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COMPARITIVE ANALYSIS OF BIODIESEL WITH COTTON SOAPSTOCK OIL FOR IC ENGINE

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ABSTRACT

The worries on environmental change, the high vitality costs and the waning oil holds and supplies have required a solid enthusiasm for the examination for sources of alternative fuel. Biodiesel is an option sustainable fuel that has increased gigantic consideration as of late. Concentrates on the physical properties of biodiesel have demonstrated that it is totally miscible with oil diesel. Since the burning of biodiesel produces particulate issue and gases which is lower than petrodiesel, ignition of biodiesel and biodiesel mixes have demonstrated a huge decrease in particulate issue and fumes emissions.In this comparative paper, the utilization of biodiesel with cotton soapstock oil for IC engine for Performance, Emission and Combustion characteristics with other oils used by researchers has been analysed.

Keywords: Biodiesel, Soapstock, Performance, Emission, Combustion.

IINTRODUCTION

Biodiesel is a vegetable or animal oil based diesel fuel that consumes without the outflow of much residue, carbon IV oxide and particulate issue. It comprises of long chain mono-alkyl esters and is delivered by transesterifying vegetable oil or creature fat. In this procedure, the creature or vegetable oil is changed over into biodiesel when one mole of triglyceride responds with three moles of liquor to create a mole of glycerol and three moles of mono-alkyl esters. Biodiesel like petro-diesel is made of hydrocarbon chains that don't contain sulfur, or aromatics mixes in its piece. It is an elective fuel that is gotten from sustainable assets that consumes in diesel motors with less natural contaminations. This article manages the comparative analysis of Biodiesel blend with the cotton seed soapstock oil to other oils for performance, emission and combustion analysis. The biodiesel is delivered from cotton seed oil utilizing the transeseterification response. From all Biodiesel generation techniques transeseterification is the best and most utilized strategy. The liquor utilized for transeseterification is Methanol as it is the least expensive liquor accessible. KOH is utilized as the impetus. The generation of biodiesel is done in research center scale.

II ENGINE PERFORMANCE CHARACTERISTICS

The engine performance characteristics have been compared with the heading of Specific Fuel Consumption, Brake Thermal Efficiency, Torque and Power.

Specific Fuel Consumption

After analyzing the past research work undergone on “biodiesel fuel with cotton oil soap stock,” it was found that the percentage difference between specific fuel consumption of conventional diesel engine and biodiesel fuel with cotton oil soap had increased up to 10 % (Ali Keskina*et al.* 2007). But in the current research work, the specific fuel consumption percentage difference has increased up to an average of

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16 % for various proportion of biodiesel using cotton oil soapstock.

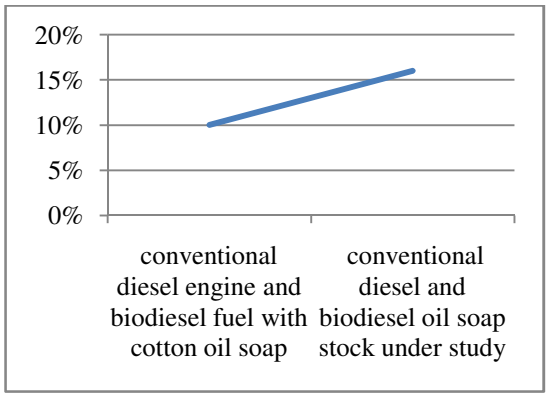

Figure 2.1 Comparison of specific fuel consumption in conventional diesel engine biodiesel fuel with cotton oil soap and conventional diesel and biodiesel oil soapstock under study

Brake Thermal Efficiency

It is observed that when the test engine was fueled with WPOME or COME instead of Petroleum Based Diesel Fuel (PBDF), the brake power is reduced by 4-5%, while the brake specific fuel consumption is increased by 9-10%. (Venkat Reddy *et al.* 2014) which is less efficient in comparison to the current work. The brake thermal efficiency at maximum power decreased from 28.12% with base diesel and the indicated thermal efficiency for similar condition for diesel and biodiesel are 41.97%(Harish Kumar Gangwar*et al.* 2008), which is less than our increase in brake thermal efficiency and indicated efficiency of 40% and 47%. The research which used Pongamia and waste cooking biodiesel and their ternary blend with diesel showed that brake thermal efficiency was 12.63%, which is lower than our finding i.e, average of 16% for various proportions. The results observed were slight reduction (Senthilkumar*et al.* 2014) of brake thermal efficiency by a scholar, but in our research there was average drop, increment, reduction of hydrocarbon emission and carbon monoxide emission.

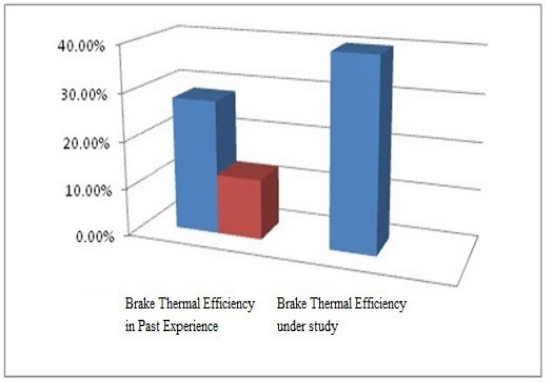

Figure 2.2 Comparison of Brake Thermal Efficiency in Past Experience and Under Study

Torque and Power

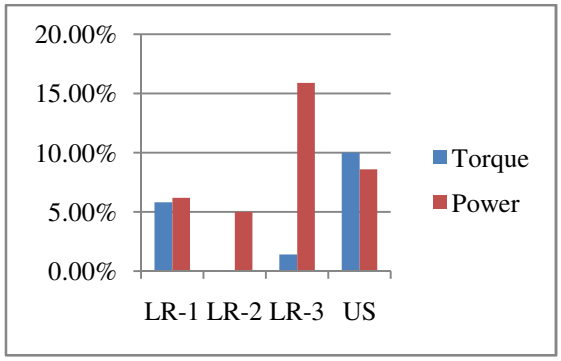

Figure 2.3 Comparisons of Torque and Power in Past Experience and Under Study (LR-Literature Review, US - Under Study)

In the past study, it was found that the torque and power of conventional diesel engine and biodiesel fuel with cotton oil soap decreased by 5.8 % and 6.2% (Ali Keskina*et al.* 2007), where as in the current study it was found that the torque and power of conventional diesel engine and biodiesel fuel with cotton oil soap decreased by an average of 10% and 8.6% respectively. The power is dropped marginally with biodiesel

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using Soya acid oil which is composed of unsaturated fatty acids such as oleic acid and linoleic acid (72.33% by weight) at maximum power and torque condition. The drop is in the range from 1.4% to 15.9% (Jayashri*et al.* 2017) with maximum power and torque conditions. In the current study the torque and power of conventional diesel engine and biodiesel fuel with cotton oil soap decreased by an average of 10% and 8.6% respectively which is compromising than past one.

III EMISSION CHARACTERISTICS

From the review of past work, it was found that at maximum torque, speed, the smoke level of engine with blend fuels decreased up to 46.6%, depending on the amount of biodiesel (Ali Keskina*et al.* 2007) which was higher than the emission of current research of 35%. Experimental result by another researcher reveals that CO concentration of biodiesel on waste cooking oil methyl ester and its blends are from 31% to 59% (Savaviraj*et al.* 2013) which is greater than current finding which is 25% to 35%. Also the hydro carbon emission was reduced by 57% (AhmetNecatiOzsezen*et al.* 2011) by a scholar, but in our work it is from 9.3 ppm to 13.6 ppm. CO emission is reduced by an average of 28% in our work but in the literature it was found that the average was 22% (NandhaGopal*et al.* 2014) by another researcher who used biofuel of blends of neem. CO and HC emissions decreased significantly with biodiesel of Soya acid oil mainly composed of unsaturated fatty acids such as oleic acid and linoleic acid (72.33% by weight) than diesel. The decrease in the emissions is in the range from 20% (CO) and 39% (HC) respectively (Harish Kumar Gangwar*et al.* 2008), where as in our work the emission is less. Methyl esters caused reductions in carbon monoxide (CO) by 59-67%, in unburned hydrocarbon (HC) by 17-26% and in carbon dioxide (CO_2) by 5-8%,The results observed were slight reduction of hydrocarbon emission, carbon monoxide emission (Senthilkumar*et al.* 2014) by a scholar, but in our research there is average drop in emission. At full load, fish oil biodiesel fuel produced higher smoke CO and HC emissions of 14.6%, and 1.8% respectively with reference to diesel fuel (ShewetaTripathi*et al.* 2017) which is higher than our emission.

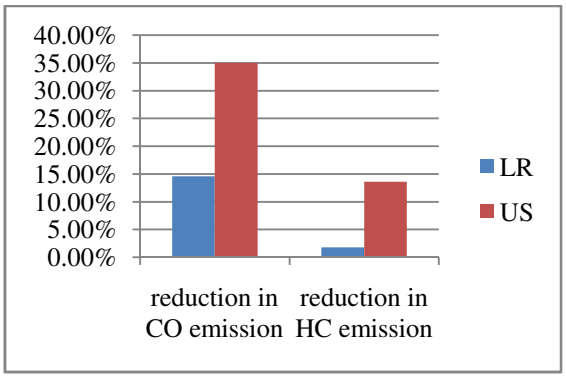

Figure 3.1 Comparison of Emission Characteristics in Past Experience and Under Study

IV COMBUSTIONCHARACTERISTICS

The minimum percentage heat loss was found to be 14% in a past research (Ali Keskina*et al.* 2007) on biodiesel fuel with cotton oil soap. The maximum pressure rise was found to be 7 MPa (Savaviraj*et al.* 2013), our result also agrees with that value. The peak fuel inline pressure increases from 457 bar with diesel to 651 bar (Harish Kumar Gangwar*et al.* 2008) with biodiesel at 17 Nm torque and 2200 rpm (maximum torque). In our study the pressure rises to 6.39 MPa which is lesser than the past research. Higher peak heat release rate was increased by23.19%, 14.03%, 26.32%, 21.87%, and 25.53% for the blends (Avinash Kumar Agarwal*et al.* 2015) but in the current study the heat release rate is decreased by some percentage. In literature, a researcher examined the performance,

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emission, and combustion characteristics of a direct-injection transportation diesel engine running with diesel, 20% blend of Rice Bran Oil (RBO), and 20% blend of RBOME with mineral diesel (Prem Kumar *et al.* 2015). The results agree well with the emission characteristics in the current research. Biodiesel has more heat release rate than pure diesel at initial stages compared to pure diesel and biodiesel which have large negative heat release rate due to cooling effect of the liquid fuel injected into the cylinder (Jayashri*et al.* 2017) similar result was found in our experiment. The heat release rate wa iew and it i

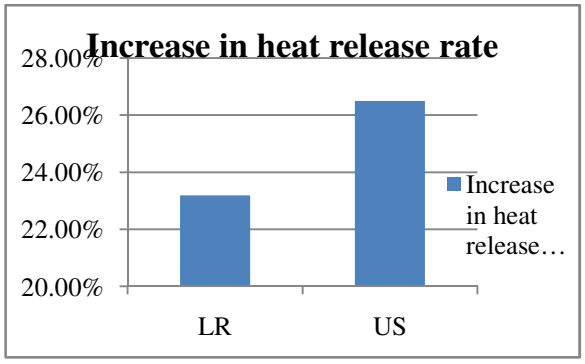

Figure 4.1 Comparison of Combustion Characteristics in Past Experience and Under Study

VCONCLUSION

From the overall comparison with research that have been undergone by eminent scholars on biofuel it is found that various characteristics are as per the standard and in par with our biodiesel using cotton soapstock oil. Initially, the performance characteristics which are important for running of engine was good when compared with others. Then the combustion characteristics were better as required for the smooth operation of engine. Finally, the emission rate was very low in comparing to other fuels which is as per standards of regulating emissions. So, by using this type of fuel the overall performance of engine can be increased thereby it increases the overall efficiency.

REFERENCES

1. Agarwal AK, Gupta T, Shukla PC, Dhar A. Particulate emissions from biodiesel fuelled CI engines. Energy Conversion and Management. 2015 Apr 1;94:311-30.
2. Gangwar HK, Agarwal AK. Emission and combustion characteristics of vegetable oil (Jatrophacurcus) blends in an indirect ignition transportation engine. SAE Technical Paper; 2008 Jan 9.
3. Keskin A, Gürü M, Altiparmak D, Aydin K. Using of cotton oil soapstock biodiesel–diesel fuel blends as an alternative diesel fuel. Renewable Energy. 2008 Apr 1;33(4):553-7.
4. Keskin A, Gürü M, Altıparmak D. Biodiesel production from tall oil with synthesized Mn and Ni based additives: effects of the additives on fuel consumption and emissions. Fuel. 2007 May 1;86(7-8):1139-43.
5. Ozsezen AN, Canakci M. Determination of performance and combustion characteristics of a diesel engine fueled with canola and waste palm oil methyl esters. Energy Conversion and Management. 2011 Jan 1;52(1):108-16.
6. Savariraj S, Ganapathy T, Saravanan CG. Performance, emission and combustion characteristics of fish-oil biodiesel engine. European Journal of Applied Engineering and Scientific Research. 2013;2(3):26-32.