Preparation of Biodiesel from Chicken Feather oil and Performance analysis on VCR Diesel Engine Equipped with EGR and Smoke Analyser

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Abstract *— Diesel engine emits more pollutants which are detrimental to the human health. Pollution control boards around the world made it mandatory to reduce the tail pipe emissions. Research on emission control is in full swing and several alternative fuels have been tested to reduce emissions. Bio- Diesel is an environmental friendly alternative diesel fuel which consists of the alkyl esters of fatty acids. Bio-diesel can be derived from food grade vegetable oils, non-food grade vegetable oils, animal fats and waste restaurant greases.*

This project deals with the preparation of biodiesel from the chicken feather oil. It is obtained from triglycerides through the transesearification process. The experiments conducted on the VCR Diesel engine. Diesel blended with chicken feather oil at 20%, 40% and 60% at compression ratios 16.5:1 & 18.5:1 with 30%EGR & without EGR and the performance characteristics are to be drawn.

Keywords—*Transesterification, Fatty acids, Tail pipe, Alkyl esters, Variable Compression Ratio, Exhaust Gas Recirculation, Smoke Analyser.*

I. INTRODUCTION

Fuels derived from renewable biological resources for use in diesel engines are known as biodiesel. Biodiesel is environmentally friendly liquid fuel similar to petro-diesel in combustion properties. Increasing environmental concern, diminishing petroleum reserves and agriculture based countries are the driving forces to promote biodiesel as an alternate fuel. Vegetable oils and animal fat oils being renewable, non-toxic, biodegradable with low emission profiles are suitable alternative fuels to diesel. Biodiesel derived from vegetable oil and animal fats is being used to reduce air pollution and to reduce dependence on fossil fuel. Biodiesel can be harvested and sourced from chicken waste. Higher viscosity, lower volatility and polyunsaturated character of animal fat oils pose normal engine operational problems. Transesterification is the method of optimizing the characteristics of animal fat oils.

II. NEED OF CHOOSING CHICKEN FEATHER OIL AS A BLEND

Chicken waste means the one which is left after getting the meat from the chicken. This is taken into a vessel, boiled along with the water and the temperature is maintained above 100°C. After water gets evaporated, the stock is squeezed to extract the oil. Then the extracted oil is heated to get water free oil. It has the following benefits:

- Oxygenated fuel
- Sulphur free, less CO & HC, Particulate matter and aromatic compound emissions.
- No need to modify the existing diesel engines
- Non toxic, Bio degradable

III. PREPARATION OF BIO DIESEL

- Extraction of oil from the chicken waste.
- Esterification of raw oil Extracted from the chicken waste.
- Transesterification of Esterification product.
- Separation of biodiesel from the glycerin.
- Water wash and separation of biodiesel from water
- Removal of alcohol from the biodiesel.
- Testing the biodiesel.

(a)

(b)

a: Raw chicken waste
b: Chicken feather meal

c:Esterification & Transesterification

Final Product of Biodiesel:

d: Biodiesel

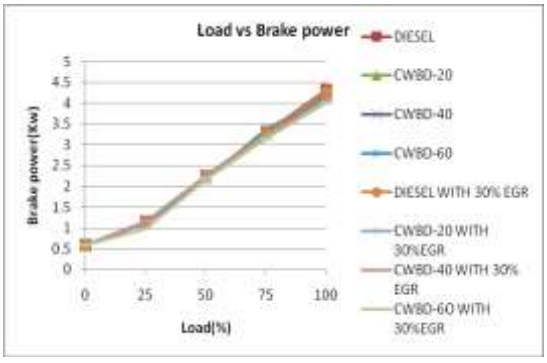
IV. PERFORMANCE CHARACTERISTICS

The following observations were obtained by conducting the experiments on VCR diesel engine with and without EGR system and Smoke Analyser.

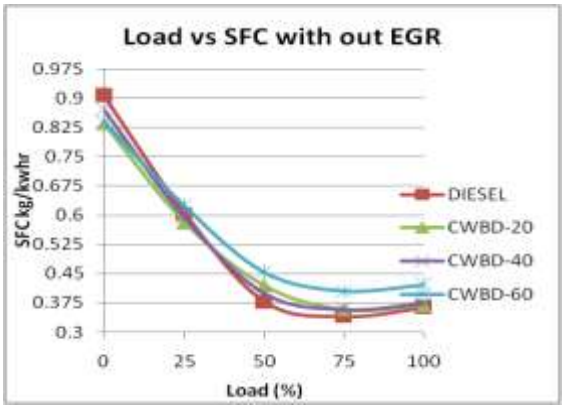
1. Load Vs. Brake Power
2. Load Vs. Specific Fuel Consumption
3. Load Vs. Brake thermal efficiency
4. Load Vs. Emission characteristics
5. Load Vs. Smoke

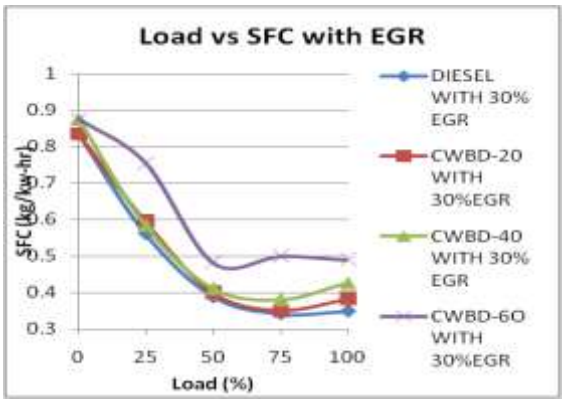
AT 16.5:1 COMPRESSION RATIO:

1. *Load Vs. Brake power:*

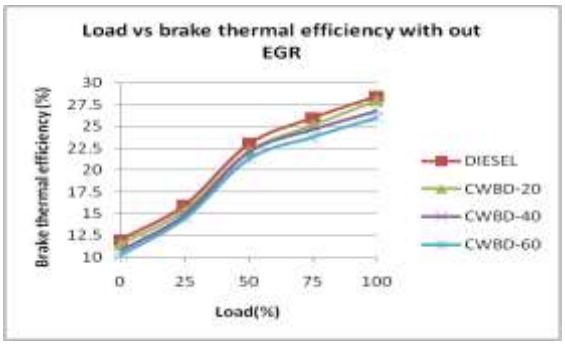


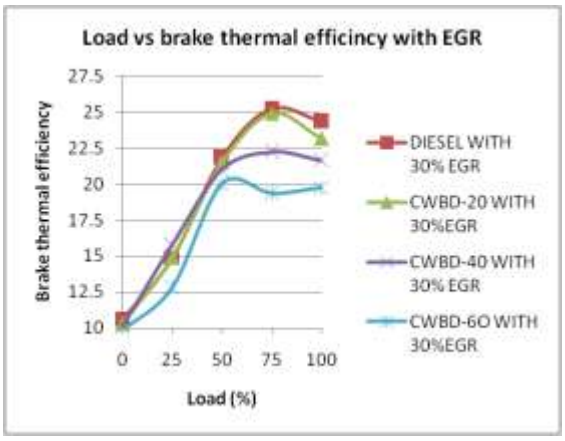
2. *Load Vs. SFC:*



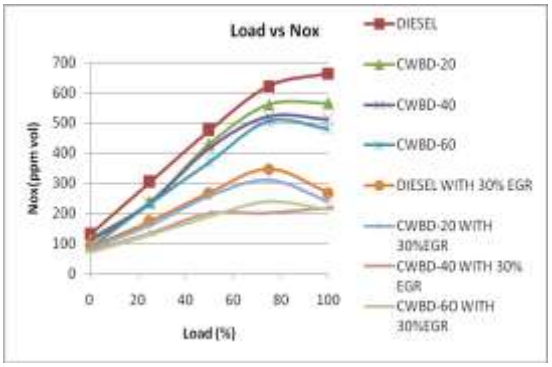


3. *Load Vs. Brake Thermal Efficiency:*

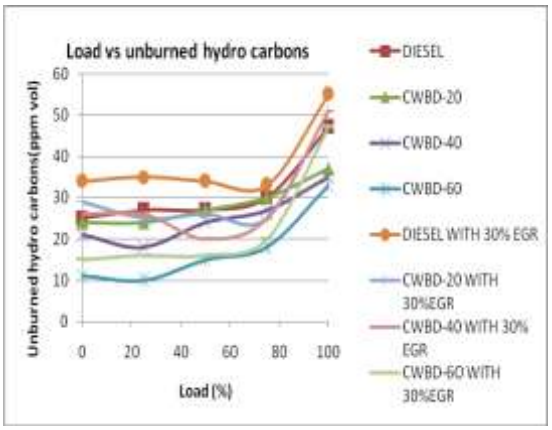




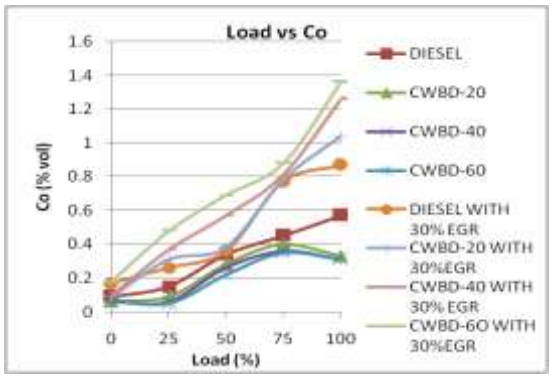
4. *Load Vs. NOx:*



5. *Load Vs. HC:*

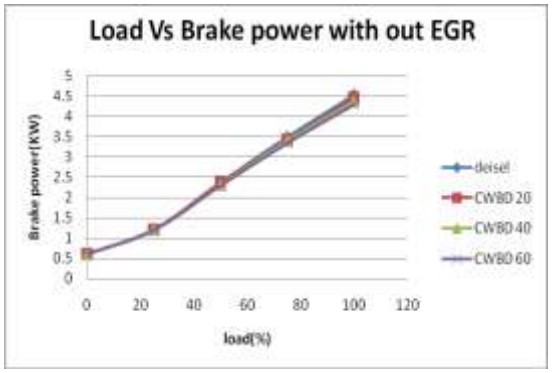


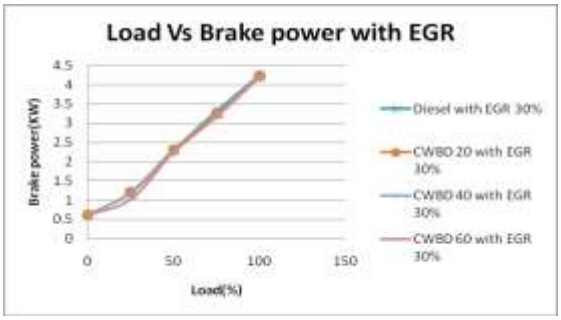
6. *Load Vs. CO:*



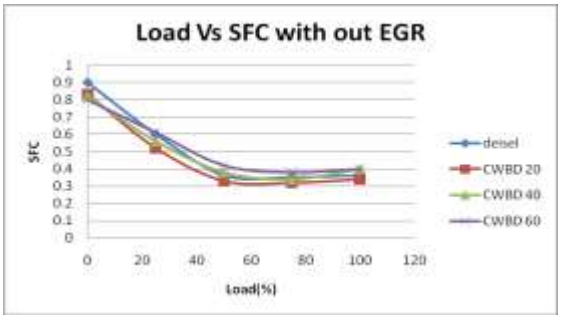
AT 18.5:1 COMPRESSION RATIO:

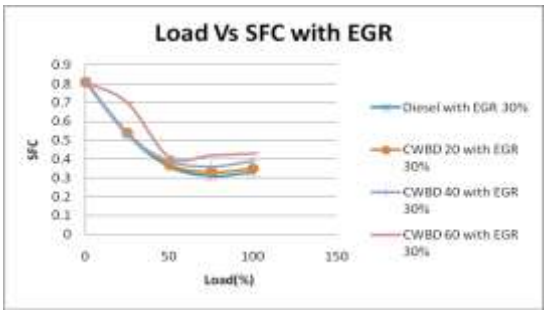
1. *Load Vs. Brake power:*



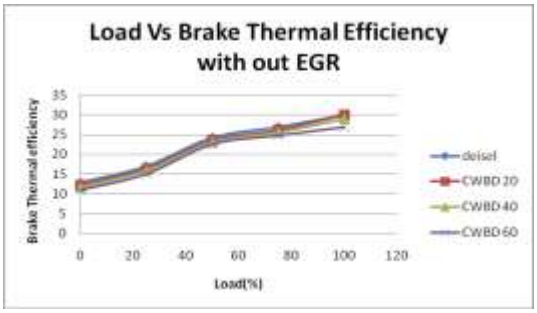


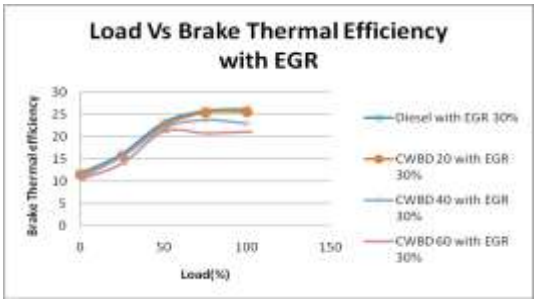
2. *Load Vs. SFC:*



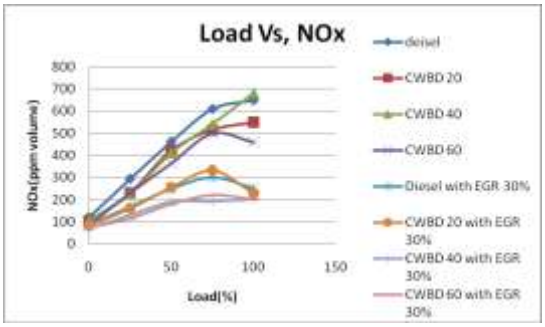


3. *Load Vs. Brake Thermal Efficiency:*

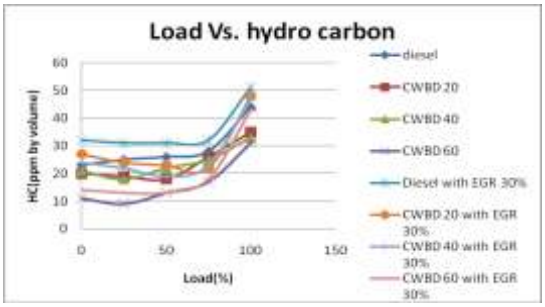




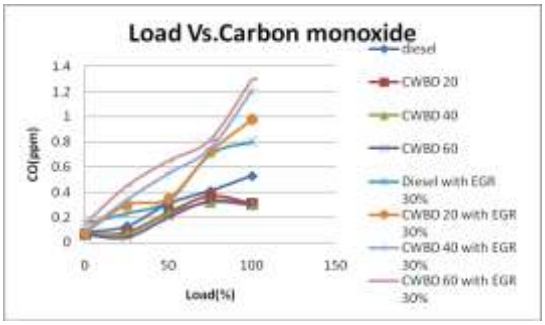
4. *Load Vs. NOx:*



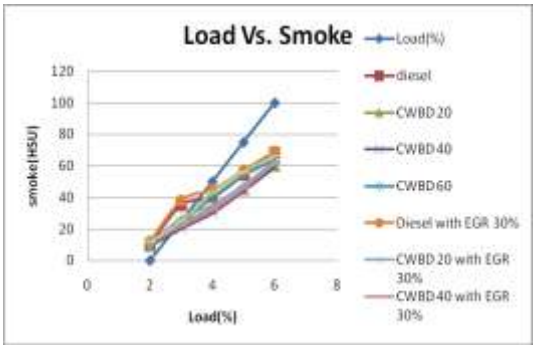
5. *Load Vs. HC:*



6. *Load Vs. CO:*



7. *Load Vs. Smoke:*



V. CONCUSION

The Chicken waste based biodiesel with20%, 40%, and 60% blend with petroleum diesel are used in the conventional diesel engine without any modification in engine design or fuel system, performance evaluation. It was observed that the Performance operating characteristics that is Torque, brake power, frictional power, indicated power, brake thermal efficiency, Indicated Thermal Efficiency, Specific fuel consumption Volumetric Efficiency, and mechanical efficiency is nearly equal to petroleum diesel at various loading conditions at constant speed for Chicken waste based biodiesel blend with diesel at 20% [CWBD 20], CWBD 40, and CWBD 60 Biodiesel blends.

VI. FUTURE SCOPE

Biodiesel has distinct advantage as an automotive fuel. Initial investment cost may be higher but feedstock diversity and multi-feedstock production technologies will play a critical role in reductions in production cost and making the fuel economically viable. The following points may be considered before introducing the fuel in India:

- Biodiesel may be introduced as a diesel fuel extender or blends (CWBD 10, CWBD 20) and not as a sole diesel engine fuel (CWBD 100) without engine modifications.

- The blends prepared for this project work were utilized within short time span. Thus, long term stability of blends was not studied. So there is scope for study of long term stability of blend.

- The technique of Transesterification can be extended to various waste and non-edible vegetable oils. Further investigation can be carried out to prepare ethyl ester from various waste and non-edible vegetable oils and to conduct various engine tests.

- Performance and emission tests can be carried out on multi-cylinder generator engines and surface transportation engines like tractor, car, jeep, bus, trucks etc. Emission studies for measurement of particulate matter, and regulated emissions as well as unregulated emissions such as volatile organic compounds, aldehydes etc. has to be carried out to reveal a total picture of environmental impact using biodiesel blended diesel fuel.

- Further studies can also be carried out on material compatibility, storage and utilization of by-product from biodiesel.

VII. REFERENCES

1. Ram Prakash,S.P.Pandey,S.Chatterji, S.N. Singh," Emission Analysis of CI Engine Using Rice Bran Oil and their Esters". JERS/Vol.II/ Issue I/2011, page no.173-178.

2. Babita Singh, Dulari Hansdah, S.Murugan, "Performance and Exhaust Emissions of a Diesel Engine Using Pyrolysis Oil from Waste Frying Oil and Castor Oil Mixture".
3. B.K.Venkanna, C. Venkataramana Reddy, Swati B Wadawadagi, "Performance, Emission and Combustion Characteristics of Direct Injection Diesel Engine Running on Rice Bran Oil / Diesel Fuel Blend". International Journal of Chemical and Bio molecular Engineering vol 2, No.3, 2009.
4. T. Venkateswara Rao a, G. Prabhakar Rao , and K. Hema Chandra Reddy ," Experimental Investigation of Pongamia, Jatropha and Neem Methyl Esters as Biodiesel on C.I. Engine." Jordan Journal of Mechanical and Industrial Engineering, vol.2, no.2, jun 2008,pg no.117-122.
5. S. Murugana, M.C. Ramaswamy and G. Nagarajan, "The Use of Tyre Pyrolysis Oil in Diesel Engines". Volume 28, Issue 12, December 2008, Pages 2743-2749.
6. Nagarhalli M. V, Nandedkar V. M. and Mohite K.C, "Emission and Performance Characteristics of Karanja Biodiesel and its Blends in a CI Engine and it's Economics". ARPN Journal of Engineering and Applied Sciences, vol.5, no.2, feb 2010.
7. G Lakshmi Narayana Rao, S Sampath, K Rajagopal, "Experimental Studies on the Combustion and Emission Characteristics of a Diesel Engine Fuelled with Used Cooking Oil Methyl Ester and its Diesel Blends". International Journal of Applied Science, Engineering and Technology,vol. 4,no.1, 2008,pg no 64-70.
8. A.S. Rocha, M. Veerachamy, V.K. Agrawal & S.K. Gupta, "Jatropha Liquid Gold – The Alternative to Diesel". 1st WIETE Annual Conference on Engineering and Technology Education, page no. 22-25, February 2010.
9. K. Purushothaman a, G. Nagarajan, " Performance, Emission and Combustion Characteristics of a Compression Ignition Engine Operating on Neat Orange Oil". Renewable Energy an international journal , vol-34, (2009), page no. 242–245.
10. Deepak Agarwal , Avinash Kumar Agarwal , " Performance and Emissions Characteristics of Jatropha Oil (preheated and blends) in a Direct Injection Compression Ignition Engine". Applied Thermal Engineering an international journal vol.27, (2007), page no. 2314–2323.
11. D.H. Qi, L.M. Geng, H. Chen, Y.ZH. Bian, J. Liu, X.CH. Ren, "Combustion and Performance Evaluation of a Diesel Engine Fueled with Biodiesel Produced from Soybean Crude Oil". Renewable Energy an international journal,vol. 34, (2009),page no. 2706–2713.
12. N.R. Banapurmatha,_, P.G. Tewaria, R.S. Hosmath, "Performance and Emission Characteristics of a DI Compression Ignition Engine Operated on Honge, Jatropha and Sesame Oil Methyl Esters". Renewable Energy an international journal,vol. 33,2008, page no.1982-1988.