Experimental Investigation Work of Diesel Engine by Developing Combustion Chamber Geometry

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Abstract

Morden internal combustion engines must meet high emission standard including better performance and fuel economy. An increased diesel engine population has created pressures on controlling diesel PM and NOx emissions. EGR to control NOx emissions by reticulating exhaust gases back into the combustion chamber to be burned a second time, thereby reducing emissions associated with health risks and also change in combustion chamber geometry to reduce exhaust emission. Major emissions from a diesel engine are NOx, SOx, CO and particulate matter (PM), amongst these pollutants CO and sox and some quantity of particulate matters are reduced by some after treatment methods, improve combustion chamber geometry etc.

Keywords: BSFC-Brake Specific Fuel Consumption, BTDC-Before Top Dead Centre, ATDC-After Top Dead Centre, IVO-Inlet Valve Open, IVC-Inlet Valve Close, EVO-Exhaust Valve Open, EVC-Exhaust Valve Close

I. INTRODUCTION

A. Carbon Monoxide:

CO A gas formed by the incomplete combustion of carbon containing fuels. The more efficient the combustion processes the lower the emissions.

B. Nitrogen Oxides:

NOx All combustion products in air produce oxides of nitrogen: nitrogen dioxide (NO2) and nitric oxide (NO) – collectively known as NOx. Road transport accounts for about 50% of total emissions, more than the electricity supply industry and the industrial and commercial sectors put together. NOx is also a precursor of ozone and therefore an indirect greenhouse gas.

C. Particulates:

PM10 Particulate matter smaller than 10 microns (10 millionths of a metre). They consist of primary particles arising from combustion sources (mainly road transport); secondary particles (mainly sulphate and nitrate formed by atmospheric chemical reactions); and coarse particles (suspended soils and dusts, sea salt, biological particles and particles from construction work).

D. Hydrocarbon (HC):

Hydrocarbon emissions in the exhaust gases can be caused by valve overlap, incomplete combustion and ignition system misfiring.

II. TECHNOLOGICAL INNOVATION IN AUTOMOTIVE EMISSIONS CONTROL

Automotive emission-control technologies comprise all technologies that are used to reduce pollutants produced and released into the atmosphere by automobiles. Based on the point of emission, pollutants fall broadly into two categories: tailpipe (or exhaust) emissions (e.g. CO, HCs, NOx, PM) and evaporative emissions. Tailpipe emissions are produced as a by-product in the
(imperfect) combustion of fuels to power the vehicle and are released from the vehicle’s exhaust system. Evaporative emissions are produced as a result of the evaporation of fuel due to heating of the vehicle or release of vapour while refuelling. There are four primary methods used to control tailpipe emissions: increasing engine efficiency, treatment of emissions emitted, increasing vehicle efficiency, or increasing driving efficiency.

III. EXPERIMENTAL SETUP

IV. RESULT AND CONCLUSION

A. Performance and Emission Analysis:

With a view to evaluate the performance parameters, important engine operating parameters such as engine shaft speed in rpm, time in second for 50 ml (41.75 gm) fuel consumption, engine exhaust emissions, and emission parameters such as CO, HC, CO₂, NOₓ were measured. The performance characteristics were determined from their fundamental relations while varying the load on the engine from 10%, 25%, 50%, 75%, 100%. These results are analysed and represented graphically as shown from subsequent figures. The results are analysed and discussed below.

B. Performance Parameters:

Compression of different performance parameter of current piston and new piston with modified combustion chamber of diesel engine

C. Effect of Brake power on Corrected Brake Thermal Efficiency:

The brake thermal efficiency of the engine is the one of the most important parameter for evaluating the performance of the engine. It indicates the combustion behaviour of the engine to a greater extend. The compression of the brake power to brake thermal efficiency of the standard and modified engine is shown in the above figure. It is been noticed that the BTE of the engine increase with the increase in load.
D. Effect of Brake Power on Corrected Brake Specific Fuel consumption:

![Graph showing variation of BSFC with Brake power](image)

Fig. 3: Variation of BSFC with Brake power

From the figure it is shown comparison of the Brake power with respect to the Brake specific fuel consumption. It is seen that brake specific fuel consumption has decrease as the brake power of the diesel engine. From the figure its identify that’s the BSFC of the modified engine has lower compared to the standard engine.

E. Effect of Brake Power on Carbon Monoxide (CO):

![Graph showing variation of CO emissions with Brake power](image)

Fig. 4: Variation of Carbon Monoxide (CO) With Brake Power

Figure Compares the CO emission of engine at varying brake power. It is seen that, CO emission decreases up to half load then after increase CO emission with increase Load. Because of the high temperature and due to high temperature its combustion of the engine has reduces its delay period, and due to modified engine, reduce its heat loss. So, exhaust emission of CO is reduced compare to the standard engine.

F. Effect of Brake Power on Hydrocarbon:

![Graph showing variation of Hydrocarbon emissions with Brake power](image)

Fig. 5: Variation of Carbon Dioxide (CO₂) with Brake power

Figure shows the variation of hydrocarbon exhaust emission for different load with modified engine and standard engine. Hydrocarbon is due to incomplete combustion of carbon compounds in the fuel.
V. CONCLUSIONS

This experimental investigation has been carried out to optimize performance and exhaust parameters of the engine which is modified combustion chamber geometry. For performing this experimental investigation special experimental set up was used. By doing experimental investigation on various fuel injections timing, satisfactory results have been noticed on engine with 10.5º BTDC on the basis of brake specific fuel consumption. The results obtained are as follows:

1) An experimental investigation has been conducted on single cylinder four stroke diesel engine with great concern on exhaust emissions such as CO, HC and NOx.
2) The optimized crank angle for diesel engine is 10.5º BTDC on the basis of brake specific fuel consumption.
3) By Performing modified combustion chamber, emission of NOx is increase compare to normal working combustion chamber but retarding fuel injection timing, NOx value is reduce and CO value is increase.

REFERENCES

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