International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 7, Issue 6, June 2017)

Design & Analysis of LPG Gas Kit for Two Wheeler

Preetesh Saxena
Faculty of Mechanical Engineering, MCSCET, LKO, AKTU,

***Abstract*-- An attempt has been made in this project to use alternative fuel in IC engine & to use non conventional fuel against conventional fuel which is becoming scare and costly now days, as non conventional fuel will lead to less polluted air than conventional fuel. It is also good with regard to economical considerations and engine efficiency. In this project study is done by installing a LPG fuel system to four stroke vehicle where in we can use both gasoline and LPG as a fuel. The alternations are made to install LPG in the vehicle & its effects are studied & discussed. For lower speeds, LPG is suitable for vehicle but gasoline is suitable for higher speed operation .So ,there combinations are studied as fuel supply which can be suitable for city traffic conditions , in which mostly the mode of operation is low . Using this concept we can control our expenditure in buying of fuels.**

I. Introduction

This project studies about duel fuel bike which can be capable of running on two type of fuel i.e. PETROL and LPG. Both can be interchangeable in running condition. It means when bike is running on petrol then we can change the fuel system i.e. from petrol to LPG or vice a versa. Petrol gives high power and LPG gives better millage and is also eco-friendly. So it gives advantages of both. Dual-Fuel Bike: DUAL-FUEL term itself suggest us that the using of two fuel in a system. In this dual-fuel bike, study is done to run a bike on two fuels i.e. LPG and PETROL.

Usually a bike normally runs on a petrol fuel in some cases diesel powered bikes are also available in markets, but the problem is that these fuel's resources are in the danger of scarcity and also burning of these fuels raises global warming, which is also a great threat to the entire world. Running a bike on LPG and Petrol combination from which we can actually select what we want i.e. POWER or EFFICIENCY. Although we can run the bike entirely on LPG as we can see in the recently available BS4 pollution control BHARAT norms rated cars and busses which is capable of running on LPG, but the problem is that we can't put a bigger LPG tank as we have space limitation in bikes.

II. Objective Of This Project

This study has following objectives

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

Difference Between LPG And Gasoline

PROPERTIES/FUEL	GASOLINE	LPG
Chemical structure	C7H17/C4 to C12	C3H8
Energy density	109,000-125000 MJ/Kg	84,000 MJ/Kg
Octane number	86-94	105+
Lower heating value(MJ/Kg	43.44	46.67
High heating value(MJ/Kg	46.53	50.15
Stoichiometric air/fuel ratio	14.7	15.5
Density at 15 degree Celsius	737	1.83/505

III. Emission From LPG And Gasoline

On an energy basis LPG has lower carbon content than gasoline or diesel fuel. When used in spark-ignition engines, LPG produces near-zero particulate emissions, very little CO and moderate HC emissions. Variations in the concentration of different hydrocarbons in LPG can affect the species composition and reactivity of HC exhaust emissions.

CO2 emissions typically are also somewhat lower than those for gasoline due to the lower carbon-energy ratio and the higher octane quality of LPG. NOx emissions are similar to those from gasoline vehicles, and can be effectively controlled using three-way catalysts. The higher the Compression Ratio of an engine, the more efficient is the engine and more is the power generated with given amount of the fuel.

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 7, Issue 6, June 2017)

LPG has high octane rating of 110+ that allows Compression Ratio to be high ie up to 15:1, where as compression ratio is in the range of 8:1 to 9.5:1 in case of gasoline engines.

Assembly Of Gas Bike - To use the LPG as a fuel in 4 stroke bike & to get the system working, the LPG cylinder is placed inside a bag, and hanged on the rear side of a bike.

The LPG converter is fixed under the fuel tank which is placed on right side of the bike. The inlet gas pipe is connected to inlet of the carburetor, and a vacuum pipe is connected to the inlet manifold of cylinder. Interestingly to the methods used in this study are very systematic and involve a lot of practical application of auto technology. The bike studied in this study has following specification:

ENGINE DISPLACEMENT	99. 27 CC
ENGINE TYPE	AIR COOLED , 4 STROKE
NUMBER OF CYLINDER	1
VALVES PER CYLINDER	2
MAX POWER	8.3 PS @ 7500 RPM
MAX TORQUE	8.1 NM @ 5500 RPM
BORE X STROKE	54.0 X 45.0 MM
FUEL TYPE	PETROL
STARTER	KICK

TRANSMISSION

TRANSMISSION TYPE	MANUAL
NUMBER OF SPEED	GEARS 4
FINAL DRIVE(REAR WHEEL)	CHAIN

BRAKES–

FRONT BRAKE	**110 mm DRUM**
REAR BRAKE	**110 mm DRUM**

SUSPENSSION –

FRONT SUSPENSION	TELESCOPIC FORKS SUSPENSION
REAR SUSPENSION	HYDRAULIC ,DOUBLE ACTING SWING ARM TYPE

DIMENSION –

OVERALL LENGTH	1950 MM
OVERALL WIDTH	770 MM
OVERALL HEIGHT	1065 MM
WHEELBASE	1225MM
GROUND CLEARANCE	150MM
KERB WEIGHT	109KG
FUEL CAPACITY	9.3 LIT

Major Component of bike –

1. Engine
2. Spark plug
3. Clutch
4. Gear
5. Suspension
6. Brake
7. Wheels
8. Chain
9. Exhaust
10. Electronic devices

Major Component Used In LPG Kit

1. GAS CYLINDER 2. VAPORIZER 3. HOSE PIPE 4. CARBURETOR

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 7, Issue 6, June 2017)

ARRANGEMENT OF KIT IN BIKE –

Fig - 1

The figure (Fig -1) shows the top view of the gas cylinder positioned in the bike under study. The connection of the gas supply pipe and regulator is shown in the figure.

Fig -2 Fig shows how hose pipe connected with carburetor.

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 7, Issue 6, June 2017)

Difference Between Combustion Of Petrol And Combustion Of LPG Gas

PETROL	LPG
CALORIFIC VALUE 43000 KJ/KG	CALORIFIC VALUE 46100 KJ/KG
FLAME SPEED 52-58 M/S	FLAME SPEED 48 M/S
UPPER FLAMMABILITY IN AIR 7.6 %	UPPER FLAMMABILITY IN AIR 74.5 %
LOWER FLAMMABILITY IN AIR 1.3	LOWER FLAMMABILITY IN AIR 4.1
OCTANE NUMBER 85-98	OCTANE NUMBER 105 +
SOME TIMES MORE THAN 1 SPARK PLUGS ARE USED FOR EFFICIENT BURNING OF FUEL	NO NEED OF MORE SPARK PLUGS IN CYLINDER.
KNOCKING OCCURS	KNOCKING RESISTANCE
POSSIBILITY OF DETONATION	LESS POSSIBILITY OF DETONATION
PETROL ENGINE ARE NOT SO SMOOTH AT A TIME OF COMBUSTION	LPG ENGINES ARE SMOOTH AT A TIME OF COMBUSTION
PETROL PROVIDE MORE POWER AFTER COMBUSTION OF FUEL	LPG PROVIDE LESS POWER AFTER COMBUSTION OF FUEL
PETROL HAS ODOUR OR IT SMELL BADLY	. LPG IS ODOURLESS OR IT HAS NO SMELL. BUT DUE TO IDENTIFIED LEAKAGE ETHYL MERCAPTAN ADDED IN IT WHICH ALSO SMELL BADLY.

Changes Made For Combustion Of LPG Gas –

In this study one simple thing that is added, is a additional small metallic leak proof box which is fixed with the carburetor .The main purpose of this box is to provide LPG gas into the carburetor after that it goes to the combustion chamber.

The hose pipe is connected with the vaporizer at one end and another end is connected with metallic box, this box is very small in size and cannot produce any kind of bad effect on combustion process. No changes are encountered in actual bike engine & the combustion process is similar as combustion of petrol. For using LPG gas to run the bike firstly petrol fuel supply is switch off and with the help of regulator s flow of LPG gas is started inside cylinder. One additional vaporizer is used to convert the LPG gas into vapor form .The vaporizer is fix outside the engine and placed above the foot rest as shown in fig .

Fig-3 vaporizer

FUEL COMBUSTION DETAIL -

	price	Avg/litre	Distance travel in Rs 1
PETROL	70	35-40	0.571 km
LPG	41	60 -65	1.585 km

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 7, Issue 6, June 2017)

EFFICIENCY OF THE ENGINE –

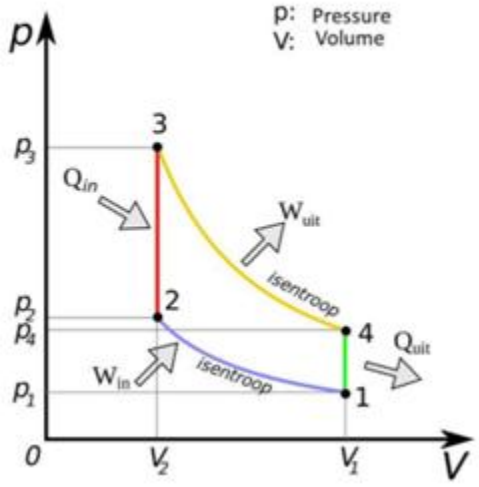

Fig -4 P-V Diagram Of Cycle

Here,

T1 = 35℃ = 308 K

P1 =0.1 MPA = 100 KPA

T3= 1100℃ = 1373 K

r = V1 /V2 = 9

Process 1-2 is isentropic –

P1 /P2= (V1 /V2) ^{r}= (9)1.4 = 21.67

Hence [P2 = 2167 K Pa]

T2 /T1 = (V1 /V2)$^{r-1}$ = (9)$^{1.4-1}$ = (9)$^{0.4}$

T2 = 2.408* 308

T2 = 741.7 K

For process 2-3 –

P2V2 /T2 = P3 V3 /T3

P3 = T3 P2 /T2

P3 = 2167*1373 / 741.7

P3 = 4011.4 KPa

Process 3-4 is again isentropic-

T3 /T4 = (V4 /V3)$^{r-1}$

= (9)$^{0.4}$ = 2.408

T4 = 1373/2.408 = 570.18 K

Heat input –

Q_{in} = CV (T3 – T2) = 0.718(570.18-308)

Q_{out} = CV (T4–T1) = 0.718(570.18-308)

Q_{out} = 188.24 KJ/KG

Net work output - Wnet= Qin – Qout= 453.2 – 188.24

W_{net}= 264.96 KJ/KG

Thermal efficiency - ηthotto = W_{net} / Qin = 264.96/453.2

= 0.58 = 58%

Otto cycle thermal efficiency – η = 1 – 1/r $^{\gamma-1}$ = 1 – 1/(9)$^{0.4}$

= 58%

AMOUNT OF SAVING DONE

Petrol	**LPG**
In RS 100 of petrol we travel 57 Km	In RS 100 of LPG we travel 158 km

So here we see that we can travel 100 km extra by using LPG in two wheeler, so it can save our money also.

International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 7, Issue 6, June 2017)

IV. Conclusion

The whole summary of this study is done by comparing & analyzing working of a four cylinder car engine kit with a kit on a bike & this study has made possible to work on present bike by changing carburetor inlet with an mixer of lpg or fuel injected engine. It is a complicated task to reconfigure the kit, but this study has successfully reconfigured the kit and hence made it possible to successfully run an single cylinder S.I. engine bike.

Study suggests to manufacture LPG tank which can be easily fitted in the Bike & it must store enough LPG so that average travel can be done on the bike in one refill.

Limitations

The study found some of the limitations such as:

1. Less LPG refueling stations.
2. Rural areas don't have Natural gas filling stations.
3. Small LPG tank.
4. Cost for conversion of bike is high.

Although this project has some limitations, but those limitations can be avoided by implying a company fitted LPG kit bike. This will reduce the cost of the LPG conversion and company can fit a bigger LPG tank in better place rather to install it in the bag. If the company fitted LPG kit bike will be available in the future, it will demand more Natural gas stations for refueling them, which force government to increase the number of natural gas fueling station

The scope of this study is to minimize overall running cost of the Bike and making it useful for daily use by reducing its cost & also to reduce the Harmful Emissions and decrease the danger of ozone depletion by utilizing a clean fuel in our bike engine.

There are also some other features of this study on LPG bike, which are:

1. Low running Cost.
2. Increase in total run of bike in one refill.
3. Low Emissions.
4. Decrease in maintenance.
5. Increase in engine life.
6. Less wear and tear in piston cylinder.
7. Cold starting Improves.

Daly Usage Of Bike Gives The Following Results:

1. On daily usage, normal person rides a bike for 50km.
2. Recent price of Petrol= 77rs/ltr and LPG=50rs/ltr.
3. Normal mileage of 150cc, for Petrol- 55km/ltr , LPG-50km/ltr (Theoretically)
4. Calculating monthly running cost (for daily 50 kms)
5. LPG & Petrol – Rs 1785
6. Petrol- Rs 2100 Saving of Rs 315/-(Savings depends on the LPG usage with respect to Petrol)

V. Future Scope

In this revolutionary time where technology is drastically changing every day, Automobile sector is also developing, growing and changing. Nowadays Fuel-Injection bikes are coming into markets which give proper air-fuel ratio and instant throttle response whenever required without wasting petrol. By using those technologies study suggests that this project can also be made more efficient. . This study proposes two fuel-injectors in single cylinder bike, one for petrol and other for LPG. Study suggests to set the ECU in such a way that when we throttle our engine ECU uses petrol injector to fuel our engine with petrol and on cruising condition where low torque is required our ECU commands LPG fuel to supply LPG into Cylinder .By this arrangement our Fuel supply can become dynamic and in the traffic conditions lot of fuel can be saved.

REFERENCES

[1] http://en.wikipedia.org/wiki/LPG_powered_bikes
[2] http://www.elgas.com.au/blog/453-the-science-a-properties-of-lpg
[3] http://www.total.co.in/lpg-b2c/know-more-about-totalgaz-b2c/lpg_properties.html
[4] http://gazeo.com/up-to-date/news/2012/The-pros-and-cons-of-autogas-systems,news,6603.html
[5] http://www.mijoautogas.co.in
[6] http://www.amazon.co.uk/Gas-Installation-Technology-R-Treloar/dp/1405189584-Gas Installation Technology Paperback – 13 Apr 2010 by R. D. Treloar
[7] http://www.bdlive.co.za/business/trade/2014/08/15/commission-releases-amended-terms-for-lpginquiry
[8] Thirumal mamidi1, Dr. J.G. Suryawnshi, Investigations on S.I. Engine Using Liquefied Petroleum Gas (LPG) As an Alternative Fuel, Issue 1, Jan-Feb 2012, pp. 362-367
[9] Performance and Emission Characteristics of SI Engine using LPG-Ethanol Blends: A Review: Ashish S. & Lanje Prof. M. J. Deshmukh,. ISSN 2250-2459, Volume 2, Issue 10, October 2012)
[10] Automobile Engineering Volume 1, By Kripalsingh.
[11] Automobile Engineering Volume 2, By Kripalsingh.
[12] Automotive Mechanics, By William H. Crouse.
[13] Zhou yi1a, Liu jian1b et al., (2007). "Study and Design for Single Fuel Lpg Vehicle", Journal of agricultural mechanization and research-02.
[14] Jin wook lee, S.I. Kweon et al., (2010), "Effect of various LPG supply systems on exhaust particle emission in spark-ignited combustion engine" International Journal of Automotive Technology, 11(6).
[15] YANG Lihong, (2003), "The Application of LPG on the Automotive Engines" Journal of ActaArmamentarThe Volume of Tank, Armored Vehicle and Engine.

[16] WANG Zhen-suo and LIU Xun-jun, (2004). Study of the,"Timing on Characteristics of Particulate Emissions for LPG and Gasoline Fuels" .

[17] Wang Xue-he and Huang Zhen, (2004). Experimental Study on, "Emission of LPG Engine and Vehicle with Electronic Multi-point Continuous Injection System".

[18] K.F.Mustafa, H.W.Gitano-Briggs, "LPG as an alternative fuel in spark ignition engine," vol. 24 pass 1179-1194, 2004.

[19] Kihyung Lee, JeadukRyu, "An experimental study of the flame propagation and combustion characteristics of LPG fuel," Fuel, vol. 84, pp.1116-1127, 2005.

[20] Syed Yousufuddin, Syed Nawazish Mehdi., "Performance and Emission Characteristics of LPG-Fuelled Variable Compression Ratio SI Engine" Turkish J.Eng. Env.Sci. vol.32, pp.7– 12. 2008.

[21] Manpreet Singh, Ankit Sharma, SumitKanchan and Sumeet Sharma, "Analytical Study of 24. Exhaust Pollutants, Fuel Consumption and Available Fuel Consumption Reduction

[22] Technologies For Petrol and Diesel Vehicles – A Review" International Journal of Mechanical Engineering & Technology (IJMET), Volume 5, Issue 9, 2014, pp. 347 - 360, ISSN Print: 0976 – 6340, ISSN Online: 0976 – 6359

[23] Arjun Chopra and Gandhi pullagura, "Performance Optimization And Emission Reduction of A Diesel Gen-Set Using Dual Fuel Diesel-Lpg Controller" International Journal of

[24] Mechanical Engineering & Technology (IJMET), Volume 3, Issue 2, 2012, pp. 817 - 828, ISSN Print: 0976 – 6340, ISSN Online: 0976 – 6359