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RESEARCH ARTICLE

AN EXPERIMENTAL INVESTIGATION ON PERFORMANCE AND EXHAUST EMISSIONS OF COMPRESSION IGNITION ENGINE FULLED WITH SOYABEAN BLENDED WITH METHANOL

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ABSTRACT

In view of the existing fossil fuel deposits may come for another 30 to 40 years and Costs of these Fissile Fuels are day by day increasing. As we know that all over the world the diesel vehicle population is growing at an alarming rate. The emission will irritate skin, eyes, nose and throat and also leads to bronchitis asthma in the long run and has been led to air pollution. It is a serious concern with the pollution point of view. Developing Countries like India depends on its fossil fuel requirements on foreign countries for which spars a huge foreign currency in purchase of crude oil. The increasing pressure on crude oil reserves and environmental degradation as an outcome. Hence in view of the above drawbacks there is an urgent need to find an alternative fuels in the existing engines. Fuelslike (Low Cetane Fuels) like Soyabean oil blended with Methanol may promise and present a sustainable solution as it can be produced from a wide range of plants and seeds.

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INTRODUCTION

Rising petroleum prices, increasing threat to the environment from vehicle exhaust emissions and fastly depleting stock of fossil fuels have generated an intense international interest in developing alternative renewable fuels for IC engines. Bio fuel is an oxygenated fuel which increases the combustion and makes reduce exhaust emission. It can be produced from crops with high sugar or starch content. Some of these crops include sugarcane, sorghum, corn, barley, cassava, linseedplants, sugar beets etc. Numerical Investigation and Fatigue Life estimation of modified Diesel Engine Piston (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), Experimental Investigation of Twin Cylinder Diesel Engine Using Methanol Piston (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), Performance & emission of Twin Cylinder Diesel Engine Using Ethanol Piston (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), Experimental Investigation of Twin Cylinder Diesel Engine Using Diesel & Methanol (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), Performance & emission of Twin Cylinder Diesel Engine Using Diesel & Ethanol (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), "Performance and Emission Characteristics of CI Engine using Hippie Oil and Cotton Seed Oil Blended with Methanol (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), "Performance & Emission of C I Engine Using Diesel & Ethanol Blended with Jatropa Oil" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), "Performance & emission of C I Engine Using Diesel & Ethanol blended with linseed oil" (Dr Hiregoudaru Yerrannagoudaru *et al*.,2014), Performance and emission characteristics of two cylinder diesel engine using diesel and pine oil (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), "Combustion Analysis of Inverted M Type Piston CI Engine By Using CFD" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014), "Investigation Of Twin Cylinder Diesel Engine Fueled With Pongamia Oil And Diesel Oil." (Dr Hiregoudaru Yerrannagoudaru *et al*.,2014), "Performance and Emission Evaluation of Direct Injection Diesel Engine Fuelled with Rubber Seed Oil (Dr Hiregoudaru Yerrannagoudaru *et al*., 2014),"Experimental Investigation of multi Cylinder Diesel Engine Using Rubber Seed Oil and diesel(Dr Hiregoudaru Yerrannagoudaru *et al*., 2014),"Performance and Emission Characteristics of Twin Cylinder CI Engine Using Cottonseed Oil Blended With Methanol" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015),"Experimental Investigation of

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Twin Cylinder Diesel Engine Using Jatropha and Hippie Oil Blend With Ethanol" (Dr Hiregoudaru Yerrannagoudaru *et al*.,2015),"Numerical Investigation And Fatigue Life Estimation of Conventional Diesel Engine Piston" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015), "Investigation And Performance Evaluation of Honge Seed Oil Blended With Diesel Using The Twin Cylinder Diesel Engine" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015), Investigation And Performance Evaluation Of Pine oil Blended With Diesel Using The Twin Cylinder Diesel Engine (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015),"Investigation of Methanol In Twin Cylinder In Line 4 Stroke Liquid Cooled Diesel Engine", (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015),"Investigation And Piston To Piston Comparison Of Twin Cylinder Diesel Engine Fueled With Pongamia Oil And Diesel Oil", (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015) "Investigation and Performance Evaluation of Ethanol Blended with Diesel Using the Single Cylinder Diesel Engine " (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015), "Investigation and Performance Evaluation of Rubber Seed oil Blended with Diesel Using the Twin Cylinder Diesel Engine" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015), Investigation and Performance Evaluation of Ethanol Blends With Vegetable Oils as Alternative Fuels in Diesel Engine Performance" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2015), "Investigation and performance evaluation of hippie seed oil blended with diesel using the twin cylinder diesel engine" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2016),"Numerical Investigation and Fatigue Life Estimation of Conventional and Modified Piston of Diesel Engine" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2017), "An Experimental Investigation of Mahua oil blended with Ethanol as substitute fuel in Diesel Engine" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2016), "An Experimental Investigation of using Ethanol as additive to Coconut oil on the Performance and Emission characteristics of a Diesel Engine at different loads" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2016), "An Experimental Investigation on Effects of Ethanol Blended Pogamia oil and Diesel Fuel to Engine Performance and Emissions of a Diesel Engine" (Dr Hiregoudaru Yerrannagoudaru *et al*., 2016),

EXPERIMENTAL SETUP

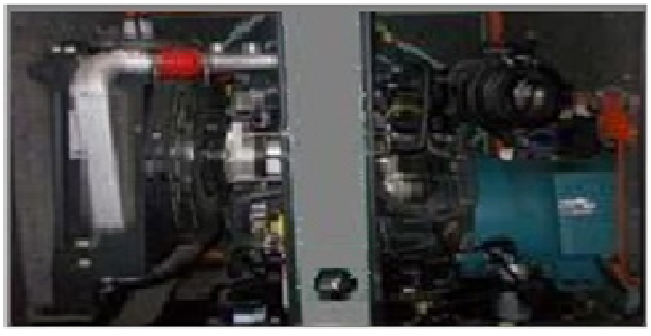

Fig. 1. Test engine (Twin cylinder Diesel Engine)

Objective

Objective of the present study is to:

- It is proposed to use Bio Fuel blended with Methanol in the diesel engine.
- The emissions like HC, CO_2, NOx and Smoke in the exhaust gases are proposed to reduce during the combustion itself.
- To study the performance evaluation of the using Bio fuel blended with Methanol in the diesel engine.
- To analyse the exhaust emissions and measurement, reduction in the exhaust gas.

Properties of Bio Fuel Blended With Alcohol Table-1

S.No	Biofuel	CV KJ/Kg
1.	Diesel	44,800
2.	Soyabean oil blended with Methanol	30,950

Engine Specification Table-2

Test Engine specification	
Injection Pressure	1800 bar
Engine type	Four stroke Twin cylinder diesel engine
No. of cylinders	02
Stroke	100 mm
Bore Diameter	87 mm
Engine Power	15KVA
Compression ratio	17.5:1
RPM	1500

RESULTS

Performance Graphs

Brake Specific Energy Consumption

	BSEC			
%	Diesel Conventional Piston	Diesel Modified Piston	50% Soyabean oil + 50% Methanol conventional Piston	50% Soyabean oil + 50% Methanol Modified Piston
0	23214.5	24762.23	13693.07	10871.04
10	18779.1	19822.43	10471.49	9698.68
25	14243.4	13587.15	8770.73	8126.74
50	12082.4	11406.47	7512.95	7631.56
75	11157	10758.58	7614.94	7710.79
100	11548.2	11315.11	7484.8	7721.23

Brake Thermal Efficiency

	BRAKE THERMAL EFFICIENCY			
%	Diesel Conventional Piston	Diesel Modified Piston	50% Soyabean oil + 50% Methanol conventional Piston	50% Soyabean oil + 50% Methanol Modified Piston
0	15.50749	14.53827	26.2906	33.11
10	19.1702	18.16124	34.37	37.11
25	25.27472	26.49562	41.04	44.29
50	29.79532	31.56104	47.91	47.17
75	32.2666	33.46166	47.27	46.68
100	31.1735	31.81586	48.09	46.62

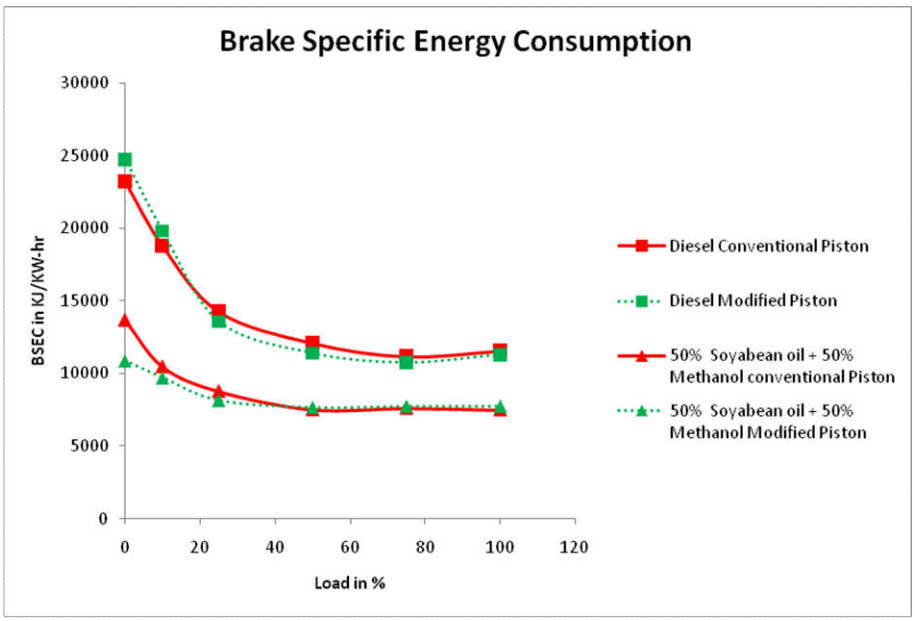

Fig.2. The variations of Brake Specific Energy Consumption for Diesel and Soyabean oil blended with Methanol in Conventional and Modified pistons

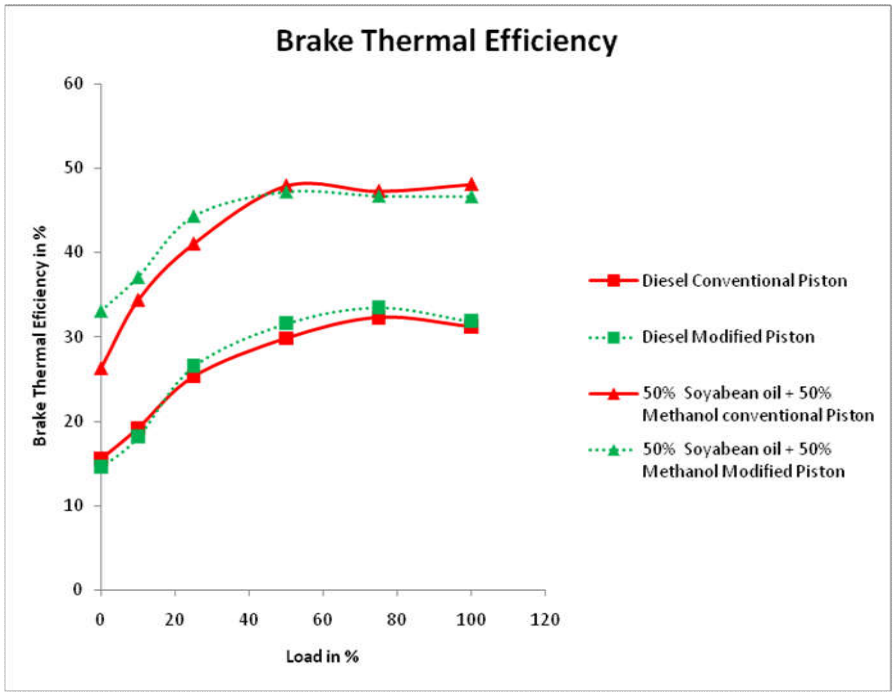

Fig. 3. The variations of Brake Thermal Efficiencyfor Diesel and Soyabean oil blended with Methanolin Conventional and Modified pistons

Emission Graphs

Unburnt Hydro Carbon

	HC			
%	Diesel Conventional Piston	Diesel Modified Piston	50% Soyabean oil + 50% Methanol conventional Piston	50% Soyabean oil + 50% Methanol Modified Piston
0	145	110	142	98
10	155	125	154	120
25	175	140	170	142
50	180	155	178	163
75	190	170	186	172
100	200	185	194	180

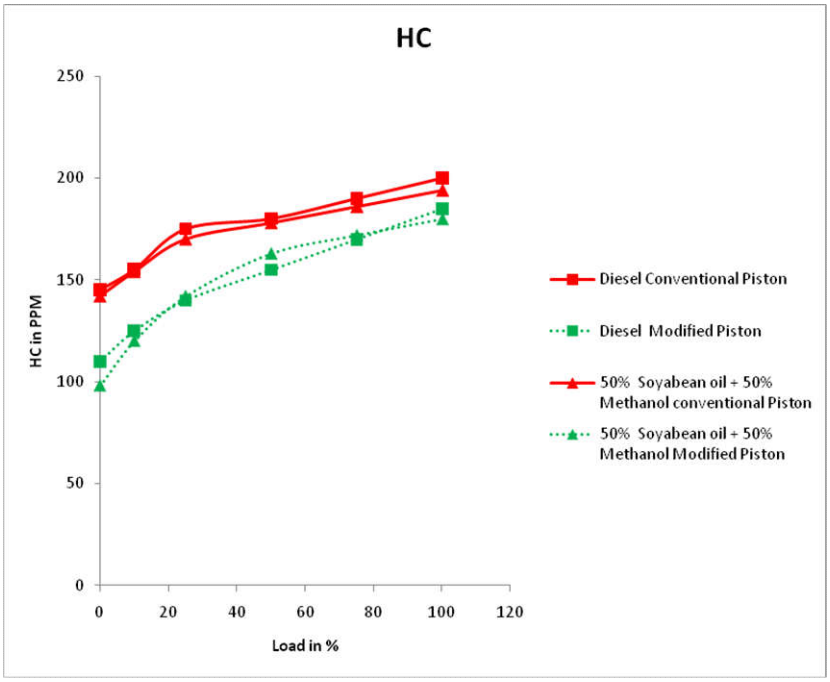

Fig 4. The variations of Unburnt Hydro Carbonfor Diesel and Soyabean oil blended with Methanolin Conventional and Modified pistons

Nitrogen Dioxide

	NO_X			
%	Diesel Conventional Piston	Diesel Modified Piston	50% Soyabean oil + 50% Methanol conventional Piston	50% Soyabean oil + 50% Methanol Modified Piston
0	164	84	68	40
10	192	132	92	56
25	280	219	180	64
50	445	317	250	120
75	550	380	490	196
100	682	450	590	320

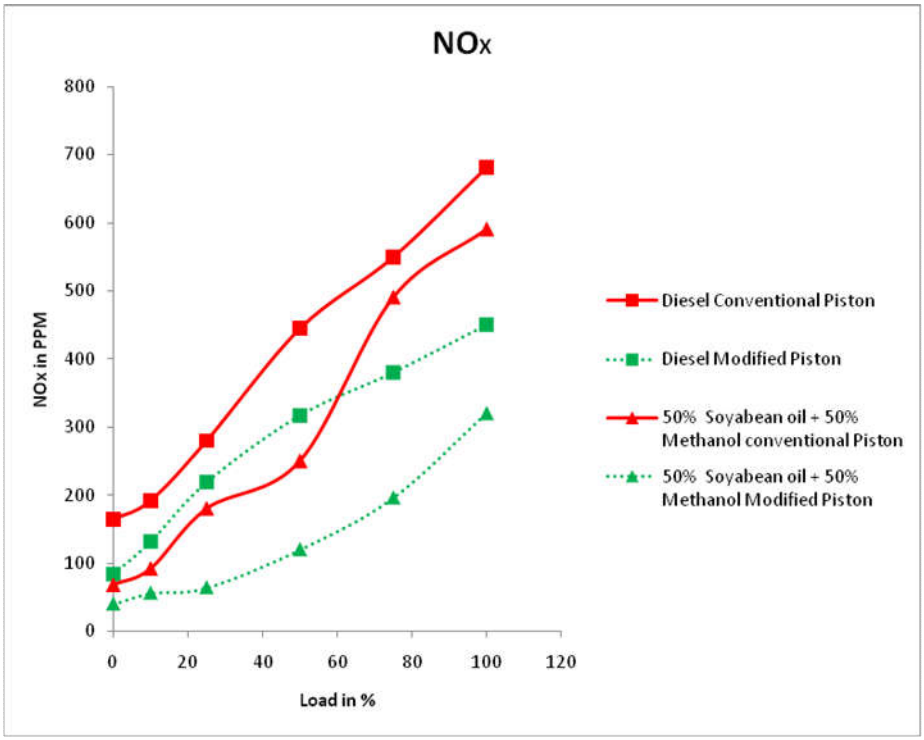

Fig.5. The variations of Nitrogen dioxidefor Diesel and Soyabean oil blended with Methanolin Conventional and Modified pistons

Carbon Dioxide

	CO_2			
%	Diesel Conventional Piston	Diesel Modified Piston	50% Soyabean oil + 50% Methanol conventional Piston	50% Soyabean oil + 50% Methanol Modified Piston
0	15	1.03	15	4
10	18	1.82	17	6
25	20	2.82	20	7
50	25	3.1	24	10
75	26	5.06	26	14
100	28	8.07	28	16

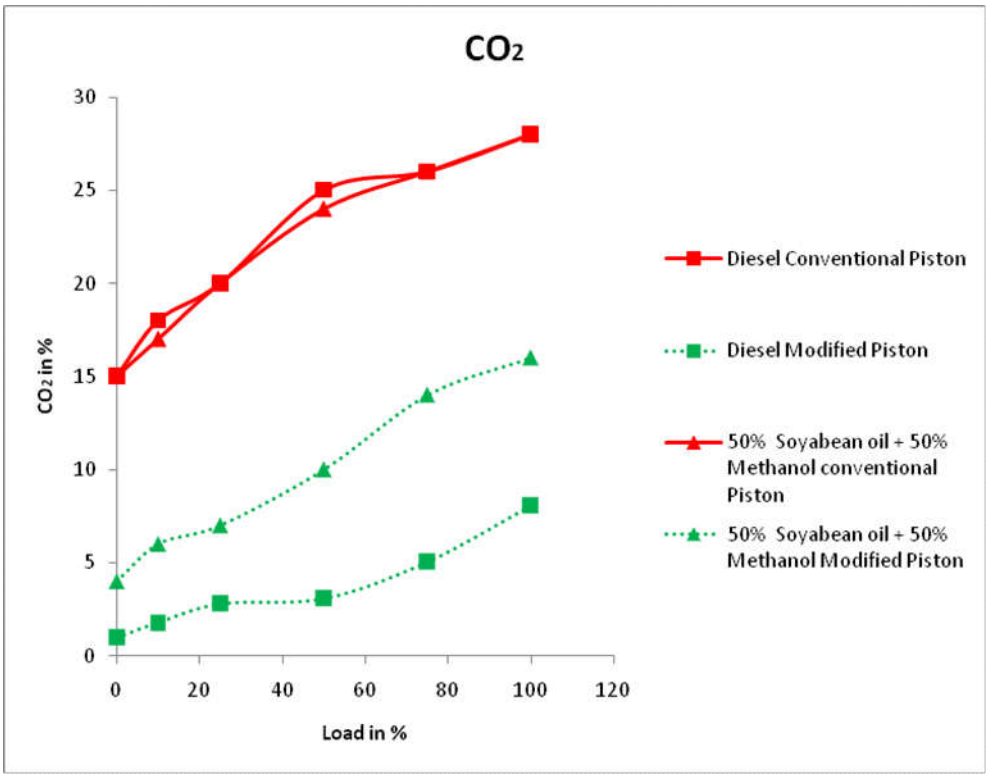

Fig. 6. The variations of Carbon dioxidefor Diesel and Soyabean oil blended with Methanolin Conventional and Modified pistons

Smoke

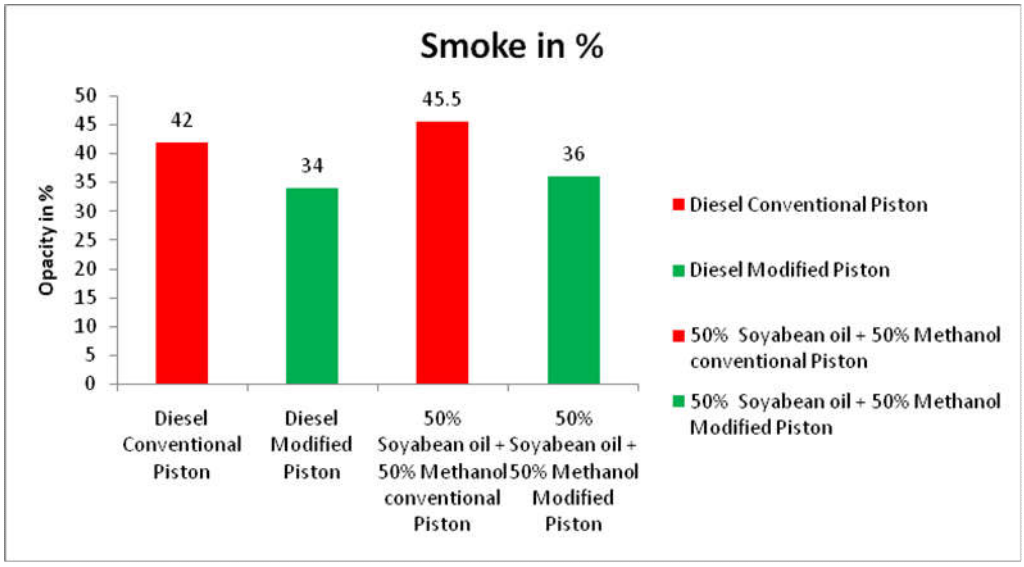

Fig. 7. The variations of Smoke for Diesel and Soyabean oil blended with Methanolin Conventional and Modified pistons

Conclusion

Based on the performance and emissions of Soyabean oil blended with Methanol, it is concluded that the Soyabean oil blended with Methanol represents a good alternative fuel with closer performance and better emission characteristics to that of a twin cylinder diesel fuel engine. From the above analysis the Soyabean oil blended with Methanolshows better performance compared to the Diesel in the sense of better performance characteristics like Brake thermal efficiency, Specific fuel consumption and decrease in the emission parameters like HC, CO_2, NOx and in Conventional as well in Modified Piston.

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