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Report on Straight Vegetable Oil as Additive In Diesel Engine to Reduce NO_x emission

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ABSTRACT

There is notable research is going on to use various Straight Vegetable Oil (SVO) as alternative fuels in diesel engine however the physical property of SVO limits direct use of SVO in diesel engine. The addition of SVO in diesel reduces the combustion temperature in cylinder which leads to higher ubHC and CO emissions, higher carbon deposits and improper combustion. In another side Addition of SVO also reduces NOx emissions significantly. Reduction in cylinder combustion temperature leads to decrease in thermal efficiency of engine and drop in power output. The present project focuses on reduction of NOx emissions from diesel engine by using various SVO in small proportion as additive in diesel to reduce NOx emission. In present assessment SVO such as palm, cotton seed castor and karanja are selected to use as additive in diesel. CI engines are most widely used in transportation, agriculture, building and construction equipment and it is most versatile engine to use alternate fuels. Considering above single-cylinder, 4-stroke, 18 CR,water cooled diesel engine of 3.5 kW at 1500 rpm was selected for the present investigation.The experiments are going to carry out to test the selected fuel to measure the engine performance and emissions. The various blends of SVO and diesel is prepared to carry out the engine performance tests along with the corresponding emission measurements at various load.The performance and NOx emission characteristics of engine will be studied by using diesel, palm, cotton seed castor and Karanja and their blends with diesel and by analyzing the performance characteristics and emission characteristics at the rated load and compared with pure diesel finding out most suitable SVO along with optimum blend ratio.

Keywords : SVO, NOx, Alternate fuels, CI Engine, emissions.

I. INTRODUCTION

Increasing energy demand and environment concerns have encouraged an evolution of alternative fuel sources. As an alternative fuel source, SVO is attractive because it reduces harmful engine emissions.

In the face of escalating oil prices and depleting oil reserves, the search for alternative sources of fuels has been intensified more than ever before in the history of mankind. Aside energy security concerns, issues of climate change as a result of the emission of carbon dioxide (CO2), carbon monoxide (CO), unHC and NOx emissions.

It is very commonly believed that Rudolph Diesel fuelled one of his early engines with peanut oil at the Paris Exhibition in 1900. He estimated in his report "...the inclusion of vegetable oils in engine fuels may seem unimportatnt for use today, but such oils may become, in the course of time, as significant as petroleum and the coal-tar products of the present time…"The references to research on vegetable oil fuels had expanded vast in recent. Raw vegetable oils, while showing promise, had a tendency to cause injector choking, polymerization in the piston ring belt area causing stuck or broken piston rings, and a tendency to thicken lubricating oil causing sudden

and catastrophic failure of the rod and/or crankshaft bearings. A method for reducing the viscosity of the oil and its tendency to polymerize were viewed as of the highest priority to make use of vegetable oils successful and the most likely candidate for that was transesterification of the vegetable oil i.e. production of Biodiesel.

However biodiesel fuelled engine emit very high NOx in the environment. In convention diesel engine NOx emission is major concern which need to be reduced. In present work focuses on reduction of harmful emission of diesel such as NOx, unHC, CO and particulate matter. In present assessment various Straight vegetable oil SVO such as palm, cotton seed castor Karanja use as additive in diesel to reduce NOx emissions.

II. METHODS AND MATERIAL

In order to achieve the objective of the present work, the following methodology has been planned:

- ✓ To select at 4 liquid biofuel sample, i.e., SVO Palm, Karanja, Cotton seed Castor and Diesel for comparative assessment.
- ✓ Fuel characterization experiments to evaluate the biofuel properties for the considered biofuels.
- ✓ To design and incorporate the necessary instrumentation for engine performance evaluation.
- ✓ Experimental evaluation of the engine performance parameters and engine emissions using the considered biofuels and petro-diesel.
- ✓ Comparative assessment to find out suitable SVO and suitable blend percentage considering engine performance with respect to NOx emission.

Experimental Setup

- ✓ The different equipment's and setup which is required for experiment is shown in the figure 1
- ✓ F1 fuel injector pressure sensor
- ✓ F2 Air flow measuring
- ✓ PT peizo sensor N rpm pick up and TDC encoder
- ✓ T1 Cooling water inlet temp to engine
- ✓ T2 Cooling water outlet temp from engine
- ✓ T3 Cooling water inlet temp to calorimeter
- ✓ T4 Cooling water outlet temp from calorimeter
- ✓ T5 Exhaust gas inlet temp to calorimeter.
- ✓ T6 Exhaust gas outlet temp from calorimeter.

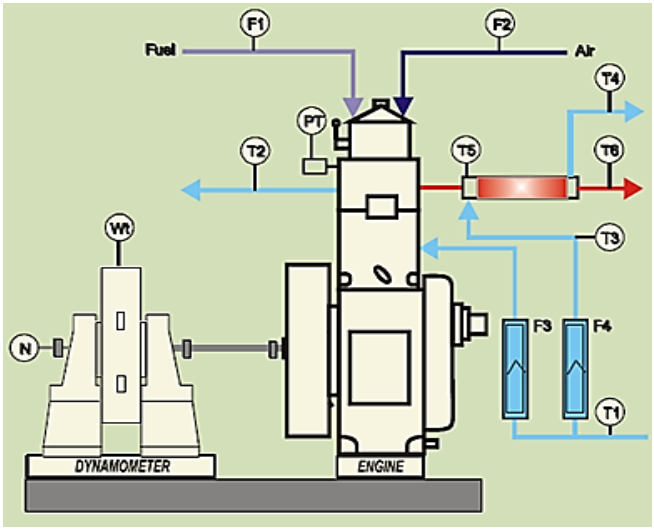

Figure 1. Experimental Setup

III. THEORY OF EXPERIMENTATION

Experimentation

The experimentation is going to conduct in following steps

Fuel characterization:SVOs blended with diesel in varying percentages from 5% to 30% and various physical and chemical properties would be tested.

Engine performance tests: The engine performance tests would be carried out to evaluate IHP, BHP, FHP, ITE, BTE, MECH EFF., BSFC, etc for each of the blends under various load condition.

Emission analysis The major engine exhaust gases namely CO, CO_2, O_2, NO_x, and unHC at the variousloading condition for various blends would be measured using AVL five gas analyzer

IV. PROPERTIES OF VEGETABLE OIL AND DIESEL USED

Physical properties of vegetable oils and diesel used in this project are as follows,

Table 1. Properties of Vegetable Oil and Diesel Used

Properties	Diesel	Palm Oil	Karanja	Castor Seed Oil	Cotton seed
Specific Gravity	**0.835**	0.924	0.925	0.96	0.672
Viscosity (mm^2/s)	2.27	40.42	46.42	226.82	33.8
Flash point (°C)	50	314	225	230	245
Calorific value (kJ/kg)	42,250	39.81	38,207	36,200	42,100
Fire Point (C)	64	341	230	345	363
Cetane No	49	46	37.5	40	47

V. CONCLUSION

From the review of all above paper it is concluded that the blend of SVO and DIESEL can directly used in the engine without modification. Also it is concluded that the engine performance is good .

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