

Emission Analysis of Two Stroke Single Cylinder Petrol Engine using Four Spark Plug

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Abstract— In conventional two stroke engine, power is delivered by igniting the charge (Air+Fuel) by the spark plug. when the compression of charge is near about to finish with help of piston approaching to Top dead center(TDC) at that time spark jumps between the electrode of spark plug which ignite the charge. Due to the design of combustion chamber and other factors like, rich mixture, lean mixture, turbulence, complete combustion of fuel is not achieved and result in power losses, increasing in temperature of cylinder, piston etc and produces the exhaust emission. In two-stroke single cylinder petrol engine if four spark plugs is used to ignite the fuel than we can achieved the complete combustion of fuel which is not achieved by using single spark plug as mono spark plug provide less spark. The complete combustion of fuel leads to reduction in exhaust emission like hydrocarbons (HC) carbon monoxide (co)and oxides of nitrogen (NOx).

Key words: IC engine, 2-stroke engine, 4-spark plug, emission, exhausts gas analyzer

I. INTRODUCTION

Fuels used for automobile engines are compound of hydrogen and carbon. All the hydrocarbon based fuel releases the harmful byproducts (like HC,CO and NOx) if incomplete combustion of that fuel takes place. If complete combustion of fuel takes places in the combustion chamber than the normal byproducts are H₂O, CO₂ and N₂ which is not directly harmful to atmosphere and human health. Due to designing limitation of engine combustion chamber there are fewer chances to complete avoidance of these harmful byproducts after the combustion. However reduction and control of harmful gases emission is possible to achieved. Current motorcycle and scooter engines have a single spark plug that ignites the air and fuel mixture inside the combustion chamber. As a result, most two stroke engines motorcycle have a certain degree of unburned air-fuel mix, since the flame front arising from the sparkplug does not reach all the area of the combustion chamber. This loss of unburned air-fuel mix leads to lower power and fuel efficiency.

The four spark technology is the result of slight change of design in ports positioning and this ignition technique gives instant throttle response, which is so needed for a power bike. The usage of these technologies ensures rapid combustion of the fuel in the combustion chamber, lower emissions and thereby an increase in the fuel efficiency.

II. TYPES OF EXHAUST EMISSION

A. Hydrocarbon (HC):

The amount of HC is closely related to,

- Induction system and combustion chamber design
- Air-fuel ratio, load, and speed

- Idling, running and accelerating
- When the mixture supplied is rich or lean; the flame propagation becomes weak which causes incomplete combustion and result in HC emission.

B. Carbon monoxide (CO):

If the oxidation of CO to CO₂ is not complete, CO remains in the exhaust. Petrol engine exhaust can be made free from CO by operation at Air-fuel ratio higher.

C. Oxides of nitrogen (NOx):

Oxides of nitrogen occurs mainly in the form of NO and NO₂ and are generally formed at higher temperature. The maximum NOx levels are observed with Air-fuel ratios higher than the stoichiometric. More air than this reduces peak temperature and therefore NOx concentration falls, even free O₂ is available.

III. EXPERIMENTAL SETUP

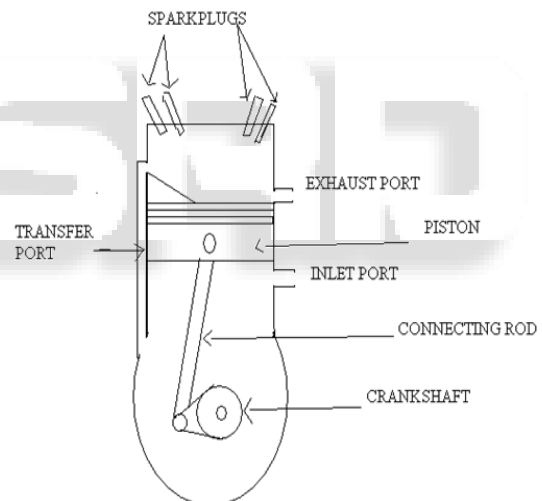


Fig. 1: Experimental Set up

IV. RESULTS

A. By using Mono Sparkplug:

CO & HC LEVEL AT IDELLING(% VOLUME) (ppm)				
FUEL	PRESCRI BED STANDA RD CO	MEASU RED LEVEL CO	PRESCRI BED STANDA RD HC	MEASU RED LEVEL HC
PETR OL	4.50	0.14	9000	584

Table 1: By using mono sparkplug

B. By using Twin Spark Plugs:

CO & HC LEVEL AT IDELLING(% VOLUME) (ppm)				
FUEL	PRESCRI BED	MEASU RED	PRESCRI BED	MEASU RED

	STANDA RD CO	LEVEL CO	STANDA RD HC	LEVEL HC
PETR OL	4.50	0.13	9000	337

Table 2: By using twin spark plugs

C. By using Triple Spark Plugs:

CO & HC LEVEL AT IDELLING(% VOLUME) (ppm)				
FUEL	PRESCRI BED STANDA RD CO	MEASU RED LEVEL CO	PRESCRI BED STANDA RD HC	MEASU RED LEVEL HC
PETR OL	4.50	0.01	9000	31

Table 3: By using triple spark plugs

D. By using four Sparkplug:

CO & HC LEVEL AT IDELLING(% VOLUME) (ppm)				
FUEL	PRESCRI BED STANDA RD CO	MEASU RED LEVEL CO	PRESCRI BED STANDA RD HC	MEASU RED LEVEL HC
PETR OL	4.50	0.01	9000	0

Table 4: By using four sparkplug

Note: Above result is taken by Electrical Exhaust gas analyzer

V. CONCLUSION

Single cylinder four stroke petrol engine equipped with four spark plugs provide effective spark into the combustion chamber for smooth completion of combustion process. It reduces the amount of pollutant and effective scavenging of combustion chamber by fresh charge for smooth operation of engine. Moreover it keeps clean the combustion chamber, valves and spark plugs as most of fuel burns in combustion chamber. Hence it can be concluded that the application of these technologies in the present day automobiles will give more power, less fuel consumption and lesser the harmful emission.

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