© 2016 IJSRSET | Volume 2 | Issue 5 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

A Review on Effects of Nano Additives with Different Chemical Blended Fuels in CI Engine

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ABSTRACT

The emissions from the diesel engines seriously threaten the environment and considered one of the major sources of air pollutions. Many countries are evaluating a variety of alternative fuels for use in motor vehicles in an attempt to reduce greenhouse emissions, global warming and to improve the energy security of the nations. Blended fuel is a replacement for the diesel fuel in compressed ignition engines due to its significant environmental benefits. The use of blended fuel leads to reduction in particulate matter, hydrocarbon and carbon monoxide emissions the decrease in fuel consumption and the nitrous oxide emission on diesel engine without any modification. The addition of Nano particles with blended fuel increases the efficiency and decreases the emissions. Hence it was planned to increase the combustion efficiency, thereby to increase the performance and to reduce the exhaust emissions by adding blended fuel at different proportions like 5%, 10%, 15%, 20%, 25% by volume with diesel; the outcome of the emission test also revealed that there was an appreciable reduction in emission of the combustion by product.
Keywords: Blended Fuels, Nano Additives, Performance, Emissions, Diesel Engine, Combustion

I. INTRODUCTION

Diesel powers much of our land and sea transport, provides electrical power. It also plays an important role in farming, construction and industrial applications. Emissions from the internal combustion engines are the major pollutant in the world, seriously disturbing the human race and the living beings. More emissions result to poor performance and low efficiency. This work was aimed at to increase the efficiency and to reduce the emissions from the exhaust.

It was established that the diesel combustion in an internal combustion engine occurs in three significant stages such as ignition delay, pre-mixed combustion phase and diffusion combustion phase. The first phase, which is the time period between the start of injection and the onset of combustion known as ignition delay period, influences all ignition processes. Reducing this ignition delay period by increasing the cetane number value of the fuel using various additives will improve the combustion performance ofthe engine and thus reduces the exhaust emissions.

The alternative fuel is the one of the greatest choice among other sources due to having enormous potential to decrease pollutant emissions and to be used in compression ignition engines. Biodiesel is suggested to be an alternate fuel to petroleum-based fuel resulting in several environment and social benefits and also economic. Biodiesel is source of less emissions of carbon dioxide (CO_2), hydrocarbon(HC), particulate matter(PM), which are the dominant factor while compared to diesel. The only problem is the case of blended fuel such as NO_X emission is to be decreased. Many researchers are doing researcher for reducing the NO_X during and after the combustion process.

Nano fuels are a fresh class of fuels, and the application of nanoscale energetic material in conventional fuels is an interesting concept, yet uncharted to its fullest potential. Very few studies have been carried out on the addition of several potential nanoparticles as additives to diesel, blended fuels and its blend. In this work, the literature survey on the effects of several Nano additives such as metal, metal oxide, magnetic, carbon nanotubes,

Nano organic additives, and mixed Nano additives on engine performance are reported. The experiment on a single cylinder air cooled direct injectiondiesel engine for evaluation of diesel doped with metal oxide additives.

The changes in diesel fuel properties (viscosity, flash point and fire point) due to the introduction of Nano metal oxide additive was observed the diesel fuel with Nano metal oxide additive had presented a marginal increase in performance. Brake thermal efficiency was increased marginally as compared to conventional diesel fuel. For the DI diesel engine, the hydro carbon emissions were the highest at lower load. The performance and emission of a four cylinder, four stroke vertical-in-line water-cooled compression ignition pick up diesel engine at full load condition using commercial diesel.

II. METHODS AND MATERIAL

Preparation of Nano Additives

Method

Hydrothermal method is helped for the preparation of the Nano particles and its chemical synthesis route. Hydrothermal synthesis is the reaction carried out at high temperature and high pressure. 0.25 gm. Of Nano particles are added to 20ml. distilled water at molar concentration of 0.1 is used for the reaction. The surfactant is help to reduce the surface energy and to reduce the reaction rate. 0.5gm. in 15ml. distilled water at 0.1 molar concentration of CTAB is worn as the surfactant and it is added to the precursor solution.

Sodium hydroxide is used as the reducing agent. The reducing agent of 0.05 gm. is taken and added to 15 ml distilled at 0.1 molar concentrations and it is added to the precursor mixture drop by drop. The reaction mixture of 60 ml is the transferred to Teflon lined auto clave. Then the auto calve is kept in the hot air oven at 500°c for the duration of 6 hours. The auto clave is taken out from the oven after the desired duration and allowed to air cooled. Then impurities are removed from the sample using ultra-centrifuge and the sample is collected using what man filter. Then the nanoparticles are kept in the hot air oven at 80°cover the duration 2 hrs. for drying. Thus the nanoparticles are prepared.

Nano particles of 0. 6gm.is mixed with 20 ml. distilled water at 0.1 molar concentration is used as the precursor for Nano particles synthesis. The CTAB of 0. 5gm.in 15ml. distilled water at 0.1molar concentration is used as the surfactant and mixed to the precursor solution. 0.1 molar concentration sodium hydroxide of 0.05gm. was taken and added to 15 ml. distilled water as reducing agent and added to theprecursor mixture drop wise. The 60 ml. of the solution is converted to the Teflon lined autoclave. The auto calve is kept at 180°c for 12 hours at the hot air oven. The auto clave is allowed to air cooled after the desired duration. The sample is washed and collected using ultra centrifuge and what man filter. Then the nanoparticles are dried at 80°c in hot air oven for 2 hrs. Thus the nanoparticles are prepared.

The characterization of the nanoparticles is done to obtain its properties. Zeta sizer is helped for the stability and size analysis, nanoparticle structure was found using XRD and nanoparticle morphology were found using SEM and XRD. The dispersion studies are to be carried out after adding the nanoparticles to blended fuel. As the size of the nanoparticles are less than 100 nm, they are more stable and the will not agglomerate and settle down. Thus the Nano-particle with high stability are obtained. The nanoparticles are then added to the blended diesel with the help of ultra-sonicator and the dispersion studies are carried out. The Nano particles we have are less than 100nm so it won't agglomerate and settle down. Thus we obtain the highly stable Nano-particle.

Materials Used

The normal diesel supplied by Indian Oil Corporation was produced from then retailer distributor. The chemicals are supplied by kemphasol limited, Mumbai was taken for blending with diesel. Blended fuels were prepared by mixing the chemicals with different proportions such as 5%, 10%, 15%, 20% and 25% by volume with diesel. Complete mixing of chemical with diesel was done by using a mechanical stirrer.

III. RESULTS AND DISCUSSION

Experimental Setup

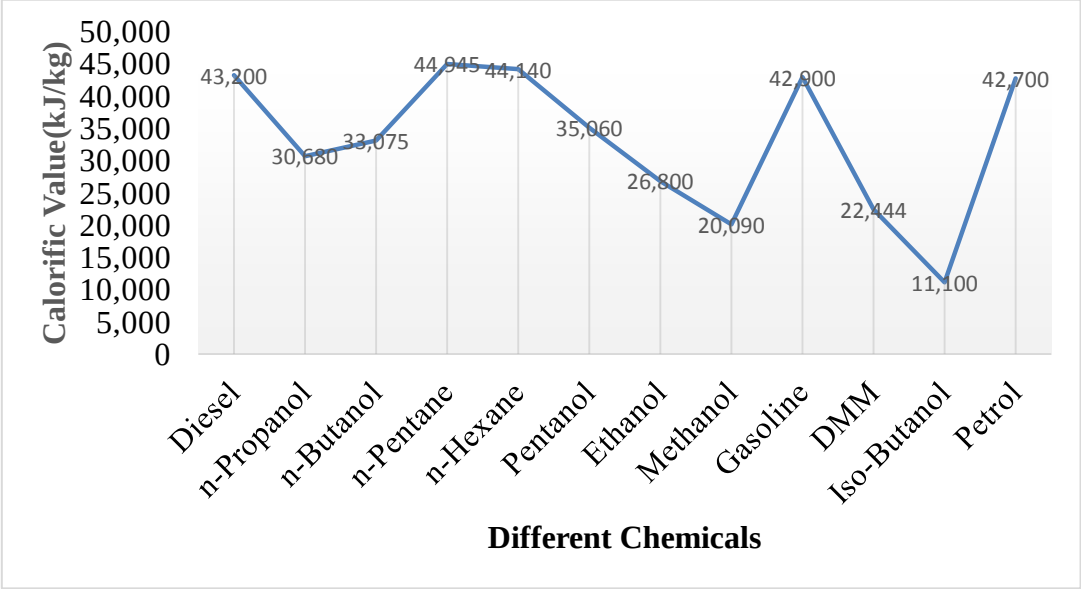
The experimental study was carried out to investigate the performance and emission characteristics of a compression ignition engine with blended fuels using

Nano additives and relating it with that of diesel. Technical specification of diesel engine is elaborated. The diesel engine was primarily started with diesel and then with the produced test fuels. Speed of the engine was maintaining constant speed at 1500 rpm under varying load conditions to measure the performance parameters such as brake thermal efficiency, brake power(BP), brake specific fuel consumption (BSFC) and exhaust gas temperature and also to measure the emission parameters like carbon monoxide(CO), unburnt hydrocarbon(HC) and nitrogen oxide(NO) emissions for both diesel and the prepared test fuels with the help of AVLDIGas 444 analyzer.

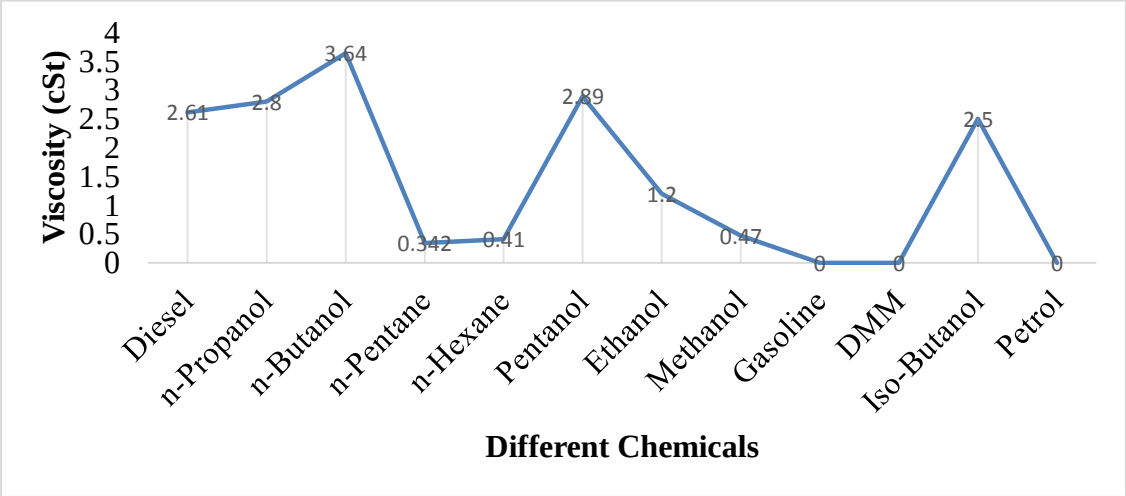
IV.DIFFERENT CHEMICALS

S No.	Types of Chemical	Molecular Formula	Calorific Value	Viscosity @40°C	Density	Latent Heat of Vaporization	Cetane Number
			(kJ/kg)	cSt	Kg/m^3	(kJ/kg)	
1	Diesel	$C_{12}H_{23}$	43,200	2.61	830.4	250	49
2	n-Propanol	C_3H_7OH	30,680	2.8	803	779	15
3	n-Butanol	C_4H_9OH	33,075	3.64	810	585	15
4	n-Pentane	C_5H_{12}	44,945	0.342	626	375.5	-
5	n-Hexane	C_6H_{14}	44,140	0.41	655	365	-
6	Pentanol	$C_2H_{11}OH$	35,060	2.89	815	308	20-25
7	Ethanol	C_2H_5OH	26,800	1.2	788	923	-
11	Methanol	CH_3OH	20,090	0.47	790	1100	-
12	Gasoline	Various	42,900	-	740	180-350	-
13	Di-Methoxymethane	$CH_2(OCH_3)_2$	22,444	-	860.0	-	29
14	Iso-Butanol	C_4H_9OH	11,100	2.5	808	-	24.6
15	Petrol	C_8H_{15}	42,700	0.4-0.8	745	223.2	24.6

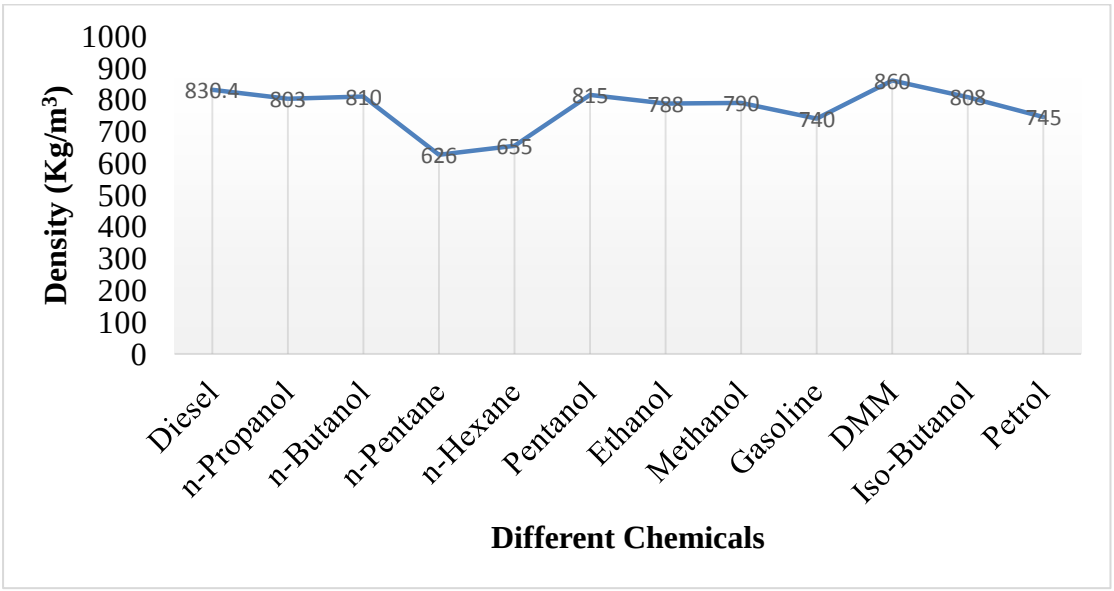
Table 1: Properties of Different Chemicals



Graph 1: Calorific Value of the Different chemicals



Graph 2: Viscosity of the Different Chemicals



Graph 3: Density of the Different Chemicals

IV. CONCLUSION

Blended fuels are most popular environment-friendly alternative fuel due to better combustion and reduce the engine exhaust emissions. In this research paper, discussed about various chemicals and its properties. The blended fuel calorific value and viscosity are most important parameters required in the design of performance and emission process and it must be closely correlated with design parameters of fuel flow system. However, the neat blended fuel should meet the preferred viscosity in order to avoid the damages of the fuel pump. This paper concludes that in recent research work Nano additive and chemical blended fuels are used in diesel engine in order to increase the performance and it decrease the exhaust emission which release in to the atmosphere or environment. In this paper the graphical representation explains about the calorific value, viscosity and density of the different chemicals.

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