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Research Article

Assessment of ec-toxicity potential of fuel by exhaust gas analysis

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ABSTRACT

The engine combustion products were measured and analyzed based on emissions of exhaust. Due to the utilization of a variety of fuels, such as petroleum diesel and bio-diesel in diesel-generated engines, they emit pollution-insecure emissions. To explore this emission quantity, a numbers of experiments were conducted utilizing a single-cylinder engine, Land Curser six-cylinder, Mazda WL31 engine mechanical biodiesel vehicle and In-Line engine. The performance research was given for the data acquired from the Mazda WL31 four-cylinder engine. Landcom III gas analyzer was used to sense and record the exhaust gas emissions from the burning of diesel fuel, which was utilized for data analysis. Various gas discharges and their constituents were independently analyzed. The results of the test show that the harmful emissions of biodiesel fuel are much lower than the emissions of fuel made from mineral oil.

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INTRODUCTION

The demand for petroleum diesel engines is growing as a result of the rapid growth in industrial activities of the 21st century, which is due to combustion in the engine combustion chamber. As a consequence, most of the world's energy requirements are met. When looking in deep inside, on the other hand, the hydrocarbons in diesel motors are oxidized to generate dangerous emissions that are harmful to the environment and its residents. Although diesel is the primary fuel for diesel engines, its contribution to pollution is considered to be highly unsafe for the health of the individual. The condition of exhaust emissions is greatly impacted by fuel properties, engine performance and parameters. The physical and chemical composition of the fuel, as well as its engine design and, operating temperature may have an impact on engine exhaust emissions. For years, exhaust emissions have been a major contributor to the pollution of the environment.

The emissions include: carbon dioxide (CO_2), carbon monoxide (CO), both nitrogen oxides (NOx) and sulphure (SOx) and compounds that are made up of a few non-burnt or only partially burnt hydrocarbons (HC). Exhaust emissions such as carbon dioxide (CO_2), carbon monoxide (CO), nitrogen (NOx), sulphure (SOx), compounds made up of unburned or partially burned hydrocarbons (HC), and particulate emissions have heavily contaminated the environment. A great number of health problems relate to emissions of exhaust. It plays a role in the development of

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cancer as well as the effects of respiratory disease. It also pollutes the water, air, and contributes to global climate change. CO, or Carbon monoxide, is a possibly destructive gas that has serious consequences for human health. The effects of the exhaust emission of the fuel resulted in Biofuel producing, through chemical reaction processes with certain alcoholic, which is methanol, as opposed to a renewable gasoline made from animal fats, soybeans, or other vegetable oils/fats As a result of the reactions, the product is a methyl, ethyl, or propyl ester with various carbonation chains. This biofuel generally has been found to be renewable as a result of the presence of carbon in vegetable and animal feed resources originating from an airborne carbon compound. Nevertheless, it should consider that the biodiesel is not carbon-neutral, because all analysis of the life cycle shows that greenhouse gases have always been emitted from farming, transport and activity processes(Hosseinzadeh-Bandbafha et al. 2018).

The effect of biodiesel on the reduction of the emission of carbon oxide, unburnt hydrocarbon and petroleum diesel engines is higher (Mills et al. 2005). Results show that 80% of biofuel emissions with diesel oil have decreased to 40%, respectively. Reducing emissions of particulate matter is a major and motivational benefit in the use of biodiesels in public fleets such as PMVs / locomotives. At the same time, petroleum diesel exhaust is regarded for human health by the World Health Organization (WHO) as a potential carcinogenic. Recently, it also links the cardiovascular effects of petrol diesel particles. Diesel is a popular fuel that is used in a variety of commercial and industrial diesel engines. Diesel exhaust gases contribute to air pollution, global climate change, and health effects. Due to the most damaging effects, new ideas are being developed for biodiesel. This study therefore focuses mainly upon the ecological efficiency of alternative fuels and biodiesel. The exhaust emissions for petroleum diesel, biodiesel and various mixing systems are measured to demonstrate that biodiesel exhaust emissions are environmentally friendly.

Climate change, air pollution, and health effects have all become significant problems affecting the world at the current stage of production of petroleum diesel engine emissions. The idea behind current research exists to analyses all exhaust emissions produced with the help of Land COM III gas analyzer from petroleum diesel, biodiesel and different blends. From here, the collected data will be compared to some previous experiments which will be the best fuel to cause people and the surrounding area less damage. Bari et al. (2019) used natural gas as alternate fuel and reported that the overall performance with CNG were less than 100% diesel operations.

REVIEW OF THE LITERATURE

Energy is a necessary and vital source of economic activity. Building a stronger foundation of energy resources is critical for countries all over the world to achieve socio-economic growth.

Unconstrained mining and increased use of fossil fuels are depleting available natural resources such as gas and oil, which are carbon-generated assets. Because the fuel used is diesel distillate or petroleum, both of which are fossil fuel derivatives, it has some energy limitations. Diesel, as one of the most cost-effective fuels for diesel engines, is in short supply because it is nonrenewable and cannot keep up with the world's ever-increasing and alarming fuel consumption. The exponential growth of populations, the rapid growth of industrializations, and the general trend toward urbanization have completely disrupted the planet's eco-stability and balancing resource. As a result, the energy crisis is unavoidable and will undoubtedly have an impact on energy demand in the near future (Semin and Ismail 2009).

Globally, the leading source of pollution is petroleum diesel. The emission of vehicles is not high individually, and in several cities the relation to pictures of the pile of several people is subject to air pollution. Cars are one of the most significant sources of air pollution, contributing to the emissions of millions of motor vehicles on the road. Vehicle emissions account for half of the particulate matter in the atmosphere, which constitutes ground level ozone and contributes to the main urban area by an increase of 90% in CO trend. Driving a private car is probably one of the most significant day-to-day "polluting" activities of the national (Semin and Ismail 2009).

As has been mentioned, the rapid increase in fossil fuel consumption over the years has recently become one of the important contributors to air pollution in cities and cities, and it is also a major source that provides greenhouse gas (GHG) for global climate change. Industrial activity is growing quickest, placing high demand on the consumption of petroleum diesel (Chaichan 2011). Fossil fuel is non-renewable and, because of high consumption, will one day run out. Thus, a new alternative way to reduce fossil-fuel consumption, environmental impacts and health effects is provided by a renewable and environmentally-friendly energy source such as biodiesel. Biofuels may be an additional hydrocarbon fuel to mitigate an aversive effect that results in combustion of fossil/petroleum fuel.

In domestic biofuels, which are produced cheaply with organic materials through trans-esterification, bio-diesel can define itself as an alternative type of renewable. It consists of different ester base fuel oxygenated by vegetable oil and fat. It usually produces a catalytic agent like sodium or potassium hydroxides, which refers to the transesterification and esterification of reactions of vegetables/waste oils corresponding to specific lower weight molecules of alcohol, such as ethanol and methanol. The methyl esters (biodiesel) are separated from glycerine by transesterification processes. With the separation of glycerine and oils, molecular particles remained, somewhat like petroleum diesel fuels, in direction of diesel engines. Such differences are even distinct. When petroleum with additional fossil fuel containing sulphur, molecular rings, and aromatic, hydrocarbon, no sulphure, molecular rings and aromatized biodiesel particles were the molecular chain. In freeing the molecular particles and aromatic, biodiesel is therefore essential. Biodiesel is made up of 10 percent of oxygen and the fuel is considered natural to produce the "oxygenated" fuel. Biodiesel may be used by diesel engine types, be they individually or mixed via Petro-Diesel. In every corner of the world, individuals use systems such as "B" factors that symbolize the volume of biodiesel in combination with a fuel mixture. Fuels have been labelled as B-20 as 20 percent bio-diesel. B100 is a term that has been used to describe the purest bio-diesel. It can be used in modern diesel engines (vehicles/locomotives, ships, generators) for a small zero-change and can reduce the emission of petroleum by 75%. Biodiesels can greatly contribute to the expected economic impact of the environmental community with their present fuel consumption and comparisons as well as the cost and concern of carbon-based fuel risks. Since this property had been associated with diesel, it will blend in with petroleum fuels in any proportion.

The production of biodiesel fuel-grade should ensure that it is reliable in compliance with industry standards (ASTM D6751-07a). Due to its high viscosity, biodiesel concerns motor manufacturing industries so control and monitoring of their viscosity are important in line with industry standards.

Biodiesel may mainly have different viscosity-temperature characteristics, leading to higher pressures of fuel injection at low operating temperatures of engine (Pascual, Sanchis, and Marroyo 2014). As for table salt and biodegrades, biodiesel is much more toxic than sugar. In fact, it is free of sulphur and is more effective and economical in the operation of diesel engines and diesel engines than the use of crude diesel oil.

Responding to the increasing energy needs has required a lot of energy in the last millennium worldwide rapid increase in population. There are many forms of energy, including all fossil fuels, sunlight, water flow, wind and many more. However, petroleum or crude oil derivatives are most energy sources used worldwide. These are non-renewable and cannot meet the global demand for energy for future generations as the world's fossil fuel reserves decrease on the face of the planet. Economic activities include energy as an essential and vital component. The strength of energy resources can define a nation's economic strength and growth. Underground carbon resources are rapidly reduced because of the growing demand for worldwide fuel consumption. The world estimates that energy consumption of 3.36 x 1020 Joules is projected to double by 2050, according to the world, (6.3 x 1020 Joules) per year. The energy equation is clearly unstable in a short period of time (Elkady, Zaatout, and Balbaa 2015). The higher the increase in population, the greater the increase in industrialization. Eco-balance and balance of resources have been disturbed by the urbanization. As a result, in the future, the energy crisis is unavoidable and unquestionable to grow. Every day, the biggest danger to global climate change and to greenhouse gases is the high demand for fossil fuels. To complete the scenarios, it is urgently needed to change the world's energy resources so that the energy equation of decreasing fossil-based energy resources is balanced with more reliable, renewable, sustainable, economical and alternative combustion. Biofuels such as biodiesel, as the world searches for alternative energy sources to satisfy demands for energy, are no exception in this crisis. It is cheap to derive biodiesel and friendly to the environment. It is very environmentally

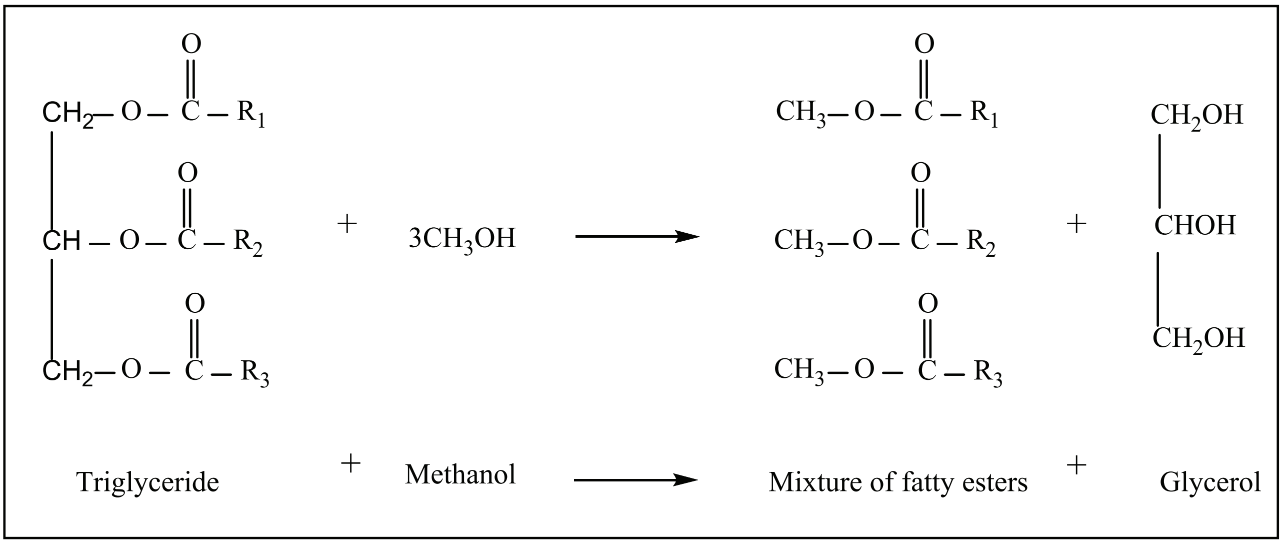

Figure 1. Trans-esterification process chemical equation.

friendly and biodegradable, so it does not contribute to air pollution. It is a renewable, long-lasting, and cost-effective resource. Can be used in small or unmodified engines.

Because of its improved performance and efficiency, it could be a future source of alternative fuels to help balance energy equations. Biodiesel can be made from a variety of animal oils and plant.

The first diesel engine, built by Dr. Rudolf Diesel in 1895, used vegetable peanut oil as a motor. Petroleum diesel, however, has become a fuel that has been selected because it's cheap and efficient. Because of the economic, social and environmental aspects and energy demands, the importance of biodiesel has been acquired until now. This is primarily to expand biodiesel production on a large scale in order to compensate for the loss of fossil fuels and meet population demands. industrialization and urbanization which are exponentially growing. History thus reaffirms itself. Biodiesel is made of organic matter (plant and animal), so it contains no petroleum diesel elements. The majority of biodiesel is, for example, sulphur free, and the sulphur content even when mixed to extremely small sulphur diesel is greatly reduced, thereby minimizing its dangers. Some of the biodiesel sources are known as more than 20: Nuts; canola; oil of palm; olive oil; oil of kernel. Most sources of biodiesel can produce about 1000 kg of oil per hectare, whereas some are low in oil. In addition to being a cheap palm oil, vegetable oil, is used as a biodiesel ingredient and fired to produce electricity in power plants. The question of global warming must effectively balance energy equations and greenhouse gases. Palm oil can produce 5000 kilograms of oil per hectare, compared to 145 kilograms for corn, 800 kilograms for sunflower, 1000 kilograms for rape, and 1000 kilograms for tropical jatropha, among other organic crops (1590). This recommends that few biodiesel plants have higher oil than others (Tat and Van Gerpen 1999), (Adams 1998). Canola and soybean oils in the United States are proven to be used in the production of biodiesel. Most transit fleets and biodiesel fuel driven vehicles now. Studies have shown that the majority of toxic emissions have been reduced to a lower level of air and environmental pollution. In regulating pollution in the environment, the Environmental Protection Authority (EPA) has taken the lead. It makes emissions and pollution control very useful since the passing of the Clean Air Act.

Biodiesel has been used in compression illuminations and the emission values that take place in the engine have been reduced. Studies by various researchers indicate that emissions of biodiesel decreased generally but for nitrogen dioxide increased.

It is also reported in (Adams 1998) that CO, CO_2, NO and SO_2 emissions have been extremely low, but that the NO_2 emissions have been greatly increased. Another study (Andika, Muaramakmur, and Code 2011) has shown that CO emissions are low and NOx is slightly greater than petroleum diesel, when more oxygen occurs in combustion with biodiesel. In cold-start CO and hot-start HC, further research (Mazzoleni, Zielinska, and Moosmüller 2007) found significant increases in the use of B20 rather than petroleum diesel. Another research group (McCormick et al. 1997) discovered that biodiesel mixed fuel reduces HC, CO, and PM NOx emissions. The United States Environmental Protection Agency conducted a global survey of soybean biodiesel emissions using heavy-duty engines, finding a significant comparative growth in NOx and a linear reduction in HC, PM, and CO emissions as a function of biodiesel percentage as a fuel. Further research (Brodrick et al. 2002)shows that fuel consumption differs with motor models, loads and engine performance. The CO, NOx and CO_2 emissions also increase if the engine speed is rapid. Experiments show that biodiesel and biodiesel blends reduce exhaust emissions. This is primarily due to biodiesel's high flash point, which is caused by the ignition delay and results in significantly higher nitrogen dioxide levels.

The preservation of fuel quality (biodiesel) depends on storage, handling and mixing. In combustion engines, one of them often deteriorates the overall performance of the fuel. Fuel suppliers should be careful to deliver fuel to the customer, to transport it and to ship it, as problems often arise during the process. All components of the biodiesel blending comply with the ASTM requirements. If the fuel does not appear to be good enough, it is obvious that the fuel is not good quality, or that storage or manipulation techniques have failed. The blending method can also have an impact on the quality of the fuel. The inline mixing method is the best way to make sure that biodiesel is completely blended in refineries. Biodiesel mixing in separate streams into tanks or containers is non-existent in-line blending. In order to separately add diesel and biodiesel, it is recommended that this diesel fuel be added, and then biodiesel added at a high speed and volume. It can be noted during mixing, B100 should be maintained greater than -12°C. During in-line blending for machinery, add one-half the diesel to achieve a perfect mix (Giakoumis et al. 2012), (Deschenes, Greenstone, and Shapiro 2017), (Ericson et al. 2006)

The majority properties of the fuel are leads to major emission factors for undesirable and hazardous gases like (CO). The fuel properties determine the characteristics of individual exhaust emissions and how they affect the environment. The following are some of the most common reasons for biodiesel fuel combustion to produce high levels of exhaust emissions from a diesel engine. The consequences can be studied either by analyzing the exhaust emissions from experimental data collected from various tests, whether diesel or biodiesel.

In addition to the characteristics of the fuel, engine parameters can also determine the emission quality. Some important factors can adversely influence the production of unwanted emissions of exhaust. The following are: The concentration of both types of fuel can result in various exhaust emissions. Looking at a simple example, CO2 cuts are proportional as base fuel to the percentage of biodiesel. Less CO2 reduction is observed between B0 and B5 (2 percent reduction). However, if the biodiesel blending concentration rises between B5 and B10, or B5 to B20, the reduction will be significant. CO and SO2 emissions, on the other hand, would increase significantly from B0 to B20, for example.

Experiments performed with one engine in cold-start mode and another in hot-start mode using fuels like diesel or biodiesel mixtures can demonstrate the temperature effects. The results will show that the CO emissions from cold start will rise in diesel but will decrease in biodiesel mixtures relatively. During the cold start all fuels, including mixed fuels, will the remaining pollutants monitored – NO_x, SO_2, and CO_2 – will, however, increase. As a result, at cold start, NO_x, SO_2, and CO_2 emissions in the biodiesel blend would be higher than at hot start. As a result of the engine's initial warm-up phase, cold starter NOx, SO_2, and CO_2 emissions are higher than hot starter emissions, regardless of biodiesel blend. The emissions of cold-start CO are lower than those of hot-start. On the contrary, cold-start generate less CO.

When a motor is running without load, the number of emissions produced from a motor with load is lower. The fact is that the power transmission due to the torque provided for the motor is lower compare to the load in a no-load condition. As the engine uses fuels to propel the engine, a great deal of fuel is consumed and excessive emissions can result. There is also a constant supply of fuel at constant speed; air-to-fuel ratios and emission values are not so much different. However, more combustion and fuel are needed as speed increases. Consequently, there are more emissions from exhaust emissions].

Now a days diesel is used as the main fuel in the diesel engine for transportation and industrial applications. It is a major source of pollution in the world's environment. In particular, emissions of exhaust are generated from unbranded or partially branded hydrocarbons (HC) and particulate emissions which have been heavily polluted in the environment and as compounds such as dioxide of carbon (CO_2), carbon monoxide (CO), nitrogen (NOx), and sulpur (SOx). Emission reductions by refuelling, refurbishing and redeveloping engines and exhaust treatment have considered. Motors still produce emissions, however. For environmental safety, reductions are essential. Few examples of carbon dioxide are carbon monoxide; Nitrogen oxides, sulphur oxides, and hydrogen sulphide which are Primary exhaust gases.

As discussed, emissions due to exhaust are damaging and highly toxic to the environment and people. Ozone depletion, global warming, , acid rain, and air pollution are some of the environmental consequences of burning fossil fuels. As a result, global temperatures are gradually being increased, the water is being acidified and harmful to fish and water life. It also affects people's health directly. These environmental and human impacts should be minimized in order to make the world safer.

Biodiesel is a key component in lowering exhaust emission levels by reducing air pollution and protecting the environment. However, some emissions tend to rise in reverse. For example, when other measured emissions decrease, NOx and its components tend to increase. Some methods may be used to control this effect. Three standard methodologies are discussed (Yue-nian, Jin-ling, and A-qiu 2013), (Li et al. 2016) to minimize harmful emissions. A recent study of buses in the UK with an extra fuel from cerium oxide showed that a saving in fuel of more than 6% could be achieved. The trials also showed that the number of soot deposits in the motor cylinders had been reduced. The environmental impact and ecological fingerprint impact of enriching cerium-oxide diesel fuel compared with single-diesel fuel were compared with an eco-efficiency life cycle investigation. The environmental impact, costs and therefore the complete eco-efficiency rate have in any case been cut to varying degrees with fuel-added cerium oxide compared to conventional diesel which is beneficial for consumers and the environment (Li et al. 2016)

EXPERIMENT TECHNIQUE

Equipment and Materials

The equipment and devices used to conduct an complete the experiments are: A magnetic machine (MAZDA WL31 engine); a computer set to record the data and configure the data into a spreadsheet, a container; a measurement cylinder; a funnel, diesel; pure petroleum; biodiesel (MAB) (B20) and biodiesel (B100);

Landcom III Gas Analyzer

Appropriate equipment will be required to complete the exhaust gas analysis. A special detection machine for the recording of smoke and emissions by means of its probes and the recording of data straight on the log sheet of the gas analyzer is the Landcom III Gas analyzer. A large range from carbon monoxide to nitrogen and hydrocarbon oxides can be measured by the analyzer. It is pre-calibrated to the full range of standard ambient air conditioning measurement systems. When prepared for the experiment, the entangled gases still present in the air pockets of the probes have to be carefully checked. The gas analyzer is portable and can be configured easily. When the exhaust emission location has been identified, the equipment has been established. The parameters required for the gas analyzer are set and the sensor is connected to the correct mode to operate, such as type of gas, operating mode, and data log interval. The sensor will receive the emission signal detected from the sensors and stored directly in the data log as soon as it is started. It is possible to get the data directly from the gas analyzer by printing them on or by transferring them to the personal computer using RS232 port. It saves data where data analysis is completed from the personal computer in the data sheet. Several types of samples are available for exhaust gas measurement. The dry sampler is the most frequently used sample. Others include smoke sensors and high-temperature sensors, besides the standard sensor. These sensors contain sensors that can be used to detect emission gases and to read – most parts per million (ppm) or percentage of the emissions readings. In conducting a proper test, the understanding of a gas analyzer is essential. If this is not done, the information presented will not be well-connected with the specific standards. All test parameters and equipment therefore have to be in good health to achieve optimal results [17].

Experiment configuration

We need to set up the equipment in the right position to successfully collect the data. Otherwise, due to interference from the surrounding environment, the information may not be available. The gas analyzer is specifically affected by this since it is sensitive to the environment and cannot contain unnecessary information after switching it on. If it does, it will deviate somewhat from the required value when correct reading takes. As a result, or in keeping with the expected reading, the analysis can be unrealistic. The gas analyzer was placed just 2 meters from the exhaust system near the exhaust collector. The dry-sampler probe, which length is approximately 3 meters, was attached to

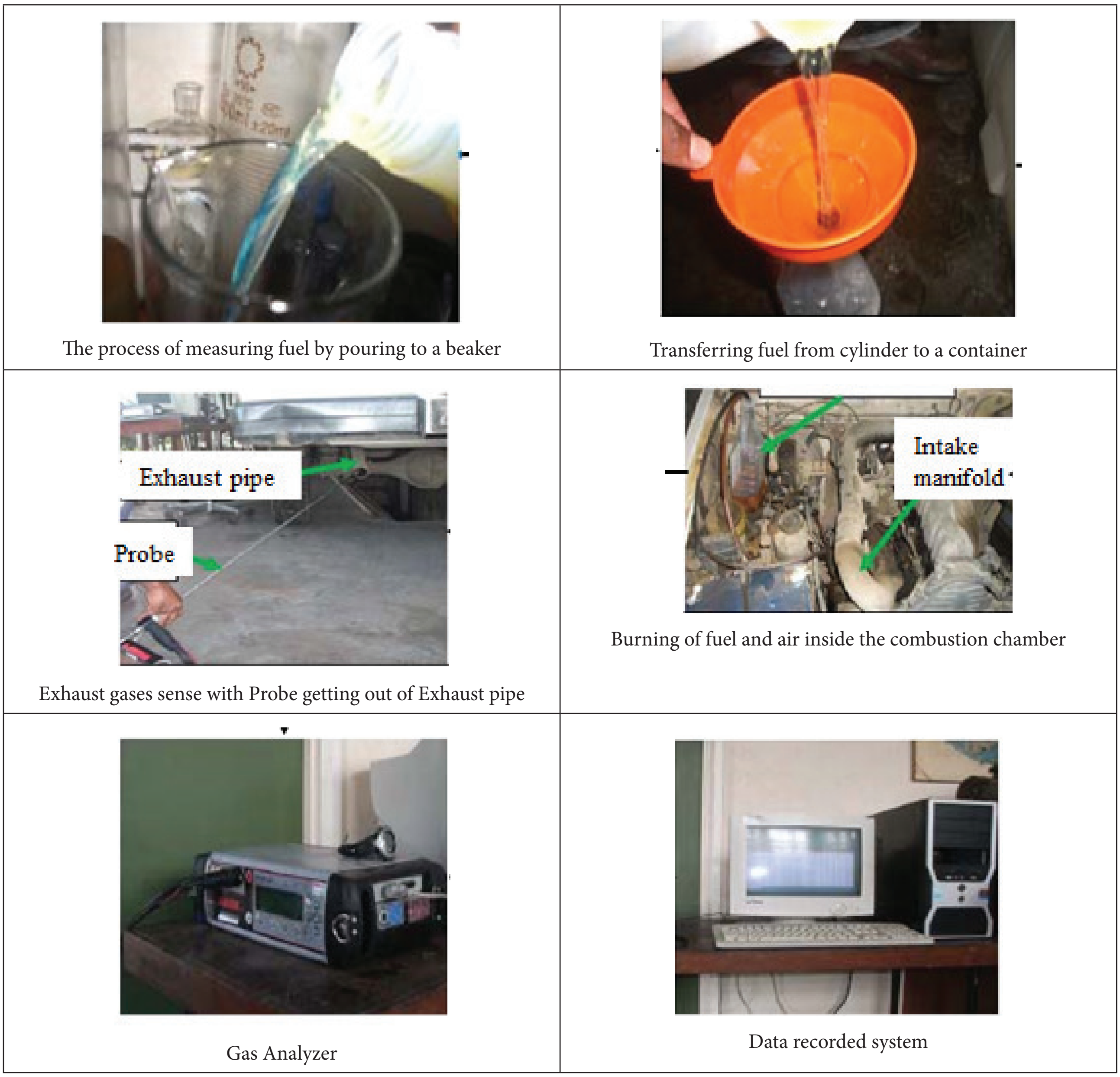

Figure 2. The schematic of experimental arrangements and procedure.

the gas analyzer and was arranged for emission detection. There are a variety of samples, including smoke sensors, high temperature samples, and standard samples. Each gas analyses are used differently and the application should not be mistaken. When the gas analyzer is enabled, data entry will take place immediately. Once the engine starts, fumes start to exit the exhaust collector from a cold start. It will be detected and logged in on the data log unit of the analyzer by the sensor within the probe. Since the analyzer screen is small, the exhaust emissions cannot be described with much detail. It is therefore connected to a personal computer via an RS232 output in the analyzer. The personal computer has an insight software for the Landcom 3. This software can transfer data from the gas analyzer to an easy-to-use data sheet.

Test Procedures

A series of tests were performed once the experiment was set up. Trials were conducted in three different types: diesel pure (petroleum diesel); biodiesel pure (B100); (B20 and B5). All tests are conducted with the same engine speed of 1,600 rpm on Mazda WL31 (Mech Biodiesel Vehicle). The fuel supply line from the fuel tank to the filters, as well as the return line from the fuel tank, the two disconnected lines connected with a fuel tank, were disconnected. First, the measuring cylinder measured petroleum diesel up to 2L and was fed into the container (fuel tank) by the funnel. The readings take 25 minutes and the starting time. When all reading for petroleum diesel was done for 25 minutes, the engine stopped and cooled down for 30 minutes. The two biodiesel containers are measured, and then the first one was used for 10 minutes in the fuel filter, fuel lines, and engine system to clean up all of the diesel petroleum, ensuring that precise data for B100 was collected. Then connected to an engine the second 2L container of the B100. It was 25 minutes in operation, and the various gas readings have been recorded on the computer data panels. Following the gas readings for the B100, the engine was shut down and the new experiment took 60 minutes to cool down. The mixture was measured separately with the help of a measuring cylinder and varied inside the same container, representing 20 per cent biological (B20) and 80 percent oil diesel (fuel tank). The first was used for 10 minutes to spotless the whole B100, including the fuel lines, fuel filter, and engine, in order to ensure that the data for B20 was accurately collected. The use of 2L B20 containers was possible. The 2L container of the second B20 was then connected to the motor. It was 25 minutes in operation, and the various gas readings have been recorded on the computer data panels. The engine was shut off after data were collected and cooled down for 30 minutes. For the B5 blending, the final experiment was 5% biodiesel and 95% petroleum diesel. The same method was repeated for B5 for the B20.

Data acquisition system

Data for the different exhaust gases are collected in two ways. In the first step manually detects the exhaust gases with the help of the sensor, which sends a digital signal to the analyzer. It logs the data manually, and prints the data from the analyzer.

Secondly the digital input system with the gas-analyzer port RS323, the sensor is connected to, computer unit. The data were recorded for post processing with the help of Data acquisition software, which is installed to download data from the computer on the data table, the second method used in the experimental collection up to n ow.

Results analysis

There are Three numbers of experiments are performed by means of a WL31 – six in-line Landcruiser motor, Mazda 4x4 4-cylinder diesel motor, and the single-cylinder emissions motor in the laboratory to estimate the emissions of the biodiesel. The last two engines are used to conduct test of exhaust emissions for diesel. The WL31 is used intentionally to determine biodiesel fuel exhaust emissions. The first WL31 test was done in the tank with regular gasoline. Before the experiment, the engine was cold and had been running for about 30 minutes. Heat supply to the engine at a continuous engine speed of around 1600 rpm up to around 70-80°C.

Exhaust Emissions gas value for Petroleum Diesel

The measurement of emissions gas for petroleum diesel by using gas analyzers. As a result of the cold beginning, hydrocarbon concentrations were increased. The reason is that the motor temperature is low relative to the room temperature during the cold start. As a result, most fuel is unburnt and hydrocarbon and particulate matter are therefore generated at an increased value. The constant increase in hydrocarbons due to oil diesel combustion is also due to the high fuel quality and the flashpoint of the fuel. In particular, it can observe the indefinite increase in exhaust emissions of petroleum diesel. As previously discussed, this is harmful to the environment and people. In this chart (Figure 2) it can also be observed that for the first

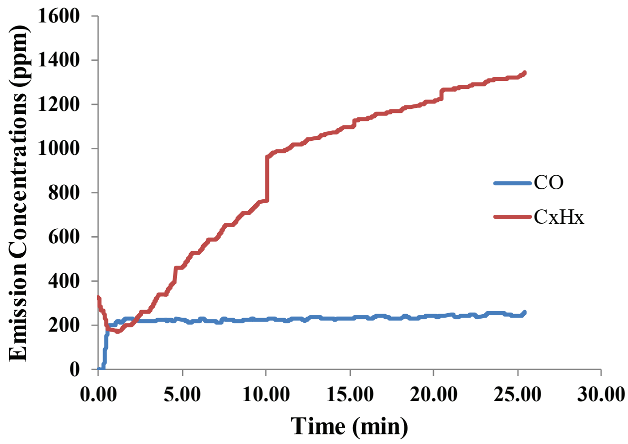

Figure 2. Emission Concentration rate of CO and CxHy.

few minutes the carbon monoxide concentration was constantly increased to 200 parts per million (ppm). This was mainly due to the entire fuel combustion, which resulted in increased combustion rate producing more heat (calorific value) leading to a higher carbon dioxide rate and consistent carbon monoxide and carbon dioxide.

There was also a relative increase in the exhaust emissions of petroleum as the engine ran. Figure 3 presents that for different exhaust gas emissions, the effect was not significant but increased. The emission concentrations are within range below 39% of the entire emission.

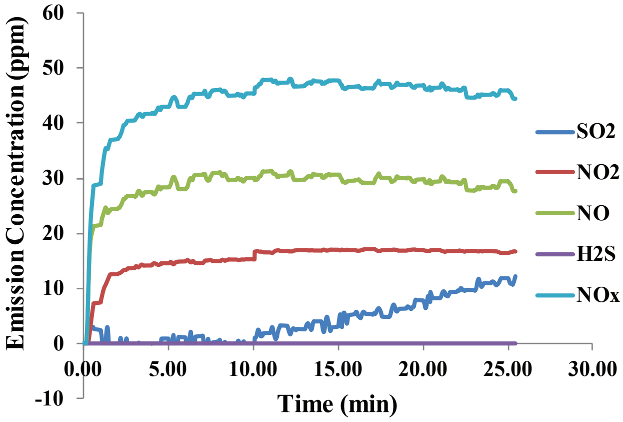

Figure 3. The rate Exhaust emissions plotted for petroleum diesel.

Exhaust Gas Emissions Values for Biodiesel

The biodiesel used to conduct the experiment made from the homegrown cocoa oil. The same engine is used to test biodiesel in which the petroleum diesel has been tested. The engine was thoroughly rinsed with 100 percent cocoon biodiesel or B100, followed by a new supply of B100 to run the test. Figure 4 shows the results obtained. The diagram

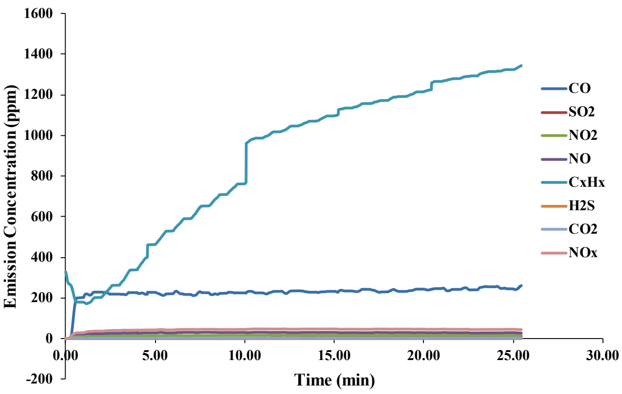

Figure 4. CxHy and CO exhaust emission for B100 fuel.

demonstrates that the combustion is effectively carried out because of the high level of coconut biodiesel and cetane (usually around 45 - 55). The result is higher carbon dioxide levels and less carbon monoxide in complete combustion. The significant decrease in hydrocarbon appears to be a consequence of greater calorific value. If the engine temperature is maintained greater than the ambient temperature, emissions about 400 ppm (in the case of carbon monoxide) are evidently reduced to 250 ppm, with emissions dropping by 37.5 per cent.

When the B100 used in the engine, a significant decrease in emissions of biodiesel was observed.

The vital features of the engine and the type of fuel used in it have significant effects on emissions of biodiesel. Hydrocarbon emissions have been reduced by about 5%, and carbon monoxide, a 10% decrease in sulphur dioxide and nitrogen dioxide, was also reduced by about 15%. between 5 and 12% of emissions are decreased by about 5% With this in mind, the use of cocoa biodiesel can be concluded as effective as possible in reducing emissions. The following tests were carried out using biodiesel blends in the 20:80 and 5:95 ratios. Therefore, the fuel was used for regular rinsing to removing excess and contaminant from reused fuels by two several tests on 20% biodiesel and 5% biodiesel. The successive decline of exhaust emission particles is also evident in the 20 percent biodiesel (B20). In ASTM D6751, the B20 mixture is considered by most car manufacturers to be the most standard fuel to conform to their design. It was thus regarded as the standard biodiesel mix. The Figure 5, presents that a certain percentage of exhaust emissions decreases.

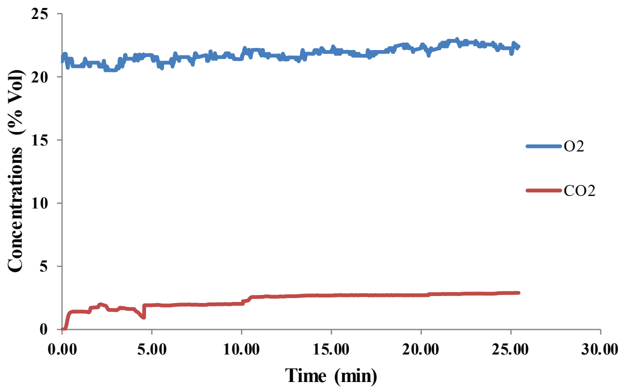

Figure 5. CO_2 and O_2 exhaust emissions for B20 blend.

Role of Biodiesel

During the test, biodiesel was successfully used in the engine. The results of the test show that biodiesel-related emissions have significantly decreased. When comparing petroleum diesel exhaust emissions to biodiesel emissions, it can be concluded that petrol diesel emits a large number of harmful emissions when compared to biodiesel emissions. The colors of the exhaust fumes were also significantly different during the test, from brown-black to colorless fumes. This shows that the combustion with cocoon biodiesel results in fewer particulate matter. Therefore, in terms of pollution, cocoon biodiesel was safe and effective for the environment. In comparison with data available in open literature and relevant sources, it is confirmed that the use of biodiesel as an alternative energy alternative can minimize pollution and other petroleum fuel problems. Oil diesel is non-renewable, toxic and can result in air pollution, unless controlled and minimized. Clean, biodegradable, user-friendly biodiesel. It can be used for the most developed nation as an alternative fuel source if it is to reduce environmental pollution effects. This test shows, if a biodiesel blend is used for most vehicles, that most contamination from combustion with petroleum diesel in compression ignition engines can be adequately minimized. For example, through an inline blending system to minimize pollution and the associated effects, the USA is currently imposing 2 percent soybean oils and canola biodiesel in the fuel system. In consequence, the amount of exhaust emissions has declined gradually over the years.

CONCLUSION

The major finding of this research can be summarized as below:

i. The used biodiesel significantly minimizing the pollution with low emissions produced.
ii. The proposed biodiesel has been tested and proved as one of the alternative fuels can be used for the diesel engine as there is a positive impact on pollution reduction.
iii. It is also reported that the exhaust emissions of the combustion can be minimized with a specific percentages.
iv. The use of cocoa biodiesel can result hydrocarbon emission reduced by 5%, Carbon monoxide reduces 10% of nitrogen oxide by almost 15%
v. As a consequence, the investigation of exhaust gas with biodiesel is a improve mental approach as it can minimize a significant amount of fuel emissions generated due to use of other diesel petroleum engines.

AUTHORSHIP CONTRIBUTIONS

Authors equally contributed to this work.

DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICS

There are no ethical issues with the publication of this manuscript.

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