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Production of Biodiesel and Investigation of Prefoemance Parameter of Ci Engine Fuled with Used Mustard Oil Biodiesel

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1. ABSTRACT

Now today as we know that the transport increase sector is increased day by day considered being one of the main reasons for failing to meet eco friendly target. In combination with the emission limits and new standards of emission, the already very low CO_2 emission levels have to be further reduced both for spark ignition and diesel engines. Particularly, in Europe the transport sector accounts for more than 30% of the total energy consumption in the Community. It is 98% dependent on fossil fuels with the crude oil feedstock being largely imported and Bio fuel use has to increase from its present low usage – less than 2% of overall fuel to a substantial fraction of the transportation fuel consumption in Europe (target of 25% in 2030). Used Mustard oil biodiesel is suitable as fuel for a diesel engine. Its B20 blend proved potentially suitable for diesel engine. Because BTE, BP is increasing and BSFC is decreasing.Without any modification in the diesel engine it can be directly used in engine.Performance and emission characteristics are better with Mustard oil than diesel. Though there is slight increase in BTE, BP and slight decrease in BSFC but emission are much less than diesel.Use of Biodiesel in diesel engine is suitable only for short term without any modification. For long term tests may reveal clearer picture of engine operation and life.

Key words – Used Mustard oil biodiesel(UMOME),B20,B50,B60,Diesel, Exhaust emissions.

2.INTRODUCTION

The demand for energy is increasing at a substantial rate as the economy of the populous developing countries is growing. Currently, this high energy demand mainly depends on fossil fuel resources but it is unsustainable and its exploitation leads to environmental degradation and increased emission of greenhouse gases. Hence, the use of alternative sources of energy, such as biofuels, is attracting the interest of researchers. In recent years, biodiesel has gained international attention as a source of alternative fuel due to characteristics like high degradability, low toxicity and emission of carbon monoxide, particulate matter and unburned hydrocarbons. Biodiesel is a mixture of alkyl esters and it can be used in conventional compression ignition engines, which need almost no modification.

Currently, partially or fully refined and edible-grade vegetable oils, such as soybean, rapeseed, mustard, mustard and sunflower, are the predominant feedstock for biodiesel production which obviously results in the high price of biodiesel. Therefore, exploring ways to reduce the cost of raw material is of much interest in recent biodiesel research. As a result, in some countries, non-edible oils such as Jatropha oil, Neem and waste cooking oil are preferred due to their low price.

Realistically, non-edible oils only cannot meet the demand of energy consumption therefore; it has to be supplemented from some edible oils. At present, India is the sixth biggest country in the world in terms of energy demands which is 3.5 percent of world commercial energy demand and is expected to grow at the rate of 4.8 percent per annum of its present demand.

The petroleum import bill is currently about 30 percent of total import bill and yearly consumption of diesel oil in India is about 40 million tones forming about 40 percent of the total petroleum product consumption.

3.LITERATURE REVIEW

This reviews the feasibility of this fuel source and some of the results obtained from investigation on the use of vegetable oils and their esters as fuel in CI engine.

3.1 Use of edible vegetable oil as engine fuel

KARA Miray et al. (2008) - The effects of KF loading into alumina were investigated for the transesterification of canola oil with methanol. It was observed that 35 wt. % of KF into Al2O3 was the best catalyst and gave a methyl ester content of 99.6% under the following conditions: 60 ◦C, methanol/oil ratio of 15:1, 3 wt. % of catalyst, and 8 h of reaction. The canola oil methyl ester obtained was characterized to determine its suitability for use as a fuel in diesel engines. The viscosity of canola oil reduces substantially after transesterification and becomes comparable to that of diesel fuel. The flash point and calculated cetane index of our canola oil methyl ester were higher than those of diesel fuel. The higher flash point of the canola oil methyl ester makes it a safer fuel. The higher calculated cetane index suggests better combustion properties of the biodiesel. The produced biodiesel's fuel characteristics indicate that it can be used as a substitute diesel fuel.

Hossain A.b.m.s. et al. (2009) - Comparison of the optimum conditions of alkaline-catalyzed transesterification process for biodiesel production from pure sunflower cooking oil (PSCO) and waste sunflower cooking oil (WSCO) through transesterification process using alkaline catalysts was studied. To obtain a high quality biodiesel fuel that comply the specification of standard methods (ASTM D 6751 & EN 14214), some important variables such as volumetric ratio, types of reactants and catalytic activities were selected. The highest approximately 99.5% biodiesel yield acquired under optimum conditions of 1:6 volumetric oil-to-methanol ratio, 1% KOH catalyst at 40ºC reaction temperature and 320 rpm stirring speed. Result showed that the biodiesel production from PSCO and WSCO exhibited no considerable differences. The research demonstrated that biodiesel obtained under optimum conditions from PSCO & WSCO was of good quality and could be used as a diesel fuel which considered as renewable energy and environmental recycling process from waste oil after frying.

Sarıbıyık Oğuz Yunus et al.(2010) - In this study, local vegetable oil named as Ricinus Communis (RC) is used as the raw material for the production of biodiesel. In order to obtain RC oil, Soxhalet Extraction apparatus was used. This paper deals with the transesterification of Ricinus Communis oil with methanol to produce biodiesel. Moreover, this study analysis the fuel properties of RC biodiesel and soybean biodiesel blend. Various properties of the RC biodiesel, Soybean biodiesel and their blends such as the cold filter plugging point (CFPP), cetane number, flash point, kinematic viscosity and density were determined. Test results were compared well with European biodiesel standards EN 14214. Analysis showed that the cetane number and the cold flow behavior of the RC biodiesel and soybean biodiesel blends were improved due to the high cetane number (80) and the low cold filter plugging point (-35˚C) of RC biodiesel.

Rahman Kazi Mostafijur et al. (2010) - The world is getting modernized and industrialized day by day. As a result vehicles and engines are increasing. But energy sources used in these engines are limited and decreasing gradually. This situation leads to seek an alternative fuel for diesel engine. Biodiesel is an alternative fuel for diesel engine. The esters of vegetables oil animal fats are known as Biodiesel. This paper investigates the prospect of making of biodiesel from jatropha oil.Jatropha curcas is a renewable non-edible plant. Jatropha is a wildly growing hardy plant in arid and semi-arid regions of the country on degraded soils having low fertility and moisture. The seeds of Jatropha contain 50-60% oil. In this study the oil has been converted to biodiesel by the well-known transesterification process and used it to diesel engine for performance evaluation.

4.MATERIALS AND METHODS

This briefly describes the methodology used for the production of used mustard oil methyl ester (UMOME), preparation of fuel blends and experimental procedure adopted to evaluate performance of a Variable Compression Ratio diesel engine on the blends.

4.1. Fuel

The experiment is carried out using diesel and used mustard oil methyl ester (UMOME) and their blends with various proportions.

4.2. Preparation of Mustard Oil Methyl Ester

Biodiesel is commonly produced by the transesterification of the vegetable oil or animal fat feed stock. Though there are several processes for transesterification, batch reaction process is adopted due to the simplicity and adoptability in the laboratory.

The percentage of free fatty acids present in the sample of the fuel is estimated by titration process, and the amount of KOH and Methanol is calculated.

Fig.Separation of water and biodiesel in Separating funnel after Water Washing

Fig. Prepared Biodiesel with glycerol and Methanol

Table. Mustard Oil Methyl Ester – Diesel Blends selected for Experiments

Sr No.	Fuel Types	Nomenclature
1.	Diesel	
2.	20%Used Mustard oil biodiesel + 80% Diesel	UMOME20
3.	50%Used Mustard oil biodiesel + 50% Diesel	UMOME50
4.	60%Used Mustard oil biodiesel + 40% Diesel	UMOME60

5.RESULT AND DISCUSSION

This briefly describes the fuel properties, performance and exhausts emissions of engine for blends of diesel and methyl ester of used mustard oil.

5.1. Properties of Diesel, Biodiesel and Blends

Properties of diesel, Biodiesel and its Blends are given below:

Table. Properties of Diesel, UMOME and its Blends

Properties	Dies	Used	UMO	B20	B50	B60
Viscosity	3.1	27.8	4.5	5.6	4.3	4.6
Density(kg/m	80	98	98	96	97	98
Specific Gravit	0.80	0.9864	0.9816	0.9652	0.9135	0.9347
Calorific	43	3935	40	3883	3924	39

5.2 VISCOSITY

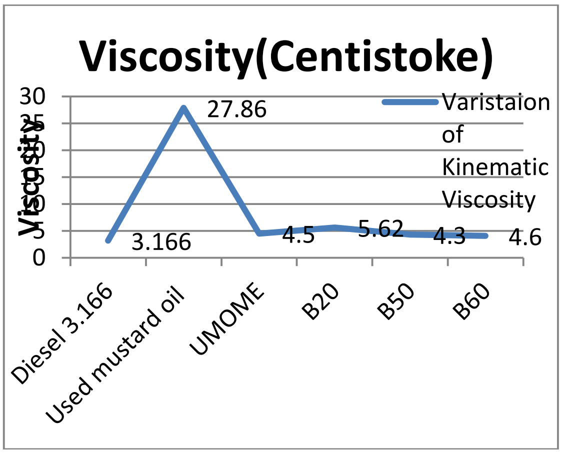

Fig. Viscosity of Diesel , UMOME and its blends

Figure show that kinematic viscosity of Used Mustard oil is about Nine times higher than of Diesel. But after transesterification viscosity of Used Mustard oil is lowered and it is 29.64% higher than Diesel. Viscosity of B20 is 43.66% higher than of diesel. Viscosity of B50 is 26.37% higher than of diesel. Viscosity of B60 is 31.17% higher than of diesel.

5.3 DENSITY

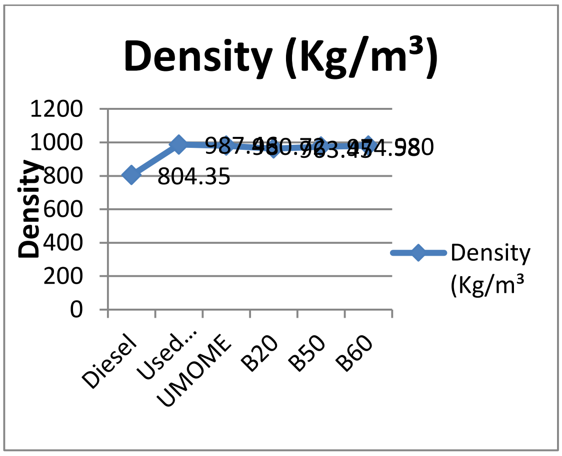

Fig. Density of Diesel, UMOME and its blends

Figure shows that Density of Used Mustard oil is higher than of Diesel. Density of UMOME is 17.98% higher than of Diesel. Density of B20 is 16.68% higher than Diesel. Density of B50 is 17.46% higher than Diesel. Density of B60 is 17.92% higher than Diesel.

5.4 CALORIFIC VALUE

Calorific Value of a Fuel is the thermal energy released per unit quantity of fuel when the fuel is burned completely.

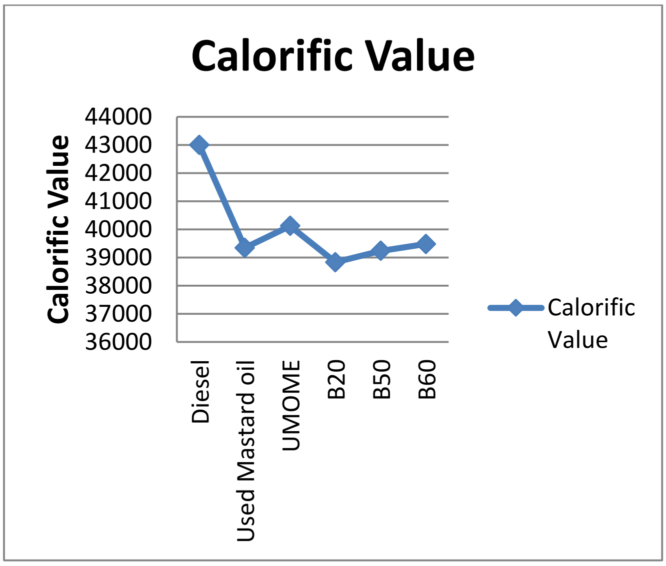

Fig. Calorific Value of Diesel, UMOME and its blends

Figure shows the Calorific value of Diesel, Used Mustard oil, UMOME and its Blends with Diesel. Calorific value of Used Mustard oil is 9.27%, UMOME 6.92%, B20 10.71%, B50 9.57%, B60 8.51% lowered than Diesel.

6. Summary and Conclusion

A 3.5 kW, constant speed diesel engine was tested on diesel, UMOME-diesel blends in 20:80, 50:50, 60:40 ratio. The performance of the engine was found to be satisfactory on the blends. On the basis of the results obtained

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from the whole experiment the following conclusion can be drawn:

1. The viscosity of Used Mustard oil is about Nine times higher than of Diesel. But after transesterification viscosity of Used Mustard oil is lowered and it is 29.64% higher than Diesel. Viscosity of B20 is 43.66% higher than of diesel. Viscosity of B50 is 26.37% higher than of diesel. Viscosity of B60 is 31.17% higher than of diesel
2. The Density of Used Mustard oil is higher than of Diesel. Density of UMOME is 17.98% higher than of Diesel. Density of B20 is 16.68% higher than Diesel. Density of B50 is 17.46% higher than Diesel. Density of B60 is 17.92% higher than Diesel.
3. The Specific Gravity of used Mustard Oil is higher than of Diesel. Specific Gravity of UMOME is 18.36 higher than Diesel. Specific Gravity of B20 is 16.57% higher than Diesel. Specific Gravity of B50 is 11.85% higher than Diesel. Specific Gravity of B60 is 13.85% higher than Diesel.
4. Calorific value of Used Mustard oil is 9.27%, UMOME 6.92%, B20 10.71%, B50 9.57%, B60 8.51% lowered than Diesel.

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