EXPERIMENTALLY ANALYSING THE EFFECT OF USE OF WASTE COOKING OIL AS A BIO-DIESEL AT DIFFERENT COMPRESSION RATIO

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***Abstract*: Here in this work, waste cooking oil is used for preparing the biodiesel. It experimentally analysed the effect of addition of waste cooking oil biodiesel in conventional diesel. Effect of different percentage of addition of waste oil in diesel at different compression ratio, for analysing the effect of different percentage of addition of oil it considered three different percentage of addition that is 5 and 10 and 15 % by volume. For analysing the performance of waste cooking oil biodiesel at different compression ratio (CR), three different CR was considered that is 16, 17 and 18. Through experiment it is found that at 10 % addition of waste cooking oil biodiesel and at 17 CR it shows the maximum performance as compared to other percentage of addition. It is also found that with the addition of waste oil biodiesel the percentage of harmful gases like CO and NOx get reduced.**

***Keywords:* biodiesel, waste cooking oil, compression ratio, percentage addition of biodiesel, efficiency**

1. Introduction

The energy needs of the world are increasing rapidly. The large increase in the number of automobiles in recent years has resulted in greater demand for petroleum products. The increase in energy demand, decrease in petroleum-based fuel reserves, increase in pollution caused by them and increasing fuel prices have focused attention on alternative sources of energy. With crude oil reserves estimated to last for few decades, there has been an active search for alternate fuels. Such alternative fuels in use today are bio alcohols, hydrogen, natural gas and biodiesel. Among the various alternate fuels under consideration; biodiesel derived from vegetable oils, is the most promising alternative fuel to Petroleum Based Diesel Fuel (PBDF) due to the following reasons (Ramadhas et al 2004). The experimental analysis of waste cooking oil addition of bio-diesel was performed at Apex innovations which are situated at MIDC area, Kupwad, Sangli Maharashtra-416436. Effect of addition of waste cooking oil in conventional diesel was carried out at three different percentages. First waste cooking oil is treated and make as a bio-fuel through transesterification, the blend of waste cooking oil and diesel was made through mechanical stirring and magnetic stirring method and then it is used as a fuel in single cylinder four stroke diesel engine.

2. Engine details:

For performing the experimental combustion of waste cooking biodiesel, CI engine was used. The specification of engine that is considered during the experimental was mention here. IC engine set up under test is Research Diesel engine having power-3.50 kW @ 1500 rpm which is 1 Cylinder, four stroke, Constant Speed, Water Cooled, Diesel Engine, with Cylinder Bore-87.50(mm), Stroke Length-110.00(mm), Connecting Rod length-234.00(mm), Compression Ratio-16.00, Swept volume-661.45 (cc).

2.1 Combustion parameters:

During combustion following parameters was considered during the experimental work. Specific Gas Const (kJ/kgK): 1.00, Air Density (kg/m^3): 1.17, Adiabatic Index: 1.41, Polytrophic Index: 0.98, Number of Cycles: 10, Cylinder Pressure Referance: 5, Smoothing-2, TDC Reference: 0

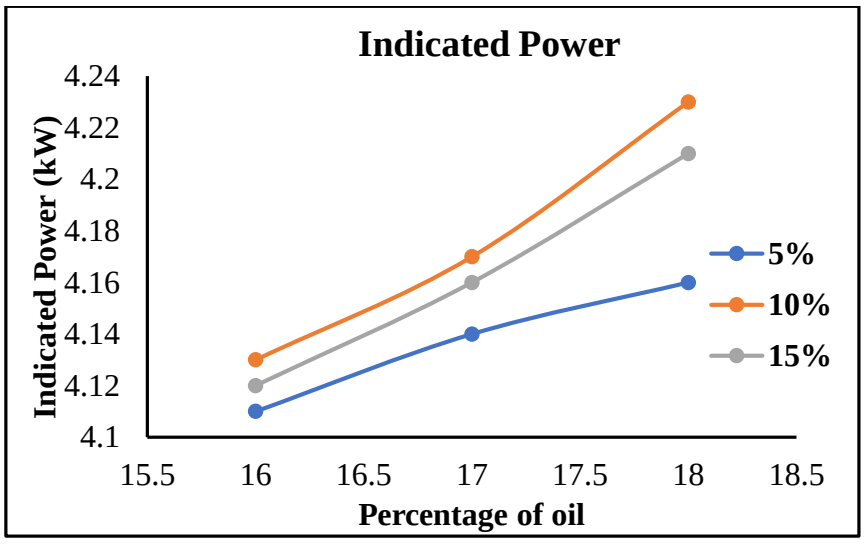
2.2 Process parameters:

Different process parameters that are considered during the experimental are mention here. Orifice Diameter (mm): 20.00, Orifice Coeff. Of Discharge: 0.60, Dynamometer Arm Length (mm): 185, Fuel Pipe dia (mm): 12.40, Ambient Temp. (Deg C): 27, Pulses Per revolution: 360, Fuel Type: Diesel, Fuel Density (Kg/m^3): 830, Calorific Value Of Fuel (kJ/kg) : 42000

Fig.1 shows the setup used for the experimental analysis

3. Result and Discussion

Researchers uses different bio oil for making biodiesel, but here in this work it uses the waste cooking oil that get remain after cooking. This cooking oil cannot be used for cooking again, so in order to utilize this waste cooking oil, it uses as a bio fuel for preparing the bio-diesel. It is very much cheaper as compared to other bio fuels and no any extraction cost is required. Different percentage of waste cooking oil was added in to conventional diesel and checked at different compression ratio. For analysed the effect of different content of bio fuel three different percentage that is 5, 10 and 15 percentages were considered during experimental analysis at different CR that is 16, 17 and 18 and measure the different performance parameters.



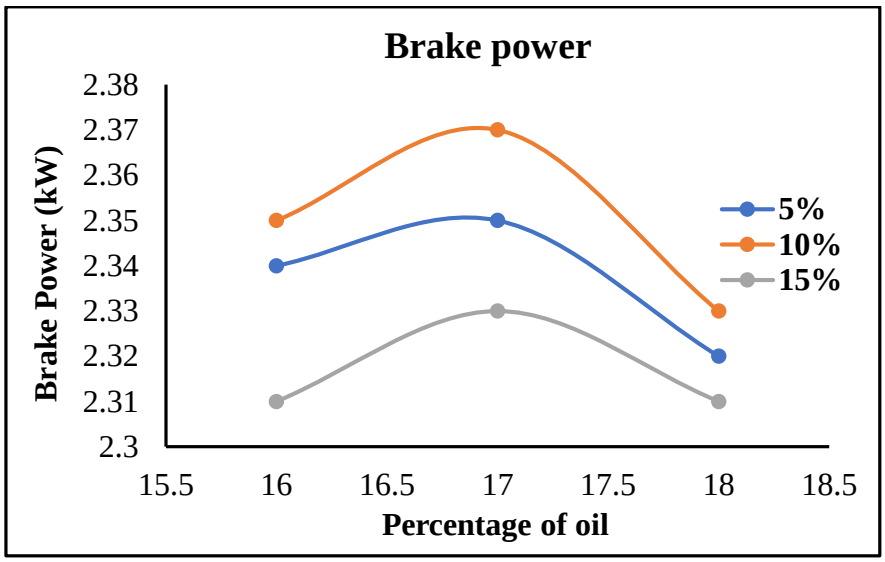


Fig.2 Comparison of indicated power and brake power at different percentage of waste cooking oil addition

From graph it is found that as the addition of waste cooing oil increases from 5 % to 10 % the indicated power of engine get increases. Whereas above 10 % that is 15 % the indicated power get decrease. At the compression ratio increases the value of indicated power get also increases and found maximum for 18 CR in each case of oil addition. So from above graph it is found that for 10 % bio-diesel indicated power produce by the engine is more as compared to 5 and 15 % addition. From above graph, it is

found that as the percentage of addition of oil increases the value of brake power get also increases up to 10 % of addition. Whereas after 10 % of waste oil addition that is at 15 % of addition value of brake power get decreases. The value of brake power at different percentage of addition of bio-fuel at 17 CR the value of brake power is significantly higher than the 16 and 18 CR. Through graph it can say that waste cooking bio-diesel at 17 CR with 10 % addition of bio-fuel shows the better performance as compared to other addition percentage and CR.

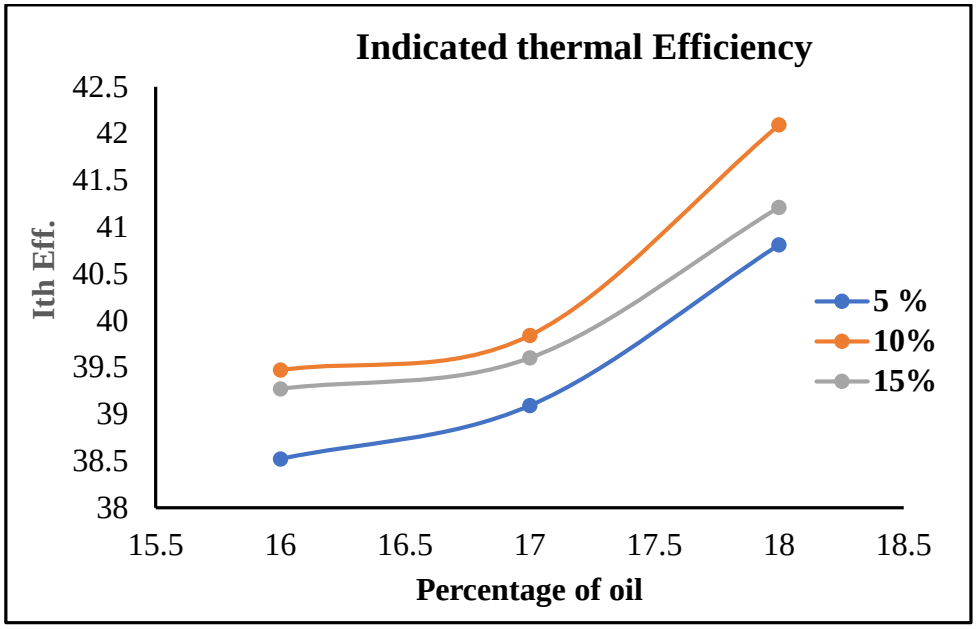


Fig.3 comparison of value of indicated thermal efficiency for different percentage of addition at different CR

Same trend was observed as observed in indicated power, as the CR increases the indicated thermal efficiency get also increased. From graph it is clear that at 10 % added bio-diesel the performance of engine is significantly higher as compared to 5 and 15 % addition. Whereas with increase in CR, the Ith Eff. Get also increased. But for measuring the actual efficiency at the crank shaft brake thermal efficiency was calculated.

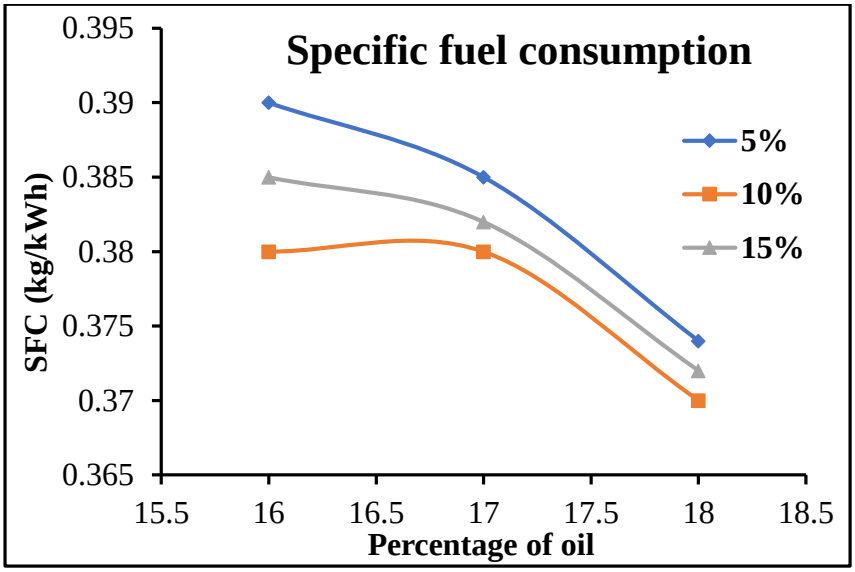


Fig.4 value of SFC for different percentage of addition at different CR

Form above graph it is found that as the percentage of waste cooking oil addition is increases from 5 to 10 %, specific fuel consumption (SFC) gets reduced whereas after 10 % addition that is at 15 % addition the value of SFC get increases. With the increase in CR the value of SFC get decreases in each case of bio-fuel addition. Through graph it can say that at 10 % addition of waste cooking oil fuel requirement is less as compared to other percentage of addition and at all CR. After evaluating the performance of CI engine, using waste cooking oil as a biodiesel at different percentage of addition with different compression.

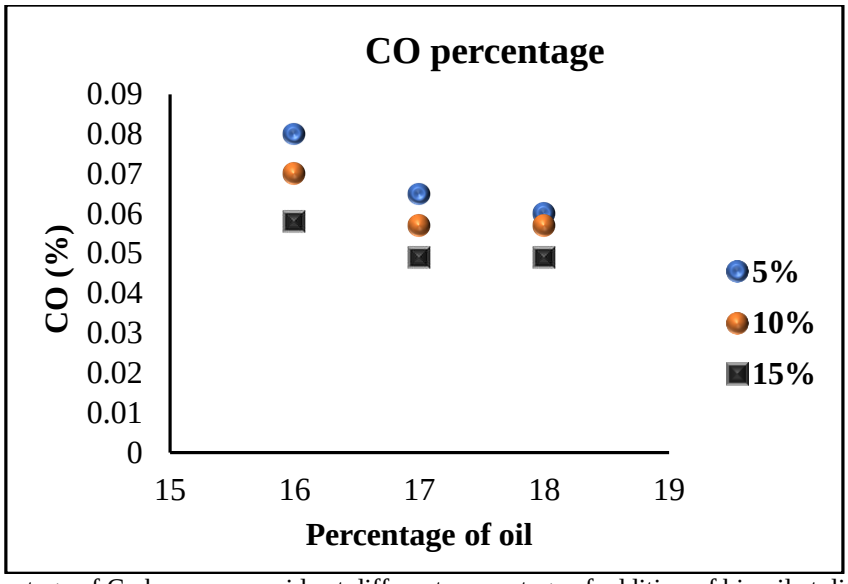


Fig.5 Percentage of Carbon mono oxide at different percentage of addition of bio oil at different CR

This work also includes the effect of use of waste cooking oil on the emission of different gases. For evaluating the effect of use of waste cooking oil on emission gases of CI engine, it measures the value of carbon di oxide, carbon mono oxide and nitric oxide for each case of addition of oil at different compression ratio.

4. Conclusion

Through experiment it is found that waste cooking oil is successfully used as a bio-diesel. Through result it is found that, by increasing the percentage of waste cooking oil in diesel from 5 to 10%, indicated and bake power of the CI engine get increases. Whereas a beyond 10 % the performance of engine start decreasing. With increase in compression ratio the indicated power and indicated thermal efficiency of the engine get increases for each case of waste oil addition. In each case of performance parameters, it is found that bio-diesel blend having 10 % of oil addition at 17 CR shows the highest performance as compared to other percentage of addition and CR. In terms of fuel consumption, as the oil percentage increases from 5 to 10 percent the value of specific fuel consumption at each compression ratio get decreases. Whereas beyond 10 % that is for 15 % it is higher. Though the content of CO2 increases with increase in addition of waste oil in smoke emission, but content of CO and NOx decreases.

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