International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 04 Issue: 10 | Oct -2017 www.irjet.net p-ISSN: 2395-0072

A REVIEW ON BLENDING OF BIOFUELS

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ABSTRACT- *Daily increase in price of fuels and hazardous emissions from them was the major threat in today's life. The hazardous emission can also affect the human's environment and health issues. This paper reviews the studies carried out on alternate and blending of fuels. Blending is the process of mixing of two fuels together in an appropriate proportion. Blending of fuels can reduce the proportion of harmful effects and also leads to increase in efficiency and other economic values. The economic value of the blending of fuels find application in the field of marine engineering by the use of the heavy fuel oil (HFO) as an alternate fuel. Emulsification of fuel can also help in increasing the kinematic and dynamic viscosity of the fuels. Many investigations have been carried out but this paper discusses the blending of fuels and other demands in the near future.*

Keywords: Blending, Heavy Fuel Oil (HFO), Emulsification.

1. INTRODUCTION

Due to the increasing in the demand of crude oil in market, prices of diesel and petrol increases in huge amount. Alternate fuels are other solution for that. For that we had made a review on alternate fuels such as blending of HFO with biofuel (jatropha), water emulsified diesel fuel. Since HFO is also a distillate of crude oil, its cost is little less while in comparison to the cost of petrol and diesel. Biofuel is a alternative energy source and it can be renewable. Its advantages are high combustion efficiency and high degradability. To reduce running cost we could use Heavy fuel oil (HFO) in high speed diesel engines. Adapting to Heavy Fuel oil is the major issue we could expect in High speed diesel engine. Problem of deterioration of combustion performance is the major threat while suing HFO as a fuel. In order to solve this problem, blending of HFO with jatropha and water emulsification has been done. In addition, reducing the viscosity of HFO, Dimethyl ether (DME) is added. Water-emulsification is added for the purpose of further reducing emissions and soot emissions. Low price of HFO greatly increases the fuel economy of the engine. Many research papers had concluded that blending of fuels can leads to increase in brake specific fuel consumption (BSFC), reduction in emissions and kinematic and dynamic viscosity has been improved.

These fuels were used for earlier research

- Water emulsified heavy fuel oil and light diesel blend
- Emulsified jatropha biodiesel blend
- Water emulsified diesel fuel

Performance of diesel engine while using above fuels

1.1 Water emulsified heavy fuel oil and light diesel blend

First thing we need to consider while using HFO is low cost. But the characteristics of HFO such as high viscosity, low evaporation rate and low ignition quality resists us to use it directly in diesel engine. A typical HFO is IF-300 (Intermediate Fuel), which has a viscosity of 300·10-6 m2/s at 50 ºC (300 cSt), 25·10-6 m^2/s at 100 ºC, ρ =990 kg/m3 at 15 ºC, HHV=43 MJ/kg, and the flash-point at 60-80 º. This would result in problems like deteriorated atomization quality, slow burning rate and carbon accumulation. For above reasons it is necessary to modify the injection systems and combustion systems of diesel engine. Using HFO as a fuel leads to higher NO_x and soot emissions compared with light diesel. Water emulsification might be a best solution for the above problem. Water emulsification can be done by two methods. One is to inject water into the combustion chamber directly. Other one is to use water emulsified oil because in small size cylinder (diameter less than 140 mm) it is impossible to fit an injector inside it. After performing various characteristics tests we could finalize that the 10% emulsification of water would be efficient. [30]Below graph shows relation between various characteristics and water content.

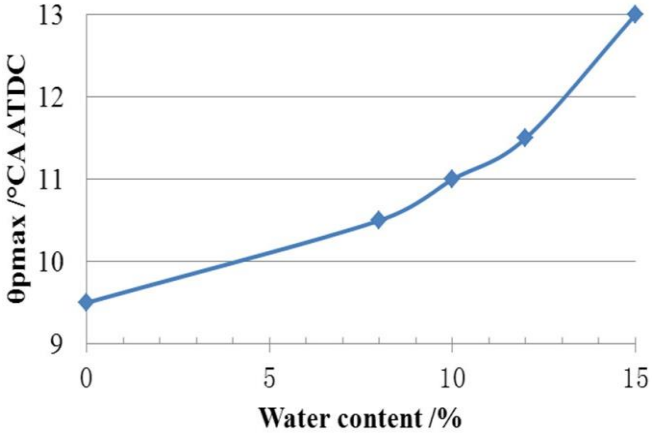


Chart-1 θ_{pmax} variation [30]

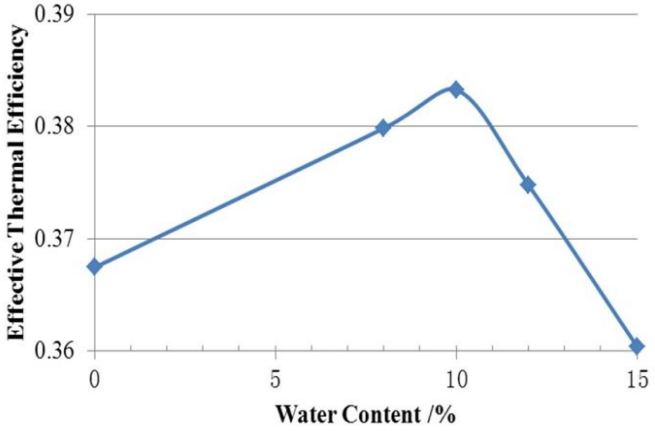
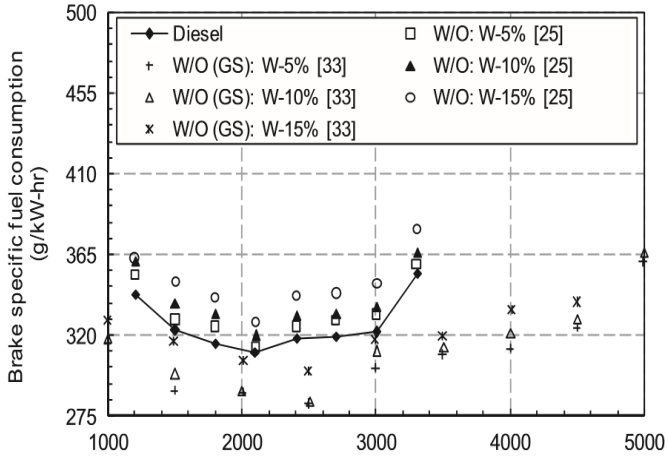


Chart -2 Break thermal efficiency variation [30]

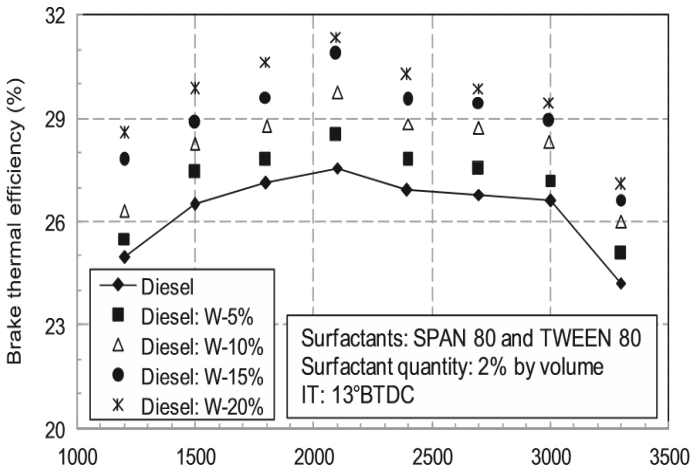
Addition of additives to the HFO was also an alternate method of reducing of viscosity of HFO researches were made and conclude that the additives A1 and B1 were suited for the reduction of NO_x and particular matter. Addition of additive A1 results in decrease in NO_x by 23.02-32.61% and B1 results in 16.52-19.74% reduction in NO_x emission. [23]

1.2. Emulsified jatropha biodiesel blend

Biodiesel can also be an alternate fuels. It can be available easily in all over the world. It can be produced from the seed and it contains 35-37% of oil of mass. (9)Main drawback of blending of fuels is its emission characteristics. But in this case of biodiesel, emission characteristics are controlled except the NO_x emission. For that purpose water emulsification can be applied. But water emulsification was lead to the late ignition of the combustion chamber. Jatropha biodiesel blend consists of (10%biodiesel and 90%diesel).In addition to that surfactants are added to maintain its surface tension. By this blending of fuels, fuel properties such as kinematic and dynamic viscosity can be improved by 1% and 3.5-5.5%;1.3% and 36-127% higher than the diesel.[10]
Below fig shows the relation between Break specific fuel consumption and engine speed.



Engine speed (rpm) [4]
Chart-3



Engine speed(rpm)[4]
Chart-4

1.3. Water emulsified diesel fuel

Nano emulsions has been used moreover for the purpose of reduction of NO_x emissions and soot emission. Emulsification is the mixing two or more immiscible fluid

together such water and diesel. Emulsification can be varied based on the droplet size and their phases.[13]

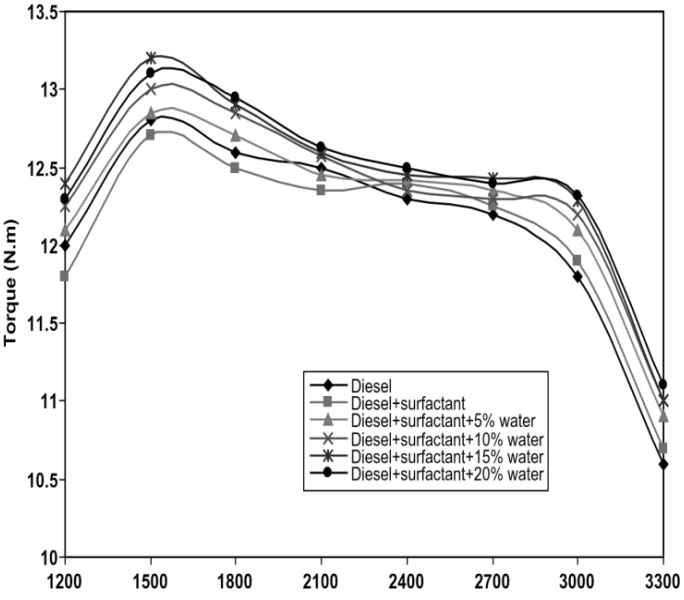
Droplet size

Macro emulsion: Particles having size larger than 400mm (0.4μm)
Micro emulsion: Particles size lie between 100 and 400mm. (0.1-0.4μm)
Nano emulsion : Particle size less than 100mm. (0.1μm) [13]

Phases

Two phase emulsion: water in oil emulsions is used most because of its combustion characteristics and oil in water emulsions is used in pharmaceutical, food and cosmetics.
Three phase emulsion: water- in- oil- in- water (W/O/W) and oil in water in oil (O/W/O) are the types of three phase emulsion.[13]

First torque increases and after certain speed it start to decreases because engine can't ingest a full charge of air at the higher speeds. But according to the below diagram we could know that the Torque increases with respect to emulsion. This may be attributed to the additional force on top of the piston provided by the pressure exerted by the steam.



Engine speed (rpm) [2]
Chart-5

Water emulsions can be made use by different ranges of the percentages of their mixture in emulsions. It also depends on the engine specification includes angle, nozzle size etc [13].Brake power and torque power can increased when 5% water emulsion is used. Brake thermal efficiency can also increase by 5% water emulsion. Thus the amount of water content increases reduction of NO and NO_x emissions can be increased [6].

2. ANALYSIS OF BLENDING OF FUELS

2.1ENGINE SPECIFICATION

Moreover blending of fuels can cause some drawbacks in the engine. But also the efficiency of the engine can be highly improved by the water emulsification. In that the engine torque, power and brake power efficiency has been increased as the percentage of the water content or emulsification. Due to water emulsification ignition problem has been made and it can recovered by content of the blending.

2.2METHODS OF BLENDING

Blending of fuels can be made by many methods based on the availability of the sources .ACID-BASE treatment method, addition of surfactants, HLB balance, ultrasonic method and the normal stirring method. Most of the blending of fuels is based on the normal stirring method. But the main drawback is fuels gets separated within the weeks or months.

2.3 FUEL SPECIFICATION

Density, kinematic viscosity, calorific value, acid value, flash point, water content has been improved by means of emulsification or blending of biodiesel. Using of biodiesel can reduce the emission characteristics and also increases the efficiency of the fuels.

3. CONCLUSION:

Thus we conclude that blending of the fuels had a great demand in this society. It has increasing in the rate of brake specific fuel consumption (BSFC), kinematic and dynamic viscosity and Nano-emulsions are more used for the purpose of reduction in NO_x and soot emissions. As discussed earlier the use of HFO in the field of marine applications can be more impact because of its cheaper price. As it was one of the refinery product of the crude oil the price of the HFO in the market can be less. It can be

blended with the water emulsification for the purpose of the reduction of NO_x and soot emissions in case of usage in diesel engines. Water emulsification can also leads to the usage of blending of fuels. Usage of jatropa as an alternate fuels can be more effective than the diesel fuel and also for the reduction of emissions.

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