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# Investigation Effects of Nano Metal Oxide Blended Prosopis Juliflora Biodiesel on Di Engine

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***Abstract:* - The studies have been focused on discovering the fuel that would be adaptable to the existing engine constructions and that would meet the criteria regarding renewability, ecology and reliability of use. The main objective of this work is to discuss the impact of biodiesel from Prosopis Juliflora oil on performance and emission characteristics with bio-diesel. In this study, the effect of bio-diesel from prosopis Juliflora oil and its blends on a single cylinder Kirloskar TV-1 diesel engine was investigated. In this work, the performance and emission analysis were conducted. The tests were performed at steady state conditions with Prosopis Juliflora bio-diesel with different proportion range from 25 to 100% in steps of 25 (Sample 1, Sample 2, Sample 3and sample 4). The experimental results reveal a marginal decrease in brake thermal efficiency when compared to that of sole fuel. In this investigation, the emission test were with the help of AVL Di gas analyser, in which CO, HC and smoke density are marginal increased on the other hand CO2, O2 and NOx are appreciably reduced when compared to that of sole fuel. From the above result we can improved the Brake thermal efficiency and reduction of emission we are attending the metal oxides for the previous results.**

**Key words: ProsopisJulifloraoil, Transesterification, Biodiesel; Oxides of nitrogen, Smoke, Nano Particles& Aluminium Oxide.**

## 1. INTRODUCTION

This would result in a daily demand of around 18.4 billion litres. Conventional fuel, however, are predicted to become scarcely as 'petroleum reserves are limited', for this reason these fuels are set to convertedgradually costly in the coming decades. Renewable fuels, made from biomass, have enormous potential and can meet many times the present world energy demand (IEA, 2008). 'Biomass can be used for energy in numerous ways; one of these is the conversion into liquid or gaseous fuels such as ethanol and bio-diesel for use in mobile source combustion'. In fact 'global demand for liquid biofuels other than tripled between 2000 and 2007. And future targets and investment plans suggest strong growth will continue in near future'.

The potential of biofuels appear to be huge from an economic, political and environmental perspective. Speaking in terms of advantages, much heard is that they, as an alternative fuel, could solve numerous issues as the increasing energy prices worldwide, the increasing need of energy imports, the negative environmental consequences of fossil fuel combustion and the security of national energy supply for many countries. Biofuels seem to be more environment friendly in comparison to fossil fuels considering the emission of greenhouse gasses when consumed. Examples of those gasses are carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($NO_2$). Those gasses pose possibilities as they tend to warm the earth's surface'. The energy content of biofuels differs from conventional fuels. Total energy output per litre of biofuel is determined by the feedstock used, region where the feedstock is grown and production techniques applied. Biodiesel has an energy ratio related to diesel of about 0.87 to 1, which means that its energy contents are 87% of those of diesel. Bio-ethanol has an energy ratio compared to gasoline of 1.42 (67% of gasoline).

## II. PREPARATION OF NANO FLUIDS

The blending of metal oxides in the biodiesel (Juliflora), we have taken best blend B25 (Diesel 75% and Juliflora Bio diesel 25%). From the best blend we should taken B25 for improving the thermal efficiency beyond diesel fuel at maximum level of metal oxide added 120ppm. We must added nano particle of metal oxide. Sample 1 one litre of bio diesel we should added 30ppm of metal oxides (Aluminium oxide and cerium oxide).Sample2 one litre of bio diesel we should added 60ppm of metal oxides.Sample 3 one litre of bio diesel we should added 90ppm of metal oxides and Sample 4 one litre of bio diesel we should added 120ppm of metal oxides.

## III. EXPERIMENTAL SETUP AND ARRANGEMENT

An experiment is executed on Kirloskar TV-1, single cylinder, four stroke, and air- cooled diesel engine. The graded power of the engine is 5.2 kW at 1500 rpm. The diesel engine is operated at a standard injection pressure of 200 bar pressure and a constant speed of 1500 rpm. The fuel flow rate is measured on volume basis using a burette and a stop watch. K-type thermocouple and a digital display are employed to note the exhaust gas temperature. The Hartridge smoke meter is utilized for the measurement of smoke density. The temperature of the exhaust gas is measured using K-type thermocouples. Exhaust emissions viz., hydrocarbon, carbon monoxide.

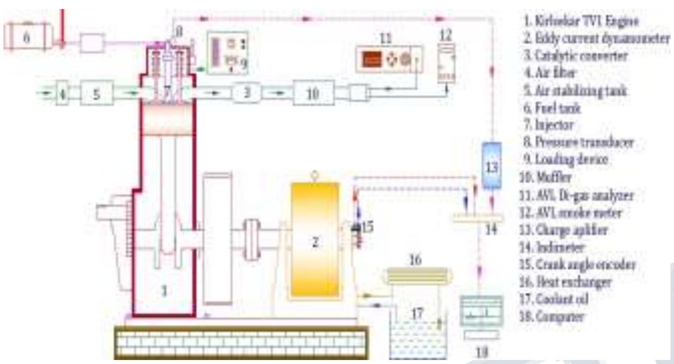


**Fig. 3.1 Schematic diagram of the experimental setup**

## IV. RESULT AND DISCUSSION

The performance and emission characteristics tests on diesel engine were conducted using biodiesels and Prosopis juliflora biodiesel blend B25 chose as best blend according to its performance andemission characteristics. B25 blended with 30, 60, 90 and 120ppm proportions of aluminum oxide and cerium oxide nanoparticles as additive. The operation of the dieselengine was found to be very smooth throughout all load conditions, without any operationalproblems for addition of aluminum oxide and cerium oxide nanoparticles with biodieselblends.

### 4.1 Brake thermal efficiency

The variation of brake thermal efficiency with brake power for Prosopis juliflora biodiesel (B25) biodiesel blend with different dosing level of aluminum oxide and cerium oxidenanoparticles is shown in Figures 4.1. The brake thermal efficiency of the diesel fuel ishigher amongst all the biodiesel blends. The brake thermal efficiency of the biodiesel blendsis lower due to their lower calorific value. However significant improvement in brake thermal efficiency is observed with the addition of aluminum oxide and cerium oxide nano particles with Prosopis juliflora biodiesel blends. From the graphs, it is clear that the brake thermalefficiency increased with the increase of aluminum oxide and cerium oxide nanoparticlesproportion with fuel blends. The BTE was found higher in the case of aluminum oxide mixed biodiesel blend when compared with cerium oxide nanoparticles. The highest brakethermal efficiency is observed as 27.9% for B25+AONP120 whereas it is 27.1% forB25+CONP120.

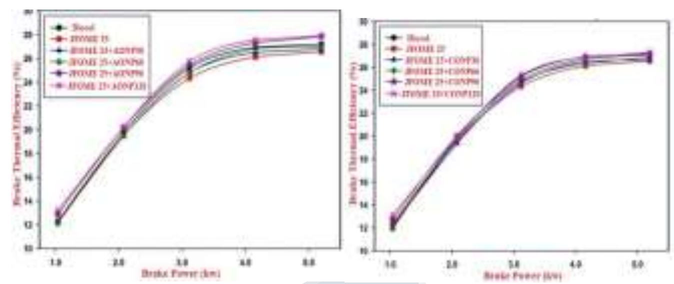

Figure 4.1 Effect of nanoparticles with brake thermal efficiency

### 4.2 Oxides of nitrogen emission

The variation of oxides of nitrogen emission with brake power of B25 fuel blend withdifferent dosing of nanoparticles is shown in Figures 4.2. From the graphs, it is clear that theNOx emission gradually increases with increase of amount of nanoparticles with biodieselblends. The effect of oxygenated nanoparticles ($Al2O3$ & $CeO2$) additive enhances the fuelblend combustion rate and the shorter ignition delay due to premixed combustion is thereason for higher combustion temperature and higher NOx emission. Many aspects likeoxygen concentration, combustion duration and combustion temperature contribute to theformation of NOx emission. The addition of nanoparticles possesses high surface contactareas which increase their chemical reactivity which in turn reduces the ignition delay. TheNOx emission dramatically increases by means of nanoparticles additives, with the averageincrease of around 6.5% and 4.2% in the cases of B25+AONP120 andB25+CONP120 fuel blends, respectively when compared to that of sole fuel.

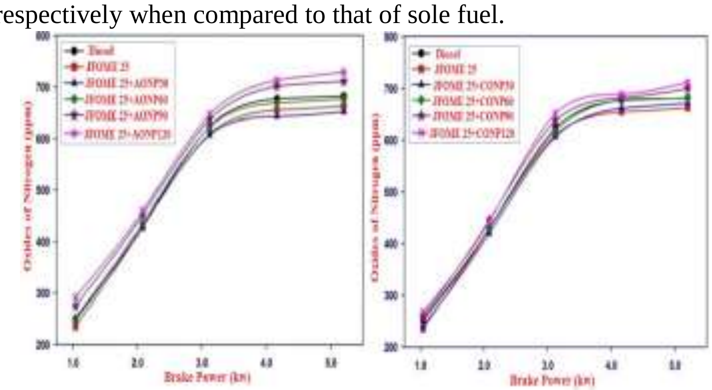

**Figure 4.2 Effect of nano particles with NOx emission**

### 4.3 Hydrocarbon emission

The variation of hydrocarbon emission with brake power of B25 fuel blend withdifferent dosing of nanoparticles is shown in Figures 4.3. The addition of aluminum oxide and cerium oxide nano particles with B25 fuel blend decreases the unburnedhydrocarbon emission when compared with neat B25 fuel blend. Both aluminum and cerium oxides act as an oxidation catalyst and thus enhance unburned hydrocarbon oxidation, hence promoting complete combustion of B25 fuel blend. Hydrocarbon emissiondecreases with increase of dosing level of both Al2O3 and CeO2 nanoparticles with fuelblends. Up to 90ppm dosing level of nanoparticles, HC emission significantly reduced andfor 120ppm further it reduced slightly. From the graphs it is clear that the Al2O3 nanoparticleseffectively reduced the HC emission when compared with Ce2O nanoparticles. The least HCemission is observed as 15.1ppm for the B25+AONP120 fuel at the maximum brakepower.

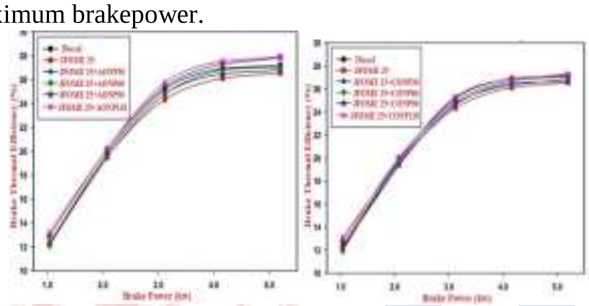

**Fig 4.3 Effect of nano particles with HC emission**

### 4.4 Cylinder pressure

The variation of in-cylinder pressure with crank angle for different dosing level of Al2O3 andCe2O nanoparticles with JFOME25 fuel blend is shown in the Figures 4.4. It is observed thatthe peak in-cylinder pressure increases with the addition of both nanoparticles in biodieselblends. The addition of nanoparticles with JFOME25 fuel blend accelerates the earlycombustion of fuel blends and reduces the ignition delay period. The addition of oxygenated fuel blends like aluminum oxide and cerium oxide nanoparticles cause for faster combustionrate which results in higher peak in-cylinder pressure. In-cylinder pressure increased withincrease of dosage of nanoparticles with both biodiesel blends. Addition of

90ppm (bothAl2O3 and Ce2O) nanoparticles with biodiesel blends improve better combustion of biodiesel blends tends to increase the peak pressure and further increase of dosage of nanoparticles(120ppm) there is no major change found in in-cylinder pressure. The highest peak pressure is observed as 62.4bar for the JFOME25+AONP120 blend, whereas is 61.8bar, 62.2 bar and 61.5 bar for JFOME25+CONP120, JFOME+AONP90 and JFOME25+CONP, respectively.

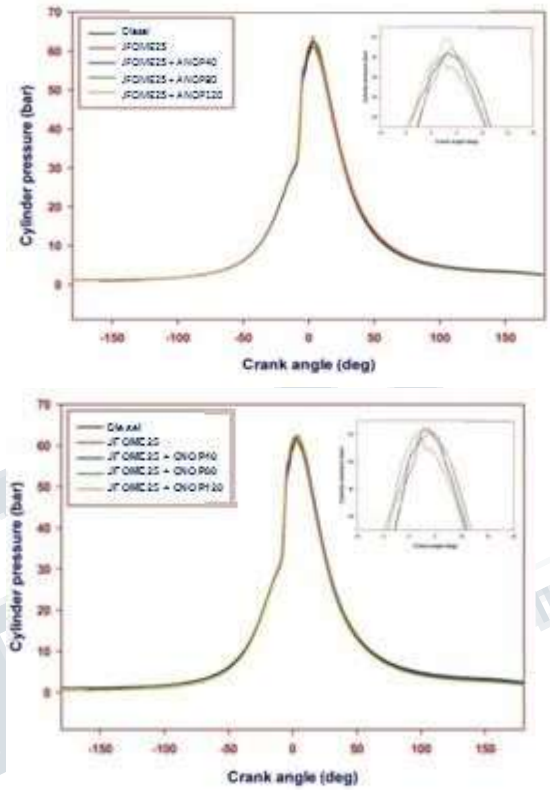


**Fig 4.4 Effect of nanoparticles with in-cylinder pressure**

### 4.5 Heat release rate

The variation of heat release rate with crank angle for Prosopis juliflora seed biodiesel blends withdifferent dosing level of aluminum oxide and cerium oxide nanoparticles is shown inFigures 4.5. The heat release rate increases with the addition of metal oxide nanoparticles(Al2O3 and Ce2O) with both JFOME25 fuel blends. The shorter ignition delaydue to the addition of Al2O3 and Ce2O nanoparticles in different proportions is the cause forthe rapid combustion of biodiesel fuel blends in the premixed phase results in higher heatrelease rate. The highest heat release rate is observed as 123.87kJ/m3deg for theJFOME25+AONP120 blend at maximum load, whereas it is 120.35for JFOME25+CONP120blend. From the results, it is clear that aluminum oxide nano particles increase the combustion temperature of the fuel blends compared with the cerium oxide nanoparticles.

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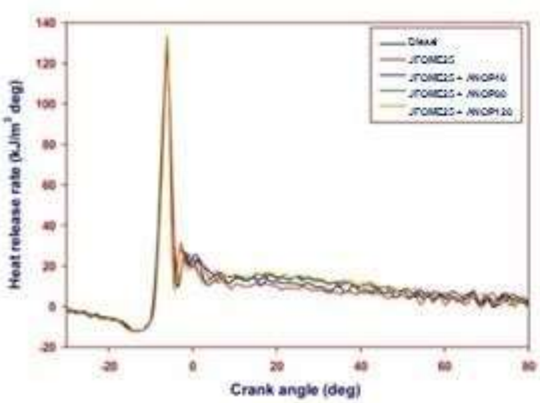


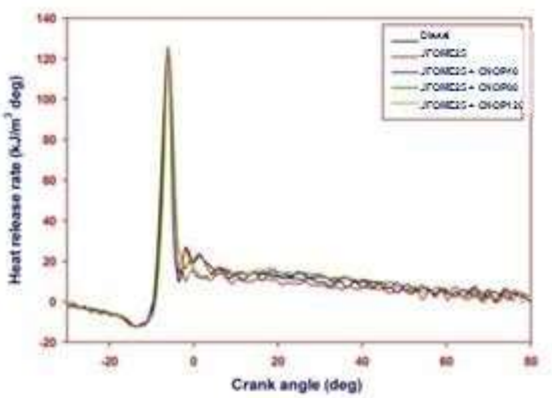


**Fig 4.5 Effect of nano particles with heat release rate**

## 5. CONCLUSIONS

In first phase of this research work, the performance and emission characteristics of Prosopis Juliflora seed biodiesels and their blends are investigated on the single cylinder CI engine Biodiesels and their blends have lower brake thermal efficiency and poor emission characteristics. In second phase, with the intention of improve BTE and emission characteristics of diesel engine while using biodiesel blend as fuel some amount of Al2O3 and CeO2 nano particles added as oxygen donating catalyst. The conclusions of this investigation are as follows:

- Improvement is observed in brake thermal efficiency with the addition of both aluminum oxide and cerium oxide nano particles with Prosopis Juliflora seed biodiesel blend (JFOME25).
- The carbon monoxide and HC emission decreases with the increase the proportion of aluminum oxide and cerium oxide nano particles in Prosopisjulifloraseed biodieselblend. Compared with cerium oxide, aluminum oxide nano particles effectively reduce the both HC and CO emission.
- A slight increment of NOx emission is observed in the cases of both (Al2O3 and CeO2) nanoparticles blended JFOME25 fuel blend.
- The peak pressure and heat release rate increases with the addition of Al2O3 andCeO2 nanoparticles with JFOME25 fuel blend. The addition of nanoparticlesdecreases the ignition delay and act as oxygen donation catalyst and cause for thehigher peak pressure and heat release rate when comparing with JFOME25.

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