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To Investigate the Efficiency of CI Engine using Blend of Diesel with Additives Bardahl

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A B S T R A C T

The reduction of oil resources as well as the environmental regulation has led to the development of alternate energy sources. Diesel with Bardhal additives is a variable substitute for petroleum-based fuel. Its advantages are improved lubricity, higher cetane number, cleaner radiation,reduced global warming. Bardhal with diesel haspobrableas analternative energy source. However, this oil alone will not solveour dependence on foreign oil within any practical time frame.Use of this with other alternative energy sources and suitable additives such as Various Blend of Bardahl could contribute toa more stable supply of energy. Bardahl blend thus produced meets the standard bardahl blend specifications.The production and consumption of bardahl blend will inevitablyrise in future due to high performance impact,ease of handling,and possibility of use without need for major adjustments of existing engines of motor vehicles. Production and use of bardahl blend leads to Saves money, Improves energy security of the nation.

Keywords: IC engine, Diesel, Blends

1. Introduction

An enormous increase in the number of automobiles inrecent years has resulted in greater demand for petroleumproducts. With crude oil reserves estimated to last only for a few decades,there fore efforts are made on way to research on alternative to diesel. Depletion of crude oilwould cause a major impact on the transport sector[1].Fossil fuels play the significant role in development ofcountry.Continious supply of fuel with increasing rate should be ensured to sustain and further development ofcountry.Recently,significant problems associated with fossil fuel like short supply, drastically increasing price,non renewability, contamination of environment, adverse effect on bio systems compiles researcher to search in thepresent for future[1]. Energy conservation is important formost of the developing countries, including rest of world.The situation is very grave in developing countries likeIndia which import 70% of the required fuel, spending 30% of her total foreign exchange on oil imports[1]In view of this, researcher found and analyze many energy sources like CNG,LNG,LPG,ethanol,methanol,hydrogen,diesel with bardahl blend and many more.Diesel engines are major source of transportation, power generation,marine application,agriculture vehicles etc.Diesel with bardahl blendis widely accepted as comparable fuel to diesel in compression ignition engine.It offers advantages like higher cetane number, reduced radiation ofp erticulates.Moreover,transportation and agriculture sector depends on diesel fuel therefore, it is essential that alternatives todiesel fuels must be developed [19]

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2. Problem Statement

Selection of fuel for diesel engines affects the maintenance required and the performance user can expect. Due to increase in prices of petroleum based fuels,the adverse effects of exhaust radiation after combustion,the monopoly of Organization of Petroleum Exporting Countries (OPEC), and the fact that petroleum contributesup to 20% of energy source in India and this topic is usedtomuch moredurability

With diesel additives barhal. It is used to increase engine performance exhaust emission and smooth operation.

3. Justification

India does not have reserves for fossil fuels and thus imports all liquid fuels. There is need thus, for research on the existing renewable sources of energy considering thefactthat,in2005,7.4%of Indi as GDP was spent in importation of petroleum products,

- Woodfuel(70%)
- Petroleum(20%)
- Electricity(9%)
- Others(solar,windetc.)

(1%)Biodiesel is increasingly valued for its environmentally friendly properties which can help meet the challenges resulting from air, water and soil pollution due to the continued use of the fossil fuels. The following key properties of vegetable oils contribute to their attraction as environmentally friendly alternative fuels:

- Low evaporation, reducing in halation risk High flash point of(160oC)reducing risk of fire
- High biodegradability
- Low toxicity,both oral and dermal
- Reduced radiation, particularly carbon dioxide, sulphur oxides soot (particulate carbon matter) and poly aromatic hydrocompounds(PAH).

4. Objective

Main objective to develop a process break power,bsec, and exhaust emission.

Specific Objectives

- To produce and characterize barhal with diesel is smooth running peration and reducing the choking, knocking.
- To assess the environmental impacts of using blend with diesel from oil compared to using petroleum diesel.

5. Experimental Setup

Experimental setup used is shown in figure 1.Engine specification, exhaust gas analyzer device and other details are discussed in following section. Also, cooling of hydraulic dynamometer is done with water circulation.

5.1 Engine Specification

Multi cylinder, four stroke, water cooled, direct injection CI engine is used for experimental purpose. Figure 3.1shows the position of engine in experimental setup.Table 3.1 shows details of engine specification and other details of engine. Cooling water is circulated at constant flow rate.

Experiment calculation formulae N= Revolution per minute (RPM) W=Load on dynamometer (KG)

t = time required for 100ml fuel consumption

Mass of test fuel (mf)= Sample volume x density Calorific value= CV

Dynamometer Constant = 2950BP= brake Power

BTE=Brake thermal efficiency

BSEC=Brake Specific Fuel Consumption

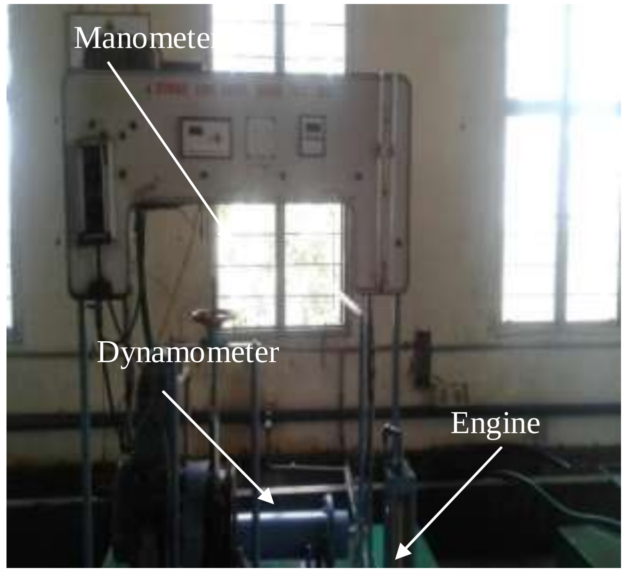

Figure1 Engine Test Rig

$$BP = \frac{WN}{2950}$$

$$BTE = \frac{BPt}{m_f CV}$$

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

5.2 Experiment calculation for Diesel Fuel

1. W=10 kg ,t=120.4sec., CV_{diesel}=41907.6Kj/kg

Mass of test fuel (m_f)=0.100*0.814 =0.0814kg

$$BP = \frac{WN}{2950}$$

$$BP = \frac{10*1500}{2950}$$

$$BP = 5.0847\text{Kw}$$

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{5.0847*120.4}{0.0814*41907.6}$$

$$BTE = 17.943\%$$

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6 * 41907.6 * 0.0814}{5.0847 * 120.4}$$

BSEC = 20.07 kj/kghr

W=20kg,t=98.4sec

$$BP = \frac{WN}{2950}$$

$$BP = \frac{20 * 1500}{2950}$$

BP=10.169kw

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{10.169 * 98.4}{0.0814 * 41907.6}$$

BTE=29.34%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6 * 0.0814 * 41907.6}{10.169 * 98.4}$$

BSEC=12.27 kj/kghr

3.W=30kg,t=68.02

$$BP = \frac{WN}{2950}$$

$$BP = \frac{30 * 1500}{2950}$$

BP=15.24KW

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{15.24 * 68.02}{0.0814 * 41907.6}$$

BTE=30.41%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6 * 0.0814 * 41907.6}{15.24 * 68.02}$$

BSEC=11.84kj/kghrs

4.W=40kg,t=58.2sec

$$BP = \frac{WN}{2950}$$

$$BP = \frac{40*1500}{2950}$$

BP=20.38kw

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{20.38*58.2}{0.0814*41907.6}$$

$$BTE = \frac{BPt}{m_f CV}$$

BTE=34.78%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6*0.0814*41907.6}{20.38*58.02}$$

BSEC=1036kj/kghr

5.W=50kg,t=50.04sec

$$BP = \frac{WN}{2950}$$

$$BP = \frac{50*1500}{2950}$$

BP=25.43Kw

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{25.43*50.43}{0.0814*41907.6}$$

BTE=37.3%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6*0.0814*41907.6}{25.43*50.43}$$

BSEC=9.57kj/kghr

2.1 Experiment calculation for Diesel Fuel with bardhal additives

1. W=10kg

t=time required for 100ml and 20ml fuel consumption115.2

m_f=mass of test fuel

= 0.100*0.874= 0.0874 kgBP=5.084kw

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{5.084*135}{0.0874*42805.9}$$

BTE=18.35%

$$BSEC = \frac{3.6*0.0814*41907.6}{15.24*68.02}$$

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6 m_f CV}{BPT}$$

$$BSEC = \frac{3.6*0.0874*42805.9}{5.084*135}$$

2. W=20kg, t=112.1secBP=10.169kw

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{10.169*112.1}{42805.9*112.1}$$

BTE=30.21%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6*0.0874*42805.9}{10.169*112.1}$$

BSEC=11.82kj/kg

3. W=30kg, t=92.4secBP=15.24kw

$$BTE = \frac{BPt}{m_f CV}$$

$$0.0874*42805.9$$

BTE = 37.68%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6 * 0.0874 * 42805.9}{15.24 * 92.4}$$

BSEC=9.56kj/kghr

4. W=40kg,t=68.41secBP=20.38kw

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{20.38*68.41}{0.0874*42805.9}$$

BTE=37.27%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6 * 0.0874 * 42805.9}{20.38 * 68.41}$$

$$BSEC = \frac{3.6 * 0.0874 * 42805.9}{15.24 * 92.4}$$

BSEC=9.66kj/kghr

5. W=50,t=60.12secBP=25.43kw

$$BTE = \frac{BPt}{m_f CV}$$

$$BTE = \frac{25.43 * 60.12}{0.0874 * 42805.9}$$

BTE=40.87%

$$BSEC = \frac{3.6 m_f CV}{BPt}$$

$$BSEC = \frac{3.6 * 0.0874 * 42805.9}{25.43 * 60.12}$$

BSEC=8.80kj/kghr

6. Result and Discussion

3.1Properties and Characteristics of Fuel and blends

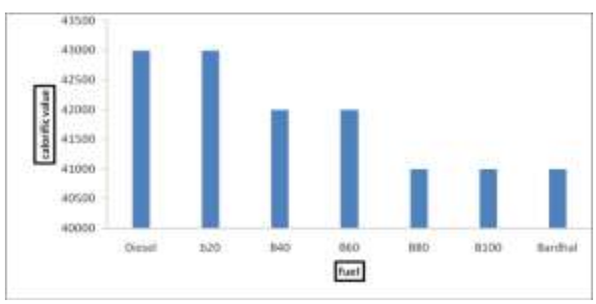

Figure3.1 Calorific Values of Various Fuels

From figure 3.1, it is seen that C.V. of diesel fuel is43000kJ/kg. and that of diesel with bardahl blend is 41208.4kJ/kg.calorific value of different blendB20 43000 k j/kgisequaltodieselcalorificvalue,B40andB60iscalorific value are same is 42000KJ/KG,B80,B100and barhal blend are calorific value same 41000KJ/KG.

This topic is used the diesel and diesel with blend bardhalI study a many paper related to using the fuel additives they are used different type of blend additives they are good result.

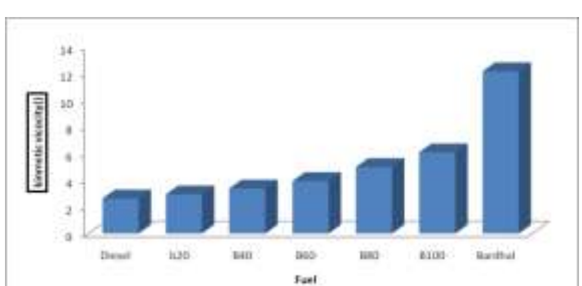

Figure3.2KinematicViscosities of Various Fuels

Higher or lower kinematic viscosity play very importantrole when Diesel with bardahl blend is used in engine with out any modification in injection pressure as this result in change of fuel atomization and distribution inside cylinder. Kinematic viscosity for pure Diesel with bardahl blend figure 3.2. Diesel with bardahl blend and another rblend.

Brake SpecificEnergy Consumption:

Figure 4.5 shows variation in BSEC with brake power and Bardhal with diesel percentage in blend.Brake specific energy consumption analysis is done instead of brake specific fuel consumption to account the effect of lower calorific value of Bardhal with diesel compared to diesel.Brake specific fuel consumption may be high ereven though brake thermal efficiency is higher with Bardhal with diesel blends compared to diesel fuel. This is due to lower calorific value of Bardhal with diesel results in more amount of fuel consumption for same energy input compared to diesel.Bardhal with diesel has11% lower energy density compared to diesel. At brake power of 5.08kW, BSEC is approximately 100% higher compared to BSEC at brake power of 25.42 kW for all fuels. Further, with increase in load or brake power BSEC for all fuel reduces. BSEC value comes to approximately50%of initial value at maximum brake power for all fuels. Lower cylinder temperature and lean fuel air ratio at part load results in in complete combustion and results in higher values of BSEC for all fuels. Minimum BSEC for diesel,B20 and B40 fuel sare10.38MJ/kWh,10.12MJ/kWhand
10.33 MJ/kWh respectively. B20 fuel has lowest BSEC followed by B40 and diesel fuels. B20 and B40 fuels show approximately 2.5% and 0.5% reduction in BSE Ccompared to diesel fuel. Inbuilt oxygen content, higher cetane number, similar kinematic viscosity and lower combustion duration compared to diesel may be major contributor for lower BSEC of B20 and B40fuels.Lowest BSEC for B100 fuel is 10.97 MJ/kWh. Lowest BSEC forB100 fuel is approximately 6% higher compared to lowest BSEC for diesel fuel. As Bardhal with diesel percentage inblend increase, kinematic viscosity of fuel increase. With higher kinematic viscosity and without change in injection pressure, droplet diameter increases and spray pattern also changes for blends as fuels compared to diesel fuel. With higher droplet diameter duration for combustion increaseswhich results in shift of peak pressure from TDC. Changein spray pattern with higher droplet diameter may results in fuel impingement on combustion chamber walls and improper mixing of fuel with air. Moreover, Bardhal with dieselis less volatile than diesel fuel. In overall effect of these effects, BSEC forB100 fuel is higher as compared to diesel fuel.

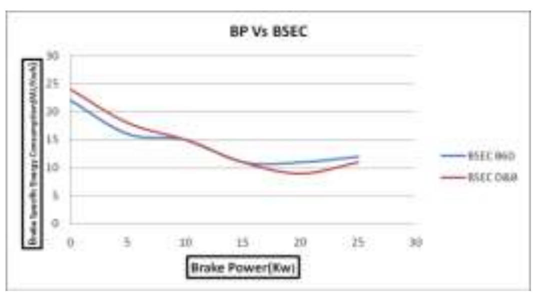

Figure 3.3 Variations in Brake Specific Energy Consumption with Brake Power B20 bardahl blend Percentage in blend

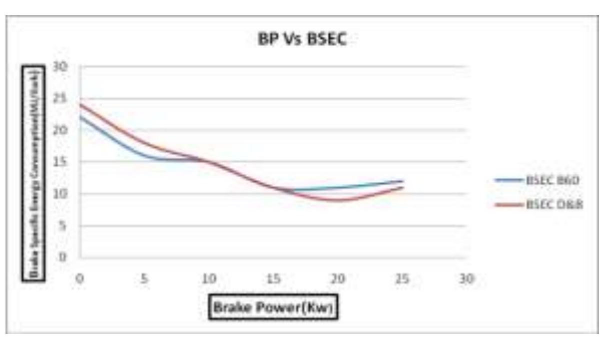

Figure 3.4Variations in Brake Specific Energy Consumption with Brake Power B40 bardahl blend Percentage in blend

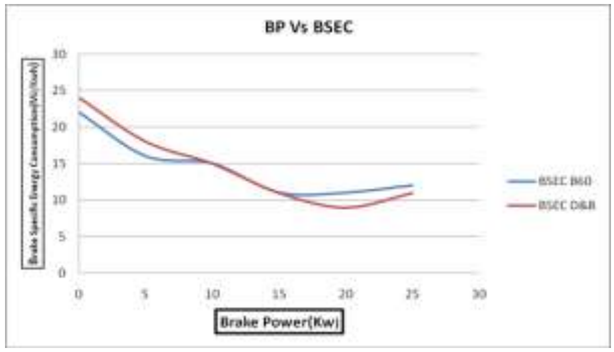

Figure 3.5 Variations in Brake Specific Energy Consumption with Brake Power B60 bardahl blend Percentage in blend

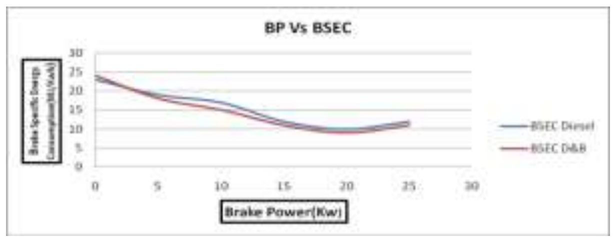

Figure 3.6 Variations in Brake Specific Energy Consumption with Brake Power and Diesel with bardahl blend Percentage inblend

7. Conclusion

The increase of Blen volume fraction decreased the fuel density, kinematic viscosity, and surface tension. These properties are directly influenced by the improved atomization performance.The blending of fuel injector cleanerca useda decrease in droplet size by increasing the number of small droplets and decreasing the number of large droplets. The decrease in droplet size was due to the decrease in surface tension as the Bardhal fuel fraction increased, which induced an increase in droplet volatility. The ignition delay was extended and a more homogeneous mixture formed as a resul tof Barhal blending.These improved combustion characteristics simultaneously reduced NOx and soot radiation. Addition of 3% (by volume) of Bardhal on diesel produce good result and it is applicable in diesel engine. However, the HC and CO radiation were slowly increased. The difference in HC and CO radiation between pure diesel and bardhal blended diesel fuels decreased, as the engine load increased. From experimental results it is determine by application of bardhal addition, effective power output increases at thelevel of 5-9% and fuel consumption decreases by approximately 6%.

In the present serve, a experiment investigate the conducted to probe the performance, combustion and emission characteristics with development to engine operation using diesel, and bardhal blends with diesel fuel in direct injection multi cylinder variable C.R. multi fuel diesel engine.The present effort as contribut mainly in the following aspects: A comprehensive survey of available literature has been done on

- C.I. engines fuelled with non edible oils, bardhal and their specified blends in diesel with dual fuel mode operation, to develop an understanding of performance,combustion ande mission behavior of theengine.In addition to this an exhaustive literature review was also undertaken on bardhal production techniques, cost estimation of bardhal production and utilization, properties and environmental impact of bardhal. A suitable test rig including pressure pickup, charge amplifier and high
- speed data acquisition system was developed to gether with emission measuring equipments like smokemeter
- and exhaust gas analyzer for conducting detailed experimental investigation of performance,combustion and emission characteristics of diesel engine fuelled with thumba oil, thum babardhal and their specified blends with diesel.

.A detailed experimental analysis of engine operation was carried out using diesel fuel and their different blendsin diesel with bardhal engine and large amount of use ful experimental data was generated

8. Suggestions for futurework and Recommendations

Bardhal and other blend additives may not eradicate the world'senergy problem,yet it could be a good fuel additive and alternative fuel for many uses. The present research work exhibits the initial feasibility of bardhal as a diesel engine fuel.Moreover,the experimental procedure adopted inpresent research work can be extended to multi-cylinder diesel engines, tractor engines and other diesel engines used in agronomics and transport.However, the long term endurance test is also necessary to evaluate the durability of the engine with prolonged operations. In add to this, the improve a production of bardhal should be performed in the future to promote bardhal properties and quality and more research in bardhal resources and engine designs are needed.Subsequently,furtherI proceed the additional fuel property measure and wear analysis of bardhal Blend fuelled engine is also require.Overall,bardhalblen,especially for the blends with a small unit of bardhal, is technically feasibility as an alternate fuel in C.I. engines without new modifications to engine. In spite of vegetable oils like jatropha,karanjaetc,which have beenr ecommended by the Planning Commission as a source of bardhal production,someun-tapped,un-exploredvegetable oils like thumba, neem etc. could also be used to produce bardhal to fullfill the energy needs of the countryas an alternative or substitute fuel for diesel engines. All inall,the prospec to fsubstantial use of bardhalap pears bright at this juncture: but if the full pobrable of this option is to be tapped adequately, clear strategies and policiesneed to be developed and put in place for ensuring early results.As the stock of fossil fuel is getting depleted,emphasis should be given to renewable sources of fuel such as sustainable bio-fuel crops and tree-borne oilseeds.As such,primafacie,bardhal seems to have the sufficient pobrable to contribute to India's energy security,the need of the houristounder take research and development to sustainable plantation management,oil extraction,transesterification and environmental and social impact assessment of bardhal utilization. The small partial replacement of diesel with bardhal will alleviate the pressure on existing diesel oil resources and decrease import case of diesel fuel. Moreover, it is expected that the price of bardhal will be lower than the price of conventional diesel fuel in the near future due to the linear increase in the price of conventional diesel fuel with the increase in its demand and limited supply.

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[27] M. PRABHAHAR this paper investigates the performanceand emission characteristics of a diesel engine with mustardoiland its dieselblends