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Effect of SC5D Additive on the Performance and Emission Characteristics of CI Engine

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ABSTRACT: *In this experimental work polymer based additive are mixed in different proportions with diesel fuel. Their emissions and performance results are compared with base fuel diesel. By mixing of this additive, it is observed that cetane index number is increased from 46.22 as of base fuel to 47.63, 49.40, 51.91, 54.91 and 60.66 respectively. The tests conducted at full load and varying speed conditions. The results show that HC, CO& NO_X emissions are reduced by 35%, 30% & 4% respectively. Brake power is increased 6% whereas brake specific fuel consumption and smoke density are decreased by 23% and 35%. Here we also observed that, when cetane index number is increases from 54.91 to 60.66 the engine performance and emission characteristics are not effective.*

Keywords: *Engine performance, Emission, Fuel properties, SC5D additive, Diesel engine.*

I. INTRODUCTION

Today improvement of fuel quality is major challenge to reduce engine emission to protect environment. The additives play effective role to counter this problem without engine modification. The diesel engine provides better fuel economy and high power output compared with the gasoline engine. Z.H. Huang [a *] et al. [1], studied the combustion characteristics and heat release for different proportions of mixing DMM (Dimethoxy methane) in diesel fuel and found satisfactory results on emission reduction. Ruijun Zhu[a,b] et al. [2], Studied regulated and unregulated emissions from diesel engine blended fuel with diethyl adipate, showed using this additive cleaner combustion is achieved. Xiangang Wang[a] et al. [3], investigated the blends of diesel-ethanol, diesel-biodiesel and diesel-DGM (diethylene glycol dimethyl ether) or named as diglyme and found that using ethanol blended fuels HC, CO, NO_X and NO_2 emissions are increases but DGM blended fuels reduces HC,CO NO_X and NO_2 emission. PM emission is also reduces by using DGM as compare to diesel. By using biodiesel blended fuels noted that the HC, CO, NO_X, and NO_2 emissions, lies between ethanol and DGM blended fuels. Ruijun Zhu [a] et al. [4], studied the combustion and emission characteristics of CI engine by using DMM blends and got satisfactory reduction of HC, CO, NO_X, smoke and PM emission. W.M. Yang[*] et al. [5], Has used nano-organic additives and investigated that when engine speed increases the HC, CO and NO_X emissions reduces. Wang Ying[a,*] et al.[6], Mixing oxygenated DME (dimethyl ether) in diesel fuel and studied the engine performance and emission characteristics of CI engine. He observed that by mixing DME in diesel fuel, the cetane number increase as compare to pure diesel. The result showed that engine performance increases and emission characteristics reduce. F.K. Forson et al. [7], Investigated the engine performance of diesel engine by using jatropha oil blends. Here it is noted that pure jotropha, pure diesel and jatropha plus diesel oil given same results under different operating conditions, but mixing of jatropha oil in diesel fuel the exhaust gas temperature is reduced. Yakup Icingur et al. [8], Investigated the engine performance and emission characteristics of diesel engine by using different fuel cetane numbers. He observed that using different cetane numbers of fuel NO_X, SO_2, emission are reduces at different speed.

Here the previous study shows that additive play effective role in increasing mechanical efficiency and reduction emission.

II. OBJECTIVE

The objective of present study to carry at experimental analysis, to evaluate effect of SC5D additive on diesel engine. The SC5D additive compare to other additives cost wise very cheap as well as quality like mileage, performance, power, reliability and going to turn your simple diesel to SUPER DIESEL. The additive manufactured by sumafine chemicals ltd pune. The company tested diesel cetane index and smoke density in CIRT PUNE with SC5D additive and compare these results with pure diesel. Here it is noted that by adding this additive, the cetane index increases and smoke density reduces. But we used this additive in different proportion of diesel and calculate engine performance as well as emission characteristics and their results compare with pure diesel.

The physical and chemical properties of SC5D additive as follows:-

Appearance: Liquid, Color: Radish yellow liquid, Odor: Aromatic, Starts to Boil: 180^0c (1.03mbar) Method DIN 51751, Flash Point: Approx 30^0c, Ignition Temperature: Approx 210^0c Lower Explosion Limit: 0.9% (v), Upper Explosion Limit: 7% (v) method 51649, Vapor Pressure: Approx 3.9 mbar method 51649, Vapor Pressure: Approx 3.9 mbar (20^0c) method DIN 51754, Density: (29^0c) 0.795, Solubility in Water: Insoluble (20^0c), Solubility /Qualitative: Soluble in hydrocarbons.

EXPERIMENTAL SETUP AND FUEL PROPERTIES:-

The experimental work is conducted on single cylinder, water cooled, two stroke, direct injection, Textool Diesel Engine. A rope brake dynamometer is used to load the engine at maximum load of 50kg and maximum spring balance reading is 20kg which is attached to the dynamometer. Experiments were performed under full load and varying speed

conditions. The schematic diagram of engine test bed is shown in fig.1. Speed of the engine shaft is measured by hand held tachometer. Flow rate was measured on the volume basis using a burette and stopwatch. The fuel from the tank is sent to the engine through a graduated burette using a two way valve. When the valve is set at position 1 the fuel is sent to the engine directly and in position 2 the fuel contained in the burette is sent to the engine. For the measurement of the fuel flow rate of the engine the valve is set at position 2 and the time for a definite quantity of the fuel flow is noted. An AVL exhaust gas analyzer and smoke meter are used to measure exhaust emission and smoke density respectively. Here fuel cetane index no. 46.22, 47.63, 49.40, 51.91, 54.91 and 60.66 respectively are tested. Increase in cetane number effect the combustion process and to short the ignition delay. The cetane number is increased by the paraffinic hydrocarbon in the fuel. The properties of fuel such as viscosity, volatility flash point is also affects the proper combustion process. Viscosity affects atomization and vaporization of the fuel and the volatility ensures good mixing of fuel to air [6].

Table 1
Fuel properties of pure diesel and mixing with additive used for experimental analysis.

S. no.	Fuel type	Density (@15^{0}C kg/m^3)	Degree of API gravity	Aniline point (^{0}C)	Flash point (^{0}C)	Cetane Index
1.	D_0 (Pure diesel)	835.13	36.80	52	56	46.22
2.	D_1 (1000:1)ml.	834.76	36.87	54	57	47.63
3.	D_2 (1500:2)	833.15	37.20	56	59	49.40
4.	D_3 (2000:3)	832.2	37.40	59	61	51.68
5.	D_4 (2500:5)	830.3	37.77	63	64	54.91
6.	D_5 (3000:7)	816.13	40.71	65	65	60.66

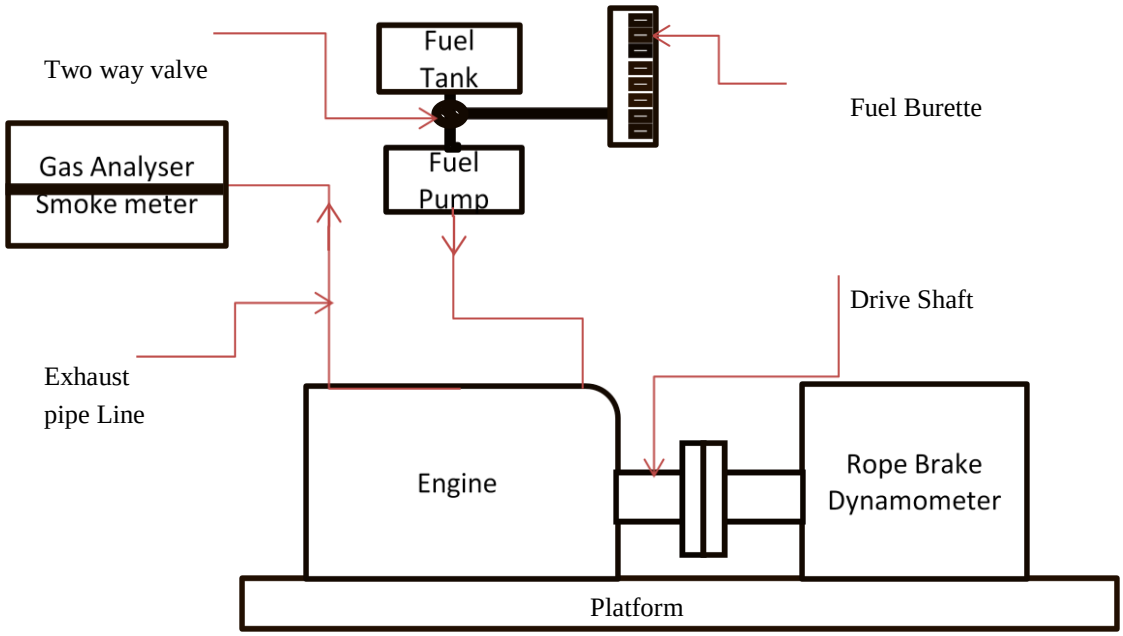

Fig1. Schematic block diagram of experimental setup.

EXPERIMENAL PROCEDURE:

The engine tests were conducted at different engine speed and full load conditions. After stable operating conditions were experiments are achieved, the engines were subjected to same load condition. The engine was stabilized before taking all measurements at constant static injection timing. An attempt was made to conduct all experiments without significant fluctuations to prevent possible discrepancies in engine operation during the tests and mainly, to avoid variations in engine loading. The experimental procedure consisted of the following three steps:

1. Initially engine tests using the base reference diesel fuel were conducted at full load condition to determine engine performance and emission characteristics of the engine base line operations.
2. The previous procedure was repeated at the same operating conditions with the engine fueled consecutively with fuels of different additives.
3. Taking the mean value by repeating the measurements at each operating conditions.

III. RESULTS AND DISCUSSION

The performance and emission characteristics of diesel fuel with additive and pure diesel are tested and compared at different speeds and full load condition. The results are shown in fig. 2-7. The brake power (BP) increases and brake specific fuel consumption (BSFC) reduces with respect to cetane index. We noted that the cetane index no. is increases from 46.22 to 54.91, brake power increases and brake specific fuel consumption reduces linearly in all speeds, 300, 500 and 700 rpm. The

maximum reduction is obtained at 700 rpm. If the cetane index no. increases from 54.91 to 60.66 the results are not effective as shown in fig 2 and 3. Fig. 4-5 shows the effect of cetane index on HC and CO emission. It can be seen that the cetane index no. increases from 46.22 to 54.91 the HC and CO emission reduces at all engine speed. Here we also noted that the HC and CO reduces maximum at 700 rpm. The variation shows that the additive mix diesel as compare to pure diesel is very effective to improve the engine performance and decrease the emissions. The cetane index no. increase from 54.91 to 60.66, the results are not effective. Fig. 6 and 7 shows the effect of cetane index on NO_X emission and smoke density at engine speed, 300, 500 and 700 rpm. Here we noted that when engine speed is increases the NO_X emission and smoke density reduces with respect to cetane index. The maximum reduction of NO_X is obtained at 500 rpm and smoke density at 700 rpm. The results are not effective when cetane index no. increases from 54.91 to 60.66. Here we observed that by adding additive the combustion process is completed very smoothly and shorter the ignition delays. We compare all additive mix diesel and pure diesel results. Here we noted that the additive mix diesel is most beneficial to environmental protection as compare to pure diesel. The observation of different test results are plotted as following:-

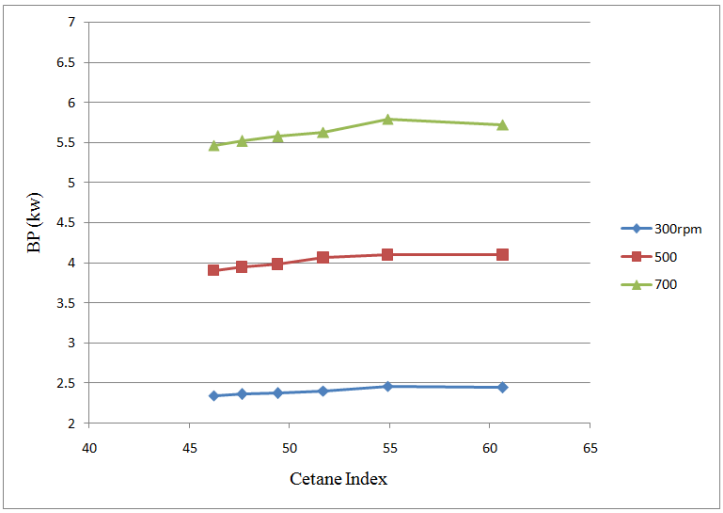

Fig.2. Effects of Cetane Index on BP (at full load)

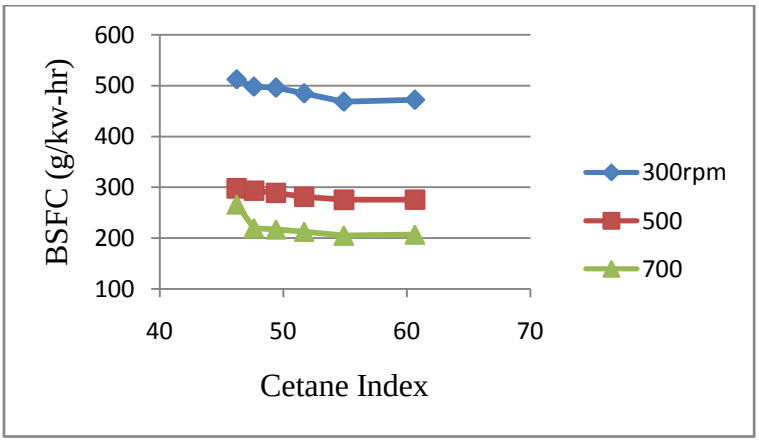

Fig.3. Effects of Cetane Index on BSFC (at full load)

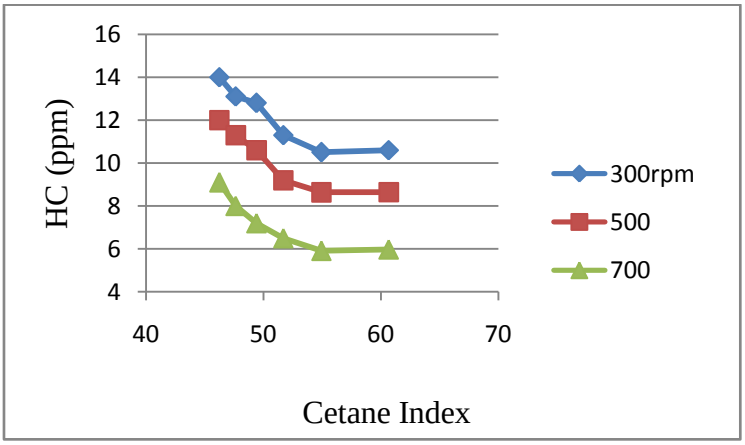

Fig.4.Effects of Cetane Index on HC emission (at full load)

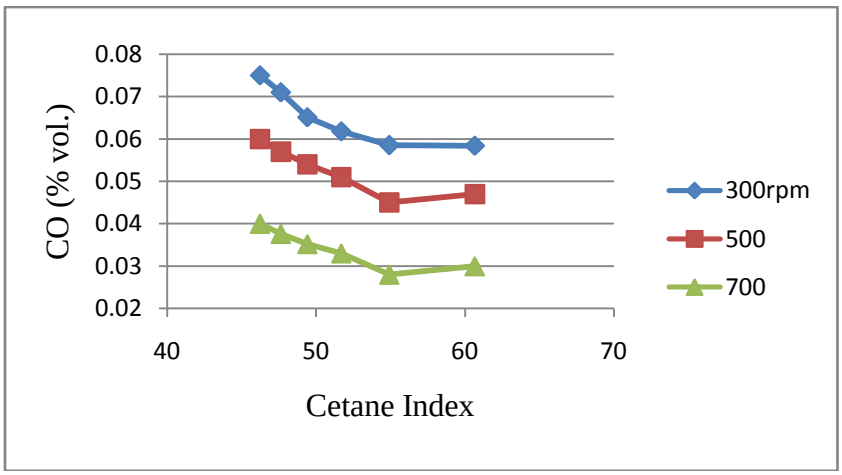

Fig.5.Effects of Cetane Index on CO emission (at full load)

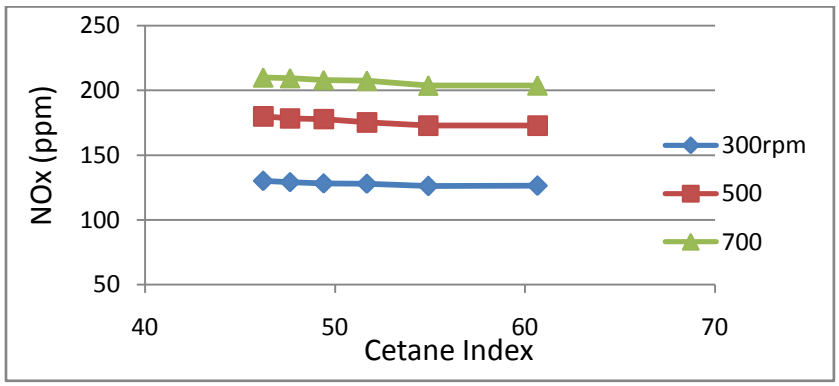

Fig.6.Effects Cetane Index on NO_X emission (at full load)

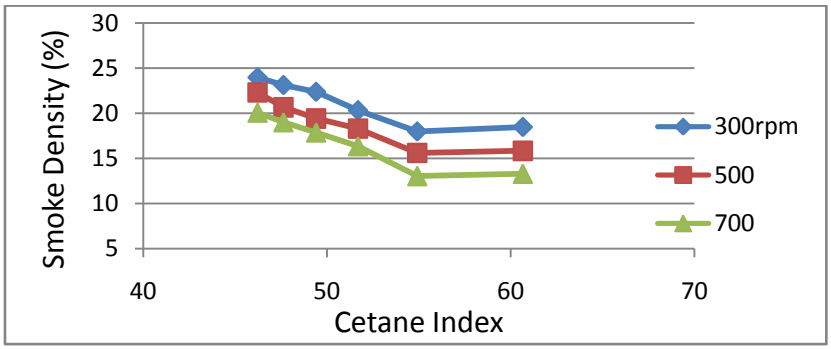

Fig.7.Effects of Cetane Index on Smoke Density (at full load)

IV. CONCLUSION

The experimental investigation of engine performance and emission characteristics is conducted in direct- injection single cylinder water-cooled two-stroke textool diesel engine and test results shows the following conclusions:

1. Test results show that when increasing cetane index number 46.22 to 54.91 the engine performance and emission is reduces at varying speed and full load condition.
2. By using additive HC, CO% &NO_X emission reduces 35%, 30% & 4% respectively as compare to pure diesel.
3. The smoke density is decreased by 35 %.
4. The brake power increases 6% and brake specific fuel consumption is reduces 23%.
5. When cetane index number is increases from 54.91 to 60.66 the results are not effective.

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REFERENCES

[1] Z.H. Huang [a] ,*, Y. Ren[a] , D.M. Jiang [b] , L.X. Liu [b] , K. Zeng [b] , B. Liu [b] , X.B. Wang [b] . Combustion and emission characteristics of a compression ignition engine fuelled with Diesel–dimethoxy methane blends. Energy Conversion and Management 47 (2006) 1402–1415.

[2] Ruijun Zhu [a, b], C.S. Cheung [b,*], Zuohua Huang [a], Xibin Wang [a]. Regulated and unregulated emissions from a diesel engine fueled with diesel fuel blended with diethyl adipate. Atmospheric Environment 45 (2011) 2174-2181.

[3] Xiangang Wang [a], C.S. Cheung [b], Yage Di [a, b], Zuohua Huang [a,*]. Diesel engine gaseous and particle emissions fueled with diesel–oxygenate blends. Fuel 94 (2012) 317–323.

[4] Ruijun Zhu [a], Haiyan Miao [b,*], Xibin Wang [a], Zuohua Huang [a]. Effects of fuel constituents and injection timing on combustion and emission characteristics of a compression-ignition engine fueled with diesel-DMM blends Proceedings of the Combustion Institute 34 (2013) 3013–3020.

[5] W.M. Yang[*], H. An, S.K. Chou, S. Vedharaji, R. Vallinagam, M. Balaji, F.E.A. Mohammad, K.J.E. Chua. Emulsion fuel with novel nano-organic additives for diesel engine application. Fuel xxx (2012) xxx–xxx.

[6] Wang Ying [a,*], Zhou Longbao [a], Wang Hewu[a, b]. Diesel emission improvements by the use of oxygenated DME /diesel blends fuel. http:/www.paper.edu.cn

[7] F.K. Forson[*], E.K. Oduro, E. Hammond-Donkoh. Performance of jatropha oil blends in a diesel engine. Renewable Energy 29 (2004) 1135–1145.

[8] Yakup Icingur *, Duran Altiparmak. Effect of fuel cetane number and injection pressure on a DI Diesel engine performance and emissions Energy Conversion and Management 44 (2003) 389–397.