Emission Analysis For Addition of Callophyllum Inophyllum Linn Methyl Ester on Diesel Engine

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ABSTRACT

Biodiesel is receiving increasing attention each passing day because of its same diesel-like fuel properties and compatibility with petroleum-based diesel fueled engines. transeterification process is used to convert the vegetable oil , animal fatts oil into biodiesel.. Experiment were carried out by using callophyllum inophyllum oil blends B10,B20, B30, B40, B50, B70 on diesel engine. Emission parameters like CO CO2, O2, HC are observed by using exhaust gas analyser. The graphical presentation of results was done to observe rate of decrease in pollution and increase in efficiency of callophyllum inophyllum with respective blends and diesel. Also emissions like CO, CO2 are reduced by 72.72% and 52.52% for B70 as compare to diesel. B70 can be better replacement for diesel fuel in future. The comparision was done with previous results of pongamia oil biodiesel blend and it was found that undi biodiesel B70 blends less emissions as compare to pongamia oil blend. It was observed as undi oil performs better than pongamia oil. If plantation of undi oil trees will be done in mass quantity then costwise also undi oil will be acceptable.

Keyword: - *exhaust gas analysis, callophyllum inophyllum, engine performance, emission measurement*

1. INTRODUCTION

Present day's energy demand is increasing continuously due to the faster industrial development, increasing population and increasing the pollution due to the petroleum based fuels. Nonedible sources like mahua oil, karanja oil, neem oil, jatropha oil, simarouba oil etc. are being investigated for biodiesel production. Fatty acids like stearic, palmitic, oleic, linoleic and linolenic acid are commonly found in non-edible oils. Vegetable oils blended with diesel in various proportions have been experimentally tested by a number of researchers in several countries. To fulfil this energy demand and to control the pollution by using alternative fuel. The alternative fuels like biodiesel production. Vegetable oil are high fatty acid with high viscosity compare to the pure diesel fuel, so it is need to reduce the free fatty acid level and viscosity of vegetable oil. The main scope of the project is to use the callophyllum inophyllum vegetable oil as bio diesel, due to high acid value of oil, preprocessing were carried out to reduce it by using sulfuric acid.[1] Calcium Oxide is used as heterogeneous catalyst in transesterification process to reduce the viscosity of biodiesel by removing glycerol content, after that post treatment processes were carried out to remove the excess alcohol and catalyst in the biodiesel.[2] The petroleum fuels are one of the major sources of energy are currently the dominant global source of CO2 emissions, greenhouse gases and global warming. The rise in petroleum prices and increase in environmental pollution Also, depletion of fossil fuels, vehicular population, increasing industrialization, growing energy demand, explosion of population, environmental pollution and emission norms jointly have necessitated to find renewable alternatives to conventional petroleum fuels.[3]

2. EXPERIMENTATION

Ultra tech analyser of ACE gas conversion private limited is used for testing of emissions like carbon dioxide, carbon monoxide, oxygen, hydrogen. The emissions of callyphyllum inophyllum oil biodiesel were measured on this set up. Its suitable for pollution testing for automobiles as per cmvr rules. It's a light weight and robust instrument

Fig-1 Exhaust gas analyzer

3. RESULTS

3.1 Carbon monoxide

Chart 1 shows variation of CO with brake power. It is observed from the figure that the carbon monoxide emissions are decreasing with increase in brake power for all biodiesel blends and diesel fuel. At maximum loading condition the diesel fuel B00 has emitted highest CO emissions of 0.008% as compare to all blends of undi biodiesel blends.

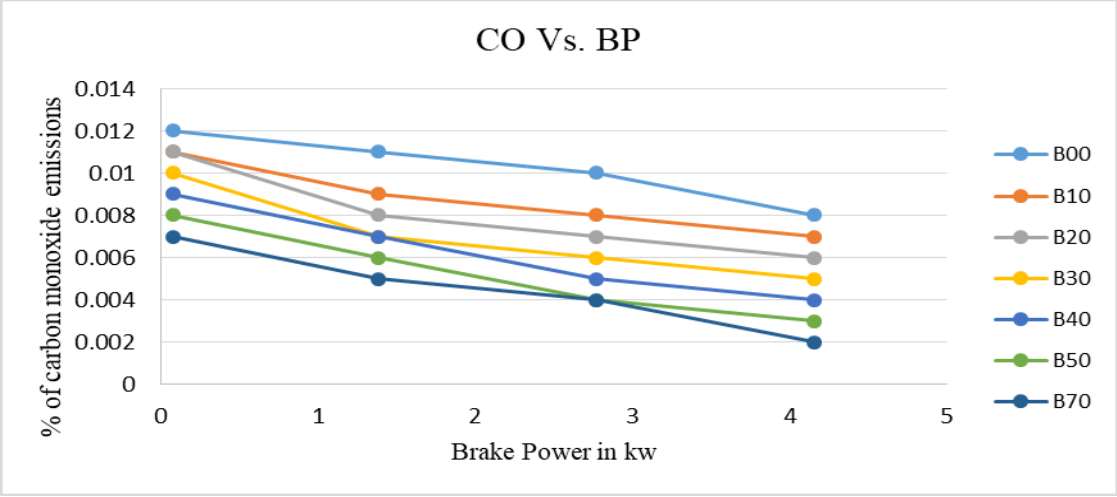

Chart-1 Variations of carbon monoxide vs. brake power

It was due the oxygen content available in diesel which was less than biodiesel. B70 has emitted 0.002% of lowest emissions of amongst all blends and diesel fuel and it emits nearly 75% less CO emissions than diesel fuel. The percentage emissions of carbon monoxide are completely depend on mixture strength, viscosity and oxygen availability and these emissions are due to incomplete combustion of diesel fuel. Also it might be due to additives like methanol and ethanol the emissions of biodiesel are reduced.

3.2 Carbon dioxide

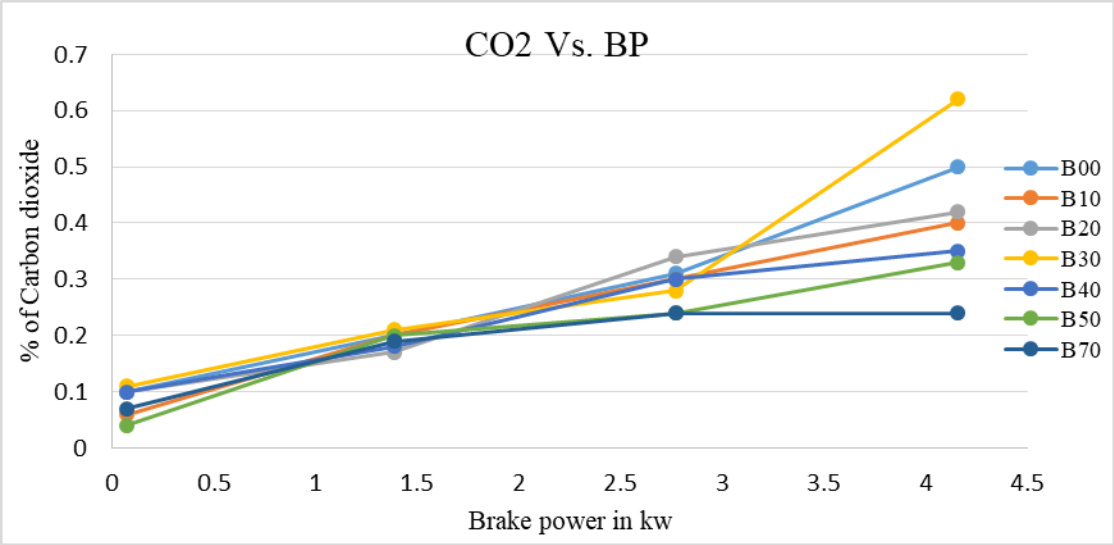

Chart-2 Variations of carbon dioxide vs. brake power

Chart-2 shows variation of CO_2 with brake power. Here B00 has emitted highest CO_2 emissions than all undi biodiesel blends except B30 because of lower percentage of oxygen in diesel fuel. The blend B70 emitted less CO_2 emissions with all load conditions respectively. Percentage of Oxygen in fuels play key role here in emissions of carbon dioxide. Also it is because of the fact that biodiesel is a low carbon fuel and has also carbon to hydrogen ratio than diesel fuel.

3.3 Oxygen emissions

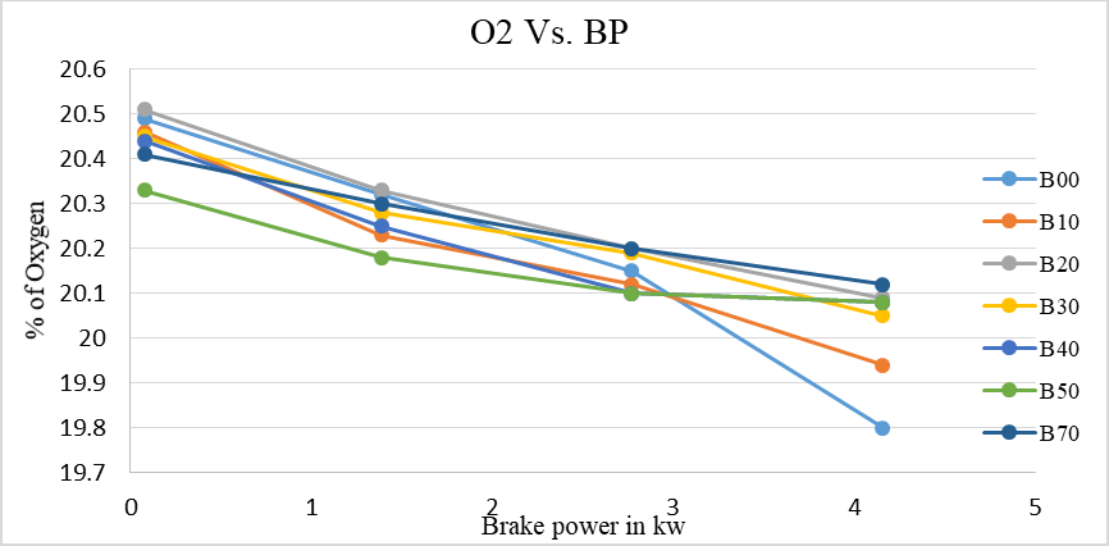

Chart-3 Variations of Oxygen vs. brake power

Chart-3 shows variation of O_2 with brake power and it was noted that the O_2 emissions were increased with load. This may be due to availability of more oxygen in biodiesel than diesel fuel that helps in complete combustion further. But the extra oxygen atom was responsible for more CO2 formation. Here B30 has emitted lowest emissions of O2 than biodiesel blends, while blend B70 had given maximum O_2 emissions.

4. VALIDATION OF EXPERIMENTATION

Comparing performance and emission results with Pongamia oil biodiesel
To validate our results comparison was done with similar work of S.V. Kale on pongamia oil with same specifications of engine set up and exhaust gas analyzer.[3]

4.1 Carbon monoxide

From chart 4 we compare both undi oil and pongamia oil, In case of undi oil at maximum load B70 has CO reduction by nearly 72.72% as compare to diesel fuel. In case of pongamia oil, at full load B100 has CO reduction of 47.05% as compare to diesel fuel. In Undi oil the percentage reduction of CO emissions as compare to diesel are more than Pongamia oil biodiesel blends.

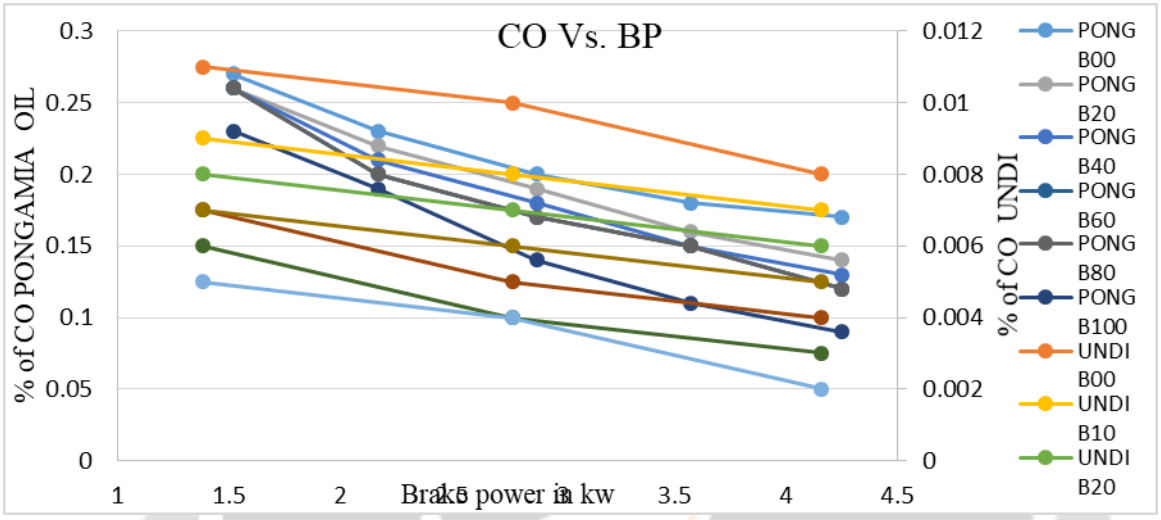

Chart-4 variations of carbon monoxide with brake power for undi oil and pongamia oil.

4.2. Carbon dioxide

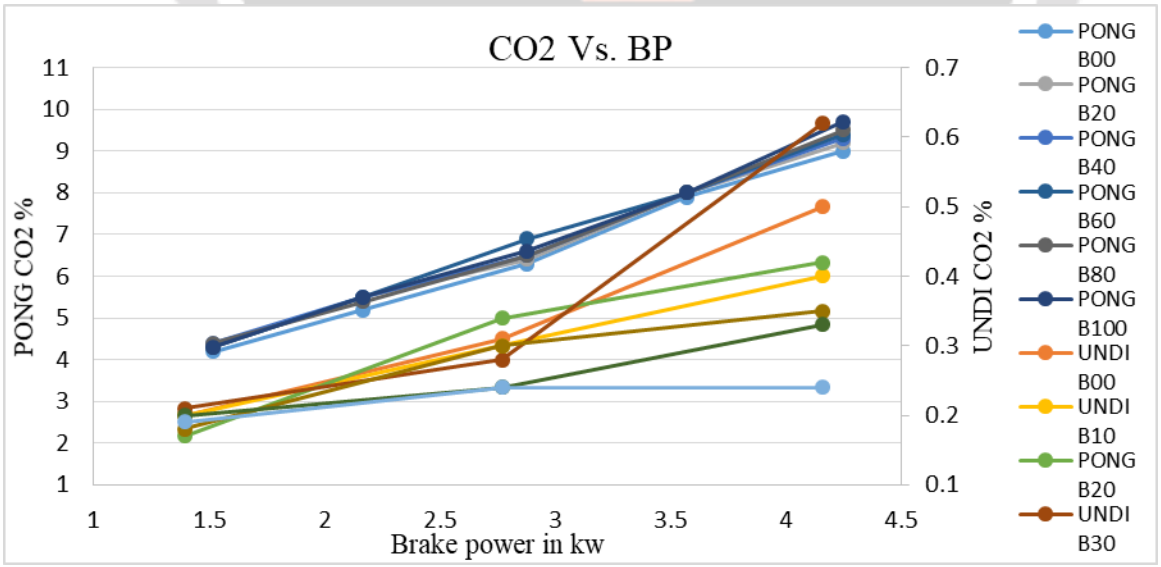

Chart-5 variation of carbon dioxide with Brake power for undi oil and pongamia oil.

As we compare both undi and pongamia oil, in case of undi oil at full load B70 has CO2 reduction of 52% as compare to diesel fuel and for pongamia oil B20 has 0.5% of CO2 emissions, but in case of pongamia oil at all loading conditions diesel fuel B00 was having less emissions of CO2 than all blends of pongamia oil B20, B40,

B60, B80, B100 by 2.17%, 3.26%, 4.34%, 5.43%, 7.61%. undi oil biodiesel CO2 emissions are less as compare to diesel and vice versa in case of pongamia oil.

5. CONCLUSIONS

1. CO emissions reduced by 72.72% in case of B70 than diesel fuel as oxygen content is more in biodiesel than diesel, CO2 emissions reduced by 52% for biodiesel B70 as a result of low carbon to hydrogen ratio. Percentage of oxygen is found more in case of biodiesel as compare to diesel which leads to improve efficiency and combustion.

2. B70 could replace the diesel fuel because of greater efficiency with 38.73% which is greater than B00. B70 also having less value of BSFC. CO, CO2 HC Emissions are also very low in case of B70 than diesel fuel. It can be possible to use undi biodiesel when more plantation will be done so that economically it will be acceptable.

3. Comparision of undi B70 with pongamia blends has been done and found that undi oil is better in some aspects of emissions percentage.

4. CO emissions of undi blend B70 is less than diesel by 72.72%, CO emissions of pongamia blend B100 is less than diesel by 47.05%. CO2 emissions of undi blend B70 is less than diesel by 52.%, CO2 emissions of pongamia B20 blend is more than diesel by 2.17%.

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