

Neem Oil Methyl Ester a promising source to power DI-CI Engine.

Rohit Wavikar¹, Nilesh Saindane², Amol Vaidya³, C. Srinidhi⁴, J.Satpute⁵

¹²³UG Student, Suman Ramesh Tulsiani Technical Campus-Faculty of Engineering

⁴⁵Asst. Professor, Dept. of Mechanical Engineering, SRTTC-FOE, Kamshet, Pune-410405

Abstract: The diminishing of fossil fuel resources and the environmental degradation have stimulated research interest to find superior renewable alternative energy sources. Bio-fuels appear to be a solution to substitute fossil fuels, because resources for it will not extinct. Biodiesel is the fatty acid alkyl ester. Biodiesel be produced from low cost Neem seed oil using Trans esterification. This review has been taken up for identifying the effects of blending Neem Seed oil with diesel on engine and performance and emissions of CI engine.

Key Words: Neem oil, Transesterification, Performance, Emissions, Biodiesel.

1. INTRODUCTION

Every aspects of day to day life depend upon energy, particularly fuel for the transport of good and people. The alternative source of energy for automobile fuel that is gaining attention today is Biodiesel. Biodiesel is a non-petroleum based diesel fuel which consists of the mono alkyl esters of long chain fatty acids derived from renewable lipid sources. Biodiesel is typically produced through the reaction of a vegetable oil or animal fat with methanol or ethanol in the presence of catalyst to yield glycerin and methyl ester whereas methyl ester is nothing but the biodiesel. Biodiesel can be produced from various sources like cotton seed, waste vegetables oil, Palm oil, Algae, Neem seed oil, Jatropha. Various researchers have found that combustion of biodiesel in CI engines has lesser percentage of emissions like unburned hydrocarbons (HC) and carbon Monoxide (CO) when compared to fossil diesel. Also Biodiesel has negligible sulphur content. [5].

1.1 Neem seed oil

Neem trees are native to India and other parts of Asia. Neem is a tree that has gained world-wide importance owing to its multiple uses. Besides agro forestry, it is used in pest control, toiletries, cosmetics, pharmaceuticals, plant and animal nutrition and energy generation. Neem trees are considered to be a divine tree in India because of their numerous valuable uses. Oil can be extracted from Neem seeds by either expeller or chemical solvent. Neem oil is a vegetable oil pressed from the fruits and seeds of the Neem. Neem oil contains fatty acids like oleic acid and linoleic acid. Neem oil and its seed contains 30% oil content[11]. Neem Seed Biodiesel itself has 11% oxygen,

which help for complete combustion of fuel [4]. Hence CO emissions decrease with increasing biodiesel percentage in fuel.

2. Literature Survey

Tejaswita Kajale et al. [1] In this paper, combustion and exhaust emission with neat diesel-NOME (Neem Oil Methyl Ester) blend were investigated. It was found that biodiesel associated with lower emissions HC, CO, and the engine running with biodiesel and blends have higher NO_x emission by up to 20%. However, the emissions of the CI engine running on neat biodiesel (B100) were reduced by up to 15%, 40% and 30% for CO, CO₂ and THC emissions respectively, as compared to diesel fuel at various operating conditions.

K.Swami Prasad naik et al. [2] investigated the results of test performed on single cylinder four stroke with water cooled and compression ignition diesel engine at constant speed of 1500 rpm. Blend N30 has given the better performance in the sense of brake thermal efficiency, specific fuel consumption and emission parameters. No engine seizing, injector blocking was found during the entire operation while the engine running with different blends of neem oil and diesel.

Suthar Dinesh Kumar et al. [3] the investigation carried out using Neem oil on single cylinder four strokes and water cooled compression ignition engine. The test carried out to analyze the brake power, brake specific fuel consumption, Exhaust gas temperature and emissions such as CO, NO_x and HC. According to the results, the best performance and less emission obtained with in B20 blend from various test fuels. Also with increase in Neem oil biodiesel percentage in fuel, emission of CO reduced at no load. They also found out that Brake thermal efficiency with B20 fuel was slightly higher compared to diesel. Maximum brake thermal efficiency with B10 and B30 were lower compared to diesel.

Ajay Gahadwal et al. [4] A 3.5 kW, constant speed diesel engine was tested on diesel, NOME-diesel blends in 10:90, 20:80, 30:70, 40:60 and 50:50 ratios. Result showed that CO emissions were increased with increased in load. Engine emitted more CO using diesel as compared to that of biodiesel blend under all loading conditions. They

concluded that for better performance of the engine B20 is recommended for low emission.

Daingade Ajit Sampatrao et al. [5] analyzed the performance and emission characteristics of diesel-ester blends on Single cylinder 5.4Kw power, DI, water cooled CI engine. Author highlights effect of compression ratio on BTHE, SFC, CO, smoke emission and EGT. Results showed that 30% blending gave optimum values of performance and emission characteristics. They concluded that the Brake thermal efficiency of blends (B30) was lower at higher part load & full load respectively than diesel.

K. Tarun et al. [6] prepared B15, B20 and B25 blends of Neem biodiesel with diesel. They observed that at no load condition the percentage of smoke in normal diesel was more than biodiesel blend (B20). Brake thermal efficiency for blends of Neem oil and diesel oil was higher than that of pure diesel during engine operations. Also B20 had more mechanical efficiency and indicated thermal efficiency when compared with diesel and other blends. At the end they concluded that B20 had most suitable characteristics.

K.Dilip Kumar et al. [7] The engine used for the experiments was single cylinder four stroke water cooled, constant speed diesel engine. From the experimental results it was observed that cotton seed methyl ester gave better performance compared to Neem methyl esters and also the emissions and smoke for these diesel blends were less as compare to the pure diesel.

L. Prabhu et al. [8] Analyzed the combustion, performance and Emission characteristics of diesel engine With Neem oil methyl ester and its diesel blends. The tests were performed on four stroke water cooled diesel engine having 4.44Kw power and at 1500 rpm speed. They observed that the BTE and BSFC for 20, 40 and 100% NOME were lower than that of diesel fuel at full load. Also there were a 10, 15 and 20% increase in NO emission for 20, 40 and 100% NOME at full load as compared to diesel fuel. Finally they concluded that the performance, combustion and emission characteristics of 20% NOME blend were better compared to 100% NOME.

K.V.Radha et al. [9] Biodiesel were prepared using Trans esterification process. After that they analyzed the exhaust emissions with neat diesel and Neem oil blends. Author observed exhaust emissions including smoke and CO were reduced, while NO_x emission was increased with the diesel-NOME blends.

Harsha B.M. et al.[10] A single cylinder, CI engine was operated by using Neem biodiesel and the performance and exhaust emissions were compared with pure diesel fuel. They observed fuel properties like kinematic viscosity, density, flash point, fire point, specific gravity

and calorific value of the produced Neem biodiesel were found to be within the limits of biodiesel ASTM standards. It was observed that the injection pressure increases BTE with increase in BP but the BTE for 300 bar was less than other lower pressure. And the BSFC was also decreased with increase in injection pressure up to 250 bar. The results indicated that the CO emissions are slightly less, HC emissions were also observed to be less for B10 and B20, and NO_x emissions increased for B10 and for B20 compared with diesel.

S.Ram kumar et al. [11] this paper deals with the experimental analysis of variable compression ratio diesel engine operated with the Neem oil methyl ester. The blends such as b40 and b80 were taken and it was operated for the constant load of 12kg and injection pressure of 200bar, and variable compression ratio such as 15, 16, 17, and 18. The engine performance was experimentally conducted for the different compression ratios. From experiment they observed that the brake thermal efficiency of the CI engine increased with the compression ratio but its value was less when compared to that of the diesel. Brake specific fuel consumption was good when increasing the compression ratio. The emissions such as carbon monoxide and unburnt hydrocarbons decrease with the blend ratio and compression ratio. A nitrous oxide emission increases with the compression ratio and blend ratio.

2. CONCLUSIONS

Good mixture formation and lower smoke emission are the key factors for good CI engine performance. These factors are highly influenced by viscosity, density, and volatility of the fuel. For bio-diesels, these factors are mainly decided by the effectiveness of the transesterification process. With properties close to diesel fuel, bio-diesel from Neem seed oil can provide a useful substitute for diesel thereby promoting our economy. Biodiesel and diesel fuel blends may prove an alternative option as diesel fuel in the future because they are renewable resources and less polluting. It is found that Indicated thermal efficiency, brake thermal efficiency, brake power, volumetric efficiency can be increased by using NOME and its blends with diesel as an alternative fuel for diesel. Exhaust emissions like CO, PM, UHC, smoke capacity can also be reduced. Only NO_x emission increases at any type of blend as compared to diesel but it can be reduced in future by after-cylinder treatment like EGR, SCR etc. Specific fuel consumption increases at any type of blend as compared to diesel.

REFERENCES

- [1] Tejaswita Kajale, Abhay Pawar, Channapatana (2015). "Study of Engine Performance and Emission with Neem Oil (NOME) Based Bio-Diesel", International Journal of

- Recent Trends in Science And Technology, Volume 11, Issue 1, 2014 pp 09-11.
- [2] K.Swami Prasad Naik, R.Jyothu Naik , P.Srinivasa Rao, (2015) “ Experimental analysis on 4 Stroke single cylinder diesel Engine blended with neem oil And nano powder”,South Asian Journal of Engineering and Technology.
- [3] Suthar Dinesh Kumar L., Dr. Rathod Pravin P., Prof. Patel Nikul K ,(2014). “The performance of multi cylinder diesel engine Fuelled with blend of diesel and neem oil Biodiesel”, International Journal of Advanced Engineering Research and Studies Vol. II/ Issue III/April-June, 2013/28-34.
- [4] Ajay Gahadwa & Sanjay Yadav “ Experimental Investigation of Emission Characteristics of CI Engine fuelled with Blends of Neem Biodiesel and Diesel”, International journal of research, Volume 2, Issue 11, November 2015.
- [5] Daingade Ajit Sampatrao, Metkari Ganesh Sunil & P. D. Kulkarni, “ Performance & emission analysis of biodiesel using various Blends (castor oil+ neem oil biodiesel) ”, International Journal of Research in Engineering & Technology, Vol. 2, Issue 5, May 2014, 117-124.
- [6] k. Tarun, g. Sai gnanarka, s. Abhinav, k. Sai satvik “performance characteristics of neem bio diesel (b20)”, International Journal of Mechanical Engineering & Technology, Volume 5, Issue 4, April (2014), pp. 51-60.
- [7] K.Dilip Kumar, P.Ravindra Kumar, “Experimental investigations of Cotton Seed Oil and Neem Methyl Esters as Biodiesel On Ci Engine”, International Journal of Modern Engineering Research Vol.2, Issue.4, July-Aug 2012 pp-1741-1746.
- [8] L. Prabhu, S. Sathish Kumar, M. Prabhahar and K. Rajan.(2013). “Combustion, performance and Emission characteristics of diesel engine with neem oil methyl ester and its diesel blends”, American Journal of Applied Sciences. (<http://www.thescipub.com/ajas.toc>)
- [9] K.V.Radha, G.Manikandan ,“ Novel Production Of Biofuels From Neem Oil” world renewable energy congress-Sweden,May 2011.
- [10]Mehta, R. N., Chakraborty, M., and Parikh, P. A. “Experimental Investigation on CI Engine Using Neem Seed Oil as Biodiesel at Different Injection Pressures”, International Journal of Emerging Technology and Advanced Engineering, Volume 5, Issue 11, November 2015.
- [11] S.Ramkumar, C.Chinnasamy, J.Yogaraja, B.Karthik. “Performance and Emission Characteristic Studies of Diesel Engine Fuelled with Neem Oil”, International Journal of Mechanical Engineering and Research, ISSN 0973-4562 Vol. 5 No.1 (2015).