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Emission and Performance Analysis of Chicken Fat Methyl Ester on Diesel Engine

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ABSTRACT

An ever increasing demand of fuels has been challenge for today's scientific workers. The fossil fuel resources are dwindling day by day. Biodiesel is to be a solution for future. Biodiesel is produced by transesterificaton the oil or fat with an alcohol (methanol/ethanol) in the presence of a base catalyst. Chicken fats are also a major feedstock in the production of biodiesel. Mainly animal fats and vegetable oils are used for the production of biodiesel. The transesterificaton reaction yields methyl or ethyl esters (biodiesel) and a by-product of glycerine. Biodiesel has better lubricating properties and much higher cetane rating than today's low sulphur diesel fuels. The diesel engines led to emission of hazardous gases like s_{ox}, c_o etc. which can further led to problems like acid rains. These can affect human health and increase the rate of global warming. Biodiesel may be used in any diesel automotive engine in its pure form or blended with petroleum-based diesel. Biodiesel can be used in pure form or may be blended with petroleum diesel at any concentration.

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I. INTRODUCTION

The concept of alternative, renewable energy has been in existence for over a century. Rudolf Diesel is credited as the inventor of the first diesel engine which was originally designed to run on fuel derived from peanut oil. Rudolf Diesel was quoted as saying; "The diesel engine would help considerably in the development of agriculture of the countries which use it." Unfortunately, due to the low cost of mineral oils at the time, the diesel engine was modified to run on petroleum oil. Biodiesel technology was overlooked while the demand for crude oil increased significantly as the automotive and industrial age ensued. Rudolf Diesel was well aware that renewable fuel would not be of major relevance during his lifetime when he said, "The use of vegetable oils for engine fuel may seem insignificant today.

Biodiesel which is defined as the mono-alkyl esters of vegetable oils or animal fats, obtained by transesterifying oil or fat with an alcohol. Mainly animal fats and vegetable oils are used for the production of biodiesel. Several types of fuels can be derived from triacylglycerol-containing feedstock. This also describes the use of glycerol which is the by-product in esterification process along with biodiesel.

II. LITERATURE SURVEY

Dr. S.V.Subbaramaiah [1] et.al their studies are conducted on transesterification process for chicken fat biodiesel blends of B20, B40, B60, B80 and B100. The fuel consumption test of a constant speed CI engine is also conducted to evaluate the performance of the engine on diesel and chicken fat biodiesel blends. The characterization of fuel is analysed by plotting graphs and important property like specific gravity of biodiesel blends were compared with the fossil diesel and 100% biodiesels.

Jayant arbune [2] et al. Bio fuel has been regarded as potential alternative fuel for partial substitution of petro diesel. Jatrophacurcas which is one of the sources of bio-diesel are easily available in tropical and sub-tropical areas. A number of plantation practices and engine test runs have been conducted across the world, which has been successful to demonstrate it as alternative source of fuel.

Nivedita Das. [3] et al. Increased urbanization and increase in population has led to an increased demand for fuels. The result is the prices of fuels are reaching new heights every day. The diesel engines led to emission of hazardous gases like sox, co etc. which can further led to problems like acid rains. These things can also affect human health and increase global warming. In the present text it can be found that chicken feathers can also prove a better source for production of biofuel.

Bhosale A.V [4] et.al Main objectives of the study are feasibility of Karanja oil for the production of biodiesel optimization of different parameters for high yield /conversion of Karanja oil to biodiesel. The study is initiated to investigate the potential of Karanja oil as a source of biodiesel. Biodiesel is an alternative fuel made from renewable biological resources such as vegetable oil and animal fat. It is completely biodegradable and non-toxic.

Bobade S.N. [5] et.al studied that, Self reliance in energy is vital for overall economic development of our country. The need to search for alternative sources of energy which are renewable, safe and non- polluting assumes top priority in view of the uncertain supplies and frequent price hikes of fossil fuels in the international market. Biodiesel (fatty acid methyl ester) which is derived from triglycerides by transesterification has attracted considerable attention during the past decade as a renewable, biodegradable and nontoxic fuel. Transesterification process has therefore been widely utilized for biodiesel fuel production in number of countries.

- **Facilities required and available:**

1. A single-cylinder, four stroke, VCR dieselengine was selected for the tests.
2. The engine test bed consists of a control panel, measurement instrument.
3. Biodiesel production unit.
4. Oil and fat testing laboratory.
5. We can check the quality of chicken fat biodiesel and its blends as per ASTM standard.

III. METHODOLOGY

1. Selection of methodology-

In recent years, the price of gasoline has remained consistently high. It is almost a common consensus that its price shows an ascending trend. Therefore, an alternative fuel supply as a substitute for petroleum would be a welcomed resource to help alleviate high cost expenditures. Biodiesel can be used as a fuel or mixed with petroleum-based diesel. The advantages of biodiesel are present in its nontoxic nature, biodegradability, and minimal chemical emissions characteristics. Biodiesel can be produced by the transesterificaton process of triacylglycerides (from chicken fats) and alcohol with the assistance of a proper catalyst such as NAOH or KOH.

Waste chicken fat oil as alternative sources for transesterificaton processes. In thisResearch, the fat from chicken waste is suggested as a raw material for biodiesel.chicken can have a 30% fat content of the total poultry meat.Large amounts of chicken by-products such as fat, skins, and tissues are discarded as wastes. The chicken fat can be simply and economically separated from wastes without chemical solvent treatment. Biodiesel production is frequently performed byAlkali-catalysis transesterification. Typically methanol reacts with triglycerides to form fatty alkyl methyl esters (FAMEs) and glycerol. Currently, methanol is considered to be a cheap and convenient source for biodiesel production.

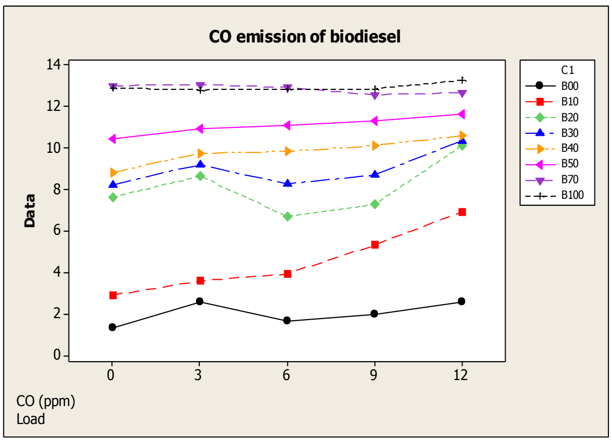
Fig. Experimental setup for biodiesel production.

Fig. Raw chicken fats.

IV. EMISSION RESULTS

CO, HC and NO_x emissions:
Exhaust emission of Carbon Monoxide (CO):

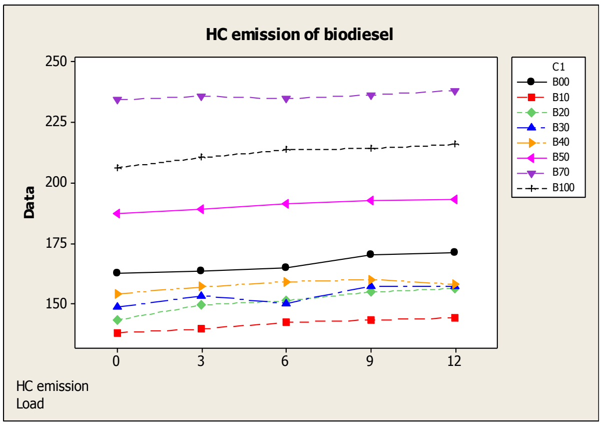
Graph no.1 shows the variation of CO emission with engine loading. It was observed that CO emissions are increased with increase in engine load. The lower CO emission of biodiesel compared to diesel is likely due to oxygen content inherently present in the biodiesel which helps in the more complete oxidation of fuel. Further it can be seen that volume of CO initially decrease but increase at full load indicating better burning conditions at higher temperature assisted by improved spraying qualities with uniform charge preparations of biodiesel.



Graph no.1 CO emission of biodiesel

Exhaust gas emission of Hydrocarbon (HC):

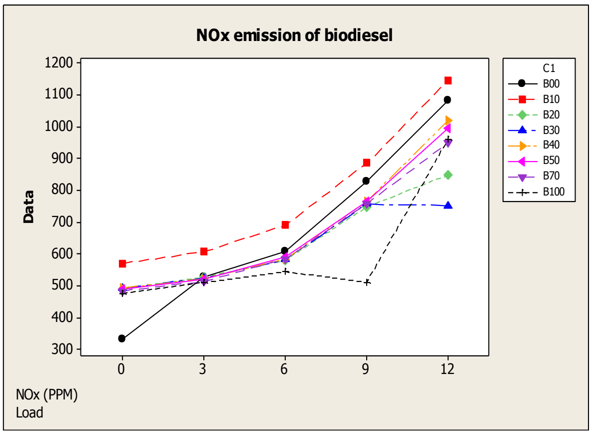
The variations of HC emission for diesel and biodiesel are shown in the figure. The emissions of unburnt hydrocarbon for biodiesel exhaust due to lower than that of diesel fuel the increased gas temperature and higher cetane number of biodiesel could be responsible for this decrease. Higher temperature of burnt gases in biodiesel fuel helps in preventing condensation of higher hydrocarbon reducing unburnt HC. The higher cetane number of biodiesel results decrease in HC emission due to shorter ignition delay.



Graph no.2 HC emission of biodiesel

Exhaust gas Emissions of Nitrogen Oxides (NOx):

The NOx values as parts per million for different blends of diesel and biodiesel in exhaust emission are plotted as function of load. From these figures it can be seen that the fueling biodiesel or its blends NOx emission increase.



Graph no.3 NO_X emission of biodiesel

The smoke emissions of WCO methyl ester were lower than those for diesel fuel at all the engine speeds. All the fuels produced a large amount of smoke at low engine speeds. The improved combustion efficiency could be attributed to increased turbulence effects. It is clear that the smoke emissions reduced all the WCO blends under all the operating conditions.

A higher thermal efficiency indicates better and more complete combustion of fuel, which implies that a lesser amount of unburnt hydrocarbons are present in the engine exhaust emissions. Therefore, lower smoke density values are achieved with biodiesel blends than with conventional diesel.

The CO emissions for all fuels at different engine speeds are given in Graph no.3 As shown in the figure, CO emissions decreased with increasing engine speeds for all the fuels. The CO emissions of biodiesel blends and diesel fuel showed similar trends at all the operation condition.

V. RESULT TABLE:

Table no.1 Observation Table Of CO.

Loads / Blends	0	3	6	9	12
B00	1.345	2.567	1.64	1.98	2.567
B10	2.9055	3.6045	3.93625	5.321	6.93975
B20	7.63225	8.64375	6.70875	7.2845	10.102
B30	8.2256	9.1946	8.27512	8.70437	10.3437
B40	8.819	9.7455	9.8415	10.12425	10.59075
B50	10.46525	10.95375	11.11285	11.2862	11.6105
B70	13.00541	13.06384	12.91913	12.57296	12.66813
B100	12.897	12.79767	12.831	12.85	13.26567

Table no.2 Observation Table Of HC.

Loads / Blends	0	3	6	9	12
B00	162.3333	163.3333	165	170.3333	171.234
B10	138	139.521	142.25	143.21	144.12
B20	143.25	149.5	151.25	154.75	156.25
B30	148.625	153.25	150.125	157.375	157.125
B40	154	157	159	160	158
B50	187.3	189.125	191.25	192.875	193.125
B70	234.3	235.7916	234.75	236.375	238.24
B100	206.23	210.431	213.612	214.213	215.872

Table no.3 Observation Table Of NO_X.

Loads / Blends	0	3	6	9	12
B00	330.4977	525.6667	608.3333	826.3333	1082.333
B10	570.25	605.75	690	885.5	1145.75
B20	489.75	525.5	579.5	748	848
B30	491	523.25	581.75	756.25	752.125
B40	492.25	521	584	764.5	1020.25
B50	489.75	520.75	589.375	765.125	996.125
B70	482.625	513.0834	583.5416	757375	950.8334
B100	475.3333	509	543.6667	3090	961.3333

The variation of NO_x emissions with engine speed for the different fuels can be seen in Graph 3 As shown in the Graph, it is clear that the NO_x emissions varied considerably with the test fuels at all the engine speeds. All the fuel blends produced higher NO_x emissions relative Figure shows the variation of CO emission with engine loading. It was observed that CO emissions are increased with increase in engine load. The lower CO emission of biodiesel compared to diesel is likely due to oxygen content inherently present in the biodiesel which helps in the more complete oxidation of fuel. Further it can be seen that volume of CO initially decrease but increase at full load indicating better burning conditions at higher temperature assisted by improved spraying qualities with uniform charge preparations of biodiesel.

PERFORMANCE ANALYSIS

Sr. no	Blends	Break power	Mech. Effi.	Break thermal Effi.	Break specific fuel consumption
1	B00	0.13	3.58	1.59	5.38
		0.66	20.37	8.70	0.98
2	B05	0.097	3.46	2.30	3.72
		0.617	21.67	13.22	0.64
3	B10	0.092	2.18	1.57	5.43
		0.52	18.70	8.91	0.96
4	B15	0.083	2.24	1.58	5.42
		3.22	58.22	61.33	0.139
5	B20	0.617	21.57	13.22	0.64
		0.59	18.43	10.11	0.84
6	B30	0.617	21.57	13.22	0.64
		0.61	21.57	9.50	0.90
7	B50	0.617	21.57	13.22	0.64
		0.63	19.62	9.00	0.95

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