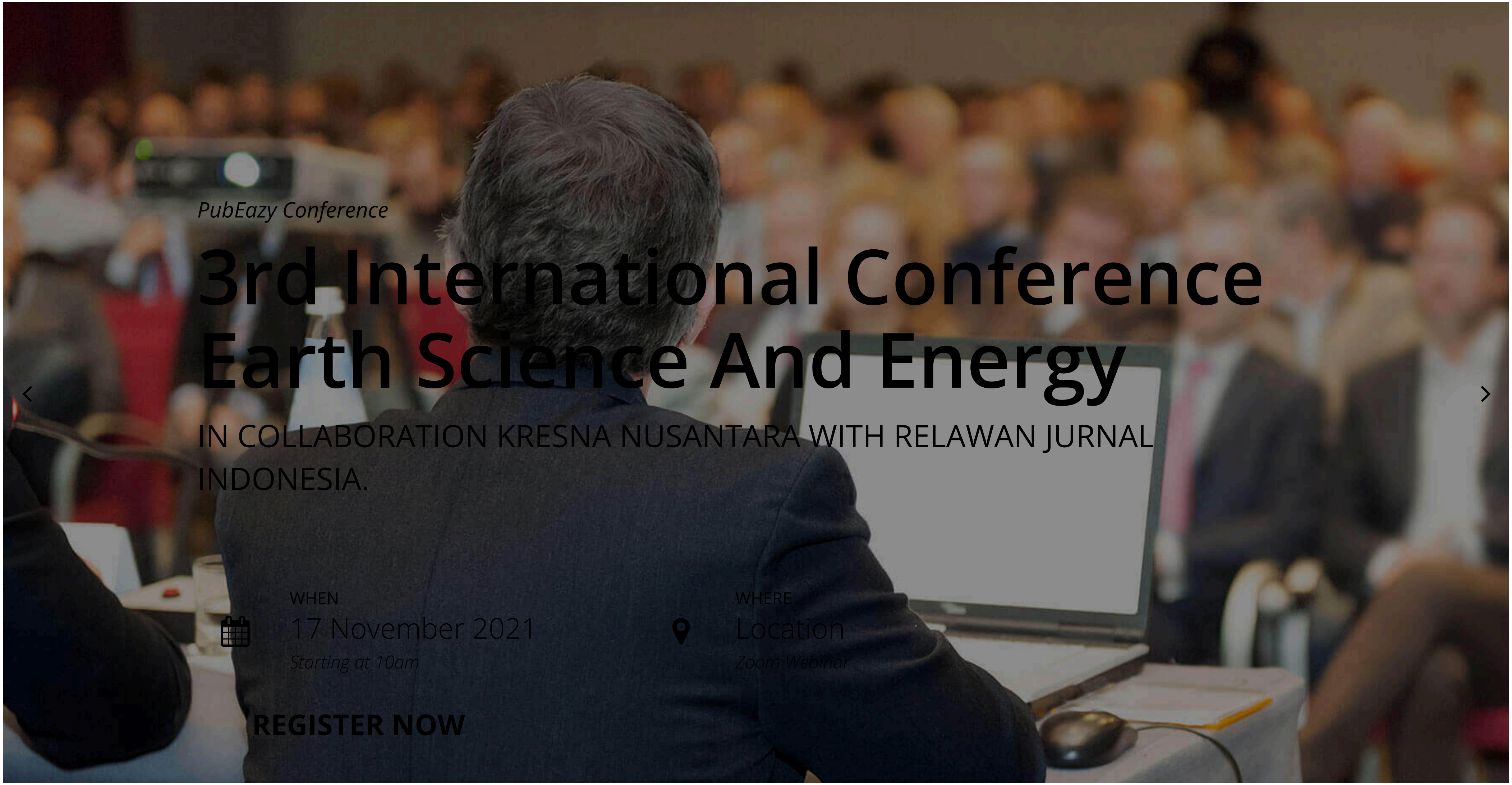

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Fuel Parameter Analysis from Kerosene Blended with Biodiesel and Diesel Fuel

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Abstract. Biodiesel is one of the potential materials that can be used to substitute for diesel fuel. The raw material is made from vegetable oil that can be renewed, produced periodically, and is easily obtained. The analysis was carried out by using kerosene blended to diesel and biodiesel. Kerosene is a colourless and flammable hydrocarbon liquid, and it was used as fuel oil. The purpose of this research is to analyse the parameters from Kerosene Blended with Biodiesel and Diesel Fuel. The materials are from Biodiesel and Diesel Fuel blended with kerosene with different percentages 80, 85, 90 and 95. The method was used by ASTM D445-19a, ASTM D1298-12b, ASTM D4737-10, and ASTM D86-17. The results of the analysis uses 5% to 95% volume, show that the A95-BS model mixture of biodiesel and diesel is poor, besides that A80-BS and A85-BS with a value of 375, in each viscosity 2.456 cSt kg/m, the performance is excellent for two mixtures, and A80-S model with a value of 357 with viscosity 2,378 cSt kg/m is excellent performance for one type of mixture.

1. Introduction

The demand of fuel as energy source to support human's living is still high [1][2]. The world's economic development cannot be separated from the increasing of automotive sector and impact of the high need of fuel [3], This can cause the decreasing in fuel all the time. Thus, it cannot be separated from the ever-changing oil prices; these changes can be caused by several factors, including the policies of oil-exporting countries, security, the world political situation, and many other factors. With the depletion of petroleum reserves, various kinds of alternative energy have emerged [4]. Many research were conducted to find alternative energy sources [5], almost all power generation engines used diesel engines. The consumption of diesel fuel in the automotive and industrial sectors is increasing [3], and the volume ratio between domestic production and consumption is not balanced. The production of diesel oil in 2003 was around 17.0 million KL, while the total consumption reached 26.4 million KL (165 million barrels) so that 9.4 million KL (35.7% of total consumption) had to be imported [6]. In terms of quantity, there is a picture of the shortage of diesel fuel supply in Indonesia. In addition, we are also faced with environmental issues regarding global warming [7], which increasingly demand the use of environmentally friendly fuel oil. Fuel oil is a commodity that plays an essential role in the supply of industrial fuel. In contrast, diesel oil is a clear brownish-yellow distillate type fuel. Diesel oil is obtained in a distillation column at a temperature of 200-350^{o}C. Diesel oil contains 75% saturated hydrocarbons (mainly paraffin including n-paraffins, isoparaffins, and cycloparaffins) and 25% aromatic hydrocarbons (naphthalene and alkylbenzenes). Diesel oil has a hydrocarbon range of C10H22 to C20H42 [8]. Kerosene or also called paraffin, is a colourless and flammable hydrocarbon liquid [9]. It is obtained from the graded distillation of petroleum at 150^{o}C and 275^{o}C (C12C15 carbon chain). Kerosene is widely used for oil lamps and stoves; now, it is widely used as fuel for jet engines (Avtur, Jet-A, Jet-B, JP-4 or JP-8). Kerosene, known as RP-1, was used as rocket fuel—the combustion process using liquid oxygen. Kerosene is distilled directly from crude oil and requires Merox unit or hydrotreater controls to reduce sulphur content and rust. Kerosene can also be produced by hydrocrackers, which increase the proportion of crude oil suitable for fuel oil. The use of kerosene for kitchen purposes is limited to developing countries [6].

Biodiesel is an alternative fuel for motor vehicles that use diesel fuel. Biodiesel can be produced from palm oil [10], soybean [11], and jatropha [11] [12]. Considering that oil palm, soybean, carberra manghas [13] and castor oil are commonly grown crops and have sufficient potential to be developed in Indonesia, the increasing demand for diesel oil in the transportation sector has resulted in an alternative blending of biodiesel and diesel fuel in Indonesia to be pursued. Mixing biodiesel with diesel oil is usually given a separate naming system, such as B2, B3, or B5, which means a blend of biodiesel and diesel oil containing 2%, 3%, and 5% biodiesel, respectively. Meanwhile, B20 or B100 is a mixture of biodiesel and diesel oil containing 20% and 100% biodiesel, respectively. In general, the highest concentration that has been commercially operated is B20. Although biodiesel can be mixed with diesel oil at various concentrations without damaging or modifying the engine, it requires replacing the rubber gasket on some equipment as the specifications are adjusted for fuel. Good diesel fuel oil must have characteristics that include, among others, appropriate viscosity, cetane number, and free from impurities or harmful chemicals so that tests are carried out according to the applicable specifications. This research aims to get fuel characteristic from Kerosene Blended with Biodiesel and Diesel Fuel using type A and B.

2. Method

2.1 Tools and Material

The tools used in this research are hydrometer to test Kinematic Viscosity, Hydrometer, and Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure *C*alculated Cetane Index and Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure. The material used is biodiesel from kerosene and diesel type A and B. The fuel analysis were carried out at the Petrolab Services laboratory, Jakarta and tested on 2021-06-25. In the lab test using biodiesel and kerosene.

2.2 Biodiesel Physical Properties Test

Biodiesel derived from kerosene is mixed with diesel fuel composed of 0 to 100% by volume. This mixture is then analyzed for its physical properties, including specific gravity, viscosity, flash point, pour point, residual carbon, color, and moisture content. The optimal composition that will be obtained is the composition containing the most significant biodiesel fraction that can meet the physical characteristics of diesel fuel.

a. Kinematic Viscosity (ASTM D445-19a.), This test method specifies a procedure for determining the kinematic viscosity, ν, of liquid petroleum products, both transparent and opaque, by measuring the time for a volume of liquid to flow under gravity through a calibrated glass capillary viscometer. The dynamic viscosity, η, can be obtained by multiplying the kinematic viscosity, ν, by the density, ρ, of the liquid [17].
b. Hydrometer (ASTM D1298-12b), This test method covers the laboratory determination using a glass hydrometer in conjunction with a series of calculations of the density, relative density, or API gravity of crude petroleum, petroleum products, or mixtures of petroleum and nonpetroleum products generally handled as liquids and having a Reid vapor pressure of 101.325 kPa (14.696 psi) or less. Values are determined at existing temperatures and corrected to 15°C or 60°F utilizing a series of calculations and international standard tables [18].
c. Calculated Cetane Index (ASTM D4737-10), It is for Estimating the ASTM cetane number (Test Method D613) of distillate fuels from density and distillation recovery temperature measurements. The value computed from the equation is termed the Calculated Cetane Index by Four Variable Equation [19].
d. Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure (ASTM D86-17), This test method covers the atmospheric distillation of petroleum products and liquid fuels using a

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laboratory batch distillation unit to determine the boiling range. The characteristics of such products quantitatively as light and middle distillates, automotive spark-ignition engine fuels with or without oxygenates, aviation gasoline, aviation turbine fuels, diesel fuels, biodiesel blends up to 5% until 95%, kerosine. Analyzing distillation is very important to understand the effect of spray characteristics in fuels. High viscosity and density can cause fuels difficult to atomize in diesel engine [20].

3. Result and Discussion

In general Biodiesel is a yellowish-coloured fuel whose viscosity is not much different from diesel oil. Therefore, a mixture of kerosene, biodiesel and diesel oil can be used as fuel for vehicles using diesel fuel without damaging or modifying the engine. In addition, the power and performance of diesel engines with diesel fuel also have not changed. The international standards for biodiesel used in this study are ASTM D445-19a., ASTM D1298-12b, ASTM D4737-10, and ASTM D86-17, as show in Table 1.

Table 1. Model Test Lab Result

Method	**Param.**	**Meas.**	**Model Test**							
			A85-BS	**A80-BS**	**A90-BS**	**A95-BS**	**B80-S**	**B85-S**	**B90-S**	**B95-S**
ASTM D445-19a	Kin. Visc. at 40°C	cSt kg/m3	2.456	2.456	2.829	2.945	2.378	2.437	2.744	2.727
ASTM D1298-12b	Dens. at 15°C	cSt kg/m3	836.8	836.8	843.0	844.2	827.1	828.1	830.9	833.4
ASTM D4737-10	Cetane Index	cSt kg/m3	52.1	52.1	52.5	53.9	53.7	54.8	54.5	55.2
ASTM D86-17	Distill. Recovery Basis : IBP	°C	160	160	165	165	171	177	180	192
ASTM D86-17	5% vol	°C	181	181	185	195	198	205	210	217
ASTM D86-17	10% vol	°C	192	192	200	208	207	213	220	227
ASTM D86-17	20% vol	°C	211	211	225	238	223	228	233	240
ASTM D86-17	30% vol	°C	232	232	253	265	236	240	246	252
ASTM D86-17	40% vol	°C	259	259	277	287	249	254	257	263
ASTM D86-17	50% vol	°C	283	283	298	305	262	267	268	274
ASTM D86-17	60% vol	°C	308	308	315	320	275	280	280	285
ASTM D86-17	70% vol	°C	324	324	328	332	288	292	292	296
ASTM D86-17	80% vol	°C	336	336	339	340	303	308	307	311
ASTM D86-17	90% vol	°C	346	346	349	351	325	328	326	330
ASTM D86-17	95% vol	°C	357	357	360	367	340	341	339	343

Table 1 describes the international standard methods tested in the models tested with the A85-BS (Type A85 with test between Biodiesel and Diesel oil), A80-BS (Type A80 with test between Biodiesel and Diesel oil) model, A90-BS (Type A90 with test between Biodiesel and Diesel oil), A95-

BS (Type A95 with test between Biodiesel and Diesel oil), B80-S (Type B80 with Diesel oil test) B85-S (Type B85 with Diesel oil test), B90-S (Type B90 with Diesel oil test), and B95-S (Type B95 with Diesel oil test).

Figure 1. Kerosene Blended with Biodiesel and Diesel Fuel

Figure 1 describes the blend types used in the study, type A, and B. In the blended used as described in table 1 it uses 5% to 95% volume. Then based on the results obtained some of the analysis are explained below:

a. Viscosity requires the most significant concern about the flow of a fluid. Viscosity is the property of a (fluid) caused by the presence of a substance between the liquid molecules and the cohesive force on the liquid. Several factors affect viscosity; The factors that affect viscosity are temperature, solution concentration, dissolved molecular weight, and pressure. Temperature is inversely proportional to viscosity. If the temperature increases, the viscosity will decrease, and vice versa
b. Kerosene has the most significant intermolecular density than other oils, so that the refractive index value will be more excellent, and oil has the lowest density so that the refractive index value will be smaller. So the refractive index value will be more excellent, and the value of the index will be smaller. The bias will be more negligible. Index values influence the intermolecular density in the oil; the higher the intermolecular density in the oil, the higher the density and refractive index values.
c. In the Cetane Index analysis, the higher the cetane number, the higher the quality of diesel fuel. The fuel must ignite when compressed in the cylinders, and because it is most flammable in the combustion chamber of a diesel engine, cetane was chosen as the standard to facilitate the combustion of diesel fuel.
d. Atmospheric distillation is a distillation to separate the air content. The atmospheric distillation column still contains some valuable compounds that must be recovered. The residue that cannot be separated from the atmospheric distillation column requires a higher temperature to break down or decompose the crude oil into the desired product. To obtain a distillate product optimally is determined specifications, optimal operating conditions are required. The factors that affect the performance of the atmospheric distillation unit must be regulated to produce optimal products. Several factors influence the design of a distillation column. Some of these factors include feed composition, column operating conditions, column height, and product composition.

4. Summary

The results of the analysis show that the A95-BS model mixture of biodiesel and diesel is poor, beside that A80-BS and A85-BS with a value of 375, in each viscosity 2.456 cSt kg/m, the performance is excellence for two mixtures. So that its performance is 375 and meets the standards and performs well as a fuel, from the parameters used for testing EP, Recovery % vol, Residue % vol, Loss % vol, and Recovery at 300°C has a good value, especially in the recovery test on a machine using 300°C which has a lower value than other models, which is 57%. Then testing with one type of mixture. The highest is A85-S with viscosity 2.437 cSt kg/m, A90-S with viscosity 2.744 cSt kg/m, and A95-S with a value of 359 with viscosity 2.727 cSt kg/m, and the lowest is the A80-S model with a value of 357 with viscosity 2.378 cSt kg/m is excellence performance for one type of mixture. This study has limitations in testing, especially in testing using other mixtures. Such as castor oil, the chemical structure of jatropha oil consists of triglycerides with straight (unbranched) fatty acid chains, with or without unsaturated carbon chains. Almost all parts of the Jatropha plant and the waste produced, both when pressing Jatropha seeds and glycerine produced in biodiesel, can be utilized by processing them further into other derivative products.

References

[1] K. Siregar *et al.*, "Review of Implementation Life Cycle Assessment for Biodiesel Production from Palm Oil (Elaeis guineensis Jacq.) in Indonesia," *E3S Web Conf.*, vol. 190, p. 00021, Sep. 2020, doi: 10.1051/e3sconf/202019000021.
[2] Y. Xin, L. Sun, and M. C. Hansen, "Biophysical and socioeconomic drivers of oil palm expansion in Indonesia," *Environ. Res. Lett.*, vol. 16, no. 3, p. 034048, Mar. 2021, doi: 10.1088/1748-9326/abce83.
[3] H. Yaqoob *et al.*, "Energy evaluation and environmental impact assessment of transportation fuels in Pakistan," *Case Stud. Chem. Environ. Eng.*, vol. 3, p. 100081, Jun. 2021, doi: 10.1016/j.cscee.2021.100081.
[4] A. Agustian, E. Ariningsih, E. Gunawan, and K. S. Indraningsih, "The study of bioenergy with molasses raw materials: analysis of potential and problems in its development in East Java, Indonesia," *E3S Web Conf.*, vol. 232, p. 04005, Jan. 2021, doi: 10.1051/e3sconf/202123204005.
[5] L. Rubianto, H. P. Sudarminto, and S. Udjiana, "Combination of biodiesel, glycerol, and methanol as liquid fuel," *IOP Conf. Ser. Mater. Sci. Eng.*, vol. 1073, no. 1, p. 012005, Feb. 2021, doi: 10.1088/1757-899X/1073/1/012005.
[6] W. Murti, "The influence of crude oil price in biodiesel and its implication on the production of palm oil: The case of Indonesia," *Eur. Res. Stud. J.*, vol. 20, no. 2, pp. 568–580, 2017, doi: 10.35808/ersj/659.
[7] C. Acar and I. Dincer, "The potential role of hydrogen as a sustainable transportation fuel to combat global warming," *Int. J. Hydrogen Energy*, vol. 45, no. 5, pp. 3396–3406, Jan. 2020, doi: 10.1016/j.ijhydene.2018.10.149.
[8] M. Skolniak, P. Bukrejewski, and J. Frydrych, "Analysis of Changes in the Properties of Selected Chemical Compounds and Motor Fuels Taking Place During Oxidation Processes," in *Storage Stability of Fuels*, InTech, 2015.
[9] B. Kanyathare and K.-E. Peiponen, "Wavelength-dependent excess permittivity as indicator of kerosene in diesel oil," *Appl. Opt.*, vol. 57, no. 12, p. 2997, Apr. 2018, doi: 10.1364/AO.57.002997.
[10] A. Bhikuning, E. Matsumura, and J. Senda, "A Review: Non-Evaporating Spray Characteristics of Biodiesel Jatropha and Palm Oil and Its Blends," *Int. Rev. Mech. Eng.*, vol. 12, no. 24, pp. 364–370, 2018.
[11] A. Bhikuning, "The Simulation of Performance and Emissions from Rapeseed and," vol. 4, no. 3, pp. 112–118, 2021.
[12] M. S. Gad and M. A. Ismail, "Effect of waste cooking oil biodiesel blending with gasoline and kerosene on diesel engine performance, emissions and combustion characteristics," *Process Saf. Environ. Prot.*, vol. 149, pp. 1–10, May 2021, doi: 10.1016/j.psep.2020.10.040.
[13] A. Bhikuning and M. Hafnan, "Biodiesel Production from Cerbera Manghas Using Different Catalyst; NaOH and Zeolite," *J. Clean Energy Technol.*, vol. 7, no. 2, pp. 11–14, 2019, doi: 10.18178/jocet.2019.7.2.502.
[14] Semin, A. R. Ismail, and R. A. Bakar, "Combustion Temperature Effect of Diesel Engine Convert to Compressed Natural Gas Engine," *Am. J. Eng. Appl. Sci.*, vol. 2, no. 1, pp. 212–216, 2009, doi: 10.3844/ajeassp.2009.212.216.
[15] D. Zabek and F. Morini, "Solid state generators and energy harvesters for waste heat recovery and thermal energy harvesting," *Therm. Sci. Eng. Prog.*, vol. 9, pp. 235–247, Mar. 2019, doi: 10.1016/j.tsep.2018.11.011.

[16] Y. Putrasari, A. Nur, and A. Muharam, "The Influence of Two Cylinder Diesel Engine Modification (IDI to DI) on Its Performance and Emission," *J. Mechatronics, Electr. Power, Veh. Technol.*, vol. 4, no. 1, pp. 17–24, Jun. 2013, doi: 10.14203/j.mev.2013.v4.17-24.

[17] V. Kumbár, P. Dostál, and J. Votava, "Kinematic Viscosity and Shear Stress of Used Engine Oil," *J. Agric. Sci. Technol.*, vol. 3, no. 12, pp. 982–988, 2013.

[18] B. Ashok, A. K. Jeevanantham, K. R. Bhat Hire, V. Kashyap, and P. Saiteja, "Calibration of idling characteristics for Lemon Peel Oil using Central Composite Design in light commercial vehicle diesel engine," *Energy Convers. Manag.*, vol. 221, p. 113183, Oct. 2020, doi: 10.1016/j.enconman.2020.113183.

[19] I. Zahos-Siagos, T. Mourtidis, D. Karonis, and M. Kamaterou, "A Comparison of Ignition Quality of Ultra Low Sulfur Diesel Fuels Measured by Different Constant Volume Chamber Methods," in *11th International Colloquium Fuels*, 2017.

[20] A. Bhikuning, R. Sugawara, E. Matsumura, and J. Senda, "Investigation of spray characteristics from waste cooking oil, bio-hydro fined diesel oil (BHD)and n-tridecane in a constant volume chamber," *Case Stud. Therm. Eng.*, vol. 21, p. 100661, Oct. 2020, doi: 10.1016/j.csite.2020.100661.

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