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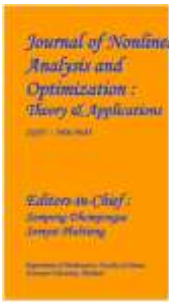

EXPERIMENTAL INVESTIGATIONS ON DICI METHANOL (WITH ADDITIVES) FUELLED WITH CERAMIC HOT SURFACE IGNITION SYSTEM

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ABSTRACT

The concept of using alcohol fuels as alternatives to diesel fuel in CI engines is a recent one. The scarcity of transportation petroleum fuels leads to the recognition of alcohol as a preferable replacement. Methanol is an excellent combustion engine fuel with a high octane rating and clean burning characteristics to be used in SI engines. It is used as a fuel primarily as M85 (a mixture of 85% hydrocarbons) or as neat Methanol, M100 (100% ethanol. It has poor self ignition characteristic; therefore, its use in diesel engines requires a means for providing ignition. For single fuel engines this entails use of a spark plug or Ceramic hot, fuel additive ignition improvers, or enhanced auto-ignition through the use of exhaust gas re-circulation.

The effect of additives mixed in Methanol is studied in the best suited coating Ceramic hot surface ignition engine, in order to get higher performance.

INTRODUCTION

Methanol, the primary emission problem associated with Ethanol is the generation of aldehydes, particularly acetaldehyde. Ethanol fueled vehicles also emit unburned Ethanol; however, the unburned Ethanol is less reactive than the complex mixture of unburned hydrocarbons emitted by gasoline and diesel fueled vehicles. The catalyst control technology developed for the control of aldehydes in Methanol fueled vehicles should be able to be extended to ethanol fueled to solve this problem.

As with Methanol, Ethanol is not well suited for use in unmodified compression ignition engines. It has poor self- ignition characteristics; therefore, its use in diesel engines requires some means for providing ignition. For single – fuel operations this normally entails use of a spark plug or Ceramic hot, fuel additive ignition improvers, or enhanced auto – ignition through the use of exhaust has recirculation. In dual fuel operation, ignition of the Ethanol is insured by use with a fuel having good self – ignition characteristics, such as diesel fuel.

LITERATURE

So far, no established method is available to run a normal diesel engine with a compression ratio from 14:1 to 20:1 by using alcohol as a fuel. This is because, the properties of alcoholic fuel differ from the properties of diesel fuel. The specific tendency of the alcohols to ignite easily from a hot surface makes it suitable to ignite in a diesel engine by different methods. The advantage of this property of alcohols enables us to design and construct a new type of engine called the surface ignition engine.

Use of Ceramic as hot surfaces

The use of alcohols as fuels for IC engines in future, especially in diesel engines, has evoked considerable interest. Alcohols by their very nature do not make good CI engine fuel. But they have peculiar property of igniting over a hot surface at a low temperature in spite of their high elf ignition temperature. It is this tendency of alcohol that has been exploited, in developing the surface ignition engine. Most of the literature available deals with the use of alcohols in surface ignition engines working at diesel engine compression ratios. Almost all the power plants tested are modified versions of diesel engines with facility to accommodate the hot surface apart from the changes in the fuel system to allow greater flow rates.

EXPERIMENTAL WORK

The details of the experimental setup are presented in this chapter. The informations about various components, the modifications or alterations made to them, the instrumentation – adapted etc., are described.The experimental set –up is designed and fabricated keeping in mind, the objectives of the present work. The capacity of the fuel injection pump is increased to enable operation up to the rated output with Methanol and Ethanol, whose calorific value is considerably lower compared to diesel oil on volumetric basis [15]. Various components of the experimental set up, including modification are presented in this Figure.

The valves and the hole for fuel injector nozzle occupied about 35 percent of the total area of the combustion chamber surface and the remaining area was coated with PSZ.

Photo Graphic View of Aluminium Piston with Brass Crown and Air Insulation

Photo Graphic View of Experimental Setup

Results & Discussion Brake thermal efficiency

Figure indicates the variation of brake thermal efficiency with brake power out for six additives of copper piston crown material Ceramic hot surface ignition engine.

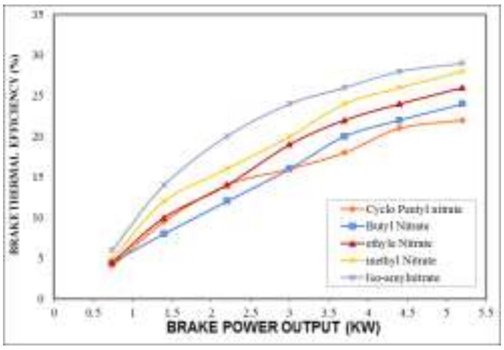

Fig. Comparison of Brake thermal efficiency with power output for five Fuels additives in Copper CHSI Engine.

It is found that the maximum brake thermal efficiency of copper piston crown material Ceramic hot surface ignition engine with Iso amyl nitrate is 33% .

Brake Specific Fuel Consumption

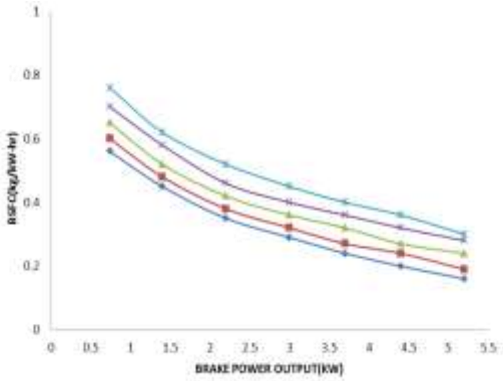

Fig. Comparison of brake specific fuel consumption with power output for five Fuels additives in Copper CHSI Engine.

All the configurations have normal CHSI brake specific fuel consumption compared to base engine. An Copper gives higher bsfc over wide range of operation.

5.3.3 Volumetric Efficiency

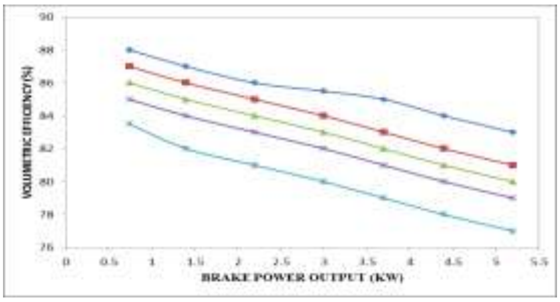

Fig. Comparison of Volumetric efficiency with power output for five Fuels additives in Copper CHSI Engine.

the volumetric efficiency varies from 88% at no load to 85% at full load. With copper configuration the volumetric efficiency comes to 82% at no load and to 75% at full load.

Hydro Carbon Emissions

The hydrocarbon emission levels for the copper piston crown material Ceramic hotsurface ignition engine with different selected additives with brake power output are shown in figure

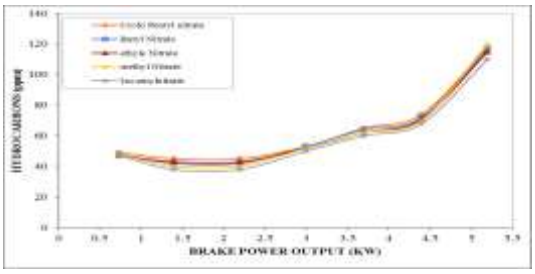

Fig Comparison of Hydro Carbon Emissions with power output for five Fuels additives in Copper CHSI Engine.

The hydrocarbon emission level for all other additives are in between the copper piston crown material Ceramic hot surface ignition engine with Iso amyl nitrate and Alcolita as an additives.

5.3.5 Carbon dioxide Emission

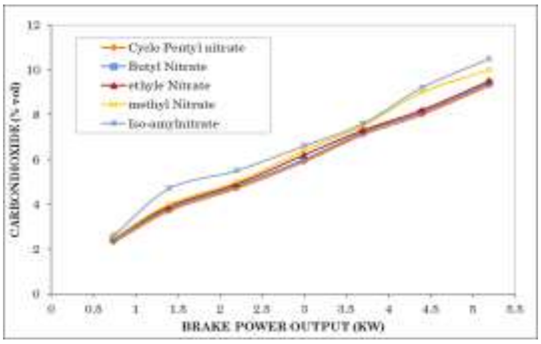

Fig. Comparison of Carbon dioxide with power output for five Fuels additives in Copper CHSI Engine.

It indicates that the level of Carbon dioxide in the exhaust is highest for Copper piston crown configuration. Higher Carbon dioxide in the exhaust is an indication of complete or better combustion.

Carbon Monoxide Emission

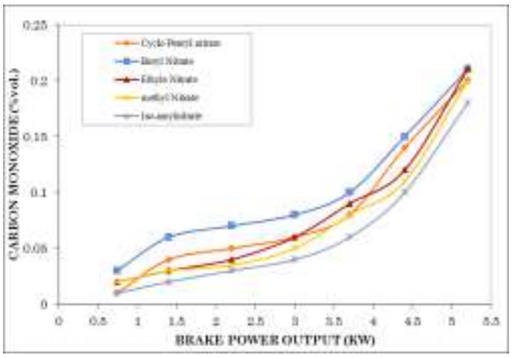

Fig Comparison of CO emission with power output for five Fuels additives in Copper CHSI Engine

The maximum reduction in carbon monoxide emission with copper piston crown material Ceramic hot surface ignition engine with Iso amyl nitrate as an additive is noted as 16% by volume at rated load.

. Nitrogen Oxide Emissions

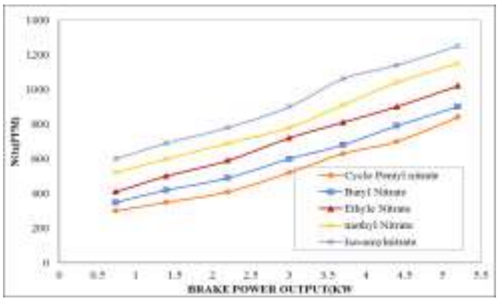

Fig. Comparison of NOx emission with power output for five Fuels additives in Copper CHSI Engine.

Because of better and complete combustion in the CHSI engines, Nitrogen oxide levels are higher for copper. Higher nitrogen oxide in the exhaust is an indication of complete or better combustion.

Exhaust Gas Temperature

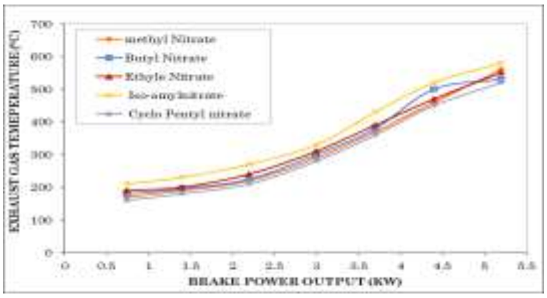

Fig. Comparison of Exhaust gas temperature with power output for five Fuels additives in Copper CHSI Engine.

The Copper CHSI configuration, the exhaust temperature is higher compared to all other configurations. There is a 210^{0}C rise in the exhaust temperature for this configurations compared to base engine.

Ignition delay

Figure indicates the variation of ignition delay period with brake power output for six additives of a copper piston crown material Ceramic hot surface ignition engine.

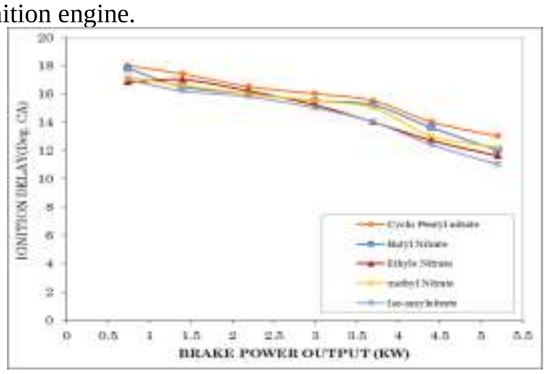

Fig Comparison of Ignition delay with power output for five Fuels additives in Copper CHSI Engine.

The ignition delay is lower by 2^0CA compared to copper piston crown material Ceramic hot surface ignition engine with Alcolita as an additive .

Peak Pressure

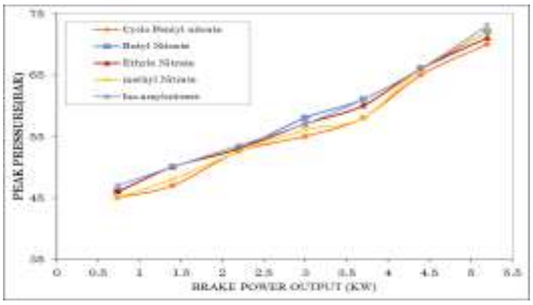

Fig. Comparison of Peak Pressure with power output for five Fuels additives in Copper CHSI Engine.. It is found that the peak pressure developed by copper piston crown material Ceramic hotsurface ignition engine with Iso amyl nitrate as an additive is higher.

Maximum Rate of Pressure Rise

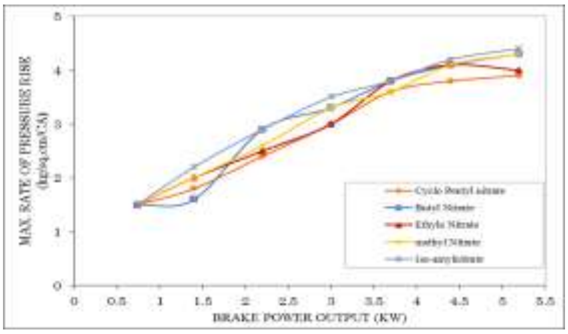

Fig. Comparison of maximum Rate of Pressure Rise with power output for five Fuels additives in Copper CHSI Engine.

It is highest for the copper piston crown material Ceramic hotsurface ignition engine with Iso amyl nitrate as an additive and is about 30% by volume at rated load.

Conclusions

It is concluded that among the six additives tested to the copper piston crown material CHSI engine with Methanol as fuel, Iso amyl nitrate gives the best results.

1. It is observed that copper piston crown material CHSI engine with Iso amyl nitrate as an additive shows maximum efficiency over a wide range of operation and is about 33%
2. The maximum reduction in HC emissions is for copper piston crown material CHSI engine with Iso amyl nitrate as an additive.
3. It is observed that the maximum reduction in CO emission with copper coating CHSI engine with Iso amyl nitrate as an additive is 16% by volume.
4. The copper coating CHSI engine with Iso amyl nitrate as an additive shows highest peak peak pressure and is about 61 bar.
5. The reduction in ignition delay for copper coating CHSI engine with Iso amyl nitrate as an additive is about 2^0CA.

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