



Review on Performance and Emission of Biodiesel in I.C Engines with and Without Addition of Nano Additive

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Abstract: Fossil fuels storages are reducing and in order to maintain the current levels of energy use to we need find alternative fuels. Power generation, transportation depends on fossil fuels will face problems because of low levels of energy. Due to this condition biodiesel used to I.C engines, but some disadvantages of

Biodiesel are high density, high fire point, high fuel consumption and high amount of oxides of nitrogen to avoid these disadvantages additives are used and maintain the international fuel standards.

In this review paper there are studies of biodiesel production, trans-esterification process and comparative study of biodiesel with and without nano additives and their effect on performance and emissions.

KEYWORDS-

Biodiesel, Transesterification, Performance, and Emission, Additives

I. INTRODUCTION

now a day present condition of fuel prices are increasing due to reducing the storage levels of fossil fuels, due to fossil fuels pollution are increasing day by day and emission norms are becoming strict. The fuels required have properties like high energy density, low pollution, low deposit formation and it should easy starting under ambient condition.

Biodiesel has contains high density and low pollution. Its made from edible and non edible crops, seeds, and animal fats. In second generation biodiesel made up from only non edible seeds and crops. Less costly non edible vegetable oil, plant oil is main resource of renewable bioenergy. The biofuls are directly used for diesel engines without any modification of current engines, and biodiesel are reduces CO,HC but increases NOx Percentage to avoid this problem additives are used to avoid this problem. Pollution and improve the combustion efficiency.

BIODIESEL-

Biodiesel is a green energy fuel because it is made up from the vegetable oil, fatty acids. Biodiesel has nearly same properties as diesel fuel then it can be used in I.C engines. Now a days fuel storages are getting down and fuel prices are increasing day by day, then biodiesel also called as next generation green fuel. Biodiesel is formed by process of transesterification and where alcohol is added near oil under the mild condition in presence of base catalyst.

TRANS-ESTERIFICATION PROCESS

There are different methods to convert oil to biodiesel as follows.

- Trans-esterification
- Blending
- Emulsion
- Pyrolysis

In Above all methods trans-esterification process are commonly used in now a days. in trans –esterification process the reaction of oil and fatty acids with the alcohol taking place to form esters and glycerol. The process of trans-esterification yield vegetable oil ester and maximize viscosity and volatility. Alcohol is mix under the mild condition in presence of base catalyst. The kinematic viscosity and yield changes with change in the reaction temperature. The temperature changes between 55 to 85 degree. As temperature increases then decreases in biodiesel yield. To produce pure biodiesel the bioproduct is washed with hot water to separate from soap formation and finally biodiesel is tested as per ASTM standards to determine fuel quality.

FUEL ADDITIVES-

Biodiesel has a some disadvantages such as high density, high fire point , high fuel consumption, and high amount of oxides of nitrogen, to reduce this additives are used. The additives will help out reduce and maintain emissions as per environmental standards and also improve the efficiency.

Types of additives

- Metal based additives
- Oxygenated additives
- Cetane number improver additives
- Antioxidant additives
- Ignition promoter additives
- Lubricant additives

Most of above metal base and lubricant additives are used .

Nano particles additives-

The addition of nano powder additives to biodiesel it enhance the properties of fuel this is due to properties of nano particles like high specific area, chemical properties etc. it improves the performance and reduces emission from engine. Reduced size of nano-particles increased specific volume ratio, surface area and magnetic properties as compared with bulk form. then metal and metal oxide increase the efficiency and reduces the emissions. Therefore nano-particles can function as catalyst and energy carrier when used in I.C engines.

LITERATURE REVIEW

Biodiesel without adding nano-additives

1) Rakesh Kumar-

Experimentally was taking reading on direct injection compression ignition engine, used argemone Mexicana oil as a fuel. And result is maximum BTE for B20 Blend and reduced emissions.also brake power increased.

2) S.S.Sajane-

Experimentally done investigation of Rapeseed oil Methyl ester powered by VCR diesel Engine with effect of Exhaust gas Recirculation (EGR) they observed as increases compression ratioincreases Nitrogen oxide. HC and CO reduced and EGR system reduces harmful nitrogen gases.

3) Supriya Chavan, Rohith Renish

was done Application of an Ecofriendly Catalyst (CaO) for synthesis of biodiesel and its characterization on VCR Engine as the result is that increases in blend content, the HC emission decreases.

4) Ashish Tiwari-

Review on production performance parameter and emissions characteristics of argemone Mexicana blended biodiesel and concluded

- Flash point of biodiesel higher than diesel fuel.

- Performance of b20 biodiesel blend is near to diesel fuel.
 - Nox is higher than diesel fuel.
- 5) Pooja Achari-
Was taking overview on performance, combustion, emission parameters for biodiesel used in I.C engine and concluded biodiesel improves the kinematic viscosity, specific gravity, surface tension, flash point, fire point etc.
- 6) Mrunay jadhav
Was prepared Mexicana biodiesel and tested on single cylinder C.I engine and following results concluded
- Maximum brake thermal efficiency noted at B25, B30, B50 is higher than diesel.
 - Mechanical efficiency is same for B5,B10,B15,B20 as compared with diesel fuel.
 - HC and CO emission are less than diesel fuel.
- 7) S.Y. Nagwase
A review on Mexicana biodiesel on single cylinder engine after more paper study taking review as
- Less work done on argemone Mexicana blend.
 - Mexicana required only 1% manganese carbonate as catalyst with alcohol for trans esterification Process.

Biodiesel with Nano- Additives and its Effect on Performance and Emissions

- 8) M.Ghafoori
was investigated experimentally effect of nano-particles on the performance and emission of a diesel engine using biodiesel–diesel blend. the test is conducted on six cylinder four stroke diesel engine as result is increases in nano-particles decreases in HC Emission.
- 9) S.P.Venkateshan
Experimental investigation carried out to determine performance and emission characteristics of diesel engine using aluminium oxide and result is
- Brake thermal efficiency improved.
 - HC,CO,Nox, emissions less as compared to without added nano additives.
 - Performance improved.
- 10) V.Nanda Kumar
Experimental investigation carried out to check the performance and emission characteristics using Al₂O₃ additive and results is CO, HC level Reduced and Brake thermal efficiency improved.
- 11) S.Karthikeyan-
Experimental checking effect of nano additive with grape seed oil on C.I engine and result is
- Flash Point and calorific value increases with increase in Al₂O₃ Nano- additive.
 - Heat release rate decreases
 - Brake thermal efficiency was increased.
 - Nox Reduced.
- 12) M.Ghanbari
investigated Performance and emission characteristics of a CI engine using nano particles additives in biodiesel- diesel blends they observed by adding nano additives in biodiesel increases in torque and brake power, and decreases in emissions and CO and HC emissions Reduces and also reduced brake specific fuel consumption when added nano metal based silver particles.
- 13) Prabhu.L
investigated performance and emission parameters of single cylinder using titanium oxide nanoparticles and results is find out
- Brake thermal efficiency increases
 - BSFC decreases
 - CO and HC decreases
 - Performance improved

- 14) Anand M. Joshi –
checking Performance of cotton seed biodiesel with cerium oxide nano-particle and result is increased Brake thermal efficiency and reduction of CO and HC emissions.and combustion properties improved due to nano additives.
- 15) Hariram Venkatesan
taking review on the effect of nano additive on fuel properties, engine performance, emission and concluded the addition of nano-additive performance increases and emission decreases and also brake thermal efficiency increases.
- 16) Harish Venu
Studied effect of diethyl ether and Al₂O₃ nano additive in diesel and biodiesel blend, results are noted with the diethyl ether addition then HC,CO,CO₂ increased and BSFC and Nox and smoke reduced. And Al₂O₃ added in biodiesel increased Nox and smoke with lowered HC,CO,CO₂ and BSFC and Performance increases.
- 17) J venkatesu naik
Experimentally investigated effect on performance and emission characteristics of C.I engine with Al₂O₃ and CuO nano additives. By using Al₂O₃ emissions HC,CO,NO_x reduced up to 13.3% and CuO using limited to 7.11 of HC,CO,NO_x emissions. Decreased BSFC for nanofuel Al₂O₃ more than CuO. Better performance getting from Al₂O₃ nanofuel.
- 18) Ramesh Babu Nallamothe
was taking review of biodiesel with and without nano particles and their effect on performance and emission and concluded the nano additives are helpful for increase the performance and reduce the emissions from engine.
- 19) V.Praveena
Review on effect of nano additives with biodiesel in I.C engines author studied and concluded that the different additives and their effect on performance increased and emissions HC and CO reduced.

Discussion on Performance Parameters

- Additives are increases the performance of diesel and biodiesel fuel, nano additives are reduces drawbacks of biodiesel such as high density, toxicity, flash point, auto ignition temperature etc.
- With the aluminium oxide (Al₂O₃) nano particles reduction of fuel consumption and brake thermal efficiency was improved also calorific value increases with heat release rate reduces.
- With addition of Titanium oxide (TiO₂) nano particles brake thermal efficiency increases, BSFC decreases and performance increases.
- With addition of cerium oxide nano particles in cotton seed biodiesel, then incresed in brake thermal efficiency additives provides better combustion because increased surface area.

Discussion on Emission Parameters

- Nano particles provides better surface area for smooth and complete combustion to I.C engines then emissions are reduced most of all nano particles reduces HC and CO emissions when they added in biodiesel.
- With cerium oxide reduction of CO,HC,CO₂ emissions done.
- With addition of carbon nano tube CO and HC emissions are reduced.
- With AL₂O₃ addition in biodiesel CO,HC,CO₂ reduces but only NO_x is not reduced.
- With TIO₂ nano additive CO, HC and smoke reduced.
- With addition of nano silver particles CO,HC Reduces with torque increases.

CONCLUSION

- Nano additives having property to increases the efficiency and reduces emissions of biodiesel it does not required any engine modification.
- From this Literature Review can be concluded nano additives are important to the reduction of CO, CO₂, HC emission and increases the brake thermal efficiency, reduction of fuel consumption, and better performance of I.C Engine.

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