International Journal of Research in Engineering, Science and Management
Volume-1, Issue-10, October-2018
www.ijresm.com | ISSN (Online): 2581-5792

A Review on Performance Test and Characteristics Emission on Bio Diesel

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***Abstract*—This study is to analyze the performance and emission of the different proportionate of the diesel with cooking oil using as the blent, Which is used to measure the performance of the bio diesel. The fossil fuel usage is increasing due to the population growth and the need is also more, so we planned to make the biodiesel as a fuel with more efficient. Many literature has been studied with various consideration of the different concepts. The aim is to know about the emission and combustion of engine with the cooked oil which is the replacement of other type of fuel. When the cooked oil is mixed with diesel, a better performance has been occurred. The exhaust gases contain less pollutant. As a result environmental pollution has been minimized in the atmosphere. The good combustion will attain without the damage of engine and its parts.**

***Index Terms*— Bio diesel, CO_2, NO_2, HC**

I. Introduction

Bio diesel is a renewable and bio degradable fuel. it is manufactured from refined vegetable oil and animal fats[1]. The lipids are composed of poly alkyl groups which is separated by covalent bonds. The alkyl groups are methyl, ethyl, and propyl. The bio diesel is only applicable for standard diesel engine [2]. Either biodiesel can be performed as fuel or it can be mixed with blents. The availability of the fuel is decreased now a days due to the usage of vehicles by the population. In the modern world each and every one is having a vehicle for their need, so the usage of fuel is more than normal [3]. Beyond the need of fuel is more, the rate is also increased now a days .These are the reason to think & how to overcome with a fuel depletion. Bio diesel which is performed in the diesel engine with the minor modification [4]. The biodiesel engine consisting of more lubrication when compared to petroleum. Vegetable oils are converted as a biodiesel, which is well suited for diesel engines [5]. The impact and economic benefits are the major reasons for the use of biodiesel. Vegetable oils are nontoxic sources of renewable energy and don't contribute to global carbon dioxide (CO2) buildup. Therefore vegetable oils are used a as fuels [6]. Many studies have been studied extensively in recent years and investigated palm oil is one of the vegetable oil widely used as an alternative fuel. The exhausts gases are NOx, CO, HC, smoke, less amount of N_2 which are harmful to the environment. When biodiesel is used in the engine, it emits less pollutant and nontoxic gases when compare to petrol and diesel [7].

II. Reason for Using Vegetable Oil as Fuel

Vegetable oils can make only a marginal contribution as a fuel supply to the worldwide. Vegetable oil could only acquire a significant share to the fuel market under certain local conditions. Fluctuations in the world market price of vegetable oil complicate the assessment of the economic viability and the availability of vegetable oil fuel compared with conventional fuels. Misra and Murthy [11] noted that vegetable oil fuel can be used for diesel engines for the following reasons: vegetable oil is biodegradable and nontoxic. Knocking tendency is lower because of the reasonable cetane number of vegetable oil .This type of fuel contains a low amount of sulfur; thus, it is an eco-friendly. Modifying the major components of diesel engines is not required because of the enhanced lubricity of vegetable oil as a fuel. The flash point of vegetable oil is higher than diesel and the safety is improved. Hence it results in low emission of exhaust and noise [12].

III. Engine Performance

The relationship among fuel properties, such as viscosity, calorific value, specific density, and surface tension are affected by engine performance. Fuel consumption increases with increasing biodiesel oil in blends and results in better combustion when injected into a combustion chamber. The performance of a diesel engine operating on sunflower oil as an alternative fuel was examined for higher fuel consumption and lower torque generation [13]. The low percentage of biodiesel (20% or less) blends provides higher brake power for completed combustion with lower fuel consumption. Palm oil blends and diesel fuel are used in KIR-LOSKAR TV-1, a four-stroke diesel engine at varying loads [14]. The maximum output of the engine is 5.2 KW with a varying load of 20–100% by maintaining constant speed at 1500 rpm. The brake thermal efficiency of25%, 50%, 75%, and 100% of palm biodiesel were 30.895%, 30.56%,29.22%, 29.58%, and 28.65%, respectively. Tran's esterification is a chemical reaction between triglyceride and alcohol in the presence of catalyst or without catalyst [15]. The purpose of the Trans esterification process is to lower the viscosity of the oil. Methanol being cheaper is the commonly used alcohol during Tran's esterification reaction. Homogeneous catalysts such as sulfuric acid, sodium hydroxide, potassium hydroxide and heterogeneous catalysts such as calcium oxide, magnesium oxide and others can be used in trans esterification reaction [16]. Non catalyzed trans esterification processes are the BIOX process and the supercritical alcohol (methanol) process. The advantage in its usage is attributed to lesser exhaust emissions in terms of carbon monoxide, hydrocarbons, particulate matter, polycyclic aromatic hydrocarbon compounds and nitrated polycyclic aromatic hydrocarbon compounds. The main advantages of biodiesel given in the literature include its domestic origin, the country economy will reduce the dependency of imported petrol, biodegradability, high flash point, and inherent lubricity in the neat form.

The biodiesel policy will help reducing of petroleum imports and saving of foreign exchange. The biodiesel high flash point makes it possible for its easy storage and transportation viscosity is more , lower energy , cloud point and pour point is high, higher nitrogen oxide emissions, lower engine speed and power, engine compatibility, and high price these are all the main factors to produce the bio diesel . Biodiesel can be used directly or as blends with diesel fuel in a diesel engine. Biodiesel is a biodegradable and renewable fuel. It contributes low level of carbon dioxide or sulfur to the atmosphere and emits less gaseous pollutants than normal diesel. Carbon monoxide, aromatics, polycyclic aromatic hydrocarbons (PAHs) and partially burned or unburned hydrocarbon emissions are all reduced in vehicles operating on biodiesel. In the biodiesel minimum amount of the toxic gases emitted to the surroundings, so that the environmental benefits are more. Biodiesel is an environmentally friendly fuel that can be used in any diesel engine without modification. Bio diesel is a nontoxic and renewable energy.

IV. Exhaust Emissions

In order to take the humidity effect on NO formation into account,a dimensionless correction factor ''kh,d'' was calculated as,

$$K_{h,d} = \frac{1}{1-0.0182\times(\mathrm{H}_a-10.71)+0.045\times(\mathrm{T}_a-298)} \quad (1)$$

Where, Ha = humidity of the intake air (g H_2O/kg dry air) and Ta = temperature of the intake air (K).Humidity and temperature of the intake air was measured byHT-785 with an accuracy. The concentration values of NO, CO and HC emissions are converted into mass value susing the following relationship,

NO_{mass} = 001587 × [NO] wet ×k_{hD}×G_{EXHW}
CO_{mass} = 000966 × [CO] wet ×G_{EXHW}
HC_{mass} = 000479 × [HC] wet ×G_{EXHW}

Where NO_{mass}, CO_{mass} and HC_{mass} are the corrected emissions concentration (g/h), $[NO]_{wet}$, $[CO]_{wet}$ and $[HC]_{wet}$ are emissions concentration on a wet basis (ppm) and G_{EXHW} are the exhaust gas average molecular weights (g/h)[18].

V. NO_2 Emission

There are eight oxides of nitrogen (N_2) in the exhaust emissions. Oxides of N_2 are composed of 90 vol.% nitric oxide (NO), 5 vol.%nitrogen dioxide (NO_2), and 5 vol.% nitric oxide (N_2O, N_2O_3, andN_2O_5) . Chemical equilibrium considerations indicate that for burned gas at typical flame temperatures are higher, overall cylinder temperature is an indicator of higher NO formation, it must be stated that the temperature distribution in the cylinder is more important, thus causing in some cases. NO is to increase and in others to decrease in the regions of engine cylinder, there is several of high temperature content score responded to oxygen contents.

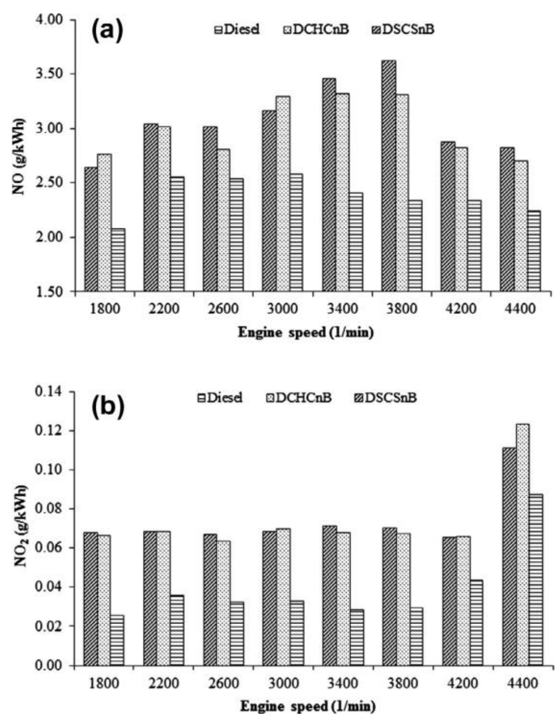

Fig. 1. Engine Speed

VI. CO_2 Emission

CO2 emission is a chemical product of a complete combustion reaction of hydrocarbon based on fuels. The variations of CO_2 emissions for diesel fuel, $DCHC_nB$ and $DSCS_nB$ with respect to engine speeds are depicted [19]. The average CO2 emission of $DCHC_nB$ and $DSCS_nB$ decreased by 1.12% and 2.30% compared to that of diesel fuel. At whole engine speed 4400 rpm the lowest percentage of CO2 emission was obtained with $DSCS_nB$ at 3400 rpm as 9.06%, while the highest percentage of CO_2 emission was observed with diesel fuel at 1800 rpm as10.80%. $DCHC_nB$ and $DSCS_nB$ provide more oxygen to the combustion chamber due to the presence of more oxygen in its chemical structure.

VII. HC Emission

Variations of HC emissions of diesel fuel and ternary blends with respect to engine speeds. Diesel fuel gavehigher HC emissions than $DCHC_nB$ and $DSCS_nB$ at whole engine speeds (except 1800 rpm). HC emissions of $DCHC_nB$ and $DSCS_nB$ are lower at high and middle engine speeds, but drastically increased with the decrease in engine speed (from 2200 rpm).Due to the presence of vegetable oils in ternary blends, droplet diameter of the ternary blends is higher than that of diesel fuel. Increasing droplet diameter leads to decrease in evaporation rate and increase in ignition delay as well as HC formation. Especially in lower engine speed air swirling is very slow. Slow mixing ofternary blends with air resulting in over rich mixture or quenching of the combustion reaction, can result in incomplete combustion products and HC being present in the exhaust gases.

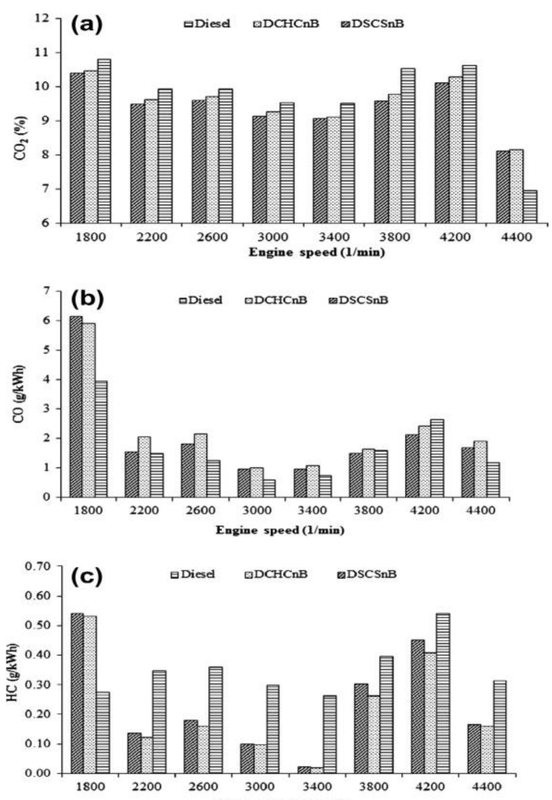

Fig. 1. CO emission

VIII. CO Emission

Main reasons of increasing in concentration of CO emission in exhaust gases are rich fuel–air ratio and low oxygen concentration.CO emissions of diesel fuel and ternary blends as a function of engine speed are depicted in indicates that CO emissions for all test fuels evidently increased with decreasing the engine speed [25]. The maximum CO emissions diesel fuel, $DCHC_nB$ and $DSCS_nB$ were obtained as 3.94, 5.89 and 6.15 g/kW h, respectively. Especially under lower engine speeds, the test engine emitted more CO emission due to local presence of a richer mixture in the combustion chamber. CO emissions were noted to decrease between maximum torque (2200 rpm) and power (3800 rpm) engine speeds. CO has the lowest emissions produced between 2200 and 3800 rpm when a homogeneous air/fuel (A/F) mixture is burned at the stoichiometric A/F ratio mixture [20].

IX. Results and discussion

In this study, engine performance and exhaust emissions of turbocharged direct injection diesel engine were evaluated at full load and various engine speeds by using two different diesel fuel-vegetable oil-n-butanol ternary blends. Effects of component type and fatty acid composition on basic fuel properties of ternary blends and those of mutual effects of engine performance and exhaust emissions were discussed in detailed. The main conclusions can be summarized in the following points: Micro emulsification of vegetable oil-diesel fuel with n-butanol can be a promising technique for using neat vegetable oils efficiently in diesel engines without any modifications in the diesel engine, and the viscosity and density of the ternary blends can be reduced to close to those of diesel. The cold flow properties of vegetable oil can be significantly improved by blending vegetable oils with n-butanol and diesel fuel blend. Oxidation stability of $DCHC_nB$ and $DSCS_nB$ are 11.6 and 10.7 h respectively, and significantly higher than requirement in EN 14214 standard (P6 h).

X. Engine Performance

Alternative fuels for diesel engines have been becoming increasingly important due to diminishing petroleum reserves and the growing environmental concerns have made renewable fuels an exceptionally attractive alternative as a fuel for the future. The edible oil in use at present is soyabean, sunflower, rapeseed and palm. The inedible oil used as feedstock for biodiesel production includes J. curcas, M. indica, F. elastica, A. indica, C. inophyllum jatropha, neem, P. pinnata, rubber seed, mahua, silk cotton tree, waste cooking, microalgae, etc. The average brake torque, brake power, BTE and exhaust gas temperature values of $DCHC_nB$ and $DSCS_nB$ decreased due to lower heating values, related to oxygen contents of n-butanol and vegetable oils, compared to those of diesel fuel. The presence of n-butanol and vegetable oils in ternary blends has increasing effect on BSFC. Addition of n-butanol to diesel fuel-vegetable oil blends leads to increase NO, NO_2 and CO formations, while decrease CO_2, HC emissions.

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