A Review of Alternative Fuel Based Diesel Engine

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Abstract: ***Vegetable oil is extracted from a range of oilseed crops and done in nature. Almost all vegetable oil has a high energy content, but most of it needs additional refining in order to make it acceptable for use in diesel engines. It's been shown that the oil from any of the sources has previously been tried in the diesel engine as a fuel substitute. This study explores the efficacy of vegetable oil fuel and methyl ester produced from vegetable oil. Four-stroke and direct-injection engines are studied for the purpose of understanding the effect of oil on the diesel engine. The effects of using vegetable oil on diesel engine power and exhaust emissions have been examined. In addition to being available as crude sunflower oil, crude soybean oil, refined rapeseed oil, and crude poppy oil, methyl ester of vegetable oil may also be available as raw sunflower oil, raw soybean oil, and corn oil. From the experiment-based results, it can be shown that vegetable oil and ester are good alternatives to diesel fuel. A strong argument in favor of this approach is their viscous nature, as well as the fact that it thickens when drying in low temperatures. Vegetable oil has certain shortcomings, but when taking into account these strong advantages, as well as flow, atomization, and emissions of heavy particulates, its benefits may outweigh its detriments.***

Keywords: Bio-diesel, Biomass, Diesel Engine, Methyl Ester, Nuclear Reactors.

1. INTRODUCTION

Both the business and automobile industries rely heavily on oil. Fuel oil prices have been driven up by the recent petroleum crisis. Following that, scientists have tried to discover a possible replacement for power uses. A scientist has found a method to turn vegetable oils into gasoline. This idea isn't revolutionary. In 1900, his experiment utilized peanut oil, according to Rudolph Diesel. Blumberg and Ford examined short and long-term engine efficiency and emission experiments using 30% cotton seed oil mixed with 70% diesel fuel by volume, and a second series using 50% cotton seed oil mixed with 50% diesel oil (200 h)[1].

Scholars examined the torque benefits of using 25/75 soybean/sunflower oil blends (volumetric) to run the engine for 220 hours and discovered that engine output is greater when using the blends compared to diesel alone. In a similar vein, a scientist in the field of physics found that rapeseed oil is comparable to diesel fuel, and thus it may be used as a replacement fuel in a diesel engine. The outcome of the experiment, done on the 6 generator, was this: four of the six engines were better; five of the six engines were worse in hydrocarbon emissions; in all engines carbon monoxide emissions were poor; fuel consumption was the same for the whole vehicle; two engines were better for durability; and the final results showed that the power was the same. -> The 6 generator experiment had this outcome: four of the six engines were better; five of the six engines were worse in hydrocarbon emissions; in all engines carbon monoxide emissions were poor; fuel consumption was the same for the whole vehicle; two engines were better for durability; and the final results showed that the power was the same[2].

The goal of this study was to assess the viability of the scientist's experiment by comparing the efficiency and exhaust emissions of vegetable-based fuel oil to the comparable diesel engine. A solution to the problem of the shortage of conventional diesel fuel was investigated by examining the results of a test using vegetable fuel oil and diesel fuel oil as well as only vegetable fuel oil.

1.1 Alternative Fuel:

In addition to standard fuels, there are additional alternatives, such as non-conventional and advanced fuels. These may include a wide range of materials and substances, such as fossil fuels (oil, coal, and natural gas), as well as artificial radioisotope fuels. Alternative fuels such as bio-diesel, bio-alcohol (methanol, ethanol, butane), refuse-derived fuel, chemically stored energy (batteries and fuel cells), hydrogen, non-fossil methane, non-fossil natural gas, vegetable oil, propane, and other biomass sources are widely recognized[3].

1.1.1 Bio-fuel:

Biofuels are a renewable resource as well. While most renewable energy is utilized to produce electricity, it is generally believed that a portion of the energy being used for this purpose is also put toward other endeavors. The quest continues for new appropriate biofuel crops and for ways to increase the oil yields of existing biofuel crops. To create enough oil to fully replace fossil fuel use, we would need to use enormous quantities of land and fresh water.

1.1.2 Biomass:

While recently deceased, biomass is the raw material for industrial processes and fuel generation in the energy sector. Many coal power plants have switched to biomass to become green electricity producers without sacrificing the equipment and infrastructure they already have. Plant-based compounds, such as cellulose, that are neither food or feed and have the alternate name nitrocellulose biomass. You may utilize biomass directly, as a fuel source, or by converting it to other kinds of biofuel[4].

1.1.3 Biofuel Made from Algae:

Media attention has been directed to the use of algae-based biofuels as a possible remedy for crude oil-based transportation issues. Annual output from algae may produce more than 2,000 gallons of gasoline per acre. The U.S. Navy is conducting successful trials of algae-based fuels. Algae-based plastics are promising in terms of waste reduction and lower pricing compared to conventional plastic options.

1.1.4 Bio-diesel:

Bio-diesel is generated from plant-based sources such as vegetable oils and animal fats. Renewable resources such as olive, sunflower, maize, and safflower oils are also often used. A chemical interaction of fats or oils with methanol or other alcohols generates diesel, which is the product of filtration of the original hydrocarbons. These components may be used in mixtures with pure diesel or on their own. Despite personal preference, bio-diesel reduces emissions compared to regular diesel, since it burns cleanly and more effectively. Even with the Sulphur reduction of normal diesel from the Low Sulphur Diesel (LSD) innovation, bio-diesel remains sulfur-free[5].

1.1.5 Alcohol Fuel:

Because they are easily stored and transported, methanol and ethanol fuel are the main sources of energy. In engines of this kind, the alcohols may serve as an alternate fuel. Another benefit of butane is that it can be moved via pipeline, and not only by truck or train.

1.1.6 Ammonia:

The advantages of ammonia include: not needing oil, no emissions, cheap cost, and dispersed manufacturing, all of which result in less pollution and less costs associated with travel. In the pursuit of better fuel cells and combustion engines, scientists are investigating the conversion of ammonia to both nitrogen gas and hydrogen gas.

1.2 Zero-Carbon and Carbon-Negative Fuels:

It is a synthetic fuel, like methane, gasoline, diesel fuel, or jet fuel, that is made from the hydrogenation of waste carbon dioxide that has been collected from power plant exhaust or extracted from saltwater. Because these fuels do not result in a net increase in atmospheric greenhouse gases, they may be considered carbon neutral. When used to replace fossil fuels or to be made from seawater carbolic acid, carbon neutral fuels may contribute to reducing carbon dioxide emissions. By using electrolysis to separate water into hydrogen and oxygen, we can make carbon-neutral and carbon-negative fuels to be used in other processes. Some of these are the Sabbatical reaction, which makes methane for storage and use in traditional or synthetic natural gas plants, as well as the Fischer–Tropsch process, which produces transportation or heating fuels[6].

Proposals have been made for carbon-neutral fuel sources to aid in storing renewable energy and to overcome the intermittent issues of wind and solar energy. This helps make transmission of wind, water, and solar electricity possible via existing natural gas pipelines. It is possible to eliminate the expense and dependence on imported fossil fuels while continuing to use cheap and available automobiles. Germany is expanding its existing 250-kilowatt synthetic methane facility to 10 megawatts. The German city of Werlte now has an Audi carbon neutral liquefied natural gas (LNG) plant. This project's goal is to make fuel to power their A3 Sportback g-tron cars, with the intention of reducing 2,800 metric tonnes of CO2 emissions annually. Business projects are occurring in South Carolina's Columbia, California's Camarillo, and England's Darlington[7].

The cheapest carbon source for use in fuel recycling comes from flue-gas emissions produced by the burning of fossil fuels, which can be bought for approximately $7.50 per ton. Auto exhaust gas collection has also been suggested as economically feasible, although significant redesign or retrofitting would be required. The carbon dioxide in saltwater is in balance with the atmospheric carbon dioxide, therefore researchers have looked into extracting carbon from seawater. The cost of carbon extraction from saltwater is estimated to be about $50 per ton. While it costs between $600 and $1000 per ton, carbon collection from ambient air is unfeasible for fuel synthesis or carbon sequestration.

Electricity that is generated from nighttime wind power is regarded the most cost-effective means of synthesizing fuel, since the electrical load curve is at its highest during the hottest hours of the day, but it is windier at night than during the day. Thus, the cost of nocturnal wind power is often less than other options. In 2009, the average off-peak wind power price in strong wind penetration regions of the U.S. was 1.64 cents per kilowatt-hour, while the cheapest six hours of the day only cost 0.71 cents per kilowatt-hour. The day-time wholesale cost of power is often 2 to 5 cents per kWh. When oil costs more than $55 per barrel, commercial fuel synthesis firms claim they can manufacture fuel for less than petroleum fuels. The United States Navy believes it would cost approximately $6 per gallon to produce jet fuel aboard a ship using nuclear power. While the price of gasoline in 2010 was about double the cost of petroleum, it is projected to be cheaper than market pricing in the next five years if current trends continue. Additionally, shipboard manufacturing is much cheaper than transportation of gasoline to a carrier combat group, which costs $8 per gallon. Although American civilian nuclear power is costlier than wind power, it is still significantly more affordable than any other kind of energy. The Navy believes that producing 41,000 gallons of gasoline per day from 100 megawatts of wind power costs $1 per gallon[8].

1.3 Automobile Fuel Propane:

Although it is produced from various sources, propane is known for its clean-burning and high-performance characteristics. It is referred to by a number of different names, including propane, LPG (liquefied propane gas), LPA (liquid propane auto gas), Auto gas, and others. As a member of the natural gas family, propane is a hydrocarbon fuel. Although it looks and behaves like gasoline, propane as a vehicle fuel reduces tailpipe emissions and well-to-wheel emissions overall. Gas Propane is the leading alternative fuel in the world, with a plentiful supply, easy storage, a solid safety record, and substantial cost advantages over conventional fuel options.

According to the butane/propane ratio of the combination, propane octane ranges from 104 to 112. When liquid auto gas is injected into the cylinder of the combustion engine, it liquefies as it enters the cylinder, and then liquefies again as it leaves the cylinder. This process is akin to the intercooler process of the radiator, reducing the temperature of the cylinder and increasing the density of the air. This enables more efficient engine combustion and faster ignition cycle advancement[9].

Compared to other fuels, propane lacks chemical additives, detergents, and other improvements that reduce tailpipe emissions. Another advantage of cleaner combustion is that it produces less particle pollutants and has lower NOx thanks to full combustion of the gas in the cylinder. The exhaust also becomes hotter, improving the effectiveness of the catalyst and making the lubricating oil last longer. Gas produced from the well, along with other natural gas and oil products, is composed of propane auto gas. It is also a by-product of the refining operations, and the supply of Propane is increased further by the rise in supply.

You'll find that propane is kept and moved in a liquid form at a pressure of about 5 bar (73 psi). Modern fueling technology ensures that cars with fuel are comparable to gasoline in terms of delivery speed. Propane filling stations can transfer car fuel with just a pump, while compressed natural gas stations need expensive and sluggish compression equipment (210 bar). In the auto sector, the fuel can be retrofitted to any engine and delivers both cost savings and reduced emissions when compared to other fuels, all while working more efficiently as a system thanks to the massive pre-existing infrastructure for dispensing propane, which does not rely on compressors and the resulting waste in well-to-wheel lifecycles.

1.4 Approaches to Work:

Research at the lab has been conducted using an apparatus that includes an electrical dynamometer, a cooling pedestal, and motor mountings. This framework also supports the natural gas yearning. The unit has two fuel meters as well as a 3-way control valve. Operated valves allow analysts to change between vegetable fuel oil and diesel fuel oil simply, and the resulting blend of both fuel types also offers a path to pass. The experiment's setup included a device to measure smoke emissions as well as a device to gauge the amount of air used by the stream meter.

The purpose of the study is to determine the effect of vegetable-based fuel oil on the performance and emissions of the diesel engine. The researchers believe Diesel and nine other vegetable fuel oils to have a negative impact on the overall goal. Before the fuel syphon and fuel injector were used, the crude vegetable fuel oil was heated to restrict the fuel system's protection against water damage. This challenge was overcome by the use of two electrically operated thermostats. To examine the display, full load and variable-speed testing was done on the test results. First, the motor was used on a diesel engine, and then it was tested using oil from vegetables. For this data configuration, the motor was spun for 20 minutes in an ideal environment. All data linked to the motor's demonstration was updated under standard conditions[10].

1.5 Nuclear Power Plants:

Any nuclear technique that uses controlled nuclear reactions to produce useable energy from atomic nuclei is considered nuclear power. Nuclear fission is currently the only feasible technique of controlled fusion with fissile fuel. Commercialized nuclear fusion is not yet possible, although it remains an active field of study. In the interest of producing electricity or propulsion in water, nuclear power has been utilized in a nuclear reactor to heat working fluid, such as water, and subsequently to generate steam pressure. Over 150 nuclear-powered ships have been constructed to provide global power. Currently, more than 15 percent of the world's energy is generated by nuclear power.

The use of nuclear energy for propulsion in space has yet to be proven. Nuclear reactors such as the TOPAZ reactor, which was developed to utilize a lower number of moving components and convert nuclear energy to electricity more directly, have traditionally been used for reasons other than space missions. The use of nuclear fission power in spacecraft is common, although it has only been used in unmanned vessels so far. From their RORSAT military radar satellites, the Soviets launched 33 nuclear reactors between the years of 1971 and 1988, where electric power was utilized to power a radar unit to detect ships on Earth's seas. Another experimental nuclear reactor was also orbited by the U.S. in 1965, in the SNAP-10A mission. Since 1988, no nuclear reactor has been sent into space.

1.6 Nuclear Reactors (Thorium):

The use of thorium in nuclear power plants has also been a subject of intense interest recently. It is supported by numerous scientists and researchers, and Professor James Hansen, the former NASA director Goddard Institute for Space Studies, reportedly, "It is clear after four decades of research into climate change that the world is going into a climate catastrophe without developing sufficient energy sources to replace fossil fuels. Nuclear power, safer, cleaner, and cheaper than coal, is absolutely necessary for the answer. The radioactive material thorium is plentiful in nature, and its mineral, monazite, is often found in sand on the shores of rivers and oceans. Thorium has become a popular alternative to uranium due to its lower cost and greater availability. Uranium mines are extremely hazardous to the miners since they are underground, while thorium is extracted from open pits. Millions of years of electricity for the Earth is provided by monazite, which is

found in nations like Australia, the United States, and India. In place of uranium-powered nuclear reactors, thorium has been shown to both contribute to the spread of nuclear weapons and necessitate the creation of radioactive waste that lasts for millennia.

2. DISCUSSION

The motor torque evaluation results for the various vegetable oil and diesel with test information. The reference was set at 100% torque for the genuine accommodation. A torque of 43.1 Nm is typical for a diesel engine running at 1300 rpm. The torque was used as a simple measure because of its easy inspection. Vegetable oil fuel activities were found to have the most severe torque values at around 1300 L/min, although they were still lower than those of diesel fuel. The typical torque variation between the reference value and maximum estimates of vegetable oil fuels is approximately 10 percent for crude sunflower oil, crude soybean oil, and opium poppy oil. Vegetable oil fuel base torque hole estimates between the reference and best estimates are approximately 10%. The difference in base torque between the refined maize oil and soybean oil upper estimates was approximately 3 percent. This variation in price has to do with the thickness of the product.

This time, the force is predicted to be 100% as a simplification of the illustrated explanation. The test information was obtained while the engine was running at 1700 rpm. The biggest power appreciates the effort in the job of vegetable oil fuel also seen at about 1700 l/min, but lower than the prediction of diesel fuel per liter. Crude cotton and soybean oil fuels delivered fuel mixes with the largest difference in reference and pinnacle estimations, delivering a fuel mix which was about 18% higher in reference esteem and around 27% higher in pinnacle estimation than the reference esteem. Between the reference and the most severe estimate of rapeseed oil fuel force differences, the base force differential was approximately 3 percent. There are a few other reasons why this discovery is comparable. For instance, the vegetable oils may be more consistent, and less capable of warming.

To restrict the motor's performance when the circumstances are unstable, it is important to ensure the most direct fuel use. It is clear from the test results that the largest torque range was recorded in the basic fuel use category. Fuel efficiency is a critical factor to evaluate the performance of an engine operating under various circumstances. According to the test results, the area around the highest torque region produced the lowest fuel consumption figures.

The differences in CO emissions are associated with the different kinds of fuel. The total carbon monoxide emission from diesel fuel was 2215 ppm. The average CO emission in rapeseed oil fuel was about 4,000 ppm, on the other hand. Vegetable oils that are both raw and refined, unlike the ester, produced reduced carbon monoxide emissions. This is what you can expect from the more accurate spray and the more dependable fuel preparation in this series.

While using CIE, there are four viable alternative fuels, all of which are usable with little effort: vegetable oil, biodiesel, F-T gasoline, and dimethyl ether (DME). Vegetable oils, including palm, maize, sunflower, peanut, and olive oils, may be utilized as alternative fuels for diesel engines. Feedstock availability is not a concern for natural gas-based F-T and DME since they can be produced. The Fischer-Tropsch product's structure is strongly influenced by the catalyst composition: the cobalt catalyst produces a product with greater paraffin content, while the iron catalyst generates one with higher olefin and oxygenate content. Since they are common replacements for diesel fuel, vegetable oil methyl esters are considered biodiesel. In comparison to traditional petroleum diesel fuel, biodiesel offers technical benefits. Vegetable oils may be a good alternative to fossil fuel-based fuels since they are all extremely viscous, with viscosity ranging from 10 to 20 times that of petroleum diesel. The goal of the trans-esterification procedure is to make the oil less viscous.

3. CONCLUSION

The following were determined based on the review: Vegetable oil, however, has the downside of containing particulate matter. Vegetable oil, like vegetable oil, is almost as polluting as diesel oil, although vegetable oil and diesel oil are comparable in terms of their production. In addition to the previously mentioned

advantage, there is another advantage mentioned in the text preceding the suggestion of applying vegetable oil to the diesel engine: The fuel system is made to improve the use of vegetable oil, which is used mainly for human consumption and has a high density, low volume of cetane, and high density, with higher exhaust smoke. While diesel fuel costs more than vegetable oils today, the price of the former has a variable yearly cost of harvesting while the latter has an always-expensive procurement cost. By increasing the amount of vegetable oil used and making farming more automated, the yield of the product may be increased, and the cost can be reduced.

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