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PERFORMANCE OF SI ENGINE USING BLENDING OF METHANOL AND PETROL: A REVIEW STUDY

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Abstract: As single cylinder, small engines have low compression ratio (CR), and they run with slightly rich mixture, their power are low and emission values are high. In this study, methanol was used to increase performance and decrease emissions of a single-cylinder engine. This method is used for increasing the fuel efficiency of a vehicle by adding different percentage of methanol to the petrol and to decrease the pollutants produced during combustion process. Due to the continuously increases in the cost of fossil fuels, demands for clean energy have also been increasing. Therefore, alternative fuels sources are sought to have alternate source for petrol without altering the existing engine or slight changes in the engine at low cost.

Keywords: I.C. engine, Carburetion and Blending, Methanol, Petrol, Compression ratio

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INTRODUCTION

Controlling operational parameters is considered to be practically attractive techniques for reducing the level of CO in spark ignition engine, because it would involve minimum additional cost and maintenance.

In the present work, our objective is to increase the performance of the 150 cc Bajaj Scooter engine to achieve better power and emission characteristics with the latter. Due to the continuously increases in the cost of fossil fuels, demands for clean energy have also been increasing. Therefore, alternative fuels sources are sought to have alternate source for petrol without altering the existing engine or slight changes in the engine at low cost.

In this study, methanol was used to increase performance and decrease emissions of a single-cylinder engine. Initially, the engine whose CR was 7.5/1 was tested with gasoline and methanol at full load and various speeds. According to the results, as the fraction of methanol in the blend increased, the specific fuel consumption increased, and CO, HC emissions decreased. Compared the performance and emissions characteristics of the alternative fuels and gasoline in an SI engine. Their results showed that the engine power and CO emissions decreased, fuel consumption increased when methanol was used instead of gasoline. The concept of blending of methanol with petrol for a SI engine has been implemented successfully to a 350 cc 4 stroke SI engine. (A.N.Basavaraju et. al. 31 march 2013).

In this study, the effect of methanol or butanol addition to gasoline on exhaust emissions and noise level has been experimentally investigated. Results showed that the concentrations of CO and NOx emissions were decreased depending on the higher alcohol contents and the carbon monoxide concentration of gasoline was higher than that of methanol or butanol-gasoline blends for all engine loads. It was determined that content of the HC was decreased at higher engine load but noise level was increased. CO emission concentration of engine operated with methanol-gasoline blend was lower than those of butanol-gasoline blend as the oxygen ratio in blend is 21,62 % in methanol, 50 % in butanol. Methanol which has lower flame temperature compared to gasoline provides better combustion and decreases the NOx and CO concentration. It was found that the most suitable fuels in terms of CO emission were M50 and B50 fuels. Concentrations of NOx emissions were decreased depending on the higher alcohol contents. The content of the HC was decreased at higher engine loads but noise level was increased proportionally. (A. YASAR, 2010).

The effect of methanol-gasoline blends are tested The work described improved engine efficiency with higher compression ratios by using methanol-gasoline blends (mixing-methanol in small proportions with gasoline) as methanol had high anti-knock characteristics. Existing engines were not generally suitable to operate on higher contents of methanol, as the engine needs major modifications. (K Venkateswarlu, M Ramesh, K Veladri,11-13) An experimental investigation of combustion characteristics of higher alcohols/gasoline (UTG 96) blends is presented. The alcohol component of the blends consisted of methanol, ethanol, propanol, butanol and pentanol. The alcohol component of the blends consisted of methanol, ethanol, propanol, butanol and pentanol. Apparatuses used in the present study were a single cylinder spark ignition engine, a hydraulic dynamometer and an exhaust analyzer. The variables that were continuously measured include engine rotational speed (rpm), CO, CO2, HC and NO emissions. During a variable load tests, the results indicate that CO and HC levels in the engine exhaust are reduced with the operation on alcohol gasoline blends. NO emissions with alcohol gasoline blends are higher than with gasoline. (Priyanka A. Taksande, 2013).

Single cylinder and multi-cylinder engine experiments using pure methanol as a fuel show that methanol burns more energy efficient, at leaner air-fuel ratios, and at higher compression ratios without detonation than commercial gasoline. The use of methanol-water blends has been proposed as a means for increasing engine compression ratios while maintaining low nitric oxide emissions. Using the beneficial properties of methanol, estimates of a 20% increase in energy economy are postulated. Although data on the optimum use of methanol in spark-ignition engines is preliminary, the results are encouraging. Methanol blends with gasoline show little or no gains in fuel efficiency. (Richard G. Donnelly, et. al, April 1976).

1. MATERIALS AND METHODS:

Initially the engine is tested using conventional carburetor without blending the petrol. The procedure is as given below.

1. The engine is started and run for few minutes to reach a steady state condition.

2. The engine once it reaches a steady state condition the engine rpm is set and the time taken for consuming a known volume of fuel is measured. This measurement is done under two conditions at constant speed of the engine, At no load Under load.

3. Methanol is blended with petrol & the blend contains 5%, 10%, 15%, 20%, 25% methanol and 95%, 90%, 85%, 80%, 75% petrol respectively (called M5, M10, M15, M20, M25)

4. The power developed by the engine is measured.

2.1 Basic Measurements: Engines are power producing systems. In order to determine their capacities and suitability for applications, it is necessary to measure their levels of performance in meeting various requirements. The important parameters considered for the measurement of performance of the engine are:

2.1.1. Measurement of Speed: An electrical tachometer or a digital tachometer can be used to measure the speed of the shaft. The digital tachometer reading is a linear function of speed of the shaft and is directly indicated in the display.

2.1.2. Measurement of Fuel Consumption: In this the time taken for a known volume of fuel consumption is measured and the fuel consumption rate can be calculated. The fuel consumption rate can be calculated as, Fuel consumption Kg/hr = Xcc * specific gravity of fuel / 1000 * t.

2.1.3. Measurement of Brake Power: It involves the determination of torque and power developed at the engine output shaft. The torque is measured by the hydraulic dynamometer. The hydraulic dynamometer is run by the chain sprocket arrangement provided between the engine output shaft and dynamometer's sprocket. The brake power can be calculated using, Brake power =$2\pi NT$ / 60000 kw

2.1.4. Specific Fuel Consumption: is the amount of fuel consumed per unit of power developed per hour. It is a clear indication of the efficiency with which the engine develops power from the fuel. SFC = (fuel consumed in kg/kW.hr) / (power developed)

2.1.5. Brake Thermal Efficiency: Brake thermal efficiency = brake power / (heat supplied/sec) The readings and results obtained are listed in the table and respective graphs are plotted.

2. RESULTS AND DISCUSSION:

The present work considered methanol blended fuels M-10, M-20 and M-30 (number denotes the percentage of methanol in gasoline) as alternative fuel for four stroke variable compression ratio spark ignition (S I) engine. Experimental results demonstrated that an increase of 48% in brake thermal efficiency had been observed compared to gasoline operation. An increase of 8% in volumetric efficiency was found and a reduction of 24% in BSFC was observed.

At 800 W engine loads, the HC emissions are higher than that of gasoline, when using methanol- gasoline blend and butanol-gasoline blend. As the load increases, the ratio of HC in the emission decreases. Also, HC emission decreases by increasing the % volume of methanol and butanol-gasoline blend. These results are similar to the results of Kim et al., Taylor et al. The dramatic decrease occurs at 50 % of methanol and butanol-gasoline blends for 2400 W engine load.

CONCLUSION:

The concept of blending of methanol with petrol for a SI engine is to determine the performance of engine at various proportions of methanol and petrol to get the efficient performance at minimum cost. as per review study for no load and at different loads maintaining the speed of the hydraulic dynamometer at a constant value of 240-260 rpm throughout the test and the engine produced a maximum power of 7.65kW, at an engine speed of 1330 rpm. Since the engine is old, the power output is very low as compared to its rated power of 13 kW at 5600 rpm. Testing this engine for higher speed has resulted in uncontrollable vibrations. Therefore loading has been done to generate a maximum power of 7.65 kW and speed being 1330 rpm. The comparative test result has obtained from figures indicate a slight improvement in performance when engine is working with methanol Blended Petrol.

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