# The Performance and Emission Analysis of Neem Oil Blends with Diesel Fueled in CI Engine

**Appese S. D, S. B. Prakash, Krishnamurthy K. N**

***Abstract— In the present paper, the performances and emission of Neem Bio-diesel are tested. The freely available resources can be used. The blends of Neem methyl ester and Diesel were prepared analyzed and their performance compared with performance of diesel oil. The engine performance intended variables are thermal efficiency, Mechanical efficiency, fuel consumption have been obtaining from different blends and results are compared with pure diesel. In this paper, the emission characteristics of Neem oil have been tested. The blends of varying proportions of Neem oil are B10, B20, B40, B60, B80, B100 with Diesel were prepared analyzed and their emission compared with emission of diesel fuel. The basic engine emissions are CO, $CO_2$, HC, and NOx have been obtained from different blends and results are compared with pure diesel. The goal of this study is to verify the affiliation between engine performances and emission by means of diesel.***

***Index Terms— Neem oil, Neem bio-diesel, Diesel oil, Emission***

## I. INTRODUCTION

Now a day the fuel requirements are increasing day by days so cost is also more and it produces more emissions to environment. For that we need alternative fuel sources like bio-diesel is substitute for diesel. IC Engine is generally the compression ignition engine have crucial task in production, transport, power generation and farming region [1]. We have to do research and find the customs of using alternate fuels which are sooner renewable and also manufacture in low levels of gaseous and particulate Pollutants presents in IC engines [2][3]. Present work the performance survey tests by using petroleum diesel fuel and also blends of Neem bio-diesel have been done. Bio-diesel has more attention as an alternative fuel for diesel because of renewable source and it can reduce the emissions [4][5]. In this paper by using bio-diesel in diesel engines reduces HC, CO, $CO_2$, and NOx without any change in engine design. The blends of varying proportions of Neem oil are B10, B20, B40, B60, B80, B100 with Diesel were prepared analyzed performance and their emission compared with diesel fuel.

**Revised Version Manuscript Received on July 09, 2015.**

**Appese S. D**, M.Tech. Student, Department of Thermal Power Engineering, VTU PG Studies Mysuru, VTU, Belagavi, India.

**S. B. Prakash**, Professor, Department of Thermal Power Engineering, VTU PG Studies Mysuru, VTU, Belagavi, India.

**Krishnamurthy K. N**, Asst. Prof., Department of Thermal Power Engineering, VTU PG Studies Mysuru, VTU, Belagavi, India.

**Table 1.1 Engine specification**

| | |
|---|---|
| Made | Kirloskar |
| Cycle's used | Diesel |
| Number of strokes | 4 |
| Number of cylinder | 1 |
| Bore diameter | 80 mm |
| Stroke | 100 mm |
| Cooling system | Water cooled |
| Lubrication | Forced method |
| Output | 3.675 kW at 1500rpm |
| Dynamometer | D.C Generator |
| Armature | Shunt |
| Voltage | 220 V |
| Rated BP | 3.675 kW |
| Air box orifice diameter | 25 mm |
| Current | 13 A |

## II. MATERIAL AND METHODS

The Neem oil biodiesel was prepared by using two-stage transesterification process due to their free fatty acids (FFA) level is more than 1%. In the first march, esterification result was carried out to minimize the FFA level. Minimum level of FFA was getting by adding 15ml methanol and 1ml $H_2SO_4$ to 100ml of Neem oil. This retort is carry at temperature sort between $55^0$C to $60^0$C with a feedback time is about 60 minutes. In the second stage, maximum capitulate was obtained by adding 35ml methanol and 0.3% NaOH to the trial 100ml get from the first march which has lowest FFA level. During this process the temperature range of $55^0$Cto $60^0$C was maintained for reaction timing is 90 minutes. Neem bio-diesel oil blends are equipped by mixing B10, B20, B40, B60, B80 and B100 respective bio-diesel with diesel oil on volume basis.

## III. RESULTS AND DISCUSSION

The basic engine performance measuring parameters are BTE, Mechanical efficiency, SFC has been obtained from different blends and results are compared with pure diesel. The basic engine emissions are CO, $CO_2$, HC, and NOx have been obtained from different blends and results are compared with pure diesel.

*3.1Effect of BP on BSFC*



*Published By:*
*Blue Eyes Intelligence Engineering*
*& Sciences Publication Pvt. Ltd.*

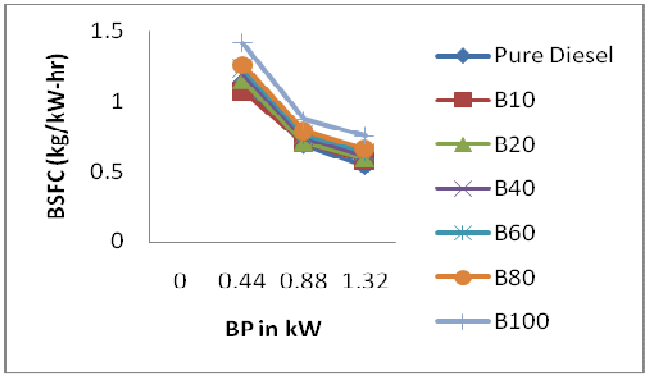


**Figure 3.1 Effect of BP on Specific fuel consumption when diesel engine has run on blends of Neem oil as B10, B20, B40, B60, B80, B100 and Diesel.**

Figure 3.1 shows that the effect of BP on BSFC when diesel engine has run on B100, B80, B60, B40, B20 and B10 respectively. Above figure shows that with increase in the Brake power in kW on the engine, BSFC has decreased. On the other hand the attentiveness of Neem oil in the blend is more than 20%, the BSFC is found to be more than diesel at all loads. The reason is lower heating value of Neem bio-diesel.

*3.2 Effect of BP on Brake Thermal Efficiency*

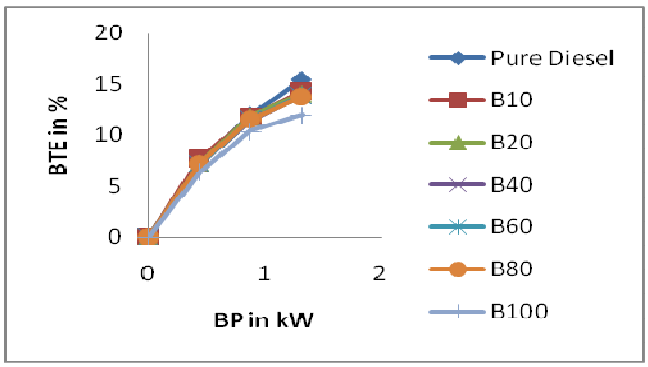


**Figure 3.2, Effect of BP on Brake thermal efficiency when diesel engine has run on blends of Neem oil as B10, B20, B40, B60, B80, B100 and Diesel.**

Figure 3.2, shows at full load the time for whole combustion of fuel was decreased, therefore a slight drop in BTE was observed. Diesel has higher BTE because of higher heating value than all blends.

*3.3 Effect of BP on Mechanical Efficiency*

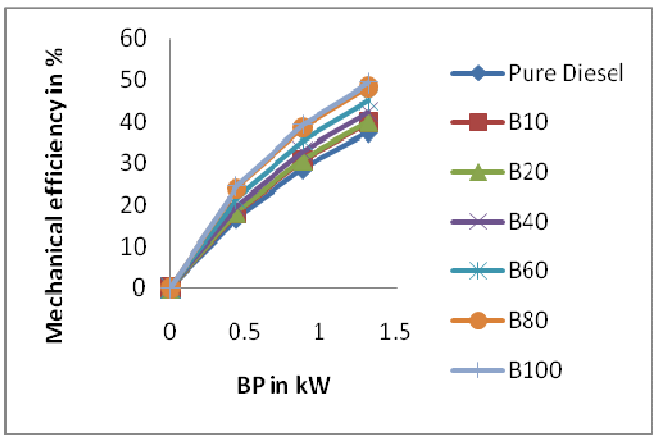


**Figure 3.3 Effect of BP on Mechanical efficiency when diesel engine has run on blends of Neem oil B10, B20, B40, B60, B80, B100 and Diesel.**

Figure 3.3 shows variation of mechanical efficiency with brake power for diesel and blends of B10, B20, B40, B60, B80 and B100 of Neem methyl esters for 180 bar injection pressure. The obtained results show that mechanical efficiency increases with increase in BP for all blends of biodiesel and diesel.

*3.4 Effect of BP on CO emission*

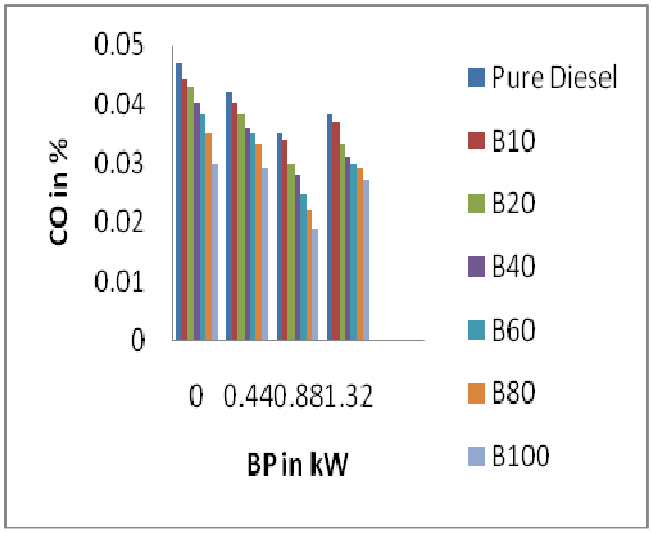


**Figure 3.4 Effect of BP on CO emission when diesel engine has run on B10, B20, B40, B60, B80, B100 and Diesel.**

Figure 3.4 indicates that CO emission increases with increase in percentage of load (BP) and decreases with increase in percentage of ester. CO emission decreases with BP starting from no load for all fuels. The high emission at no load is because lower cylinder temperature at no load. Load increases cylinder temperature increases. The problem of low volatility of Neem oil biodiesel fuel results in higher amount of CO emission with blends and Neem oil biodiesel as fuel compared with diesel.

*3.5 Effect of BP on CO2 emission*

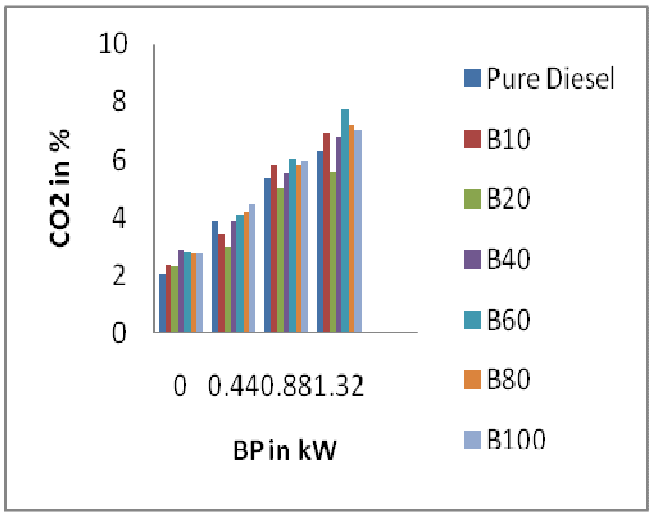


**Figure 3.5 Effect of BP on CO2 emission when diesel engine has run on B10, B20, B40, B60, B80, B100 and Diesel.**

Figure 3.5 by using higher content Neem biodiesel blends it increases the $CO_2$ emission was noted because of incomplete combustion. Blend B20 is effective fuel among all blends. $CO_2$ increases because of reducing CO emission.



*Published By:*
*Blue Eyes Intelligence Engineering*
*& Sciences Publication Pvt. Ltd.*

*3.6 Effect of BP on HC emission*

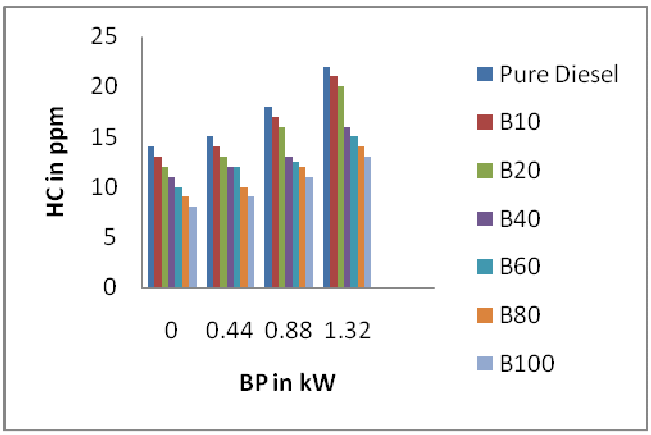


**Figure 3.6 Effect of BP on HC emission when diesel engine has run on B10, B20, B40, B60, B80, B100 and Diesel.**

Figure 3.6 indicates that HC emission increases with increase of BP and decreases with increase in % of ester. B100 has minimum HC emission at all loads. B10 has maximum HC emission.

*3.7 Effect of BP on NOx emission*

The reason of NOx emission of Neem oil biodiesel fuel is contributed towards inbuilt oxygen. B10, B20 fuel shows lower NOx emission compared to diesel fuel. With increase in Neem methyl ester % in blend the oxygen content increase and hence higher blend shows higher NOx emission compared to diesel.

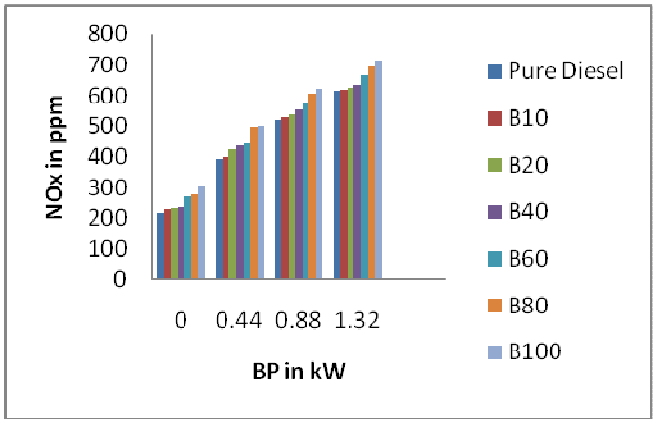


**Figure 3.7 Effect of BP on NOx emission when diesel engine has run on B10, B20, B40, B60, B80, B100 and Diesel.**

## IV. CONCLUSION

- BTE of B20 is more in Neem as compared with diesel.
- Least SFC for B20 fuel as compared to diesel and B10.
- BTE and Mechanical efficiency of Neem oil for the Blend B10, B20 is analyzed we get BTE and mechanical efficiency is more compared to diesel.
- Minimum emission of CO with diesel B10 and B20.
- More HC emissions for diesel, B10, B20 at no load, while using increasing percentage of blend of Neem oil with diesel the emission of HC reduces.
- From this study it is conclude that the B10, B20 gives optimum performance where B100 gives the lower emission of HC and CO.
- By means of bio-diesel the emission is appreciably a lesser amount of polluting.

## ACKNOWLEDGMENT

I express immense gratitude to Dr. Balakrishegowda project Co-ordinate BIOFUEL PARK, Madenur, Hassan-573225 University of Agricultural Sciences Bengaluru 560065, for providing necessary lab facilities and his motivation and constant encouragement and help to carry out project work successfully.

## REFERENCES

[1] Kandu Kalpatti Chinnaraj Velappan, Less NOx biodiesel: CI engine studies fuelled with rice bran oil biodiesel and its five blends, Journal of scientific and Industrial Research, 66, 2001, 60-71.
[2] A. Siva Kumar, D. Maheswar and K. Vijay Kumar Reddy (2009), comparison of Diesel engine performance and Emissions from Neat and Transesterified Cotton Seed oil, Jordan Journal of Mechanical and Industrial Engineering. 3(3), pp.190- 197.
[3] Ramesh, D., A. Samapathrajan, and P.Venkatachalam, 2006 "Production of Biodiesel from Jatropha curcas oil by using pilot Biodiesel plant". The Jatropha Journal 18-19: 1- 6.18.
[4] Parametric studies for improving the performance of a jatropha oil-fuelled compression ignition engine by j. Narayana Reddy, A. Ramesh_, Internal Combustion Engines Laboratory, Mechanical Engineering Department, Indian Institute of technology Madras, Chennai- 600036, India
[5] Allen CAW, Watts K, Ackman RG, Pegg MJ (1999) Predicting the viscosity of biodiesel fuels from their fatty acid composition. Fuel 78: 1319-1326.
[6] Srivastava, A., Prasad, R. (2000). Triglycerides based diesel fuel. Renewable sustainable energy reviews, 4(2), 111-133.

He is doing M.Tech in the Department of Thermal Power Engineering at Visvesvaraya Technological University College, Mysuru (India). He obtained his B.E. in Automobile Engineering from BLDEA'S DR. P.G.Halakatti College of Engg. And Tech, Bijapur under VTU Belagavi in 2012.

He is working as Professor in the Department of Thermal Power Engineering at Visvesvaraya Technological University, Mysuru. He obtained his Ph. D in Heat transfer studies from JCE Mysuru under Visvesvaraya Technological University, Belgaum (India) in 2010. He did his M.E in Thermal Power Engineering under PDACE Gulbarga University in 1996 and B.E in Automobile Engineering in PESCE Mandy under Mysore University, Mysore (India) in 1988. He published 5 technical papers in International / national journal and conferences. He is a life member of ISTE and MIE.

He is working as Assistant Professor in the Department of Thermal Power Engineering at Visvesvaraya Technological University, Mysuru. He did his M.Tech in Thermal Power Engineering in SIT Tumakur under Visvesvaraya Technological University, Belgaum (India) in 2010 and B.E in Mechanical Engineering in S.J.C.I.T Chickballapur under Visvesvaraya Technological University, Belgaum (India) in 2007. He published 7 technical papers in International / national journal and conferences. He has registered for Ph.D in VTU, has completed course work in 2012 and 7 years teaching experience.



*Published By:*
*Blue Eyes Intelligence Engineering*
*& Sciences Publication Pvt. Ltd.*