

EXPERIMENTAL INVESTIGATION OF EMISSION CHARACTERISTICS OF DUAL FUEL SI ENGINE

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Abstract

Dual fuel engines are engines which are capable of running by taking two fuels. On the spark ignition engines, one of the fuels is gasoline, and the other is an alternate fuel such as LPG. The two fuels are stored in the separate tanks and the engine runs on one fuel at a time. Dual fuel engines have capability to switch back and forth from gasoline to other fuel manually or automatically. A dual fuel engine kit consists of carburetor, gate valve, LPG reducer, LPG tank and fuel tank. This project deals with the fabrication of dual fuel engine and practical experimentation of emission character. After fabricating the engine with the kit other accessories were fabricated. When the set up is done, And the emission test for both fuels is also done. Then we need to compare the results and conclude on the effectiveness of the individual fuels and advantages of using the dual fuel engine.

Keywords – Alternate fuel, Emission, Gasoline and LPG

I. INTRODUCTION

The operation of dual fuel engine is mainly focused on emission characteristics of engine and specific fuel consumption. Dual fuel engine reduce emission of pollutants (such as CO_x, NO_x, HCs etc.) during exhaust after combustion of fuels and specific fuel consumption. Dual fuel engine is operated with a primary fuel and a secondary fuel. petrol is used as primary fuel and L.P.G., N.G. and Hydrogen are used as secondary fuel. Secondary fuels are used in gaseous form, so secondary fuel is pre-mixed with intake air, this mixture is lean and ignition of this charge is accomplished by injection of small amount of primary fuel. In dual fuel operation a small amount of gaseous fuel releases higher energy during combustion.

II. RELATED WORK

1.A. Hemnath and E. BrittoSebastiraj suggested that In the last few years, environmental impact and price rise of the petroleum based fuels have increased. For these perfect alternative, electric vehicles are much preferred commonly around the world. Now transient period of conventional vehicles to electric vehicles have started. Dual-mode vehicles are electrically powered and conventional internal combustion engine run in dual-mode for power too. Using batteries for electric drive and reciprocating engine for conventional drive either one can be operated at a time and this can be switch manually according to the application requirement. The Motorcycle with combination of IC engine and electric motor will provide a good start for electric vehicle usage by the consumers. This method of dual operation in two wheelers reduces running cost and environmental impacts. In this present paper shows dual operation of a two wheeler with mode-1 by conventional IC engine drive and the mode-2 is an electric drive

consisting of a DC motor fixed on the front of the vehicle powered by a 12V battery placed above the motor. The power from that DC motor is transmitted to the rear axle shaft with a special pulley with belt drive transmission to drive the vehicle. This power can be restored to the battery with an alternator. The motor speed is controlled through a Rheostat Control Method.

2. Neelanchal Hanta, et al Dual Fuel Engines are engines which have capable of running by taking two fuels. On internal combustion engines, one of the fuel is gasoline, and the other is an alternate fuel such as natural gas (CNG), LPG, or hydrogen etc. The two fuels are stored in separate tanks and the engine runs on one fuel at a time. Dual Fuel Engines have the capability to switch back and forth from gasoline fuel to the other fuel, manually or automatically. A dual fuel engine kit consists of Adapter, Shutoff valve, gas injector, porting tool, pressure regulator, coalescing filter and Actuators. This project deals with fabrication of dual fuel engine and practical experimentation on efficiency and working operation of Dual Fuel Engine and implemented it in a 2-wheeler motorbike engine. After fabricating the engine with the kit, other accessories were fabricated. When the set up is done, we need to carry out performance test by first taking petrol as a fuel and then taking LPG as a fuel. Then, we need to compare both the results and conclude on the effectiveness of individual fuels and the advantage of using the dual fuel engine.

3. Juan Carlos Cando Comino, et al explained Road transport is still an essential part of the transport around Europe and has tremendous importance for all EU citizens. Unfortunately, also is one of the major contributors to air pollution and climate change. Much research into methods of reducing gas emissions is being carried out because of concern over high levels of pollutants in vehicular exhaust gas, and associated government regulations specifying limits on them. Research has been directed into novel engine configuration, thermal and catalytic reactors for oxidation of pollutants, as well as alternative fuel systems. The aim of this project titled "Investigation of Knock limits of Dual Fuel engines" was the evolving of a system to utilize alcohol as alternative fuel in a dual fuel engine. For this purpose a dual fuels diesel engine was developed. A short review about this kind of engine and the engine knocking concept, the required modifications, the evolved system and the experimental results are presented in this article. Exhaust gases are investigated, where compared with the conventional diesel engine HC, NO_x, CO and CO₂ emissions were decreased. Nevertheless, not only methanol was used as primary fuel in the dual fuel engine, in order to compare the use of more fuels gasoline was also used in the same dual fuel engine giving worse results than this kind of alcohol. Furthermore, an investigation about the knock limits on this kind of engines was done, where the experiments showed that alcohols, methanol in this case, had a better resistance to this not wanted combustion phenomenon, which make shorter the engine durability, than gasoline.

4. Aman Sharma In, et al explained the dual fuel bike the driver is able to switch the fuel system used in vehicle as per the requirements and performance. LPG powered motorcycle is not the new technology it is the established technology and developed few decades ago. But there isn't a readily available kit that someone can retrofit to their existing bike. Similarly, petrol powered bike is also a technology that has already been developed. Because of the size restrictions, future component may need to be custom made to cut down their sizes, therefore this prototype may need to be setup as a bench mount to prove of concept. By this project the actual result difference can be calculated for both the fuels and it also helps to decide which fuel is more suitable for different purpose.

5. kunal Bankhile, et al Today's Energy Hungry World is consuming non-renewable sources of energy such as fossil fuels at alarming rates, which has increased the importance of developing renewable energy sources. Biomass is one such source of renewable energy which is abundantly available in India in the form of industrial and agricultural by-products. In this project we aim to contribute in a small way to this changing face of sustainable energy resources by designing and fabricating a downdraft gasifier using two sources of biomass viz. rice husk and wood pellets. The syn-gas subsequently produced would be used to run an I.C. Engine and a performance analysis would be conducted.

III. OBJECTIVES

- Reducing the running cost of the vehicle by using the cheaper fuel engine in the engine.
- Avoiding emission of the engine by burning a clean fuel in the engine.
- Increasing the engine running life.
- Preventing scarcity of non regenerative fuels by reducing their uses.

IV. WORKING PRINCIPLE

The gate valve connected to the petrol flow line is initially opened and the engine is started with the help of petrol and makes it operate to reach the normal running temperature. Whenever the fuel is completed or for reducing the usage of fossil fuel, the gate valve placed at the flow passage of petrol is closed and the gate valve for LPG flow is held open. LPG or auto gas contained in a special tank is sent to the reducer or vaporizer which reduces the pressure of LPG and also controls its state from liquid to vapour form. The pressure is reduced with the help of the reducer. Thus the vapour from of LPG is mixed with atmospheric air inside the carburettor and the fresh charge is passed to an engine for its activation. Thus the activation of engine is performed by the LPG.

V. DIAGRAM

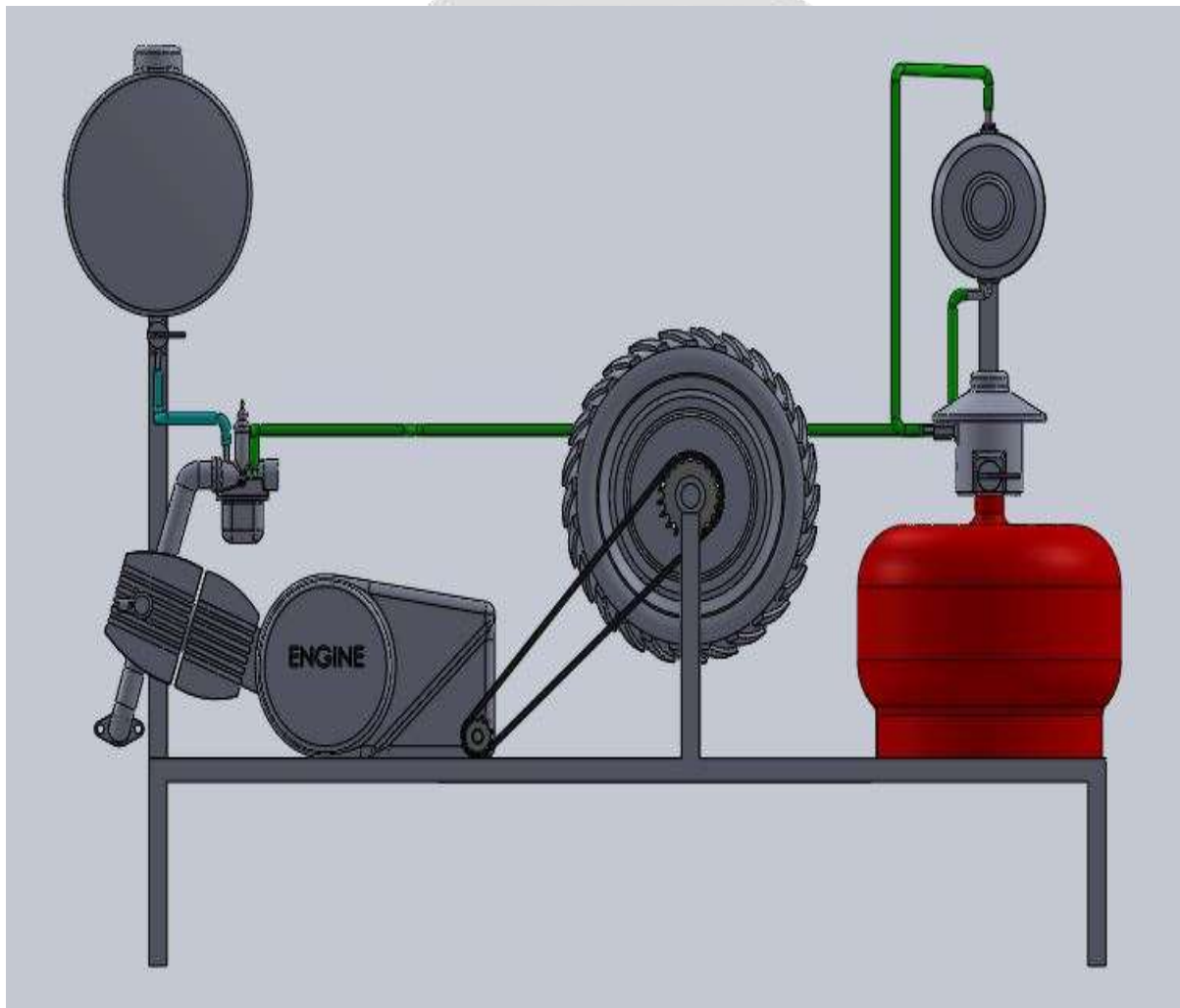


Figure 1. 3D Diagram

VI. DESIGN CALCULATION

Type	Air cooled, 4 - stroke single cylinder OHC
Displacement	97.2 cc
Max. Power	6.15kW (8.36 Ps) @8000 rpm
Max. Torque	0.82kg - m (8.05 N-m) @5000 rpm
Max. Speed	87 Kmph
Bore x Stroke	50.0 mm x 49.5 mm
Carburettor	Side Draft , Variable Venturi Type with TCIS
Compression Ratio	9.9 : 1
Starting	Kick / Self Start
Ignition	DC - Digital CDI
Oil Grade	SAE 10 W 30 SJ Grade , JASO MA Grade
Air Filtration	Dry , Pleated Paper Filter
Fuel System	Carburetor
Fuel Metering	Carburetion

VII. AFTER MODIFICATIONS



Fig 2 After Modification Engine

VIII. CONCLUSION

Dual fuel four stroke SI engine experimental setup has been fabricated and experimental investigation of the emission characteristic of the Dual Fuel SI Engine has been studied experimentally. The experimental results for the dual fuel engine shows that the LPG reduces the emission when compared to gasoline.

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