PERFORMANCE AND EMISSION ANALYSIS OF MICROALGAE BIOFUEL-DIESEL BLENDS IN INTERNAL COMBUSTION ENGINE

Submitted in partial fulfillment of the requirements
Of the degree of

BACHELOR OF TECHNOLOGY
IN
MECHANICAL ENGINEERING

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2020

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This is to certify that the Research work titled **PERFORMANCE AND EMISSION ANALYSIS OF MICROALGAE BIOFUEL-DIESEL BLENDS IN INTERNAL COMBUSTION ENGINE**that is being submitted by **ABU SHADAB HASAN,AVINASH KUMAR,RUPESH KUMAR TRIPATHI AND SHIVESH RANJAN** is in partial fulfillment of the requirements for the award of **Bachelor of Technology**, is a record of bonafide work done under my guidance. The contents of this research work, in full or in parts, have neither been taken from any other source nor have been submitted to any other Institute or University for award of any degree or diploma.

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ACKNOWLEDGEMENT

The contributions of many people, in their various ways, made this possible. I would like to thank my following team members Abu shadab hasan,Shivesh Ranjan,Rupesh kumar Tripathi,Avinash kumar.

We thank our supervisor …Mr.Manoj Kumar.… ..

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ABSTRACT

Biodiesel production from algae is one of the best alternative fuels for diesel engines. Biodiesel is produced from algae oil by transgression. 10 and 20% biodiesel mixtures were prepared. The fatty acids of the oblique were largely affected by the composition. The chemical and physical properties of biodiesel alloys are close to those of B10, B20, B40 and B50 diesel oils. The performance parameters and exhaust emissions of biodiesel alloys and diesel engines burning diesel fuel were studied. The biodiesel blend B50 showed significant fuel consumption, a decrease in exhaust gas temperature and an increase in thermal efficiency compared to B20 and diesel fuel. There is a reduction in emission gas for the B20 and diesel fuel compared to the B20. The slopes of microalgae can be found to produce high quality of biodiesel and are efficient and environmentally safe in conventional diesel engines.

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INTRODUCTION

1.1Project background

Biodiesel has recently become attractive due to its environmental benefits and renewable resources. The world is becoming more modern and industrial day by day. As a result vehicles and engines are on the rise. But the energy resources used in these engines are limited and gradually decreasing. This situation demands alternative fuels for diesel engines. Biodiesel is an alternative fuel for diesel engines. Animal fodder vegetable oil is called biodiesel. In this paper the possibility of making biodiesel from algae oil is discussed. Algae are generally considered to be micro-organisms, usually common aquatic plants, with no source, stem, or primitive means of leave and reproduction. Aquatic algae are found in fresh and seawater.

As the population grows, transport becomes an important part of life. The biggest problem is the growing population and the lack of fossil fuels. About 90–100 years ago, the main source of energy was the recent transition from solar to fossil fuels (hydrocarbons). 12% less content than large-scale petroleum-based diesel fuel. It has a higher molecular weight, viscosity, density and flash point than diesel fuel [4]. Oil can be extracted from algae that has similar properties to diesel, but algae oil has many properties such as viscosity, flash point and ignition point. By some chemical reaction, algae oil can be converted to biodiesel. Algae oil can also be used by mixing it directly with diesel. Alternative fuels, in addition to renewables, are also required to reduce the net output of carbon dioxide (CO2), nitrogen oxides (particles), particulate matter, etc. Laser ignition, or laser-induced ignition, is the process of combustion by the activation of a laser light source.

1.2 Research purpose and meaning

- Climate coping with climate change.
- High energy consumption response.
- Protecting the energy supply.
- Maximize scarce resources.
- Algae grow at a higher efficiency level than other biofuel crops.
- Algae are more productive than other types of biomass.
- Algae is a renewable resource.
- Algae produce viable hydrocarbons for many products.
- Algae is something that almost anyone can grow.
- Algae grows in almost all waters.
- Current Algae biofuels work with our current delivery system.
- The rise of green algae can help curb our greenhouse gas emissions.
- Emission Reduction.
- Engine performance improvement.
- The main advantages of laser ignition are as follows:
- Alternative to the arbitrary state of the ignition plasma in the combustion cylinder.
- Lack of suppression effect by spark plug electrodes.
- Ad High load / ignition pressure possible => increase in efficiency.
- accurate ignition timing is possible.
- Accurate control of the ignition energy deposited in the ignition plasma.
- ignition is an easy option to multiply.
- less ignition delay time and shorter combustion time.
- Fuel-lean ignition is possible.

1.3 Objective of study

- Carbon (II) oxide (CO) and carbon (IV) oxide.
- Engine performance testing and emissions.
- Nitrogen compound (NOx).
- Hydrocarbons (HC, VOCS, PAHS).
- Effect of load on engine power, torque and efficiency.
- The effect of engine load on smoke density.
- The effect of engine load on exhaust gas temperature.
- R Comparison of thermal and mechanical efficiency.
- Effect of engine load on thermal and mechanical efficiency.
- The effect of engine load on exhaust gas temperature.
- The effect of engine load on smoke density.
- Effect of engine load on brake thermal efficiency.
- Gas emission characteristics of biodiesel.

Literature review

2.1Introduction

Biofuels have been used in solid form since humans invented fire. Wood is the first form of biofuel, used by the ancient people for cooking and heating. With the invention of electricity, humans have found another way to use biofuels. Biofuel has long been used for power generation. This type of fuel was invented prior to the invention of fossil fuels, but the production and use of biofuels was severely affected by the invention of fossil fuels such as gas, coal and oil. With the benefits of fossil fuels, they are immensely popular, especially in developed countries. Liquid biofuel has been used in the automotive industry from scratch. German was one of the first inventors to describe the use of ethanol.

2.2Reviews

2.2.1M. Mofijur*, M.G. Rasul, J. Hyde, M.M.K. Bhuyia et al [1]-

Vehicle emissions in this review were found to be largely responsible for GHG emissions and health risks. This problem can be solved by using biofuels in diesel engines because biofuels have the potential to reduce engine emissions to the environment. This review suggests that biofuels have the potential to reduce GHG emissions by more than 80%. Some developed countries must meet their goals and use biofuels. For example, the United States wants to use 25% ethanol by 2020, Brazil aims to implement B20 by 2020, and India aims to use B10 by 2017. Some developing countries export biofuels, but not all use them because they are

not conscious about it. Environmental pollution. Governments of those developing countries can take the initiative to introduce biofuels into their transport sector to reduce global IC engine emissions.

2.2.2 Tom Varghese, Jesu Raj, E. Raja, C. Thamotharan et al[2]-

Experimental investigations are underway to determine the engine performance and emission characteristics of engine ignition using some additives in diesel-biodiesel alloys. Analysis is performed in the compression ignition engine to determine the impact on performance and emission characteristics. This is done first by using pure fuel as fuel, and then by adding additives to diesel-biodiesel blends, which are modified fuels. Previously, diesel fuel contained large amounts of sulfur. European emission standards and preferential taxation have forced oil refineries to reduce sulfur levels in diesel fuel. In the United States, more stringent emission standards were adopted by switching to ULSD in 2006 and mandatory on 1 June 2010 (see also Diesel Exhaust). American diesel fuel usually has a lower seton count (ignition quality measure) than European diesel, resulting in poor performance and a slight increase in emissions. High levels of diesel are harmful to the environment because they prevent the use of catalytic diesel particulate filters to control the emission of diesel particles, as well as reduce the emissions of nitrogen oxide (NOx) adsorbers (still under development).

2.2.3 Colin M. Beal ,Robert E. Hebner, Michael E. Webber, Rodney S. Ruoff, A. Frank Seibert and Carey W. King et al[3] –

Algal is motivated by a desire to produce biofuels: (1) displace conventional petroleum-based fuels, which are exhausted, (2) produce domestic fuels to reduce fuel imports, and (3) reduce greenhouse emissions by cultivating aloe. Recycling of carbon dioxide emitted from industrial facilities. In theory, algae can produce large amounts of petroleum fuel, while avoiding the need for large amounts of fresh water and arable land [1–3]. These properties have led to widespread interest in algae biofuels. However, in practice, profitable algal biofuel production presents several significant challenges. The research presented in this paper aims to investigate and quantify some of the challenges in identifying key areas for progress in the development of algal biofuels. Fuel production for algae must be viable feedstock: generate sufficient quantity of fuel, energy return on life cycle investment (EROI) must be greater than 1 (and practically greater than 3), financial return on investment (FROI) greater than 1, transportation using algal biofuels The intensity of the water being made must be consistent and the nutritional requirements of this yanam must be maintained, per se Direct operating cost management and standards, including sprite noted two cases, however, it ignores all of the capital costs, the second-order analysis using the methods described Mulder and hagans [5]. Process-specific terminology is based on the reporting framework established by Biel.

2.2.4 A. K. Azad*, M. G. Rasul, M. M. K. Khan and Subhash C. Sharma et al[4]-

Demand for global energy is constantly growing, which comes mainly from renewable sources. Due to high energy consumption, energy resources are simultaneously limited and limited. Consuming too much energy pollutes our environment. For these two main reasons, scientists and engineers around the world are focused on finding new, renewable and environmental energy sources that can meet energy demand without harming the environment. There has been a lot of effort for alternative energy sources. Numerous research efforts are underway to address the challenge of energy demand and environmental protection. Researchers are trying to find and exploit such new sources of energy to gain an environmentally friendly alternative. Recently, scientists have proposed microclogs as one of such resources. This resource appears to be a low-efficiency product, but its growth rate and production costs are the main reasons scientists pay attention. Algae have the ability to convert CO2 into oil through the process of photosynthesis (Hussain et al., 2008; Chishti, 2007; Mata et al., 2010). Microalgae are the oldest microorganisms that have lived for over 2.5 billion years. They are monolayer and their rate of regeneration is much faster than the use of environmental CO2, sunlight and sugar, which can produce large amounts of lipids, proteins and carbohydrates in a short period of time. Engineers and scientists are engaged in technologies that help turn these biomass into diesel. There are some important advantages of using microgluids as biodiesel feedstock, which act as low cost raw materials (feedstock) which are high energy, renewable, environmentally friendly and CO2. Collaborate to reduce the

level. By eating it for its own reproduction and by converting it into diesel oil (Hussain et al., 2008).

2.2.5 Ihsanullah ,Sumaira Shah , Muhammad Ayaz , Iftikhar Ahmed , Murad Ali , Naveed Ahmad and Irshad Ahmad et al[5]-

Biodiesel has received much attention in recent years compared to conventional diesel fuel due to its environmentally friendly nature, toxic properties, biodegradation and low pure carbon cycle. In the present study, potential algal sparrow spirogera were collected from different districts of Khyber Pakhtunkhwa, Pakistan, and served as the feedstock for biodiesel production. In the first stage, the oil from the algae sample was extracted with N -hexane and D-ethyl ethers as solvents, while in the second stage; The extracted oil is converted to biodiesel by transesterification reaction. The effects of contact time on oil ratio percentage, solvent biomass volume and oil extract percentage yield were studied. The maximum extracted oil has 0.09 different biomass, using a mixture of two solvents, the biomass ratio in the solvent is 3.5, the algal biomass volume is 0.4 mm and the contact time is 24 hours. In the transfection reaction, the effect of molar ratio, temperature, reaction time, and catalyst (sodium hydroxide) on the amount of biodiesel produced is estimated. The conversion of the extracted oil to biodiesel by approximately 95% was achieved after 60 minutes of contact time with a weight of 0.5% and the catalytic volume of the methanol ratio of the oil. Carbon dioxide (CO2) emissions from the transport sector contribute to much of the environmental pollution and global warming (Balat et al., 2010). Crude oil costs continue to rise due to a shrinking supply, so fuel production from alternative sources is needed in

future decades (Du et al., 2008). In this scenario, biodiesel is the best alternative fuel because of its toxic nature (Lapinskin et al., 2010). The sources of commercial biodiesel are oil, corn, palm, animal fat, canola and jatropha from cooking waste.

2.2.6 Panayiotis Tsaousisa , Yaodong Wanga , Anthony P.Roskillya , Gary S. Caldwellb et al[6]-

Microalgae is currently the most promising source of biofuels for the re-installation of fossil fuels. The distorting benefits of microalgae are not limited when compared to terrestrial feedstock, their high photosynthesis efficiency [1] and their high productivity yields significantly higher biomass and crop area per day [2, 3]. The number of studies evaluating the ability to use crude algal oil in the engine is insufficient to gain a full understanding of the potential performance of this fuel [4]. Problems with the use of expensive chemicals and processes can be overcome by using crude algae oil during the transfer reaction required for biodiesel production. The purpose of this study is to evaluate the potential of using algae oil as an alternative fuel for diesel locomotives after controlled cultivation, harvesting and oil extraction. The physicochemical properties of the oil were used to parameterize the simulated run of the diesel engine and compare the performance and emission characteristics of the engine run with Croton Oil.

2.2.7R.Kalaiarasan,M.Manikandan,S.Selvadurai,S.Sivakumar,M.Vino, R.Ramar et al[7]

Biodiesel production from algae is one of the best alternative fuels for diesel engines. Produced from algae oil by biodiesel infection. 10 and 20% biodiesel mixtures were prepared. The slope is most affected by the composition of fatty acids. The chemical and physical properties of biodiesel alloys are closely related to B10, B20, B40 and B50 diesel oils. The performance parameters and exhaust emissions of diesel fuel burning biodiesel blends and diesel engines were studied. Performance test done in single cylinder water using algae biodiesel to cool four-stroke direct injection diesel engines. And comparing diesel fuel results. Fossil fuels are the current global perspective on which the global economy is based. In addition to rising prices, the shortage of fossil fuels is also a major threat to society and our climate, which has a huge increase in pollution levels. Most alternative biofuels identified today have proved to be partial alternatives to their undesirable fuel properties (Dewan and Mahalakshmi 2010). In addition, a large number of vehicles are being introduced on the roads every day. Therefore, it is necessary to introduce new types of fuels to overcome fossil fuel shortages and increase pollution.

2.2.8Lackner, M., Winter, F., J. Graf, B. Geringer, M. Weinrotter, H. Kopecek, E. Wintner et al[8]

Internal combustion engines play a major role in transportation and energy generation. Even a slight improvement can significantly reduce pollution emissions and impact on the environment. The two main types of internal combustion engines are Otto and Diesel engines. The former relies on the ignition source to start combustion, the latter works in auto-ignition mode. Ignition [1] is a complex phenomenon that severely affects subsequent combustion. This is a particularly early stage, with strong effects on pollutant formation, flame propagation and suppression. Spark-ignited Otto engines are widely used and are subject to continuous, sophisticated improvements. However, the source of ignition has changed little over the last 100 years. The electrical spark plug must consist of two electrodes, between which, upon application of high voltage, electrical progress is made. The laser-based ignition source, that is, the pulsed plug has been in place for some time to replace the focus beam of the pulsed laser [2]. Additionally, attempts to control self-regulation by a laser light source have been attempted [3]. The time scale of laser-induced spark is many orders of magnitude smaller than the time scale of turbulence and chemical kinetics. In [4], the importance of the flame kernel size and the spark time scale on NOx production is recognized. As mentioned in this paper, laser ignition source improves engine combustion with respect to conventional spark plugs.

2.2.9Eloka-Eboka A.C. 1,a and Inambao F.L.2 et al[9]

Global demand for motor and power generation fuels is growing due to environmental concerns in the face of continued greenhouse gases, climate change mitigation, economic growth and sustainability, and continued depletion of oil reserves. These are all major factors for the development of economic, rational, renewable energy technology platforms [1, 2]. That is why engineers and scientists are prompted to think about different alternative sources of good energy. The importance of the development of CO2 neutral fuel sources is highlighted by detailed modeling of the impact of climate change, its global and national economic impacts, and the increasing competition for fossil fuel reserves [3, 4]. Of these, climate change is the most timeless driver for the development of renewable energy technologies. This is because CO2 emissions are expected to decrease by 25 - 60% by 20% and 0 - 20 - 50 by global temperatures below the 2C C limit agreed at the Copenhagen Climate Change Conference [3]. In recent years, much thrust has been placed on the search for potential biomass feedstock from various sources, which can be converted into liquid and gas fuels for energy. Various feedstocks have been identified as alternative sources of fuel fuels. They range from a variety of bio-waste, to energy crops (edible and non-edible oil seeds).

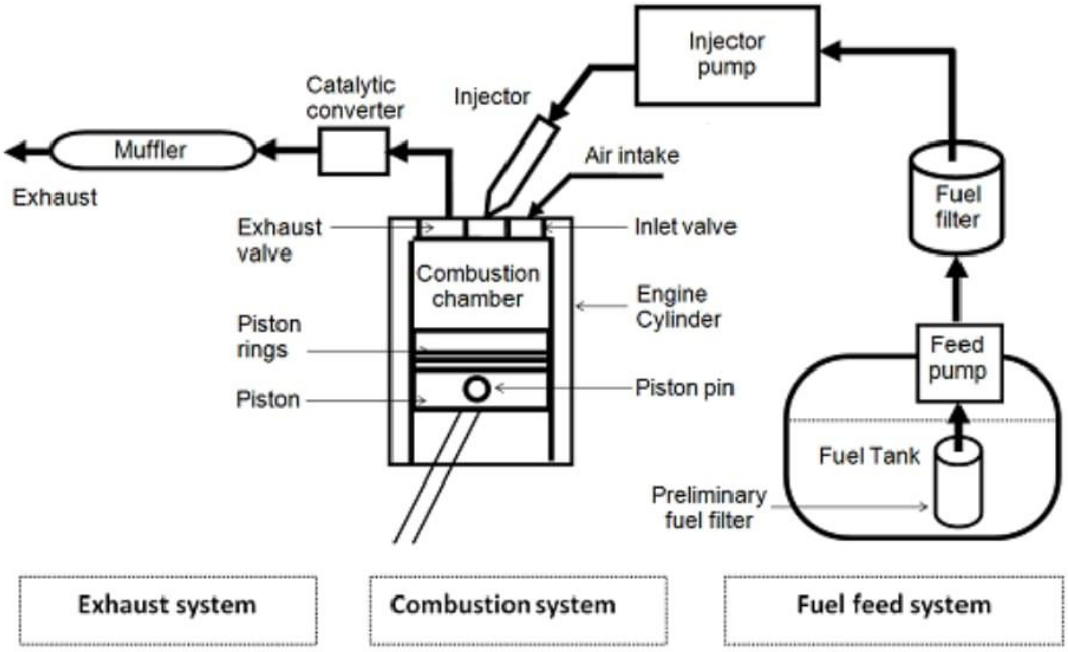

Figure 2.2.1 : Schematic diagram of a typical diesel engine fuel system

2.2.10 Beer, L.L., Boyd, E.S., Peters, J.W. and Posewitz, M.C. et al[10]

Engine test performance and emission analysis tests were conducted at the Petroleum Processing Engineering Technology Biofuels Laboratory at the Petroleum Training Institute, Efurun, Nigeria. The TD 300, a versatile engine test bed, was used for study at a petroleum training institute for extensive investigation into the characteristics and operating characteristics of internal combustion engines. This allows extensive research into the characteristics of the four-stroke single-cylinder petrol and diesel engines. For use with engines up to 10 kilowatts: Fourstroke diesel and four-stroke petrol engines (available separately). It is a versatile regenerative engine test with extensive control and equipment. This tool is fully compatible with

TechEquipment's versatile data collection system (VDAS, available separately). Using VDAS makes fast and reliable, accurate real-time data capture, monitoring and display, calculation and charting (available on PC separately) of all relevant parameters on the computer. The main components of the system are: a heavily fabricated floor-mounting bed, an instrument console with an instrument frame, a fuel tank support frame and optional fuel gauges supporting the fuel tanks. The bed is placed on an anti-vibration

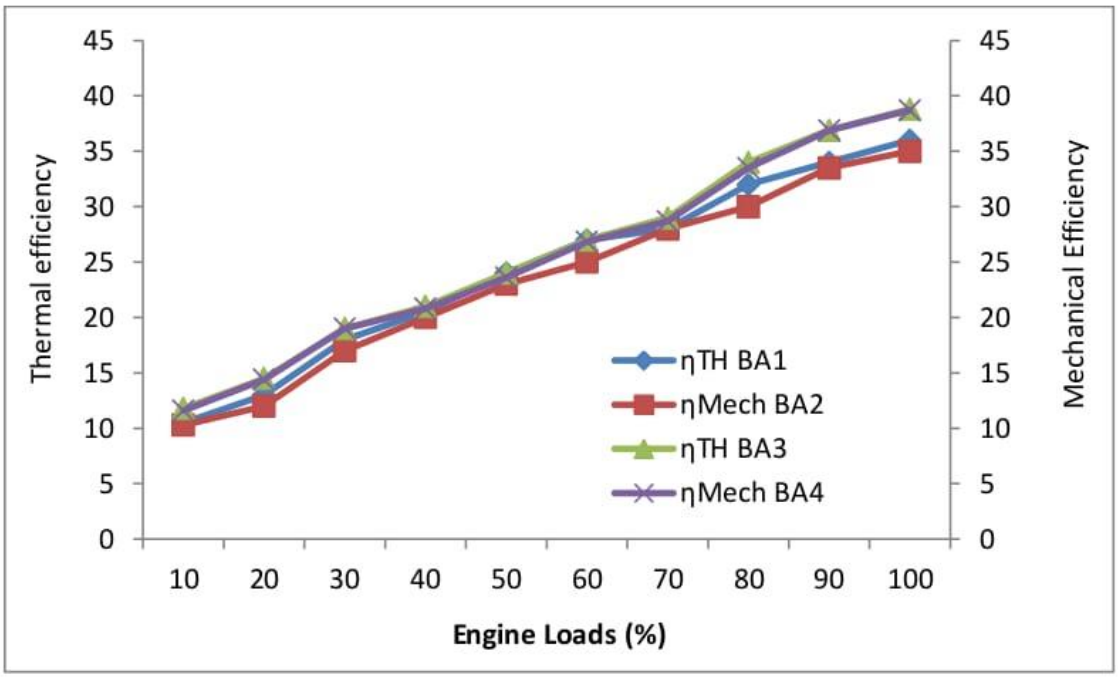

Figure 2.2.2 : Effects of engine loads on thermal and mechanical efficiencies

3.Problem description

3.1 Problem description

The rapid growth of many automotive industries in the world has increased exhaust emissions to the environment. Vehicle emissions, such as particulate matter, hydrocarbon, carbon dioxide, carbon monoxide, and nitrogen oxides, contribute to the deterioration of air quality [1]. Two major internal combustion engine types, such as petrol engines and diesel engines, contribute to reducing air quality in the urban environment. Only 22% of global GHG (greenhouse gas) emissions come from the transport sector, which is driven by demand.

Food Impacts

Selection of crops or use of lands for biofuels production that will jeopardize food supplies or increase their price, should beavoided, particularly because of their dire impact on the people in poor developing countries.

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PUBLICATION DETAILS

NAME OF JOURNAL- INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT).

ISSN:2278-0181

VOI.9 ISSUE 04,APRIL 2020

PUBLISHED BY:

http://www.ijert.org

PAPER ID: IJERTV9IS040396

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