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Study of Neem Biodiesel as a Fuel for CI Engines: A Review

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ABSTRACT

In today's scenario, researchers around the world are looking for ways to develop alternate forms of fuel. With the ever-rising fuel costs, developing alternate energy is a top priority. Biodiesel was developed to combat the high gas and oil prices. It is especially made for use in diesel cars and trucks. Biodiesel can be made from all Natural foods that can produce oil. Virtually all oils that are used in the kitchens every day can fuel automobiles. Biodiesel fuel is better for the environment because it burns cleaner than Petroleum Diesel and does not pollute the atmosphere. It is non-toxic and bio degradable, making it the perfect fuel. Many car manufacturers are realizing that the bio diesel automobile is becoming more popular, and are jumping for developing their own version of a biodiesel vehicle. They realize that the need for these vehicles will increase, and predict that they will be ready for the onslaught.

Diesel engines have superior fuel efficiencies, and hence they are predominantly used in commercial transportation and agricultural machinery. Due to the short-age of diesel fuel and its increasing costs, a need for an alternate source of fuel for diesel engines is imminent. This paper investigates the suitability of Neem as a biodiesel with particular reference to CI Engine.

Keywords: Neem, Biodiesel, Performance, Emissions.

I. INTRODUCTION

The world has been confronted with energy crisis due to the decrease of fossil fuel resources and the increase of environmental restrictions. Therefore attention has been focused on developing the renewable or alternate fuels to replace the petroleum based fuels for transport vehicles. There are several alternative sources of fuel like vegetable oils, biogas, biomass, primary alcohols which are all renewable in nature. Among these fuels, vegetable oils appear to have an exceptional importance as they are renewable and widely available, biodegradable and non-toxic, and environmental friendly. In agriculture-based country, like India, the use of vegetable oils has to be identified and initiated in order to prevent environmental degradation and reduce dependence on imported fossil supplies by partially replacing them with renewable and domestic sources. A great deal of research has been conducted on their feasibility and the researchers have concluded that neat vegetable oils hold promise as alternative fuels for Diesel engines for short-term use [1-4]. However researchers have reported that the use of neat vegetable oil causes engine-related problems. High viscosity, low volatility, and poor cold flow conditions of these fuels cause severe engine deposits, injector coking, piston ring sticking, and difficulty in starting especially in cold weather. There are four ways to use neat vegetable oils in diesel engine [5-8]: (1) direct use or blending in diesel fuel, (2) micro emulsions in diesel fuel, (3) thermal cracking of vegetable oils, and (4) transesterification. It has been reported that dilution of vegetable oils with such materials as diesel fuels, a solvent or ethanol produced heavy carbon deposit on the inlet valves and showed a considerable top ring wear. Thermal cracking refers to a chemical change caused by the application of thermal energy in the presence of air or nitrogen sparge. The viscosity of pyrolysed vegetable oil is reduced, but still exceeds the specified value of 7.5 cSt. It has been reported that dilution of vegetable oils with such materials as diesel fuels, a solvent or ethanol produced heavy carbon deposit on the inlet valves and showed a considerable top ring wear. Hence, out of these,

transesterification is the most popular and best way to use neat vegetable oils [8].

II. PROPERTIES OF NEEM BIODIESEL

Physical and chemical properties of neem oil, neem methylester and conventional diesel are presented in Table 1 .The fuel properties of neem biodiesel were within the limits and comparable with the conventional diesel. Except calorific value, all other fuel properties of neem biodiesel were found to be higher as compared to diesel [9] & [19].

Properties	Diesel	Neem Oil	Neem BioDiesel
Density(gm/cc)	0.84	0.778	0.61
Kinematic viscocity at 35^{o}C (Centistokes)	4.0	21.38	5.96
Calorific value (MJ/kg)	45	26.65	38.15

III. LITERATURE REVIEW

Sahoo et al. [10] have experimented with jatropha, karanja and polanga biodiesel in a Diesel engine. They reported higher peak cylinder pressure and shorter ignition delay for all biodiesels when compared with diesel.

Banapurmath et al. [11] have experimented with methyl esters of honge (HOME), jatropha (JOME), and sesame (SOME) in a single cylinder, four stroke, direct injection compression ignition (CI) engine and reported a higher emission of CO, HC, and smoke and lower NOx as compared to that of diesel.

Edwin et al. [12] have studied the combustion process of rubber seed oil (RSO) and its methyl ester (RSOME) and also reported higher emissions of CO, HC, and smoke and lower NOx as compared to that of diesel.

Balusamy et al. [13] have experimented with methyl ester of Thevetia Peruviana seed oil (METPSO) and reported a lower emission of CO, HC, and a higher NOx as compared to that of diesel.

Qi et al. [14] have compared the combustion characteristics of diesel and biodiesel from soybean oil in a single cylinder, naturally aspirated Diesel engine and concluded that the peak cylinder pressure of biodiesel is close to that of diesel. They also reported that the peak rate of pressure rise and peak heat release rate during premixed combustion phase are lower for biodiesel.

Narun et al. [15] have conducted experiment with diesel fuel and diesel NOME blends in a four stroke naturally aspirated Diesel engine.

Atul Dhar et al. [16] reported that brake thermal efficiency was highest among all test fuels. All blends showed higher brake thermal efficiency than mineral diesel. Author found 20% efficiency with mineral diesel, 23% efficiency with pure biodiesel of 100% blend, which is 15% higher. They attributed this increase in brake thermal efficiency is due to presence of oxygen in the biodiesel molecules which improves the combustion efficiency using neem as biodiesel.

R.Senthilkumar et al. [17] observed that the brake thermal efficiency of blends 10% neem biodiesel and 90% diesel, 20% neem biodiesel and 80% diesel are almost very close to brake thermal efficiency of diesel. Brake thermal efficiency found 24.7% brake thermal efficiency by using pure diesel while 25.1% brake thermal efficiency by using30% neem biodiesel and 70% diesel, which is 1.63 % higher for blend 30% neem biodiesel and 70% diesel than pure diesel. They attributed this due to presence of increased amount of oxygen in respective fuels, which might have resulted in its improved combustion as compared to pure diesel.

Nishant Tyagi et al. [18] observed that break thermal efficiency of B10 is very close to break thermal efficiency of pure diesel. Author found 28% brake thermal efficiency by using pure diesel while 31% brake thermal efficiency by using20% neem biodiesel and 80% diesel. Break thermal efficiency of B20 is 14.2 % higher than break thermal efficiency of pure diesel due to the more oxygen content. Author attributed that an increase in break thermal efficiency may be attributed to the complete combustion of fuel because of oxygen present in blends perhaps also help in combustion of fuel using neem as biodiesel.

IV. CONCLUSION

Neem can be used as an alternative fuel without much modifications of diesel engine and almost the same performance of a diesel engine with a petro diesel fuel. The Performance and Emission characteristics of Neem vary from Engine to engine. The conventional methods used for the analysis of performance and emission characteristics of neem are expensive. So one can think over utilizing the CFD, which provides alternative to cost effectiveness speedy solution to engine design and optimization of engine for the Neem Fuel. CFD results are the integral part of the design process and it has eliminated the need of Engine.

V. FUTURE SCOPE

As per the literature study, it is clear that Biodiesel can be used as the alternative fuel for CI engines. But it is observed that in some cases, the life of fuel carrying hoses is reduced. This is due to viscosity of Biodiesel. The viscosity of biodiesel can be reduced by increasing the temperature of biofuels to certain degrees.

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