Advancement in Different Biodiesel Blends and Its Performance: A Review

Akshay Shelke[1] V.W. Khond[2]
[1,2]G.H. Raisoni College of Engineering, Nagpur, Maharashtra, India

Abstract— Most of the energy demand is fulfilled by fossil fuels in the world. Also these fuels are responsible for the rise in the amount of pollutants in the air which includes CO, HC and NOx. Different researches are carried out to obtain an alternate source of fuel which can replace the current fossil fuels. Hydrogen fuel and biodiesel rise as an alternative. Due to limitation of hydrogen fuel, it's not practically possible till date to be used as fuels in automobiles. Biodiesel is one such alternative which can be used as a fuel and can reduce the pollutants emission to a certain extent. This paper contains the researches which were carried out in the field of biodiesel and its different blends to find out the feasibility of using it to obtain the desire results.

Key words: CO (carbon mono-oxide) and HC (hydro carbons) emissions, NOx-Nitrogen Oxides

I. INTRODUCTION

Fossil fuel is non-renewable source of energy which getting depleted day by day due ever increasing dependency on it and rises in energy demand. This steep rise in demand is also due to ever increasing population. Also the amount of pollutants that are emitted due to over use of these fuels becomes the cause of environmental pollution which causing different environmental issues like global warming etc. All these issues made the researchers to dig for the alternate source of fuel which should be suitable for the environment and feasible for the users. Two of the many findings from the researches are hydrogen fuel and biodiesel and its blends. Research is still going on the hydrogen fuel due to its attractive calorific value. Also many studies were carried out for the biodiesel its feasibility for using the same in the diesel engine without much modification has been made. Also biodiesel is mainly derived from renewable feedstock like edible oil, non-edible oil or animal fats. Producing biodiesel fro, edible oil may leave the negative impact on the agriculture growth and prices in the market. Therefore it is preferred to be produced from non-edible oils or animal fats. The main advantages of using biodiesel are its portability, being readily available, good combustion efficiency, lower sulphur content, higher cetane number, higher biodegradability, domestic origin, higher flash point and good lubrication property. In most of researches it's found that that (NOx) emission increases whereas HC and CO along with (PM) particulate matters decreases when compared with diesel parameters. The present paper concentrates on the different types of biodiesel being used and their performance during testing in comparison with mineral diesel.

II. LITRATURE RIVEIW

Lovekush Prasad et al [1] experimentally investigated the performance of diesel engine working on diesel and Neem oil blends. It is found that the blends of Neem oil and diesel can be used in the diesel engine with an acceptable performance. Although study does not support the direct use of Neem oil in CI engine due to higher viscosity, density which results in poor atomization of oil during injection in combustion chamber results in incomplete combustion and deposition of carbon in the chamber. Study also reveals that this biodiesel blends produce lower brake thermal efficiency and higher brake specific fuel consumption then diesel because of low calorific value. The study suggests that the blend of neem oil should be restricted up to 20% and not above than that because at this percentage the density is equivalent to specified range for CI engine.

N.S. Senthur et al [2] investigated the suitability of eucalyptus oil as fuel in CI engine. It is found that the properties of eucalyptus oil are closer to diesel in comparison with the others biodiesel. Also the calorific value is greater than the diesel which is good thing in performance point of view. It is also found that the UBHC and CO emissions were remarkably within the limit but NOx emissions were greater. It's suggests that the heating value of the eucalyptus oil was appreciably good. Also it recommends carrying out the study to reduce the NOx by emulsification.

Sri Harsha Tirumala et al [3] carried out study on synthesis of neem oil biodiesel. It is found in the study that the neem oil biodiesel is of the clean, renewable, nontoxic, biodegradable fuel which can be used in neat form or in blends with petroleum derived diesel in diesel engine.

K. Vijayaraj et al. [4] investigated the performance and combustion characteristics of a diesel engine with Methyl ester of mango seed oil and diesel blends. In the study, the performance, emission and combustion characteristics of a direct injection, compression ignition engine fuelled with methyl ester of mango oil and its blends with diesel is compared with that of diesel. It is found that the most of the properties are very close to that of diesel which is good sigh. The BSFC increases with the increase in the percentage of the blends of biodiesel which is due to lower heating value. But the brake thermal efficiency was found to be very close for B25 when compared with diesel. It also found that the emissions were low for the blend of B25, B50, B75 but increases for blend ratio B100 which negative sign. The combustion starts little earlier than diesel. This study revealed that the optimized blends is B25 with respect to performance, emission and combustion characteristics for all loads compared with diesel and it could be used as a viable alternative fuel in CI engine without modification being made.

K.V.Radha et al [5] studied the production of novel biodiesel from neem oil. The effect of methanol to oil molar ratio and acid and alkali catalyst transesterification were analyzed. The exhaust emission of neem oil blended biodiesel is studied. Compared with conventional diesel fuel, diesel exhaust emission including smoke and CO were reduced, while NOx emission was increased with diesel-NOME blends. The reduction in CO and smoke emissions and the increase in NOX emission with diesel-NOME

blends may be associated with oxygen content in the fuel. More than 15% NOME-diesel blends created poor atomization tendency and incomplete combustion in engine. So the engine exhaust level is increased.

M. Mofijur et al [6] studied comparative evaluation of performance and emission characteristics of Moringa oleifera and palm oil based biodiesel in a diesel engine. In study it is found that the properties of the palm and M. oleifera methyl ester and their blends meet ASTM D6751 and EN14214 standards. It shown in the study that the M.oleifera oil is a potential feedstock for the biodiesel production and the performance of the MB5 and MB10 biodeisel blends are comparable with those of the PB5 and PB10. These blends can replace diesel fuel in unmodified engines to reduce global energy demand and exhaust emissions into environment.

Saswat Rath et al.[7] investigated vegetable oil as a fuel in compression ignition engine. The source of oil is mainly from wastage material hence it's also called as wastage vegetable oil. During investigation it is found that the viscosity is very high to be used in engine. Although its methyl ester can be used as an alternate fuel. The thermal efficiency and mechanical efficiency is closer to that of mineral diesel for a certain blending ration and load. The emission of carbon monoxide carbon dioxide, nitric oxide and hydrocarbon are found be greater than that of mineral diesel.

Shirish Sonawane et al. [8] experimentally investigated the process of production of biodiesel from karanja oil to be used as fuel in compression ignition engine. First the oil is extracted and passes through the trasisterification process for the production of biodiesel. This process gives biodiesel as product and glycerol as by product. This process requires methanol and catalyst. In this case the catalyst was NaOH. It is found that when the amount of catalyst increases by mass, output of biodiesel increase. After 0.6 gm, when increase, the output found to be decreases.

Venkateshwara Rao et al. [9] investigated the suitability of methyl ester of vegetable oil from Jatropha, Neem and Pongamia to be used in diesel engine as a biodiesel. Different blends are taken into consideration like B10, B20, and B40. It is found form experimentation that B20 blend shows closer performance parameters when compared with mineral diesel. Also B20 blend of Pongamia was found to be more suitable than Neem and Jatropha blends. It is due to their high viscosity and lower calorific value. Also when used 100% biodiesel, the brake thermal efficiency found to be reduced. Also for B20 blend, the emission is also less in comparison with mineral diesel.

Anand kumar Pandey et al. [10] studied the impact of emission from the vehicles on environment and suggests the remedies to reduce it. Experimentation was carried out to test compression ignition diesel engine fuelled with methyl ester of karanja oil. It was noted the CO and HC emission decreases but the NOx increase to little extent with lower wear. Metal debris analysis was carried out and found that the wear of metal has significantly reduced by 35% in comparison with diesel. Also due to high viscosity of biodiesel, it fulfills the role of lubrication resulting in lower wear.

S. Altun et al. [11] experimentally investigated the combination of biodiesel-diesel-and ethanol fuel in compression ignition diesel engine. It compares its performance parameters with that of pure diesel and diesel–biodiesel blend (blend of 20% biodiesel). Experiment is conducted on 4 cylinder diesel engine at different load and different speed. It was found that the BSFC increase for BDE fuel in comparison with pure diesel. The emission like CO and HC were found to reduce for blended fuel while NOx increase to some extent for blended fuel.

P.K. Devan et al. [12] studied the blending of two biodiesel in equal quantity (50%-50%) and investigated the performance testing on single cylinder four stroke diesel engines. Blend of paradise oil and eucalyptus oil were prepared and tested for its performance on engine. It was found that the emission of Smoke and HC reduced along with the reduction in CO. but the NOx emission increases for the blend. Ignition time improves as paradise oil is known for its ignition improver.

Mohite K. C. et al. [13] studied the blending of two fuel, diesel and biodiesel at injection pressure of 200 bar. Break thermal efficiency, break specific fuel consumption and the emission were the parameters to measure. All these parameters then compared with baseline diesel. It was found that carbon monoxide emission was slightly higher and hydro carbon decreases with12 % for B20.Also BSFC was more for B20 and B40 compared to mineral diesel.

Puneet Verma et al. [14] studied performance and emission characteristics of biodiesel fuelled diesel engine. It was found that the main problem is the viscosity and low calorific value. But it can overcome with preheating. Rest of the properties is very close to that of mineral diesel and can be replacing as an alternate fuel. Other way of using it is blending it with diesel in some proportion so as to get desired result.

III. Conclusion

Biodiesel can be used with or without blending with diesel. Viscosity and lower colorific value is remains the problem which requires more research to dig its solutions. Moreover in studies it is clear that the NOx increases with the increase in the proportion of biodiesel. While rest of the emission parameters like carbon monoxide, hydro carbon and particulate matter decreases which is good sign for the future scope. Performance parameters like thermal efficiency remains very close to that of mineral diesel but brake specific fuel consumption increases due to lower heating value of biodiesel.

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