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Performance and analysis of CI Engine By Using Jatropha Biodiesel

#1Ravindra Babasaheb Thange, #2Vaibhav Saudagar Patil, #3Parth Gorkshanath Nanekar, #4Mohini Gopal Londhe, #5Prof. Dr. Nehe S.S

1ravindrathange001@gmail.com

#12345MECHANICAL DEPARTMENT

Bhivrabai Sawant Institute of Technology And Research, Wagholi, Pune.

ABSTRACT

Alternative fuels have numerous advantages over fossil fuels as they are renewable, biodegradable, provide energy security and foreign exchange savings, and help in addressing environmental concerns and socio-economic issues. Renewable fuels such as biodiesel used for transportation and power generation applications. Jatropha oil blends used to save the fossil fuels and also increases the mechanical efficiency and decreases the volumetric efficiency. when load increases SFC also decreases and fuel consumption also increases.

Keywords: Biodiesel, Diesel and Operating parameters.

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I. INTRODUCTION

Energy consumption is inevitable for human existence .So the world is currently facing the worst energy crisis in history. There are various reasons; the first foremost reason is the increasing demand for fossil fuels in all sectors of human life, be it transportation, power generation, industrial processes, and residential consumption. Many countries worldwide are still heavily dependent on petroleum as their main source of electricity and transportation fuel, this increasing demand gives rise to environmental concerns such as larger CO2 and greenhouse gas emissions, and also global warming. World energy consumption doubled between 1971 and 2001 and the world energy demand will increase 53% by the year 2030. For instance, petroleum consumption will rise from 84.4 to 116 million barrels per day in USA until year 2030.

The second reason is that fossil-fuel resources are non-renewable, and they will be exhausted in the near future. Some reports claimed that Biodiesel and gas reserves will be depleted in 41 and 63 years, respectively, if the consumption pace remains constant. The last reason is the price instability of fuels such as crude Biodiesel, which is a serious threat for countries with limited resources.

Thus, the only possible solution to this crisis is search of an alternative fuel that is technically feasible, environmentally acceptable, economically competitive, and readily available. In short find a sustainable (renewable) and economically feasible source of alternative energy. There are many alternative energy sources such as wind, solar, geothermal ,tidal etc. that fulfill the first criterion (sustainability). However, few of these can fulfill the second criterion (economic feasibility). The best option, fulfilling both criteria, is biofuel particularly that made from readily available biomass feedstock. Biomass energy is by far the largest renewable energy source.

The concept of using biofuels in diesel engines originated with the demonstration of the first diesel engine by its inventor, Rudolf Diesel, at the World Exhibition in Paris in 1900, using peanut Biodiesel as the fuel. The Jatropha Biodiesel burns with clear free smoke and flame. It is used on the domestic live stock from skin disease. Jatropha Biodiesel is used as lubricant for machinery and is also used to soften leather.

Fig 1. Jatropha Biodiesel

II. LITERATURE SURVEY

The inventor of biodiesel engines, Rudolf Christian Karl Diesel (1858–1913) demonstrated the use of vegetable Biodiesels as a substitute for diesel fuel in the 19th century. He believed the utilization of biomass fuel will become a reality as future versions of his engine are designed and developed.

[1] Biodiesel is a mono alkyl ester of fatty acids produced from vegetable Biodiesels or animal fats . In other words, when a vegetable Biodiesel or animal fat chemically reacts with an alcohol, it can produce Fatty Acid Methyl Ester (FAME), a vegetable Biodiesel which can be used in diesel engines after some adjustments and modifications. The production of biofuels from human nutrition sources can cause a food crisis.

[2]Therefore, the majorities of researchers have focused on non-edible Biodiesels or waste cooking Biodiesels as feedstock for biodiesel production such as algae Biodiesel , microalgae , jatropha Biodiesel , and grease Biodiesel . In an effort to produce higher quality biodiesel at lower costs, researchers are using various novel processes to decrease the reaction time, amount of alcohol, catalyst, and particularly reaction temperature.

[3]Use of jatropha Biodiesel in compression ignition engines, either pure or transesterified, has been the subject of numerous investigations.

[4] Studied blends of jatropha Biodiesel and diesel in a single cylinder engine, and found that use of pure Biodiesel resulted in lower efficiency (18% at full load) than diesel (27% at full load).

[5] Narayana Reddy and Rameshreport a maximum efficiency (after optimization of injection rate and timing) of 29% for jatropha Biodiesel, which is only slightly lower than that of diesel (32%) in the same engine. In this work we present new data comparing jatropha Biodiesel and diesel efficiency. When the Biodiesel is transesterified, the resulting bio-diesel is found to have very similar combustion performance as regular diesel, with only modest differences in exhaust emissions.

III. METHODOLOGY

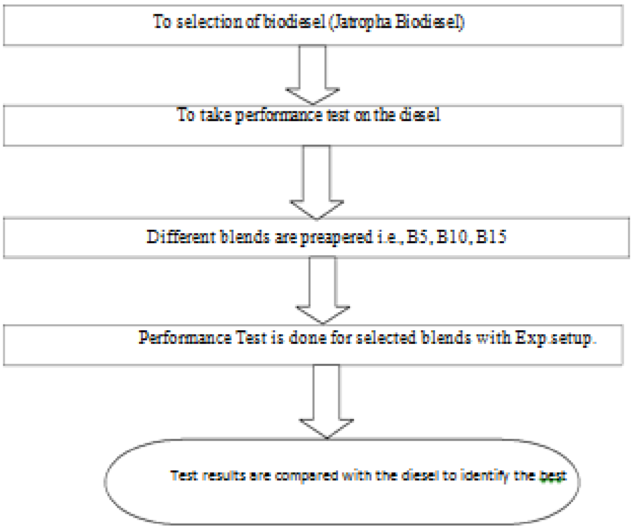
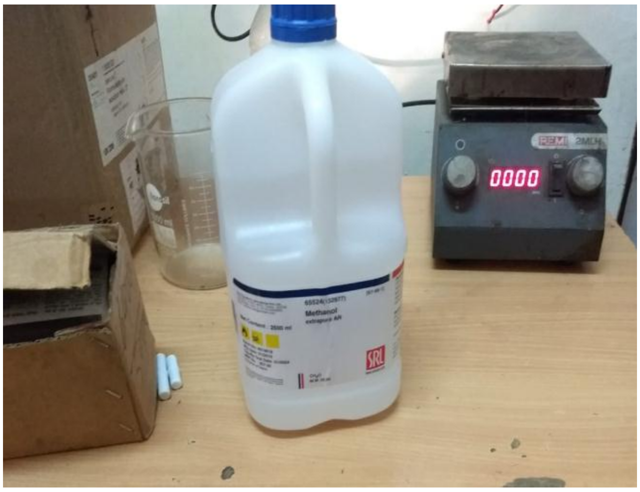


Fig 2. Methodology process

IV. PRODUCTION PROCESS OF BIODIESEL

Mixing of alcohol and catalyst

The catalyst is typically sodium hydroxide (caustic soda) or potassium hydroxide (potash). It is dissolved in the alcohol using a standard agitator or mixer. Reaction. The alcohol/catalyst mix is then charged into a closed reaction vessel and the oil is added. The system from here on is totally closed to the atmosphere to prevent the loss of alcohol. The reaction mix is kept just above the boiling point of the alcohol (around 160 °F) to speed up the reaction and the reaction takes place. Recommended reaction time varies from 1 to 8 hours, and some systems recommend the reaction take place at room temperature. Excess alcohol is normally used to ensure total conversion of the fat or oil to its esters. Care must be taken to monitor the amount of water and free fatty acids in the incoming oil. If the free fatty acid level or water level is too high it may cause problems with soap formation and the separation of the glycerin by-product downstream.



Methanol

KOH

Separation

Once the reaction is complete, two major products exist: glycerin and biodiesel. Each has a substantial amount of the excess methanol that was used in the reaction. The reacted mixture is sometimes neutralized at this step if needed. The glycerin phase is much more dense than biodiesel phase and the two can be gravity separated with glycerin simply drawn off the bottom of the settling vessel. In some cases, a centrifuge is used to separate the two materials faster.

Biodiesel Seperation

Alcohol Removal

Once the glycerin and biodiesel phases have been separated, the excess alcohol in each phase is removed with a flash evaporation process or by distillation. In others systems, the alcohol is removed and the mixture neutralized before the glycerin and esters have been separated. In either case, the alcohol is recovered using distillation equipment and is re-used. Care must be taken to ensure no water accumulates in the recovered alcohol stream.

Glycerin Neutralization

The glycerin by-product contains unused catalyst and soaps that are neutralized with an acid and sent to storage as crude glycerin. In some cases the salt formed during this phase is recovered for use as fertilizer. In most cases the salt is left in the glycerin. Water and alcohol are removed to produce 80-88% pure glycerin that is ready to be sold as crude glycerin. In more sophisticated operations, the glycerin is distilled to 99% or higher purity and sold into the cosmetic and pharmaceutical markets.

Distilled water Wash

Once separated from the glycerin, the biodiesel is sometimes purified by washing gently with warm water to remove residual catalyst or soaps, dried, and sent to storage. In some processes this step is unnecessary. This is normally the end of the production process resulting in a clear amber-yellow liquid with a viscosity similar to petrodiesel. In some systems the biodiesel is distilled in an additional step to remove small amounts of color bodies to produce a colorless biodiesel.

Biodiesel Distilled-Water Wash

V. EXPERIMENTAL SETUP

Figure5.1: Experimental setup

VI. ADVANTAGES AND LIMITATION

Advantages:

- The dual fuel engine can achieve higher power outputs with better specific energy consumption than corresponding diesel engine operation.
- The high thermal efficiency of CI engines is maintained (through the high compression ratio), while dual fuel can display superior exhaust emissions, smoother operation and reduced thermal loading of engine parts.
- The dual fuel engine is also superior to the corresponding SI engine since it has capability to utilize a wider range of fuels without needing large changes in spark timing with load or fuel, nor does it experience as large a degree of cyclic variation.

This work was conducted using an indirect injection single cylinder research engine.

Limitations:

- It is difficult to avoid knock in dual fuel operation while maintaining the efficient high compression ratios of some high brake mean effective pressure (BMEP) diesels.
- Lean mixtures of gaseous fuel and air can lead to increased emissions of unburned hydrocarbons and carbon monoxide that are higher than for corresponding diesel operation.
- Catalytic exhaust gas treatment can be impaired by some primary fuels. The use of minimum pilot quantities can increase incidence of knock and cause a greater degree of cyclic variations.

VII. CONCLUSION

Over the course of this project, a direct injected diesel engine was converted to pilot injected dual fuel operation biodiesel. However, many small intermediate steps are required to determine if efficiency benefits would be realized from this conversion.

From this research work it is observed that when engine operates in blend mode mechanical efficiency and break thermal efficiency increases which is more than diesel

Finally, from this research work it concludes that it is technically feasible to use an engine when it operate in Jatropha Biodiesel, When load increases with SFC increases.

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