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Performance and emission characteristics of C.I. engine with diesel-biodiesel blends

Om Shakti[1], Rajneesh Gidam[2]

[1]M. Tech., Rajiv Gandhi Prodyogiki Mahavidyalaya, Bhopal
[2]Assistant Professor, Rajiv Gandhi Prodyogiki Mahavidyalaya, Bhopal

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ABSTRACT: *Today energy demand is very high due to increasing population and limited resources of non renewable energy in the world. So many government, private researchers are search alternative resource of energy. The emission of fossil fuel like CO2, NOx are harmfully for all living things and CO2 is reason for global warming. Biodiesel is an alternative diesel fuel produced from domestic renewable resources like vegetable oil, animal fat and waste cooking oil. Biodiesel is a biodegradable, lower emission, high flash point and non toxic in nature. The physical and chemical property of biodiesel and petro diesel are same but biodiesel is a biodegradable, lower emission and environmentally friendly. This study has been focused the use of sunflower biodiesel as an alternative fuel. The Performance and emissions characteristics of C.I. engine fuelled with sunflower oil methyl ester blended with diesel fuel is experimentally performed. Biodiesel was prepared from sunflower oil by transesterification process. The biodiesel, blended diesel and pure diesel are performed at different loading conditions. The performance and emission parameters studied are BTE, BSFC, CO, CO2 and NOX. The result was compared and presented in this thesis. The Sunflower Biodiesel showed the comparable performance and emissions characteristics as that of diesel. The application of biodiesel engine in industrial equipment, heavy vehicle engine, marine engine etc.*

Keywords: Sunflower oil, Biodiesel, Transesterification, Diesel engine, Performance and Emission.

INTRODUCTION:

Biodiesel is a clean burning alternative bio fuel, which is produced from Sunflower, karanja, jatropha, waste cooking oil, thumba, soybeans, animal fats sunflowers, alge etc. These are domestic and renewable source. The extracted crude oil cannot be used as a directly in diesel engine because it has a high viscosity; due to high viscosity of pure vegetable oils it will be responsible for high engine deposits and lubricating oil thickening. That would reduce the fuel atomization and increase fuel spray penetration[1]. To create a biodiesel blend it can be blended with conventional diesel. Biodiesel is manufacture from a chemical process which is known as transesterification. Chemically biodiesel is referred as methyl esters of long chain fatty acid derived from renewable biological sources [2]. It can be directly used in the compression ignition engine. Vegetable oil has been good alternative oil instead of petro diesel oil. Vegetable oil obtained from renewable resources which is biodegradable, non toxic, less emission and environmentally friendly nature and can be used blend bio diesel oil [3]. Due to population growth and increasing vehicle demand rapidly consumption of fossil fuel. So alternative fuel is reducing the dependency of fossil fuel .The fuel properties like density, viscosity, cetane number, calorific value and flash point are compared with pure diesel fuel [4]. Flash point of biodiesel is higher than diesel fuel, so biodiesel is good alternative fuel than diesel fuel and safer than biodiesel engine. The two-step transesterification response from rice bran oils toward using acid oil for production of biodiesel in a solvent free system. He taken acid oil to ethanol 1:5 by molar ratio, temperature range 30-40 °C and enzyme is 5-10 [5]. The concentration of carbon monoxide is decreases for the blends B20 and B100 for all loading conditions. thus biodiesel concentration increase, become negative effect due to high viscosity and less increase in specific gravity in the complete combustion process, which produces less amount of CO. Carbon dioxide emission is due to incomplete combustion of fuel and it is basically depends on engine temperature, and Air fuel ratio[6].

BIODIESELE SOURCES:

Palm oil:

Palm oil is an edible vegetable oil. In palm oil saturated fats are very high and very less of trans fats. Palm oil is derived from the Palm fruit and palm kernel oil is derived from palm kernel seed. The scientific name of palm oil is elaeis guineensis and its native from West Africa.

Rapeseed or canola oil:

Rapeseed oil is extracted from the seeds of the rape plant. Scientific name of rapeseed oil is *Brassica napus,* is a specie oil seed in the cruciferous family. Canada is the largest producer of rapeseed oil in the world. It is an edible oil and high in monounsaturated fats.

Sunflower oil:

Scientific name of sunflower is Helianthus annuus. Sunflower oil extracted from sunflower seeds. Sunflower oil is high quality nature due to low percentage of saturated fatty acids and a high percentage of unsaturated fatty acids.

Karanja oil:

Karanja oil is extracted from seeds of Karanja tree. Its scientific name is Pongamia glabra. Karanja seed commonly found in india. Karanja Oil is used for agriculture purpose.

Soybean oil:

Soybean oil is extracted from seeds of soybean seed. Soybean oil is used for cooking purpose. In soybean oil less trans fats and high polyunsaturated fats. Soybean is known as Glycine max, in North America, is a species of legume native to East Asia.

Argemone oil:

Is a specie oil seed in the papaveraceae. Its scientific name is argemone maxicana. Argemone oil is on edible oil and its navitve from western US.

METHODOLOGY:

The *sunflower seed* is the fruit of the sunflower native to America. *Sunflower oil,* also known as "Surajmukhi tel" is non-volatile oil extracted. Biodiesel reactor is used to produce bio-diesel from sunflower seeds. 20L capacity biodiesel reactor is used to produce bio-diesel from sunflower seeds. The production of biodiesel, methyl ester is well known. The ester production from oils and fats is catalyzed based transesterification of the oil with alcohol [7].

1 oil/fat + 3 methanol →3 methyl esters + 1glycerine

In the transesterification process exchanging of the organic group R of an ester with the organic group R of an alcohol. In this process reaction is catalyzed by use of catalyst. In this stage the Sunflower oil is make reaction with the methanol and catalyst. The catalyst is added to methanol so that it reacts with the oil. In this experiment NAOH is used as the catalyst. The ratio between methanol and oil is 5:1 and the mixture is stirred at 300 rpm for 60 min. When transesterification process is completed then the mixture is taken to the separating flask and left to setting for 18 hours. There will be two layers formed one is the biodiesel in the top and other is Glycerine in the bottom. The Glycerine is removal from the separating flask. Washing is define as the obtain pure biodiesel from Glycerine. Washing is basically done to reduce the PH value and obtained pure biodiesel.

EXPERIMENTAL SETUP:

Four cylinder 4-stroke diesel engines was used for the study the complete technical specification and CI engine test kit used for performance testing is given below.

Table 1.1: Feature of the 4 stroke, 4 Cylinder diesel engine

Parameter	Dimension
Bore (mm)	80
Stroke (mm)	95
Compression ratio	16:1
Rated power (H.P.)	29
Rated speed (rpm)	1500
Cylinder no. and type	Four and four stoke

RESULTS AND DISCUSSION:

Experiments were conducted at a constant speed and by varying the loads. Compare the emission and performance of blended, biodiesel and pure diesel oil.

Carbon monoxide emission:

Carbon monoxide emission with respect to load observed that the engine emitted more carbon monoxide for pure diesel as compared to biodiesel blends at all loading conditions. The concentration of carbon monoxide is decreases for the blends B20 and B100 for all loading conditions. .

Carbon dioxide emission:

When the loads are increased the diesel engine emitted more Carbon dioxide in comparison to blend diesel (B20) fuel. Carbon dioxide emission is due to incomplete combustion of fuel and it is basically depends on engine temperature, and Air fuel ratio.

Nitrogen oxide emission:

NOx emission for blend B20 and B100 is more as compared to pure diesel engine increasing trend with respect to load. The reason higher average gas temperature and residence time at higher load conditions. A reduction in the emission for all getting after adding the ignition improve blends as compared to optimum blend was noted.

Brake specific fuel consumption:

We observed that the brake specific fuel consumption is higher than that of diesel when the B20 and B100 blends are used in diesel engine due to low heating value of biofuels. The brake specific fuel consumption is an essential parameter by which compare the engines and determine the fuel efficiency of engines.

Brake thermal efficiency:

The brake thermal efficiency of B20 and B100 is decreasing when the blends were increasing. The brake thermal efficiency of B20 and B100 is less than that of pure diesel fuel at 1500 rpm constant engine speed.

CONCLUSION:

In this chapter concluded that the use of biodiesel blends slightly increases the brake specific fuel consumption in comparison to the diesel fuel at the same load condition. The reason behind the situation is due to lower calorific value of bio diesel. The CO percentage of B20, B100 lower than diesel. CO2 emission is reducing in biodiesel blends (B20) than diesel fuel. This may result in lower CO and CO2 emission with blend of biodiesel. It has many advantage high biodegradability, reduction in greenhouse gas emissions, non-sulphur emissions, non-particulate matter pollutants, low toxicity, and excellent lubricate and is obtained from renewable source like vegetable oils, animal fat etc. Finally it is concluded that the biodiesel can be used as good alternative fuel in the Diesel engine without any change to the engine.

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