INVESTIGATION ON PERFORMANCE CHARACTERISTICS OF PREHEATED DIESEL FUEL ON COMPRESSION IGNITION ENGINE

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ABSTRACT

This study contain the performance characteristics of Kirloskar VCR research engine while using fuel preheating technology. Characteristics were investigated for various inlet fuel preheating temperature. Four fuel preheating temperatures (20°C, 30°C, 40°C & 50°C) were used. Compression ratio 16:1 is preferred for experimentation. Experiments were performed at rated speed of 1500 RPM from no load to full load conditions. Effect of fuel preheating on performance characteristics like Brake Power, Indicated Power, Friction Power, mechanical efficiency, Brake Thermal Efficiency, Indicated Thermal Efficiency, Specific Fuel Consumption and emission characteristics were investigated. Brake specific fuel consumption of preheated fuel is decreased. At 40°C preheating temperature gives lowest Brake Specific Fuel Consumption for all loading conditions. Brake thermal efficiency of preheated fuel is higher. 40°C preheating temperature gives 39.26% BTE then without preheated engine. Mechanical efficiency increases as load increases. CR 17 and preheating temperature 40°C gives 56.85% efficiency.

Keyword: - *Preheating of fuel, compression ratio, performance, diesel fuel, compression ignition engine*

1. NOMENCLATURE

CR	Compression ratio
BP	Brake power
IP	indicated power
BSFC	brake specific fuel consumption
BTE	brake thermal efficiency
ITE	indicated thermal efficiency
VCR	variable compression ratio
DI	direct injection
DAQ	data acquision system

2. INTRODUCTION:

Because of high price and lack of option of crude oils it's important to get the ways to triumph over this problem. We discover many choices available in market, one is using different fuels or bio fuels nevertheless they are costly to create and having low efficiency then standard fuels. Other way is changes in engine geometry but it could be applied limited to particular conditions so that it became costly option. Other way is using EGR systems but mostly it can be used for standalone engine installations. One effective way to increase performance is using preheating method. We have discover two ways to where we may use preheating method, one is air preheating and another is fuel preheating. fuel preheating is preferable to the air preheating because in fuel preheating viscosity of fuel is decreased all together its aerosol characteristics increased so fuel clogging problem is reduced employing this method. This analysis investigates the performance characteristics when using fuel preheating strategy.

From the books review it could be concluded that a lot of research work has been done on the mixing of fuel. Looking into the performance characteristics of different kind of mixes at standard compression ratio has been

completed. Very less work has been completed on after effect of preheating of inlet fuel temperature. Diesel energy having low flash and fire point scheduled to which unusual work is performed on the diesel preheating. No work is performed on the incorporate after effect of preheating of inlet fuel and compression ratio influence on performance characteristics and discover different combo of preheating temperature and compression ratio in line with the requirements. Hence, the scholarly analysis of characteristics of preheated diesel energy for changing compression percentage is very essential. In present work, after effect of preheating of inlet diesel fuel on performance and emission characteristics of fuel has been studied. The various fuel preheating temperature are picked and pursuing investigations are completed.

3. EXPERIMENTAL SETUP AND PROCEDURES:

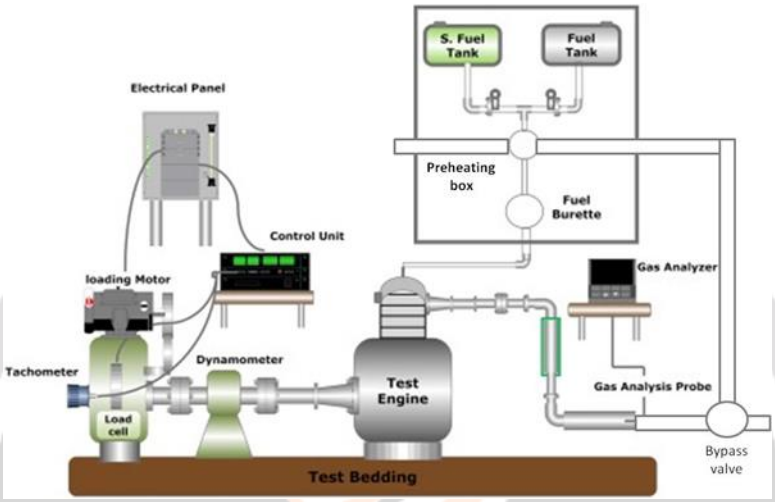

Figure 1: Schematic diagram Experimental Setup

Experimental setup of engine is shown in figure. Kirloskar engine is used having single cylinder four stoke direct injection system. Engine is water cooled and coupled with eddy current dynamometer. It generates 3.5 kW of rated power at constant speed of 1500 RPM. Compression ratio can be varied from 12 to 18. DAQ system is installed in engine for accurate measurement of parameters. As per the requirement various instruments are coupled with engine. Various parameters like fuel flow, air flow, temperature, speed and load are measured. By this setup, we can study the engine performance parameters like indicated power, frictional power, brake power, BMEP, IMEP, ITE, brake thermal efficiency, volumetric efficiency, specific fuel consumption and air-fuel ratio. Experiment is conducted with compression ratio 16:1 using diesel as working fuel. Computerised system is used to measure the performance and emission parameters. Variation in parameters due to changing in loads (1, 3, 5, 7, 9 kg) and preheating temperature are being observed.

4. RESULT AND DISCUSSION

4.1 Mechanical Efficiency (ηmech)

Figure shows that mechanical efficiency increases with increasing the loads. Mechanical efficiency is maximum at full load conditions. As the preheating temperature increases, mechanical efficiency is decreases. We get minimum mechanical efficiency at preheating temperature 50°C. Maximum efficiency is found 54% at 20°C preheating temperature.

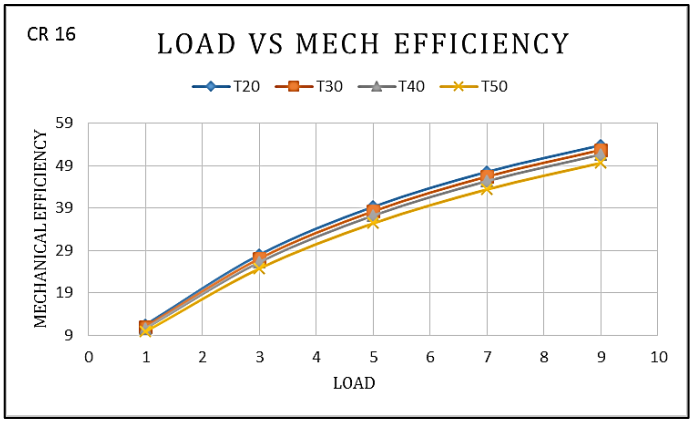

Figure 2: load vs. Mechanical efficiency

4.2 Break Thermal Efficiency (BTE)

From the experiment result shows that as the load increases, brake thermal efficiency increases. While using fuel preheating method there is an improvement in BTE. From the figure the BTE were maximum at 40°C fuel preheating temperature. Maximum BTE achieved using preheating method was 39.27% at compression ratio 16 and 40°C fuel preheating temperature.

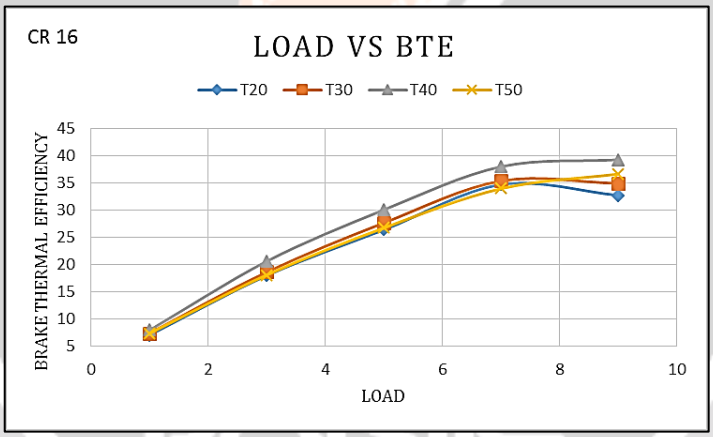

Figure 3: load vs. Brake Thermal efficiency

4.3 Brake specific fuel consumption

Impact of preheating on BSFC is appeared in the figure. BSFC diminished in every exploratory condition with increasing engine load. This decrement in BSFC can be clarified by the way that as the engine load increments, there was constant change in burning quality and productivity.

Figures demonstrates the BSFC at various fuel preheating temperature. BSFC is most extreme at no load condition yet when load and in addition Fuel inlet temperature Increase BSFC diminish constantly. Without preheating 20°C the BSFC different 1.30 kg/Kwhr – 0.2 kg/Kwhr. Where after the increasing fuel inlet temperature at 30°C, 40°C, 50°C same as diesel fuel it diminish however at temperature rise the BSFC are best at 40°C temperature.

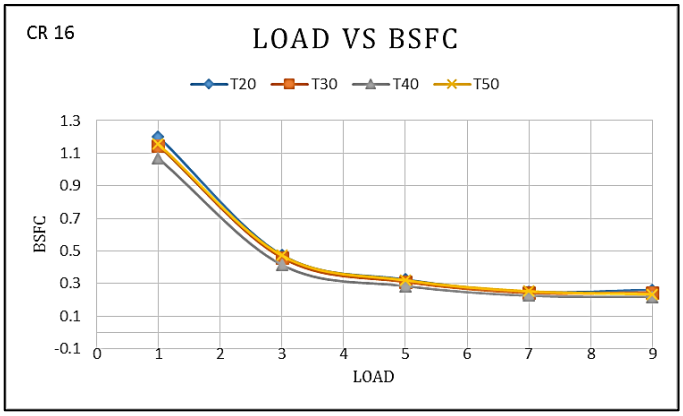

Figure 4: load vs. Brake Specific Fuel Consumption

5. CONCLUSION

From above observation, it has been seen that fuel preheating temperature 40°C gives best desire performance and emission characteristics at all loading conditions. Experimental results also show that preheated fuel gives better characteristics then without preheated fuel.

Present work explores the performance and emission qualities of preheated diesel fuel. The accompanying results can be finished up for VCR engine with capacity of fuel preheating, load and CR.

- BSFC of preheated fuel is decreased. Preheating temp. 40°C gives least BSFC for all loading conditions.
- BTE of preheated fuel is higher than without preheated fuel. At 20°, 30°, 40° and 50°C, BTE were 32.72%, 36.64%, 39.25% and 36.64% at full load. We get best BTE at 40°C.
- As load increase, mechanical efficiency increases. Efficiency is better for 30°, 40° and 50°C. At full load efficiency were 49.21%, 56.89%, 51.96%. We get best effectiveness at 40°C.

From above perception, it has been seen that fuel preheating temperature 40°C gives best performance and emission qualities at all loading conditions. Test comes about likewise demonstrate that preheated fuel gives better attributes then without preheated fuel.

6. REFERENCES

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