PERFORMANCE ANALYSIS OF 2-METHYLTETRAHYDROFURAN BLENDED ON BIO-DIESEL ENGINE

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ABSTRACT

Biodiesel nowadays is emerging as an alternative fuel which is a good replacement to the petroleum diesel. Biodiesel is mainly derived from fats and oils by different methods such as dilution, pyrolysis, micro emulsification and transesterification but these days most commercial method used for bio-diesel production is 2-methyltetrahydrofuran transesterification. Biodiesel was prepared using transesterification process by optimizing the production parameters such as alcohol to oil molar ratio, catalyst concentration etc. Engine design also plays an important role as if it is improved it reduces fuel consumption and give better performance parameters. In this thesis the main emphasis has been laid on optimum production of biodiesel from neem oil and then using the biodiesel blends with diesel studying the comparative exhaust emission characteristics and engine performance. A four stroke single cylinder compression ignition engine was used to measure performance and emission parameters. Biodiesel (fire point and calorific value) added to the diesel (fire point and calorific value) at Three different volume concentrations i.e. 10, 20, &30 of Biodiesel and to blend the Biodiesel with 2-Methyltetrahydrofuraneto study the emission levels.

Keywords: Bio-diesel, Engine, 2-Methyltetrahydrofuran, Brake Power and Mechanical Efficiency

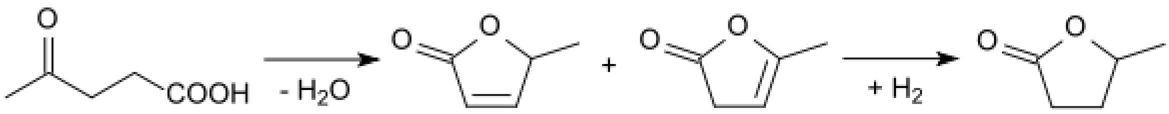
1. INTRODUCTION

The use of vegetable oils and its derivatives has been used as alternative diesel fuels. From the times of petroleum crisis in 1970 as the demands and prices has been increased day by day more interests are seen towards substitution of fossil fuels with biodiesel. Also biodiesel production has been in great interests because of concern seen towards world growing environment problems in the last few decades .Now a days biodiesel is emerging as an alternative fuel as viable alternative to petroleum diesel. So many methods are used for production of biodiesel conventionally such as pyrolysis, micro emulsification, dilution, trancesterification etc.

2. PREPARATION: 2-Methyltetrahydrofuran is usually synthesized by catalytic hydrogenation of furfural.

$OC_4H_3CHO + 4\ H_2 \rightarrow OC_4H_7CH_3 + H_2O$

Furfural is produced by the acid-catalyzed digestion of pentosan sugars, C_5 polysaccharides, in biomass. Thus, the raw materials of 2-methyltetrahydrofuran are renewable biomass rich with cellulose, hemi-cellulose and lignin, such as corncobs or bagasse and other plant and agricultural waste. 2-Methyltetrahy- drofuran can also be produced starting from levulinic acid. Cyclization and reduction gives γ-valero- lactone



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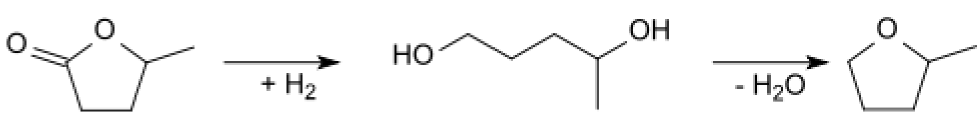
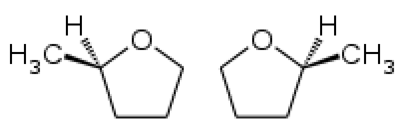
This lactone can be hydrogenated to 1,4-pentanediol, which can then be dehydrated to give 2-methyltetrahydrofuran:



2-Methyltetrahydrofuran has one chiral center, so it exists in two enantiomeric forms. The commercial processes involving hydrogenation gives a racemic mixture of the two. The asymmetric synthesis of (*S*)-(+)-2-methyltetrahydrofuran can achieved by using a wool–rhodium complex as a chiral catalyst for hydrogenation of methyl furan.



3. PROPERTIES OF BIODIESEL AND DIESEL BLENDS

Table 1. Properties of Biodiesel and Diesel Blends

S. No	Properties	Neem Oil Methyl Ester	B00	D10+B10	D20+B20	D30+B30
1	Specific Gravity	0.8	0.83	0.845	0.856	0.871
2	Kinematic Viscosity in mm^2/ sec @ 40°C	6.81	3.02	3.78	3.855	3.92
3	Absolute Viscosi- ty in NS/m^2 @ 40 °C	5.945	2.464	3.01	3.184	3.26
4	Flash Point in °C	168	53	43	46	49
5	Fire point in °C	184	55	45	48	51
6	Cloud Point in °C	10	-10	-4	-2	-5
7	Pour Point in °C	5	-20	-11	-14	-12
8	HHV in MJ/Kg	36.398	44.80	43.895	42.787	42.717

4. RESULTS AND DISCUSSION

4.1 BP VS SFC

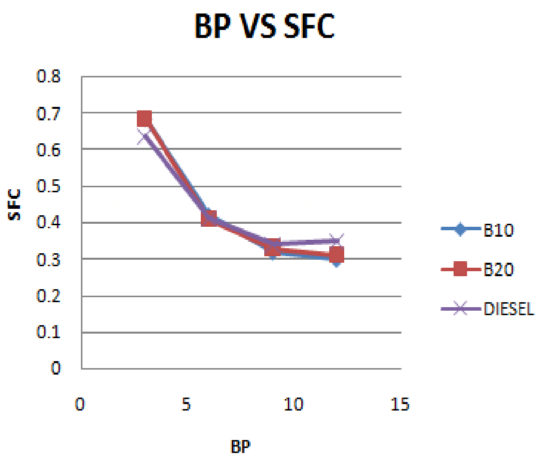


Figure 1. Variation of BP Vs SFC

Figures shows the variation of BSFC (brake specific fuel consumption) with load of diesel and different biodiesel blends. As the load increases in the above figures the BSFC decreases at lower loads and then it remains almost constant.

4.2 BP VS BTE: Figure 2 shows the variation of Brake Thermal Efficiency with Brake Power. The rate of increase was higher at Lower Brake power and increases at High Brake power. Dhar et al and Heroor et al. 2013 has also obtained similar trends for brake thermal efficiency using neem oil biodiesel. Nayak et al. 2014 and Sakthivel et al. 2014 also showed similar variations for brake thermal efficiency using mahua oil biodiesel and fish oil biodiesel

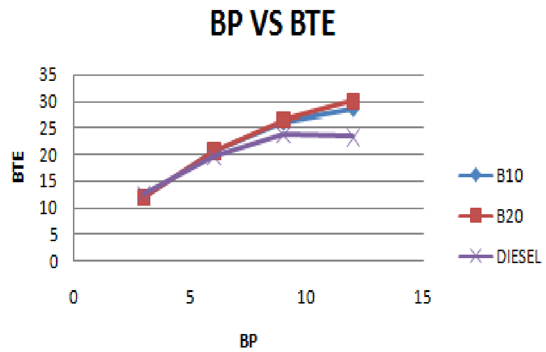


Figure 2. Variation of BP Vs BTE

4.3 BP VS MECH.EFF.

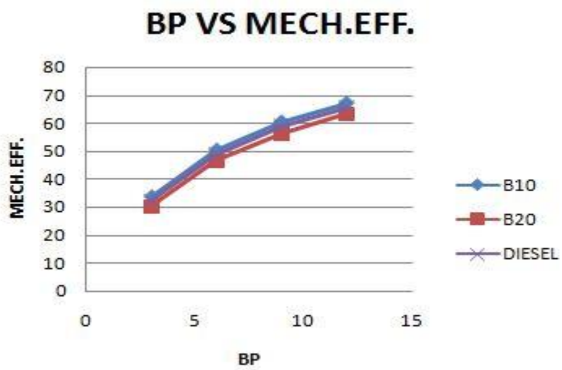


Figure 3. Variation of BP Vs Mechanical Efficiency

Figure 3 shows the variation of Mechanical Efficiency with BP. Mechanical Efficiency increases by 17% during Starting Brake Power and when it increases the percentage of increase in BP is only 5%. At higher loads the temperature of engine increases which leads to decrease in viscosity of the lubricating oil hence frictional power losses increases with more rate at higher loads

5. CONCLUSION

The performance and emission characteristics of single cylinder four stroke diesel engine using methyl ester blends B10, B20, B30 were experimented. The results are plotted and concluded that oil blends shows BSFC, mechanical efficiency and brake thermal efficiency results were close to that of diesel and carbon monoxide, hydrocarbon emissions were closer to diesel. Nitrous oxide emissions were higher for B10, B20 blends and slightly lower for B30 blends. In the various literature it has been evidenced that the mixed variation of Co, NOX and Co2 emissions on addition of biodiesel depending upon the specific properties of the fuel, intermixing, oxygen availability, viscosity etc. NOX is reduced by 30% using oxygenated additives.

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