Emission Analysis in VCR Engine Fuelled with Karanja Oil Using Ethanol as an Additive

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Abstract— Biodiesel is a well-recognized choice for diesel and has a benefit over the later because of it is renewable, biodegradable, sulphur free and non-less poisonous in nature, better lubricity and can considerably reduce exhaust emissions from the engine. This study investigates the use of ethanol as an additive with 20% Karanja oil diesel blend (B20). The transesterification process is used to reduce the viscosity of the karanja oil. The main aim of this paper is to examine the emission parameters of variable compression ratio diesel engine runned with karanja oil 20% (B20) and ethanol as an additive by adding 5% and 10% at steady speed of 1500 rpm with variable loads and changeable compression ratio 17 and 18. The outcomes of these blends are to be compared with the normal diesel. The fitness of karanja oil with ethanol is established as a biofuel in this study. The impact of compression ratio on exhaust gas emissions has been investigated and offered. The exhaust emissions Hydrocarbons, Carbon monoxide and Carbon dioxide are almost reduced compared to diesel.

Key words: VCR Engine, B20

I. INTRODUCTION

A. Biodiesel:

The huge increase in number of automobiles in current years has resulted in great require for petroleum products. With Karanja oil reserves predictable to last only for few decades, there has been an dynamic look for for alternate fuels. The depletion of Karanja oil would effect a major blow on the transportation segment. Biodiesel is renewable petroleum created from vegetable oils and living thing fats that can be used in diesel engine. Biodiesel is differently blended with standard diesel in the formation of B20 (20% biodiesel and 80% normal diesel). The clean form of Biodiesel (B100) is cannot used in the normal diesel engine, it required some alteration. The biodiesel created from a variety of vegetable oil such as sunflower oil, rubber oil, jatropha oil, karanja oil, soyabean oil, rapeseed oil, mahua oil, palm oil, rubber seed oil etc. In this study we are using karanja oil as biodiesel petroleum in normal diesel engine. Transesterification process is recovering the karanja oil characters to change the character in approximately diesel characters. In transesterification process, Karanja oil reacts with methyl alcohol in occurrence of catalyst (NaOH) to create glycerol and fatty acid ester. The solution of methoxide was mixed with Karanja oil. The combination was heated at 65°C and held at the temperature with steady speed stirring for 2 hours to shape the ester. Then it was permitted to cool and resolve in a separating flask for 12 hours. Two layers were created in the separating flask. The floor layer was glycerol and upper deposit was the methyl ester. Behind decantation of glycerol, the methyl ester was washed with distilled water to eliminate overload methanol. The transesterification enhanced the

II. LITERATURE SURVEY

P.L.Naik et al. [1] The emission characteristics of diesel engine operating with karanja oil and the blends with diesel to be analyzed and compared to normal diesel. Transesterification process is used for the research of biodiesel which reduces the thickness of the oil. A variety of proportions of biodiesel analyzed are B10, B20, B30 and these outcomes are compared with diesel. The outcome of B10 and B20 are comparable to diesel. So, B20 and less than B20 can be used as a fuel to get better the performance and emission of the CI engine. Carbon monoxide and Hydrocarbon emissions reduced with augment in blend proportion of the biodiesel. Biodiesel use could protect the environmental air superiority by reducing harmful emissions at large by normal diesel fuel.

C.V.Teixera et al. [2] The biodiesel and biodiesel blends became alternatives to the diesel fuel. Although, clean biodiesels cannot be used in diesel engines due to technological problems, biodiesel blends have been engaged
in diesel engines. The investigational apparatus used an electric generator as a substitute of a dynamometer to manage the load on the engine. Engine is prepared with electric generator at 1500W, 3000W, 4500W. Various scope of biodiesel used in the engine is from B10 to B100. B100 NOx emissions are larger than diesel at 4500W of electric load. Specific fuel consumption increases with the quantity of the palm oil on the blended fuel.

S.Imtenan et al. [3] This experimental evaluates the development of palm biodiesel-diesel blends with assist of ethanol, n-butanol and diethyl ether. The utilize of additives improves the brake power, brake thermal efficiency and reduce in brake specific fuel consumption. To advance the 20% blend of palm biodiesel with diesel fuel (DP20) with assist of three additives ethanol, n-butanol, diethyl ether.

B.De et al. [4] The strength of raw palm oil using preheated in the hotness series of 90º C as a fuel has been obtainable in this study. The experiments were agreed out at constant speed of 1500 rpm with full load and at compression ratios of 16:1 to 20:1. Emission parameters such as CO, CO₂, HC and EGT are discussed with different compression ratio (16:1 to 20:1) of dissimilar blends at full load situation. The experimental effect proves that inferior percentages of preheated palm oil can be used as diesel fuel. Major reduction in CO and HC for all blends at elevated compression ratio at full loads condition.

S.Naga Sarada et al. [5] This paper is to pick up the emission characteristics of cotton seed oil in an unchanged engine and the effect of enlarge in injection pressure was studied. Tests were conducted with cotton seed oil and compared with normal diesel. Quieter function of the engine is observed through the usage of cotton seed oil. Enlarged injection pressure has a significant result on attractive engine performance and falling the emissions. Performance of engine with cotton seed oil is just about similar to the engine running with normal diesel.

III. RESULTS AND DISCUSSION

A. Emission Characteristics:
In this study, the various blends are tested in Variable compression ratio engine with change in compression ratio 17 & 18. The various blends are diesel, B20, B20+5% Ethanol, and B20+10% Ethanol respectively. The graphs are discussed below with different parameters of emissions and various loads.

B. Carbon monoxide:
It is observed from the Fig.3.1, the results of carbon monoxide for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 17. The result concluded from this graph is the CO decreases with help of increase in loads when B20+5% Ethanol is used as a fuel in the VCR engine.

C. Hydrocarbon Emission:
It is observed from the Fig.3.3, the results of hydrocarbon emission for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 17. The result concluded from this graph is the HC almost decreases when B20+5% Ethanol is used as a fuel in the VCR engine.
decreases compared to diesel when B20 is used as a fuel in the VCR engine.

**Fig. 4:** Variation of HC with loads (CR 18)

**D. Carbon Dioxide:**
It is observed from the Fig.3.5, the results of carbon dioxide for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 17. The result concluded from this graph is the CO₂ decreases compared to diesel when B20+5% Ethanol is used as a fuel in the VCR engine.

**Fig. 5:** Variation of CO₂ with loads (CR 17)

It is observed from the Fig.3.6, the results of carbon dioxide for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 18. The result concluded from this graph is the CO₂ decreases slightly up to 75% load compared to diesel when B20+5% Ethanol is used as a fuel, but at 100% load B20 is increased compared to diesel and B20+5% Ethanol.

**Fig. 6:** Variation of CO₂ with loads (CR 18)

**E. Oxygen:**
It is observed from the Fig.3.7, the results of oxygen for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 17. The result concluded from this graph is the O₂ increases slightly up to 75% load compared to diesel when B20+5% Ethanol is used as a fuel, but at 100% load B20+5% Ethanol is almost equal to diesel.

**Fig. 7:** Variation of O₂ with loads (CR 17)

It is observed from the Fig.3.8, the results of oxygen for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 18. The result concluded from this graph is the O₂ increases slightly up to 75% load compared to diesel when B20+5% Ethanol is used as a fuel, but at 100% load B20+5% Ethanol is almost equal to diesel.

**Fig. 8:** Variation of O₂ with loads (CR 18)

**F. NOₓ Emission:**

**Fig. 9:** Variation of NOₓ with loads (CR 17)
It is observed from the Fig.3.9, the results of NO\textsubscript{X} for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 17. The result concluded from this graph is the NO\textsubscript{X} decreases highly upto 75% load compared to diesel when B20+5% Ethanol is used as a fuel, but at 100% load B20+5% Ethanol is almost equal to diesel.

![Graph showing NO\textsubscript{X} vs LOAD at CR 18](image)

**Fig. 10: Variation of NO\textsubscript{X} with loads (CR 18)**

It is observed from the Fig.3.10, the results of NO\textsubscript{X} for diesel, B20, B20+5% Ethanol, B20+10% Ethanol are evaluated with help of a variety of loads like 0%, 25%, 50%, 75%, 100% at compression ratio 18. The result concluded from this graph is the NO\textsubscript{X} decreases highly compared to diesel when B20+5% Ethanol is used as a fuel in VCR Engine.

IV. CONCLUSION

The conclusions arrived from this paper are given below

- Carbon-monoxides emissions decreases when the blend B20+5% Ethanol is used as a fuel at compression ratio 17, but B20+5% Ethanol is almost equal to diesel when the engine is operated at compression ratio 18 with varying loads.
- Hydrocarbon emissions decreases when the blend B20+5% Ethanol is used as a fuel at compression ratio 17, but at compression ratio 18 the blend B20 decreases compared to diesel.
- Carbon dioxides emissions decreases when the blend B20+5% Ethanol is used as a fuel at compression ratio 17, but B20+5% Ethanol is almost equal to diesel when the engine is operated at compression ratio 18 with varying loads.
- \textsubscript{O}_2 increases slightly upto 75% load compared to diesel when B20+5% Ethanol is used as a fuel, but at 100% load B20 is increased compared to diesel and B20+5% Ethanol at compression ratio 17, but at compression ratio 18 the \textsubscript{O}_2 increases slightly with B20+5% Ethanol.
- NO\textsubscript{X} decreases highly compared to diesel when B20+5% Ethanol is used as a fuel when the engine is operated at compression ratio 17 & 18.

REFERENCES


