Global Journal of Engineering Design & Technology

Extended Abstract

Comparative Analysis of Performance Characteristics of CI Engine with and without HHO Gas (Brown Gas)

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Abstract

Internal combustion engine is used in daily life activity. Fossil fuels are primary fuels which are used in IC engines because of increasing consumption day by day its alarming that these will deplete in near future. Researchers in field of inter combustion trying to use alternate fuels to fulfill energy demand of IC engine. Among the others, hydrogen is capturing attention as alternate fuel in engine for proper combustion without smoke as there is no carbon is present in it. In this article, hydroxy (HHO) gas has many excellent combustion properties that can be used for improving performance characteristics of diesel-fired Compression Ignition (CI) engines. Brown gas (HHO) was produced by using the electrolysis process with KOH $_{(aq)}$ as catalyst with stainless steel electrodes in a leak proof plexiglass reactor was presented in ongoing piece of writing. Produced gas is used as supplementary fuel in inlet manifold of engine test bed (modal#TQ200) which has one cylinder, air cooled, four stroke compressed ignition. Performance characteristics of engine were recorded under the same test condition with and without installation of HHO generator. Experimental results were taken over the range of speed from 1950 to 3450 rpm using hydraulic dynamometer at constant

Load condition of torque 2 N-m. Different engine performance parameters were calculated like engine brake power, the brake specific fuel consumption, the thermal efficiency, the mechanical efficiency and the specific fuel consumption with or without HHO gas. The results clearly indicated that engine's brake power, thermal efficiency and mechanical efficiency increased 22%, 47% 24%, respectively while engine's brake specific fuel consumption and specific fuel Consumption (SFC) decreased up to maximum value of 35% and 27% respectively compared with engine operating without HHO generator. Main objectives of this research are to decrease the fuel consumption and increase power and efficiencies of CI engine and successfully achieved as witnessed in results.

Keywords:

HHO gas; CI engine; Mechanical efficiency; Thermal efficiency; SFC.

Introduction

In modern days, energy demands increased due to increase the population of world. Energy demands fulfilled from fossil fuels such as natural gas and petroleum oils but fossil fuels produced harmful gases after burning and have negative impacts on environment. Many scientist and researcher are working on alternate fuel to control emission and better performance of vehicles .The water hybrid system introduces in vehicles that to produce the hydrogen gas as used as a supplement fuel. It is a cleaner system; one that develops supplemental fuel from unlimited resource water. It has distinctive property that is able to remove pollutants from the air during combustion, even decreases the carbon residue within the engine and improves performance of engines. HHO gas is referred as brown gas which is a weekly bonded water molecule in gaseous state 2:1 molar mixtures of hydrogen and oxygen.

To improve the hydrocarbon combustion in CI engine is done by using hydrogen as supplementary fuel in it. HHO gas exhibits properties that make to more reactive than standard hydrogen. Brown Gas can enhance performance and fuel efficiency .Emission and performance of a Skoda Felicia 1.3 GLXi engine was checked out by the series of laboratory experiments with HHO generator. It was concluded that HHO cell

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can be incorporated into engine systems without modification.

Experimental Setup

The engine test bed which was aspirated direct injection diesel engine TQ200 with single cylinders having the total capacity of 232 cc, absolute maximum power of 3.5 kW (4.8 hp) at 3600 rev/ min, Continuous Rated Power 3.1 kW (4.8 hp) at 3000 rev/min and compression ratio 22:1. The schematic diagram of experimental setup is shown in Figure 1 with symbol of main components.

Results and Discussion

HHO gas was used as a supplementary fuel in engine with single cylinder, four strokes but without any modification in this experimentation. Various parameters such as Specific Fuel Consumption (SFC), break power, mechanical efficiency, thermal efficiency, break specific fuel as function of engine speed was recorded and promising results were reported by conducting tests.

Specific fuel consumption and engine speed

The decline in SFC is due to uniform mixing of HHO with air (high diffusivity of HHO) as well as oxygen index of HHO gas which assists diesel during combustion process and yields better combustion. An average decrease of 27% is achieved in SFC by using HHO gas. The improvement in engine brake thermal efficiency for the HHO enriched engine is more evidently seen at low manifold absolute pressure conditions.

Conclusion

The present study has investigated efficiency and performance of CI engine in dual fuel mode with HHO gas in induction air without any modification in design of engine. All data points are carried at least 5 times for each result.

Acknowledgement

Authors are very grateful to Department of Mechanical Engineering CIIT Sahiwal and Bilal Engineering (Pvt) Lahore who provide us a chance to perform some of the experiments with proper guidance.

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