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EFFECT OF OXYGENATED ENRICHED FUEL ADDITIVE ON THE PERFORMANCE AND EMISSION CHARACTERISTICS OF DIESEL ENGINE: A REVIEW

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ABSTRACT: Fossil fuels play a crucial role in the world energy market. The world's energy market worth around 1.5 trillion dollars is still dominated by fossil fuels. The World Energy Outlook (WEO) claims that energy generated from fossil fuels will remain the major source and is still expected to meet about 84% of energy demand in 2030. As population increases and the standard of living improve, there will be a shortage of source of energy. Bio fuel such as bio-diesel and bio-ethanol are now receiving the impetus required for becoming the fuel source for the future. One of the way to reduced the dependence on the fossil fuel is the blending of bio-ethanol with the conventional diesel. Advances in technology have allowed development of alternative energy sources. In this review paper we briefly discuss replacement of fossil fuel with bio-diesel + bio ethanol + diesel and its effect on the engine performance and emission characteristics.

Keywords – Biodiesel, Ethanol, Diesel Engine

I. INTRODUCTION

Fossil fuels play a crucial role in the world energy market. The world's energy market worth around 1.5 trillion dollars is still dominated by fossil fuels. The World Energy Outlook (WEO) claims that energy generated from fossil fuels will remain the major source and is still expected to meet about 84% of energy demand in 2030. As population increases and the standard of living improve, there will be a shortage of source of energy. Bio fuel such as bio-diesel and bio-ethanol are now receiving the impetus required for becoming the fuel source for the future. One of the way to reduced the dependence on the fossil fuel is the blending of bio-ethanol with the conventional diesel. Advances in technology have allowed development of alternative energy sources. In this review paper we briefly discuss replacement of fossil fuel with bio-diesel + bio ethanol + diesel and its effect on the engine performance and emission characteristics.

A. BIO-ETHANOL AS A TRANPORTATION FUEL

Bio-ethanol is ethyl alcohol, grain alcohol, or chemically C2H5OH or EtOH. Bio-ethanol and bio-ethanol/gasoline blends have a long history as alternative transportation fuels. It has been used in Germany and France as early as 1894 by the then incipient industry of internal combustion (IC) engines [1]. Brazil has utilized bio-ethanol as a transportation fuel since 1925. The use of bio-ethanol for fuel was widespread in Europe and the United States until the early 1900s. Because it became more expensive to produce than petroleum-based fuel, especially after World War II, bio-ethanol's potential was largely ignored until the oil crisis of the 1970s [2]. Since the 1980s, there has been an increased interest in the use of bio-ethanol as an alternative transportation fuel. Countries including Brazil and the United States have long promoted domestic bio-ethanol production. In addition to the energy rationale, bio-ethanol/gasoline blends in the United States were promoted as an environmentally driven practice, initially as an octane enhancer to replace lead. Bio-ethanol also has value as oxygenate in clean-burning gasoline to reduce vehicle exhaust emissions [3]. Bio-ethanol has a higher octane number (108), broader flammability limits, higher flame speeds and higher heats of vaporization. These properties allow for a higher compression ratio and shorter burn time, which lead to theoretical efficiency advantages over gasoline in an IC engine [4].

B. PROPERTIES OF DIFFERENT FUEL AND ADDITIVES

PROPERTY	BIO-DIESEL	DIESEL	BIO-ETHANOL
Cetane No	51	45	10
Lower heating value Mj/kg	37.5	44	26.8
Density Kg/m3	871	860	780
Viscosity mm2/s	5.28	3.4	1.35
Heat of evaporation kj/kg	300	260	-
O %	10.8 %	0 %	34.8 %
C %	77 %	86 %	-
H %	12.1 %	14 %	-
Auto ignition temp. 0C	320	225	415
Flash point 0C	130	165	55

Table 1

Paper 1:
In this paper the effective utilization of B20 blend with DEE and ethanol as a oxygenated additives and effect on diesel engine. The present work aims at employing B20 blend in order to improve its utilization effectively with addition of oxygenates such as ethanol and diethyl ether in different proportions. The vegetable oil under consideration was Jatropha curcas oil. Besides studying the effect of these additives, simultaneous influence of fuel injection pressures and fuel injector nozzle hoe size were also investigated on the performance and emission characteristics of a single cylinder diesel engine under NA condition. From this paper it was concluded that by adding 5%,10% and 15% diethyl ether and 6%,10% of ethanol to B20 blend with simultaneous effect of fuel injector nozzle hole size and fuel injector pressure. The higher cetane rating of DEE is an advantage for obtaining lower smoke opacity and also lower NOx emission. Larger benefits were deriving using bio-diesel –diesel blend.

Paper 2:
Since bio-diesel is non-toxic and biodegradable. If only bio-diesel is used in the engine then No. of problem is generated in the engine like clogging of filer, improper fuel injection from the injected pump due to high viscosity of bio-diesel, difficulty to start the engine in the cold atmosphere. From the emission characteristics point of view bio-diesel producing the more NO_x .the nitrogen oxides formation depends on the availability of oxygen and combustion temperature. As the concentration of bio-diesel increased the NO_x formation also increased. In order to reduced the NO_x formation the DEE was used in this paper. DEE is a cetane no improver as the cetane no increased the NOx reduced. Anand and Mahalaxmi have investigated that a 20% DEE in the diesel along with the 5% EGR result in the simultaneous reduction of smoke and NO_x emission. Ramdas et al studied that the used of DEE as fuel additives for reducing the cold starting problem and improved the performance and emission characteristics of diesel engine fuelled with bio-diesel.

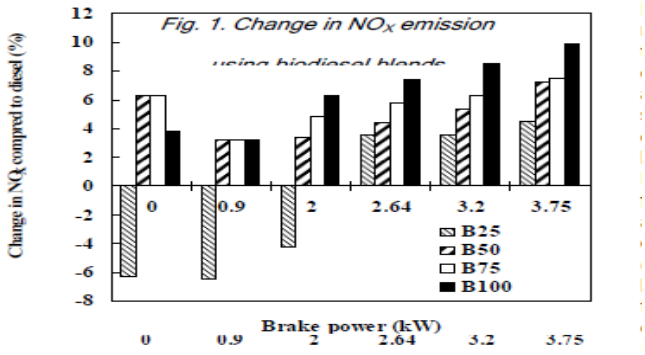

Fig 1 – Change in NOx compared to diesel vs Brake Power

In this paper the effect of adding DEE to bio-diesel-diesel blends (B25,B50,B75) and bio-diesel (B100) were investigated. DEE was added in 10%, 15%, 20% (v/v) to the bio-diesel fuels. Fig 1 and fig 2 show that the NO_x emission using bio-diesel blend and NO_x emission with the addition of DEE to the B25 blend.

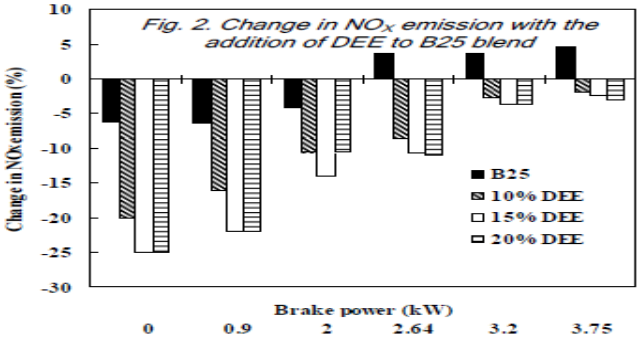

Fig 2 - Change in NOx emission vs Brake Power for DEE to B25 blend

From this paper it was concluded that with B25 blend, the NO_x emission was reduced by addition of DEE at all load conditions. With B50, B75and B100 blends, the NO_x emission was lowered by the addition of DEE at low and medium loads .however at high loads the NO_x emission was higher relative to the diesel fuel but lower as compared to the corresponding fuel blend. The addition of 15% to 20% DEE was more beneficial in reducing NO_x compared to the 10% DEE. The addition of 15-20% DEE to the bio-diesel blend would result in the reduction of both NO_x and smoke emission. Figs 3 show that the change in NO_x emission with the addition of DEE to B %) blends.

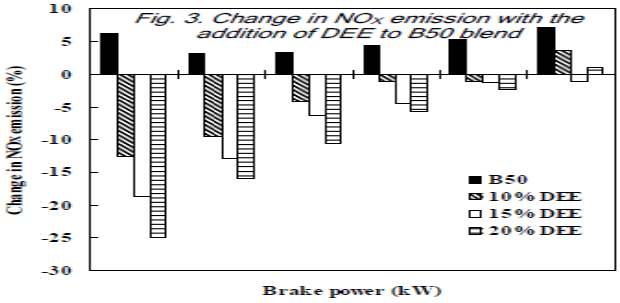

Fig 3 - in NOx emission vs Brake Power for DEE to B50 blend

Paper 3:
In this paper they investigated the engine performance and emissions characteristics with fuel blends of petroleum diesel fuel, methyl soyate, and ethanol on a diesel engine. Brake specific fuel consumption (BSFC), regulated emissions, including PM, Bosch smoke number, nitrogen oxide (NOx), carbon monoxide (CO) and total unburned hydrocarbon (THC), were investigated and discussed. Water tolerance and stability of the blends fuels were also considered.

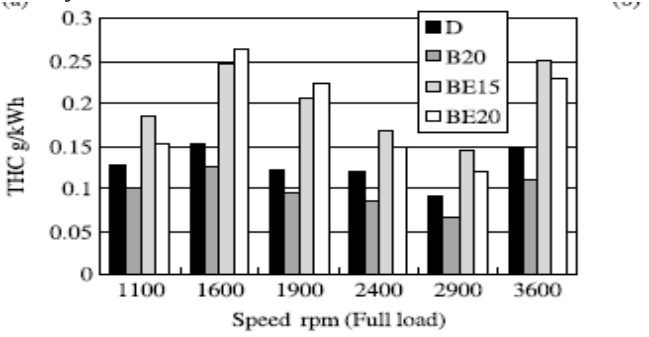

Fig 4 – THC Vs Speed rpm

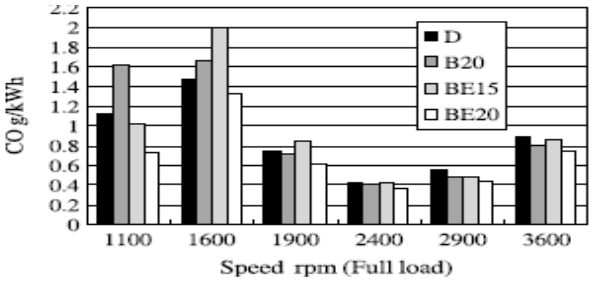

Fig 5 - CO Vs Speed rpm

From this paper it was concluded that the all oxygenated fuels tested show a beneficial effect on reducing smoke emissions and PM emissions at the operation conditions compared with diesel fuel. BE20, which has the highest oxygen weight content in all tested fuels in this study, showed excellent ability to eliminate soot emissions, and the maximum reduction of PM was observed at 48%.NOx emissions were observed to increase when oxygenated fuels were used.

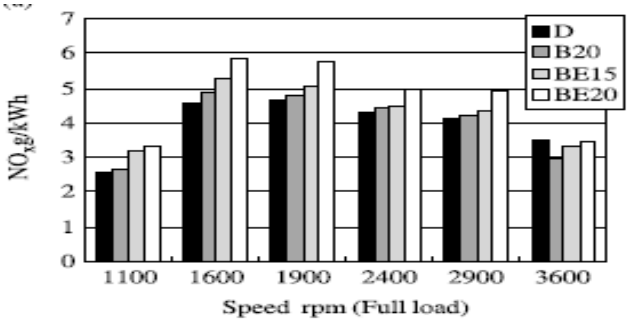

Fig 6 - NOx Vs Speed rpm

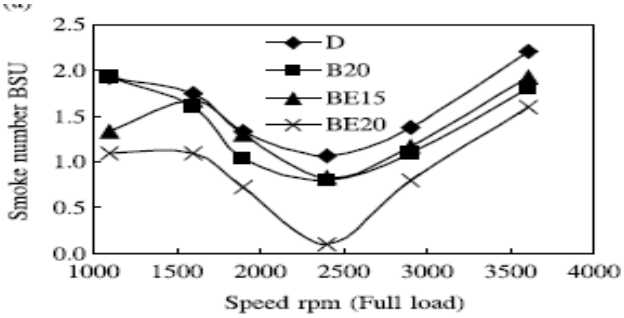

Fig 7 – smoke number BSU Vs Speed rpm

The CO emissions with BE15 and B20 were slightly lower than that with diesel fuel. BE20 decreased CO emissions relative to diesel fuel. BE15 and BE20 increased THC emissions while B20 decreased the THC compared with diesel fuel. All above graph indicating the various blends effect on the emission gases.

Paper 4:

In this paper the effect of bio-diesel and bio-ethanol blended diesel fuel on the performance and emission characteristics of direct injection diesel engine discussed .Diesel-ethanol blend require little or no change in conventional engine. The use of ethanol combined with diesel can significantly reduced the emission of toxic gases and particulate matters when compared to the pure diesel. They also found reduced smoke emissions, CO emissions above half loads and increased HC emissions with the blends comparing with the diesel fuel. The above studies reveal that the diesel-bio-diesel- ethanol blends can be used as alternative fuels for diesel engines. Recent research has shown that the use of diesel- bio-diesel-ethanol blends can substantially reduce emissions of CO, total hydrocarbons (HC) and particulate materials [11]. The mixing of bio-diesel and bio-ethanol with diesel significantly reduces the emission of particulate matter (PM) because the blended bio-fuel contains oxygen [9]. Hadi rahimi et al showed that the bio-ethanol and sunflower methyl ester can improve low temperature flow properties of diesel- bio-diesel-ethanol blends due to very low freezing point of bio-ethanol and low pour point of sunflower methyl ester. The power and torque produced by the engine using diesel-bio-diesel- ethanol blends and conventional fuel was found to be very comparable. The above study concluded that the diesel-ethanol-bio-diesel blend reduced the CO, HC, PM, smoke emission and increased the NO_x emissions compared with the diesel fuel. In the present paper the bio-diesel is produced from the rice-bran oil and the effect of this bio-diesel on the engine performance and emission characteristics find.

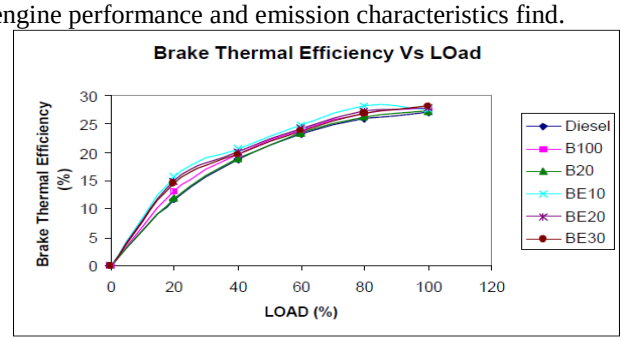

Fig 8 - Brake thermal efficiency Vs Load

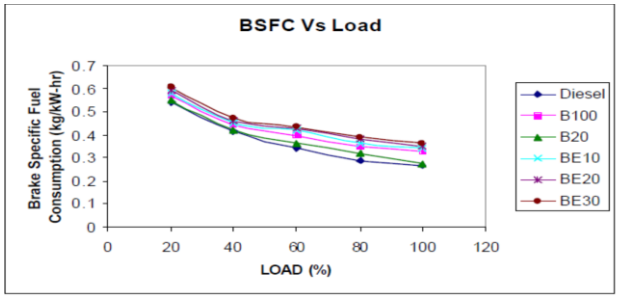

Fig 9 – BSFC Vs Load

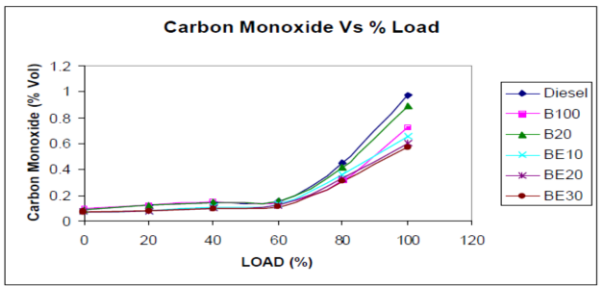

Fig 10 – Carbon MonoxideVs Load

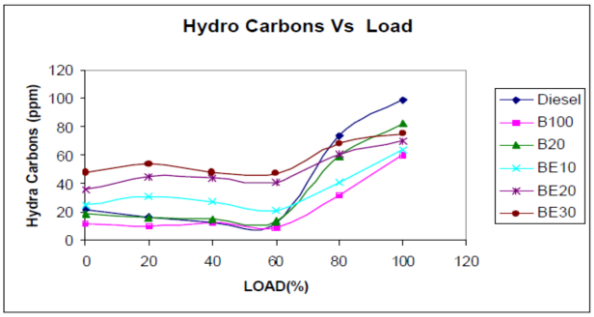

Fig 11 – Hydro Carbon Vs Load

From this paper it was concluded that the break thermal efficiency ,BSFC, oxides of nitrogen, carbon dioxide and unused oxygen increased with the increased in the percentage of ethanol in the diesel-bio-diesel-ethanol blend also reduction in the exhaust gas tempreture, sound intensity, CO and smoke in the blend of BE30. The blending of 20% rice bran bio-diesel into the diesel ethanol blend allows the higher amount of ethanol mixing with diesel.

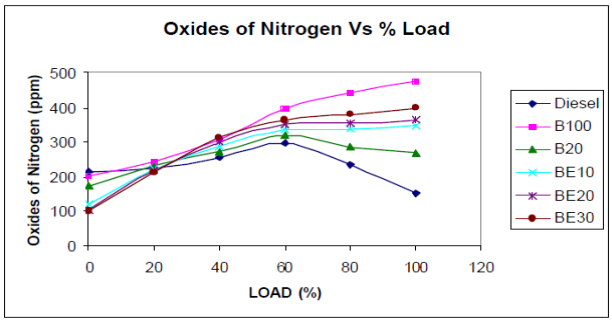

Fig 12 – Oxides of Nitrogen Vs Load

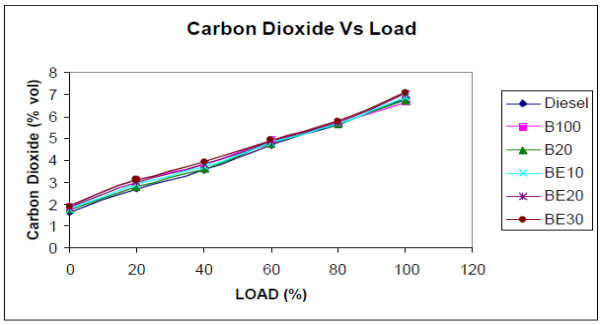

Fig 13 - Carbon Dioxide Vs Load

II. CONCLUSION

From the above review it is concluded that the blend of oxygenated additives and diesel improved the engine performance and emission characteristics. The main goal of this work is to be finding out the best suitable blend of diesel- and additives to the emission characteristics and improved the engine performance by using the best proportion of blending of various oxygenated additives. Oxygenated additives like DMM, DEE, DBM, EGE, and DMC etc are costly and easily not available .so it is advantageous but not economical. Scope of our work is to make economic blend which gives improved performance and emission characteristics.

REFERENCE

[1] Demirbas A, Karslioglu S. Bio-diesel production facilities from vegetable oils and animal fats. Energy Sources Part A 2007; 29:133–41.
[2] Balat M. New bio-fuel production technologies. Energy Educ Sci Technol 2009; 22:147–61.
[3] Demirbas A. Bio-ethanol from cellulosic materials: a renewable motor fuel from biomass. Energy Sources Part A 2005; 27:327–37.
[4] Balat M. Global bio-fuel processing and production trends. Energy Explor Exploit 2007; 25:195–218.
[5] Istvan Barabas, Adrian Todorut, Doru Ba˘ldean. Performance and emission characteristics of an CI engine fueled with diesel–bio-diesel bio-ethanol blends.2010: 3827–3832.
[6] G. Venkata Subbaiah, K. Raja Gopal and Syed Altaf Hussain. The Effect of Bio-diesel and Bio-ethanol Blended Diesel Fuel on the Performance and Emission Characteristics of a Direct Injection Diesel Engine. 2010, 211-221.
[7] Graboski MS, McCormick RL. Combustion of fat and vegetable oil derived fuels in diesel engines. Prog Energy Combust Sci 1998; 24:125–64.
[8] Sharp C, Howell S, Jobe J. The effect of bio-diesel fuels on transient emissions from modern diesel engines, part II. SAE paper no. 2000-01-1967; 2000.
[9] McCormick RL, Williams A, Ireland J, Brimhall M, Hayes RR. Effects of bio-diesel blends on vehicle emissions. Int J Eng Res 2006; 2:249–61.
[10] Fontaras G, Karavalakis G, Kousoulidou M, Tzamkiozis T, Ntziachristos L, Bakeas E, et al. Effects of bio-diesel on passenger car fuel consumption, regulated and non-regulated pollutant emissions over legislated and realworld driving cycles. Fuel 2009; 88:1608–17.
[11] Shi, X., Y. Yu, H. He, S. Shuai, J. Wang and R. Li, 2005. Emission characteristics using methyl soyate-ethanol-diesel fuel blends on a diesel engine. Fuel 2005; 1543-1549.
[12] M.Pugazhvadivu and S.Rajagopan investigation on the diesel engine fuelled with biodiesel blend and DEE as an additive.2009; 31-35.
[13] Vara Prasad et al .effective utilization of B20 blend with DEE and ethanol as a oxygenated additives.2010; 1-11.

