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Performance on the Effect of N-Butanol Diesel Blends on Single Cylinder Four Stroke Diesel Engine

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ABSTRACT

Experimental work was conducted to evaluate the effect of using n-butanol (normal butanol) in conventional diesel fuel biodiesel blends on the engine performance parameter of a single cylinder direct injection compression ignition engine with the engine working at different three engine loads. A blend of biodiesel and diesel fuel known as B20 (20% biodiesel and 80% diesel in volume) was prepared, and then n-butanol was added to B20 at a volume percent of 5%,10%,15% and 20% (denoted as B5,B10,B15 and B20, respectively). The performance parameters evaluated include thermal efficiency, brake specific fuel consumption (BSFC), brake specific energy consumption (BSEC). Results were compared with the neat diesel. The blended biodiesel is being injected to cylinder and tested up to 20% blended biodiesel. The experiment ensures that up to 20% biodiesel blended with diesel can be used without any modification in the diesel engine and enhancement of combustion, FC, BSFC, efficiency and the over all performance of the engine.
Keywords : N-Butanol Diesel Blends, Diesel Engine, Normal Butanol, Brake Specific Energy Consumption, Brake Specific Fuel Consumption

I. INTRODUCTION

Alternate automotive fuels are currently an important issue all over the world due to the efforts on reducing global warming which is contributed by the combustion of petroleum or petrol diesel. Biodiesel is non-toxic, biodegradable, produced from renewable sources and contributes a minimal amount of net green house gases, such as CO_2, SO_2 and NO emissions to the atmosphere.

Need of a suitable sustainable fuel for existing internal combustion engines is being desperately felt these days, when petroleum reserves are soon going to vanish from the surface of earth. Biodiesel proposes one such option with its suitability as a replacement fuel for existing compression ignition engines, it becomes interesting to know performance of a dedicated CI engine with biodiesel fuel

Butanol is a potential alternative to ethanol and offers many benefits including a much higher heating value and lower latent heat of vaporization. It also has a higher cetane number than ethanol and improved miscibility in diesel fuel. Additionally, which allows it to be transported using the existing fuel supply pipelines?

Fuel properties	Diesel fuel	n-Butanol C4H9OH
Density at 20 _C (kg/m3)	837	810
Cetane number	50	25
Lower calorific	43	33.1
value (MJ/kg)		
Kinematic viscosity	2.6	3.6
at 40 _C		
(mm2/s)		
Boiling point	180-360	118
Latent heat of	250	585
evaporation		
(kJ/kg)		
Molecular weight	170	74

II. ENGINE DETAIL

Technical Specification
DIESEL ENGINE

TYPE: - Vertical, Totally Enclosed, Compression Ignition Four
Stroke Cycle, Water cooled engine,
MAKE: - Kirloskar Oil Engine, Pune,
MODEL: - SV1

NO. Of CYLINDER: - ONE

BORE: - 87.5 mm
STROKE: - 110 mm
CUBIC CAPACITY: - 662 CC
COMPRESSION RATIO: - 16.5: 1
RPM: - 1800

RATE OF OUTPUT: - 8 HP

III. TEST PARAMETER

These are to be entered every time engine testing has to be done. First load is selected and set then its results like temperature, fuel consumption ration, RPM etc for corresponding load to be entered Manually/Automatically.

Parameter Description:

Fuel Consumption Rate

Air Intake Velocity
Load
Mean Efficiency Pressure
Actual Speed

Temperature of water Inlet to Calorimeter Temp. of water Outlet From Calorimeter

IV. ENGINE PERFORMANCE

1. Power and Mechanical Efficiency
2. Mean Effective pressure and Torque
3. Specific Output
4. Specific fuel consumption
5. Thermal Efficiency and Heat Balance.

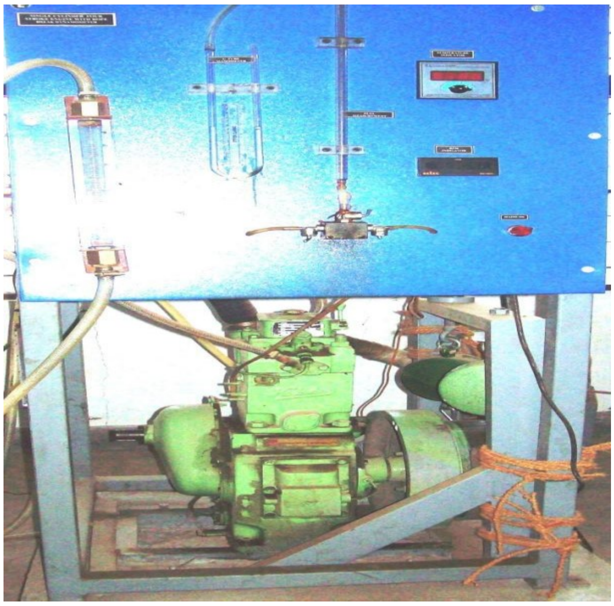

Figure 1.

V. SINGLE CYLINDER FOUR STROKE DIESEL ENGINE GRAPHS

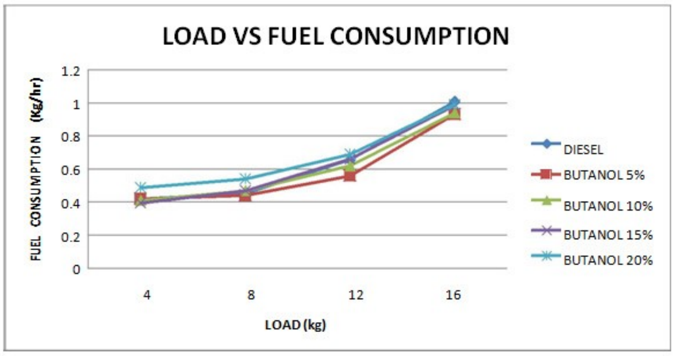

Figure 2. Variation of fuel consumption with load for pure diesel and n-butanol blends

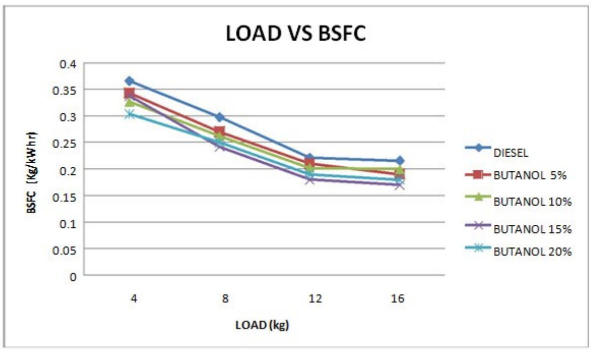

Figure 3. Variation of brake specific fuel consumption with load for pure diesel and n-butanol blends

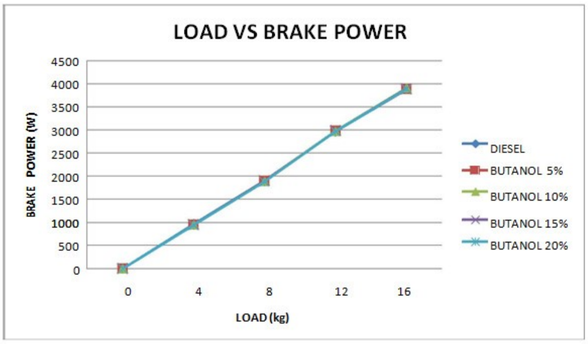

Figure 4. Variation of brake power with load for pure diesel and n-butanol blends

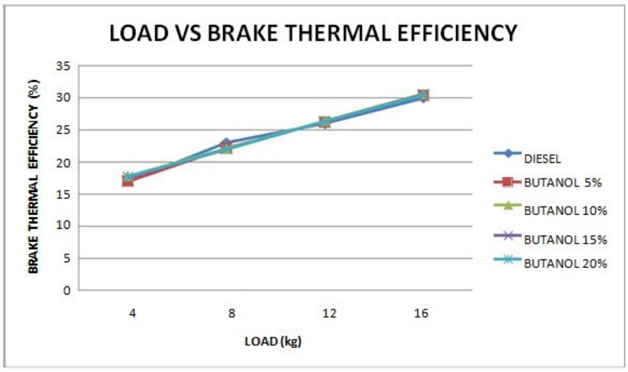

Figure 5. Variation of brake thermal efficiency with load for pure diesel and n-butanol blends

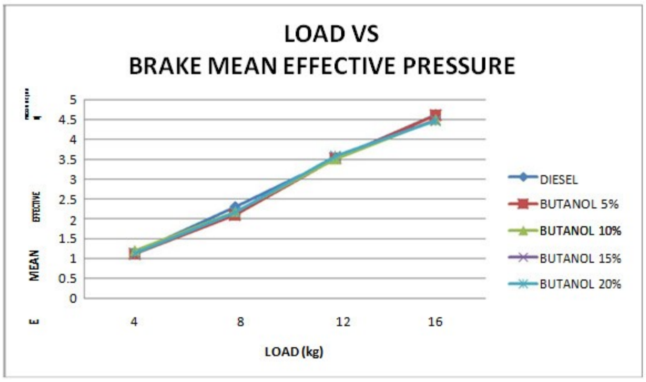

Figure 6. Variation of brake mean effective pressure with load for pure diesel and n-butanol blends

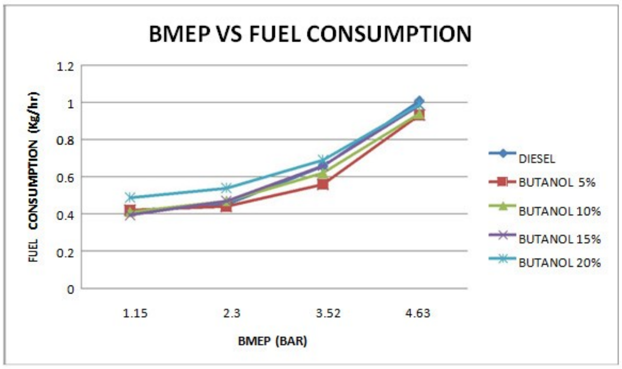

Figure 7. Variation of fuel consumption with brake mean effective pressure for pure diesel and n-butanol blends

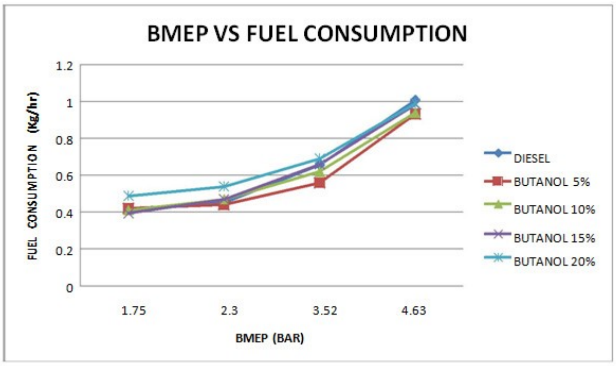

Figure 8. Variation of fuel consumption with brake mean effective pressure for pure diesel and n-butanol blends

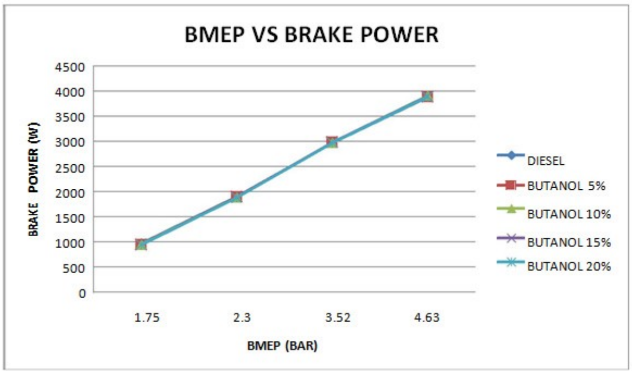

Figure 9. Variation brake power with brake mean effective pressure for pure diesel and n-butanol blends

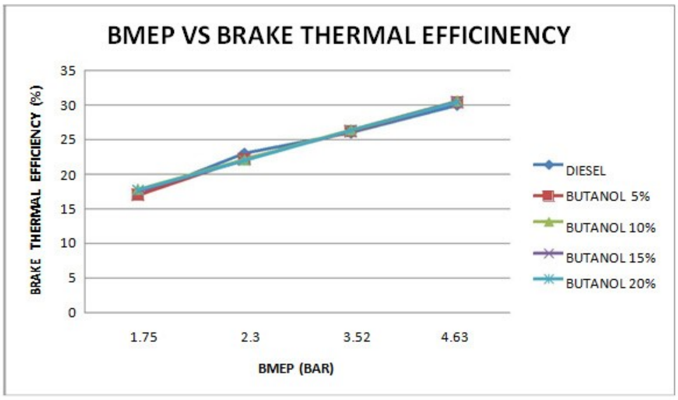

Figure 10. Variation of Brake thermal efficiency with brake mean effective pressure for pure diesel and n-butanol blends

INTERPRETATION OF GRAPH

It is observed from the above graphs that the fuel consumption and BSFC are nearly same for neat diesel and blends of biodiesel with diesel at all loads, which increases as load increases and have lowest value for neat diesel. It is also observed that brake power and brake thermal efficiency are same for neat diesel and blended diesel at all loads and its value increases as load increases and have higher for neat diesel. The air fuel ratio for neat diesel and blends of biodiesel with diesel is nearly same at all loads and have lower value for neat diesel.

VI. CONCLUSION

As from the above result and discussion we can conclude that Bio-diesel from n-butanol biodiesel diesel blends resemble very much with the conventional diesel, in properties as well as in the performance on CI engines. The economical analysis suggests good scope for biodiesel in comparison to diesel.

Biodiesel is an environmentally friendly fuel that can be used in any diesel engine without any modification up to 20% lean mixtures. The dependency on the diesel can be reduced by use of biodiesel instead of diesel in the applications where it is possible which will save the environment as well as our foreign exchange.

VII. REFERENCES

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