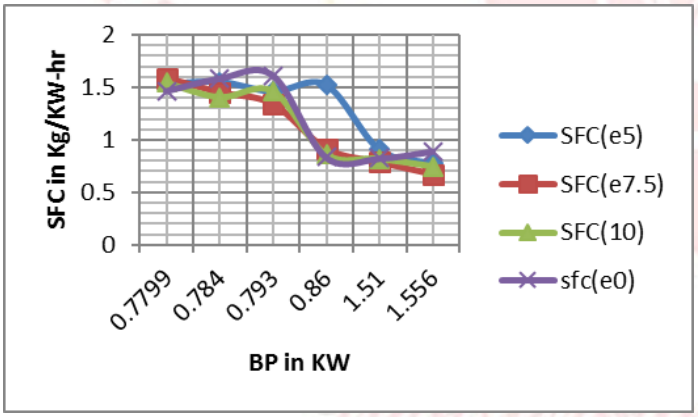

Fig 3. Comparison of SFC with BP for different blends

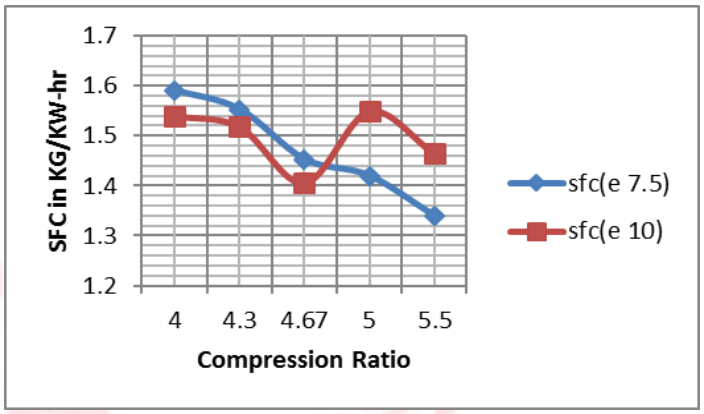

Fig 4. Comparison of SFC with CR for E5 & E10 blends

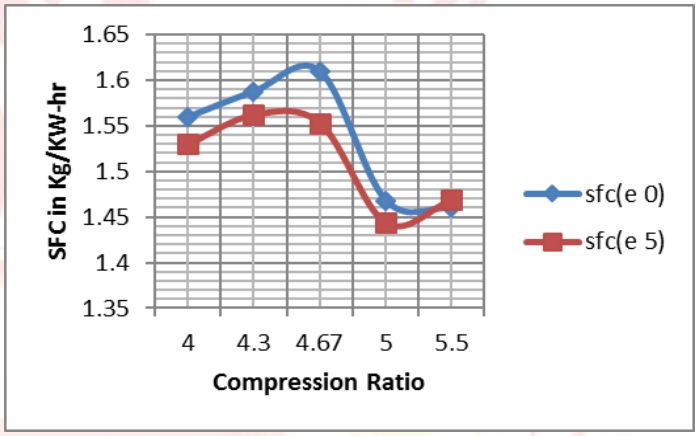

Fig 5. Comparison of SFC with CR for E0 & E5 blends

VII. Concluding Remarks

- Bioethanol blends are quite successful in replacing pure petrol in four stroke spark ignition engine.
- Bio ethanol can be effectively used for blending with petrol.
- The Specific Fuel Consumption increases with increase in Brake Power. This can be seen in the graph.
- The SFC v/s BP graph for E 7.5 blend of bio ethanol with petrol is in accordance with SFC increases with increase in BP, but for other blends this condition was not satisfied. Hence E 7.5 blend is the optimized blend among remaining all other blends
- The Brake Specific Fuel Consumption v/s Compression Ratio graph for E7.5 blend is accordance with BSFC decreases with increase in CR. This clearly shows that 7.5 % bio ethanol blend with petrol is the best blend for SI Engine.
- It shows least brake specific fuel consumption and better engine performance. So from the result it is seen that E7.5 bioethanol blended with petrol is the

best choice for use in the existing Spark Ignition Engines without any modification.

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