World Wide Journal of Multidisciplinary Research and Development

WWJMRD 2017; 3(2): 42-46
www.wwjmrd.com
Impact Factor MJIF: 4.25
e-ISSN: 2454-6615

Karthe Manivannan
M.Kumarasamycollege of technology, Karur, Tamil Nadu, India

Prasanna S C
M.Kumarasamycollege of technology, Karur, Tamil Nadu, India

Manivel R
M.Kumarasamycollege of technology, Karur, Tamil Nadu, India

Sathishkumar S
M.Kumarasamycollege of technology, Karur, Tamil Nadu, India

Correspondence:
Karthe Manivannan
M.Kumarasamycollege of technology, Karur, Tamil Nadu, India

Investigations on the emission characteristics of diesel engine blende with n-Butanol

Karthe Manivannan, Prasanna S C, Manivel R, Sathishkumar S

Abstract
Now a days population intensity of vehicle rapidly increase so cost of the fuel like petrol diesel, etc. are increase highly and emission of the vehicle create many problems like affecting human health, cause the depletion in ozone layer, affecting the photosynthesis of plants, etc. so reducing the pollution diesel is blended with the n-Butanol at various different proportion. First n-Butanol is converted into fuel by using transesterification by adding acid catalyst. Now n-Butanol is blended with diesel fuel at various proposition 5%, 10% and 15% by total volume of fuel. The emission characteristics of 5%, 10% and 15% of blending of n-butyl alcohol with ordinary diesel to record and evaluate the emission characteristics of blending fuel and ordinary fuels. The emission test at 80% load revealed that, the CO, HC and smoke density are increased by 22.222%, 28.571% and 14.757% respectively for 10% addition of n-butyl alcohol with diesel. The NOx emission while using 10% n-Butanol blend with diesel is decreased by 19.131% at 80% load. n-Butanol increase the atomization of the fuel so complete combustion can take place and low calorific value of n-butyl alcohol so heat release during combustion of engine rapidly decrease so NOx emission significantly reduce.

Keywords: N- butyl alcohol, Emission, compressed ignition Engine, Alternative fuel, calorific value

Introduction

Some experimental studies by using sesame oil,Honge, methyl esters and Neem as fuel concluded that theengine emission characteristics are comparable. It was also other researcher told that the use of up to 45% the Neem oil could be blended in a normal diesel engine without any major changes in engine. The experimental analyses on the compressed ignition diesel engine while blendedrice bran oil, linseed oil and mahua oil with diesel, concluded that blend of 50% rice bran oil with diesel increases the smoke density and decreases the BSE (brake specific energy) consumption of the fuel, and also reported that the blending of 35% mahuaoil blended with diesel reduces the smoke intensity or density and increases the thermal efficiency of the engine as compared to the diesel engine. The usage of karanja methyl ester blend with the diesel as fuel in the engine concluded that there is an improvement in brake thermal efficiency of the engine and mechanical efficiency, and also reduction in CO, CO2, NOx and unburned hydro carbon emissions. The simple modifying in the internal combustion engine received considerable amount of attention among the compressed ignition engine researchers in order to improve the combustion and emission characteristics, and reducing the engine emission from the diesel as a fuel engine. The introduction of EGR (exhaust gas recirculation) technique reduces the nitro oxide emission considerably. The various researcher reported that by increasing the injection fuel pressure and advancing the fuel injection timing concluded that there is a noticeable increase in brake thermal efficiency of the engine and decrease in engine emission like CO, HC and smoke intensity of the emissions.

Methodlogy

First converting the n- butyl alcohol into fuel by using the transesterification process.n-butylalcohol is blended with diesel at various proposition like 5%, 10% and 15% by total volume of the fuel. Run the computerized IC engine by using n-butyl alcohol blending with diesel as a fuel at Exhaust gas partially send to the AVL 444 Di gas exhaust gas analyzer for analyzing the exhaust gas emission. For recorded reading draw the graph for load vs different exhaust gas like CO, HC and NOx. After analyses the emission exhaust gas send to the AVL

413 smoke meter for smokeanalyses mission and smoke level. In recent years, considerable attention is given for using alcohols as blend or additive with fuel like petrol or diesel.

Table 1: Engine specifications

S.No	Parameter	Engine Specification
1	Engine model	KirloskarTV-1, DI, Naturally aspirated, Water cooled
2	Number of cylinders	1
3	Bore diameter	880 cm
4	Stroke length	1100 cm
5	Compression ratio(CR)	17 to 18
6	Maximum power at rated rpm	6HP
7	Rated speed	1560 rpm
8	Injection pressure	215 to 220 bar
9	Injection timing	23° BTDC

Results and Discussion

Exhaust gas temperature

Table 2: Exhaust Gas Temperature VS Load

LOAD	DIESEL	DIESEL+5%	DIESEL+10%	DIESEL+15%
2	220	200	190	180
4	240	220	210	200
6	260	240	230	220
8	340	320	310	290
10	420	400	385	365

Below graph shows the comparison of the exhaust gas temperature with respect to theapplied load of the engine. From the graphs, it was clear that at all applied load ranges, the engine exhaust gas temperature of all n-Butanol is blend with diesel fuel are lesser than that of diesel. The engine exhaust gas temperature reduced due to the low calorific value of the n-butyl alcohol

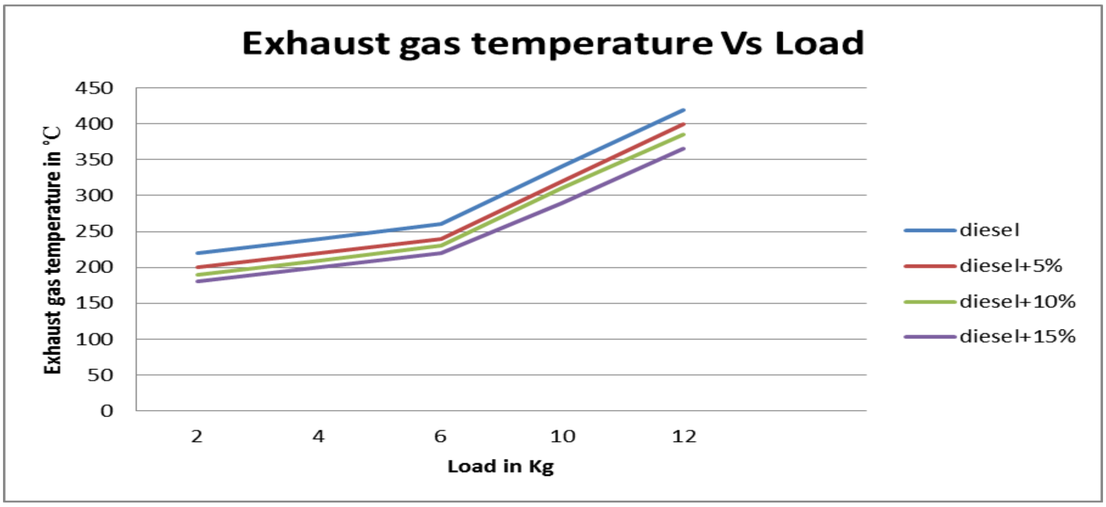

Fig 1: Exhaust Gas Temperature VS Load

Comparison of Emission

Figure given below indicates the relation or comparison between emission Carbon oxide and load. From the graphs, it was observed that the Carbon Oxide emission decreases gradually up to 55 to 60% applied load on the calibrated engine for all blends ratio, then the Carbon Oxide emission gradually increases up to 80% applied load, and after that it increases suddenly up to full load condition of the engine.The sharp increase in Carbon Oxide(CO) emission at full load codition of the engine is because, when at high load the mixture supplied to the engine is rich. It was also observed that, the Carbon Oxide emission for all the blend fuels is greater than that of normal diesel at applied all load ranges.

Table 3: CO emission and load

LOAD	DIESEL	DIESEL+5%	DIESEL+10%	DIESEL+15%
2	0.08	0.07	0.07	0.09
4	0.06	0.07	0.07	0.07
6	0.05	0.08	0.09	0.09
8	0.1	0.01	0.09	0.09
10	0.3	0.38	0.32	0.33

At 80% load, the CO emission is 0.09%, 0.11%, 0.09%, 0.10%, 0.11% and 0.11% for diesel, and 5% addition, 10% addition and 15% addition of n-butyl alcohol with normal diesel respectively. The increase in CO emission is due to the reduction in combustion chamber temperature by the quenching effect caused by the high latent heat of n-Butanol.

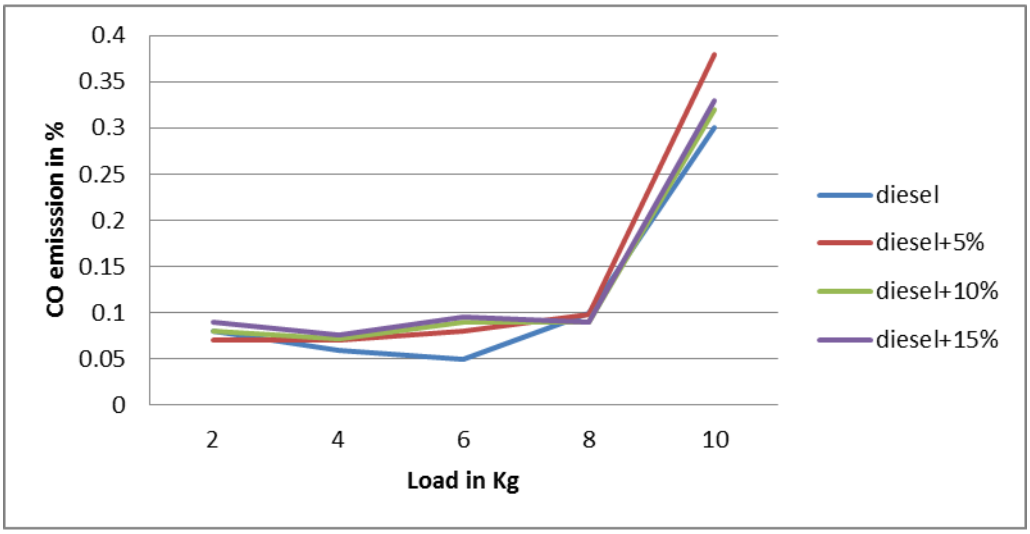

Fig 2: The relation between Carbon Oxide emission and load

CO2 Emission

Figure shows that the graphs drawn between Carbon di oxide emission VS load. Since the Carbon di oxide emission is a main source of the greenhouse effect of the environment and world global warning, it is necessary to measure the Carbon di oxide emission from the engine. From the graphs, it was recorded that the Carbon di oxide emission increases gradually as the applied load increases of the engine for all n- butyl alcohol blend and also the emission of Carbon di oxide is almost less for all the n-butyl alcohol blended fuels at all applied loading conditions engine when compared with that of normal diesel. This is because of the lower operating temperature of the engine due to the high latent heat of vaporization of n-Butanol

Table 4: CO2 Emission and Load

LOAD	DIESEL	DIESEL+5%	DIESEL+10%	DIESEL+15%
2	2.9	2.8	2.4	2.5
4	3.5	3.5	3.1	2.9
6	4.5	4.2	3.7	3.5
8	5.0	4.9	4.5	4.3
10	6.2	5.9	5.6	5.4

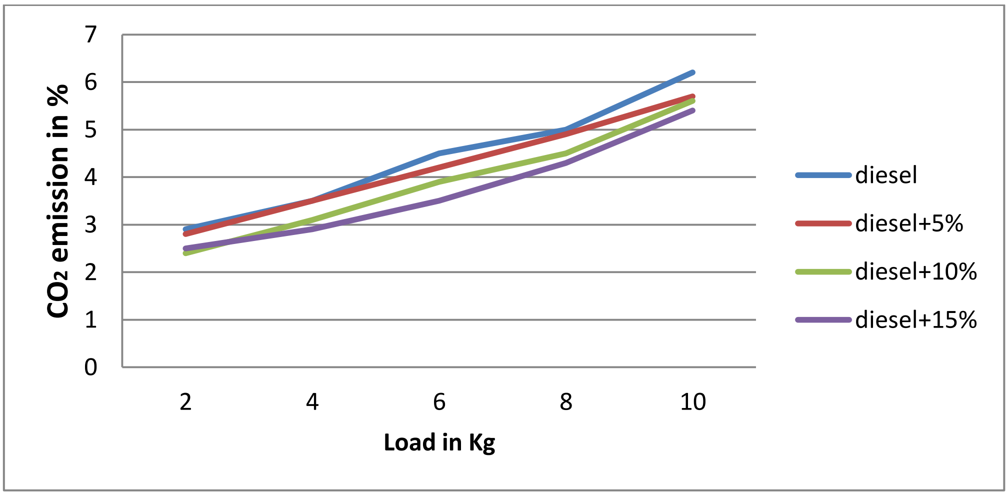

Fig 3: Relationbetween CO2 emission and load

HC Emission

Figure represents the graphs drawn between unburned Hydro Carbon emission and applied load of engine. The graphs concluded that the unburned Hydro Carbon emission emission is more for all blended n- butyl Alcohol fuels and at all applied load ranges of the engine. Moreover the unburned Hydro Carbon emission emission increases with the increases in applied load of the

Table 5: HC Emission and Load

LOAD	DIESEL	DIESEL+5%	DIESEL+10%	DIESEL+15%
2	52	65	66	70
4	53	60	72	74
6	60	68	74	76
8	70	90	91	95
10	118	120	122	123

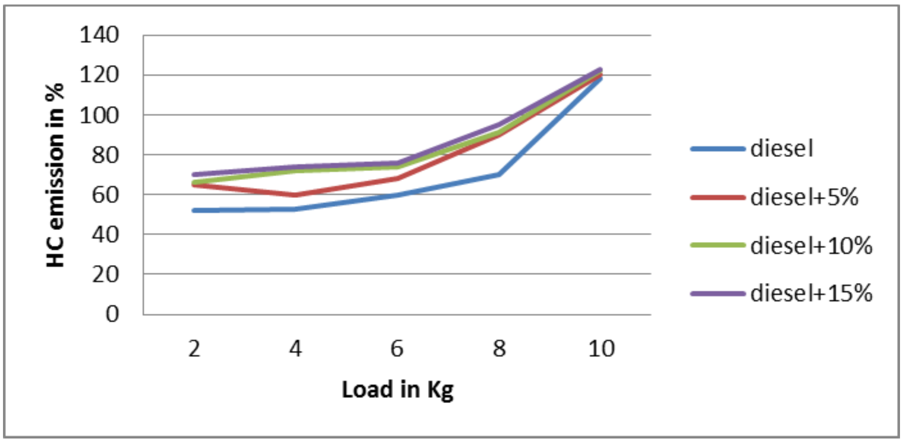

Fig 4: Relation betweenHC emission and load engine.

Here it was noted that the increases in percentage of n-Butanol with diesel increases the unburned Hydro Carbon emission emission, the rate of increase in unburned Hydro Carbon emission emission at medium applied load is higher than the rate of increase in unburned Hydro Carbon emission at higher applied load. This may be due to the high latent heat of vaporization of n-Butanol, which leads the development of quench layer, reduction in temperature inside the cylinder, slow vaporization and incomplete mixing.

NOx Emission

Figure and Table indicates the presence of NOx in the engine exhaust with respect to load. From the graphs, it was observed that at all applied load condition, NOx emission redcrese with adding of n-butyl alcohol with normal diesel

Table 6: NOx Emission and Load

LOAD	DIESEL	DIESEL+5%	DIESEL+10%	DIESEL+15%
2	400	300	280	260
4	750	740	720	700
6	1150	1080	1050	990
8	1300	1240	1170	1090
10	1200	1170	1130	1110

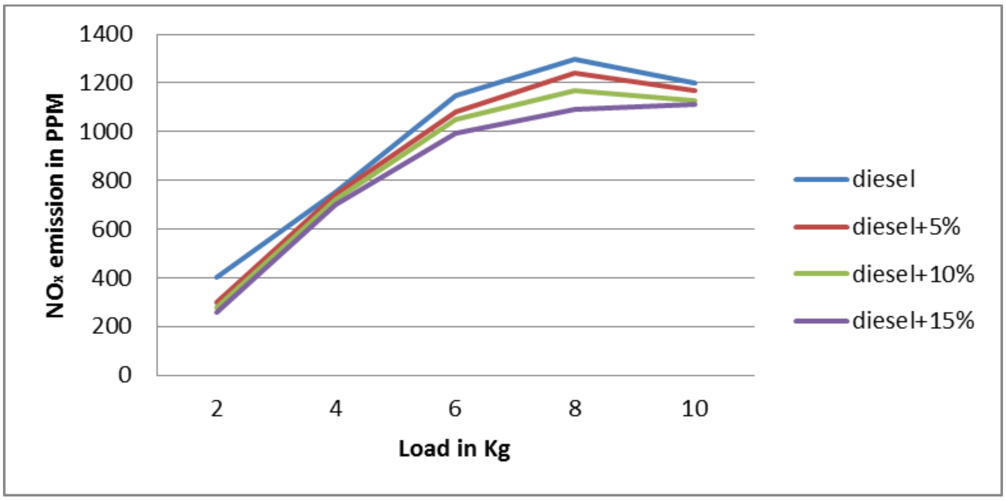

Fig 5: Relation between NOx emission and Load

At 80% load, the decrease in NOx emission is decreased by 7.927%, 11.585%, 12.881%, 14.329% and 19.131% for the addition of 2%, 4%, 6%, 8% and 10% n-butyl alcohol with diesel respectively. The high latent heat of vaporization and lower calorific value of n-butyl alcohol reduces the in-cylinder temperature which in turn reduces the NOx emission (Chenetal, 2007).Since NOx is the most harmful compare to other emission, the reduction of it holds a prime importance in the current engine research

Smoke density

At 80% load, the smoke density is increased by 9.320%, 11.262%, 11.845%, 13.398% and 14.757% for the addition of 5%, 10% and 15% n-butyl alcohol with normal diesel respectively. This is due to the fact that, as the load increases the richness of the mixture increases which in turnreduces the in-combustion cylinder temperature increase due to high latent heat of vaporization of the blend.

From the above discussions, the blending of n-butyl alcohol with diesel at certain percentage may be suggested and further researches level in this area by introducing the EGR(exhaust gas recirculation) techniques and advancing the injection timing will turn out to be highly effective

Conclusion

This experimental investigation aimed to reduce the emission of the normal compressed ignition diesel engine while using diesel blended with n-butyl alcohol at various proportions like 5%, 10% and 15% is attainable. The blending of n-Butanol with diesel results in the reduction in engine combustion chamber temperature which in turn increases the life cycle of the engine. The blending of n-butyl alcohol with diesel increases the CO and HC emission, and also increases the smoke density over the entire load ranges. The blending of n-butyl alchol with diesel results in gradually reduction in Nitrous Oxide emission over the entire applied load ranges. Since NOx is the most harmful emission compare to other emission, the reduction of it holds a prime important in the engine research.

References

1. Sethusundaram, P.P., K.P. Arulshri and K. Mylsamy, Biodiesel blend, fuel properties and its emission characteristics sterculia oil in diesel engine, International Review of Mechanical Engineering, 7(5), 925-929, 2013.
2. M. Chandrasekar, S. Rajkumar, D. Valavan, A review on the thermal regulation techniques for non integrated flat PV modules mounted on building top, Energy Build. 86, 692–697, 2015.
3. Mukesh Kumar, P.C., Palanisamy, K., Kumar, J. et al. J MechSciTechnol (2015) 29: 697. doi:10.1007/s12206-015-0129-7
4. Balamurugan, T., R. Nalini. et al. "Experimental investigation on performance, combustion and emission characteristics of four stroke diesel engine using diesel blended with alcohol as fuel", Energy, 2014
5. Balamurugan, T., R. Nalini. Et al. "Experimental study on performance, combustion and emission characteristics of a four-stroke diesel engine using blended fuel", International Journal of Ambient Energy, 2014.
6. R. Deepak Joel Johnson, K. Leo Dev Wins, Anil Raj, B. Anuja Beatrice, Optimization of Cutting Parameters and Fluid Application Parameters during Turning of OHNS Steel, Procedia Engineering, (2014), Vol.97, 172-177, DOI: 10.1016/j.proeng.2014.12.239
7. Ramesh.C, Valliappan.M, Prasanna.S.C "Fabrication Of Ammcs By Using Stir Casting Method For Hand Lever" International Journal of New Technologies in Science and Engineering, 2015 Vol. 2, Issue. 1
8. C.D. Rakopoulos,, K.A. Antonopoulos, D.C. Rakopoulos Comparative performance and emissions study of a direct injection Diesel engine using blends of Diesel fuel with vegetable oils or bio-diesels of various origins Energy Conversion and Management Volume 47, Issues 18–19, November 2006, Pages 3272–3287
9. Karthe.M, Tamilarasan.M, Prasanna.S.C, Manikandan.A, "Experimental Investigation on Reduction of NOX Emission Using Zeolite Coated Converter in CI Engine", Applied Mechanics and Materials, (2017) Vol. 854, pp. 72-77
10. Prasanna. S.C, Ramesh.C, Manivel. R, Manikandan. A, "Preparation of Al6061-SiC with Neem Leaf Ash in AMMC's by Using Stir Casting Method and Evaluation of Mechanical, Wear Properties and Investigation on Microstructures", Applied Mechanics and Materials, (2017) Vol. 854, pp. 115-120,
11. Prasanna. S.C, Ramesh. C. "Property Evaluation of Aluminium Metal Matrix Composites Fabricated Using Stir Casting Method for Hand Lever In Automobile Applications" International Journal of Applied Engineering Research (IJAER) 2015 Volume 10, Number 85
12. Ramesh. C, Manickam.C, Prasanna. S. C. "Lean Six Sigma Approach to Improve Overall Equipment Effectiveness Performance: A Case Study in the Indian Small Manufacturing Firm" Asian Journal of Research in Social Sciences and Humanities 2016, Vol. 6, No. 12