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EVALUATION OF EMISSION CHARACTERISTICS ON CI DIESEL ENGINE USING MUTTON TALLOW METHYL ESTER

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ABSTRACT: *Nowadays for any country petroleum based fuels have become important for its development. Products derived from crude oil continue to be the major and critical sources of energy for transportation sector all over the world. However, petroleum reserves are non renewable and are depleting day by day. For a growth of any country, it is strongly depends on transportation and power generation. Thus, For India it has become a major challenge in facing fuel crisis. It is important to identify suitable alternate fuel as substitution in place of diesel fuel. Any alternate fuel which finds suitable as substitute to diesel is comparatively inferior to diesel in both performance and combustion characteristics. Hence there is a need to improve and optimize the fuel properties and operating parameters respectively. In this work an attempt is made with different combustion chambers using mutton tallow biodiesel. This oil transesterified using methyl alcohol and an alkaline catalyst to produce tallow methyl ester. The experiments are conducted on CI diesel engine of 5.2 KW with eddy current dynamometer using Mutton Tallow Methyl Ester (MTME). The emission characteristics are computed from the experiments and are compared with diesel fuel.*

KEYWORDS: CI diesel, Engine, Mutton tallow methlester, Emission

INTRODUCTION

The consumption of fossil fuels have been increased tremendously in both industries and transport sector[10] .For economic development of any country there are two factors are very important. It is learnt that day by day the increase in demand of fossil fuels leads to exhaust of petroleum products in near future [7]. So the time has come to locate alternative fuels for diesel such that it may serve as fossil fuel, which are depleting at much faster rate than expected [6]. And also the rising prices of petroleum products and environmental concern led to intensive studies on use of alternative fuels.

There is lack of sufficient oil reserves in India. Because of growing demand of petroleum products our government spending billions of dollars for their imports [1]. Though diesel engines play a vital and indispensable role in today's modern life, it contributes to pollution substantially.

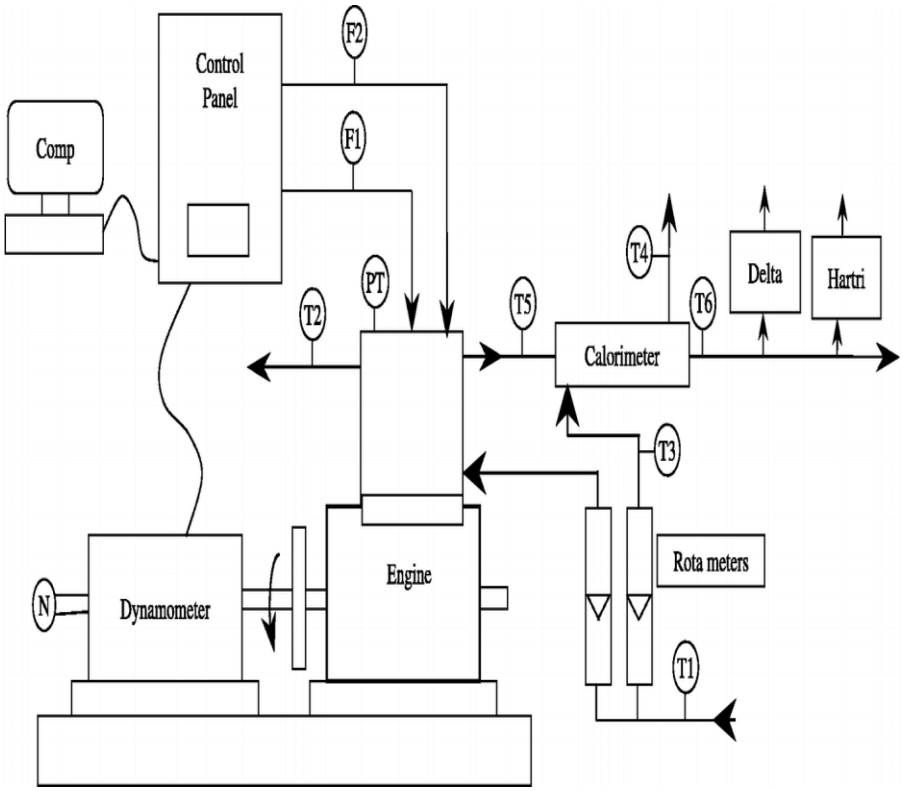
An intensive search is being conducted in developing diesel engine fuels and lubricants based on vegetable oils [5]. Therefore it is the right time to search for alternative fuels. The

vegetable oils are renewable and are produced easily in rural areas [9]. Its usage has been studied even since the advent of the internal combustion engine [2]. However it is only recent years focused much on usage of vegetable oils [3]. Since they have properties comparable to diesel fuel, they may be used in compression ignition engine.

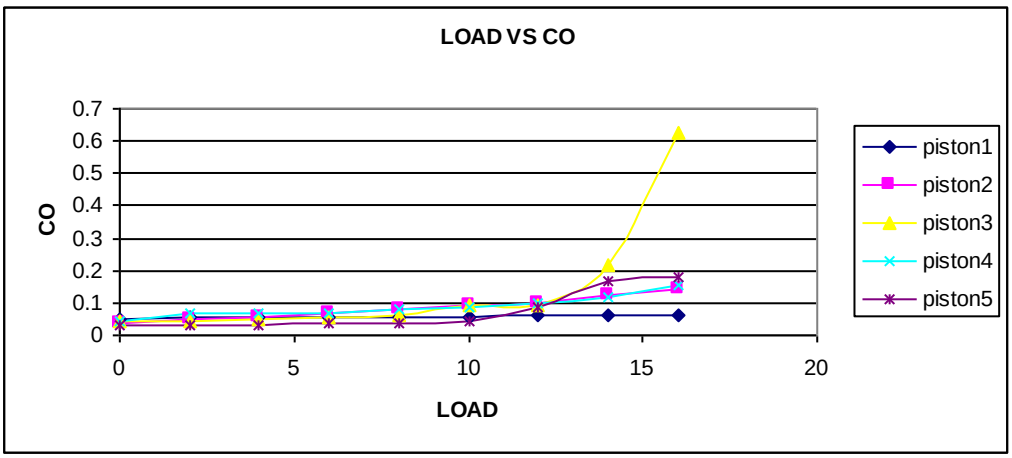
Liquid fuels are more suitable fuels because of their high energy content per unit volume, ease of handling and distribution. The most suitable and available alternative fuels are alcohols and vegetable oils, where they are derived from renewable biomass source. Due to low cetane number Alcohols are not suitable for direct use in diesel engines. Majority of the vegetable oils having properties closer to diesel fuel prompted to use directly in existing C.I engines [4]. Vegetable oils typically have large molecules, with carbon, hydrogen and oxygen being present. They have a chemical structure similar to diesel fuel, but differ in the type of bond structure leads to higher molecular mass and viscosity [8]. The viscosity increases the work necessary to spray vegetable oils in diesel engines and also makes it difficult to break them up into fine droplets. The carbon residue of vegetable oils is higher than that of diesel. This leads to a smoky exhaust in a diesel engine. The presence of oxygen in vegetable oils raises the stoichiometric fuel air ratio. Contrary to fossil fuels, vegetable oils are free from sulfur. The heating value of vegetable oils is approximately 90% of that of diesel fuel.

EXPERIMENTATION

The experimental set-up consists of a water cooled diesel engine, an engine test bed, and a gas analyzer. The schematic layout of the test system can be seen in Figure. A single-cylinder, four-stroke, direct injected diesel engine is selected for these tests. The technical specifications of the test engine are summarized in Table. The diesel engine has water-cooling system. The engine test bed consists of a control panel, measuring instruments and a eddy current dynamometer. The fuel consumption is measured with a burette (10 ml volume) and a stopwatch. An oblique manometer was used to measure air consumption. The lubricating oil, fuel and ambient temperatures were measured by thermocouples and read from the digital screen of control panel. The uncertainties in the experimental results were then calculated.



RESULT AND DISCUSSION



From the graph it is observed that the carbon monoxide emissions are more or less same at low loads and medium loads. Closer to rated load, the carbon monoxide emissions of the fuel are increased significantly for the piston 3.This is due to inadequate air moment, where relative velocity between the fuel droplets and the air affected.

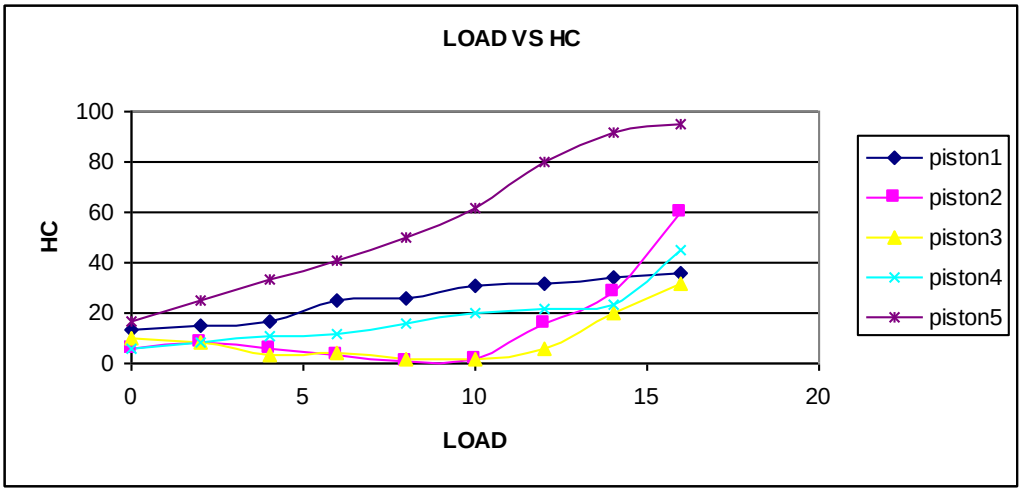
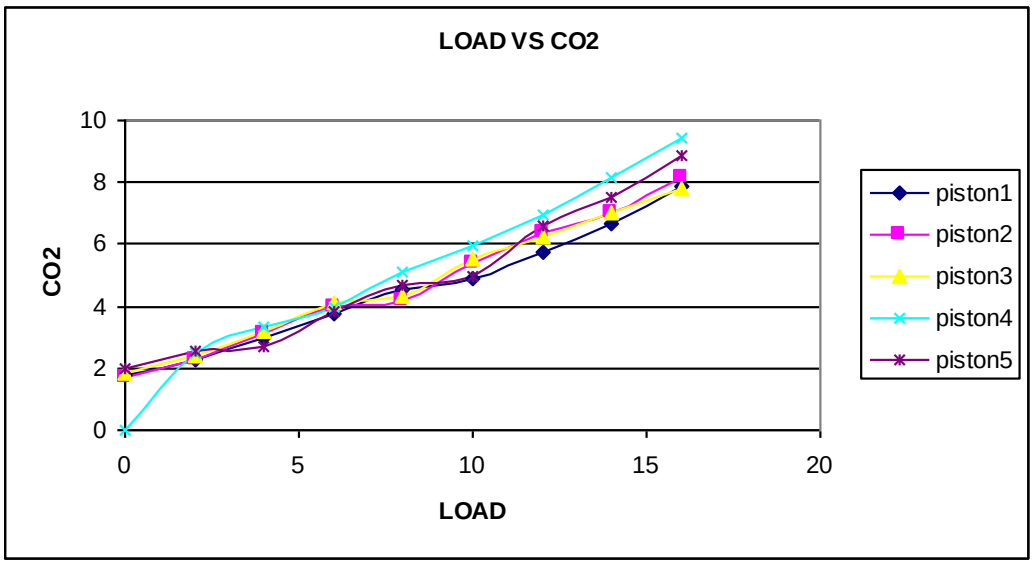
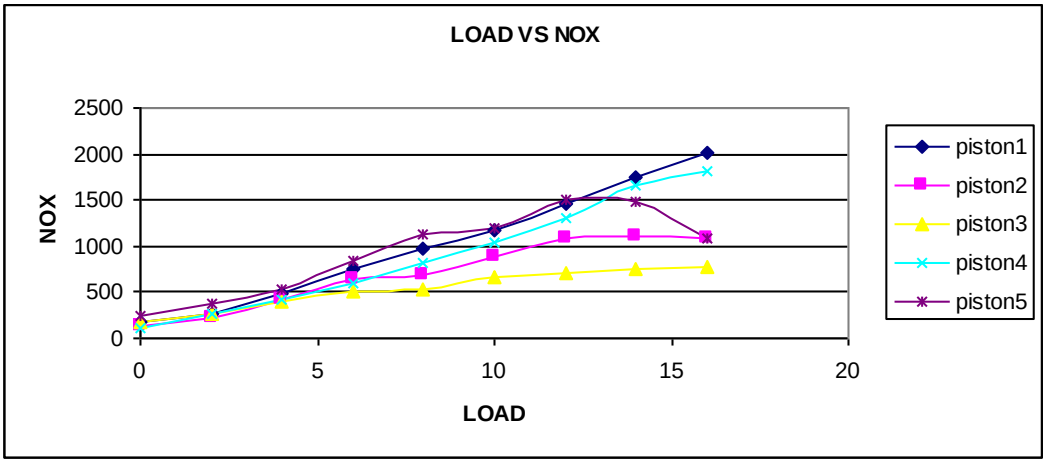


Figure the graph it is learned that the hydrocarbon emissions for piston 2, piston3 and piston 4 are comparatively less than the piston1 upto 80% of the rated load. For the piston 5 for all range of load operations the hydrocarbon emissions are high and also increased linearly. This is because of disturbance in spray cone of combustion chamber.



From the graph it is observed that the carbon dioxide emissions are almost same at lower loads for all the pistons. For medium and higher loads the co2 emissions are more for piston 2, piston3, piston 4, piston5 compared to piston1.however for the piston4 the co2 emissions are slightly higher side compared to other four pistons. This may be occurred due to concentration of oxygen in the mixture after dilution.



From the graph it is observed that at higher loads the NOx emissions for piston 2,piston3 ,piston 4 and piston5 are less compared to piston1.it is also observed that the in cylinder flow coupled with oxygenated fuel blends would result for increase of NOx emissions. The effective reduction of NOx is achieved with only slight increase in break specific fuel consumption

CONCLUSION

The following conclusions are drawn from the experiments carried out on stationary CI engine at thermal engineering lab, mechanical department.

The diesel engine is operated with the air flow unthrotled at partloads.hence co2 emissions are low at part loads.

The CO generated is high, when accelerating under load i.e. at 80% and above the rated load. this has been occurred due to local rich regions.

The HC emissions are high for piston 5 at all loads of operation compared to piston 1 of the existing engin e. The increasing in HC emissions about three times at full load operations.

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