EVALUATING THE QUALITY OF PETROLEUM DIESEL-BIOFUEL BLENDS
Evaluasi Kualitas Pencampuran Minyak Solar dan Bahan Bakar Nabati

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Abstract

As one of the largest archipelagic countries, there is a challenge in biofuel production and distribution because the raw materials, biodiesel refineries, and the fuel blending terminal are separated far apart. It creates a problem in maintaining quality. A good quality product of biofuel will raise customer acceptance. This paper aims to investigate the quality system of petroleum diesel-biodiesel blends in Indonesia after implementing B30 in 2020. This descriptive study was conducted with a quantitative approach showing that fuel producers should comply with the blending mandate and fuel standard to get the subsidies. But there is only one accredited laboratory to control the quality. The B30 quality verification report is also government subjectivity because it is not published. To ensure the acceptance of new biofuel specifications, the Government of Indonesia (GoI) established road tests and trial tests. The Indonesian automotive association, which Japan Manufacturers dominate, accepted the development of new biofuel specifications. The quality of biofuel production has been a concern for GoI. Still, there is a need to study the business model because the implementation of biofuel in Indonesia is highly dependent on subsidies.

Keywords: biofuel blend, biofuel policy, biodiesel quality, palm oil biodiesel.

Abstrak

Sebagai salah satu negara kepulauan terbesar terdapat tantangan dalam produksi dan distribusi Bahan Bakar Nabati (BBN) dikarenakan bahan baku, kilang biodiesel, dan terminal pencampuran bahan bakar yang terpisah jauh. Hal tersebut menimbulkan permasalahan dalam menjaga kualitas. Produk BBN yang berkualitas baik akan meningkatkan keberterimaan pengguna. Studi ini bertujuan untuk mengkaji sistem mutu campuran minyak solar-biodiesel di Indonesia setelah penerapan B30 pada tahun 2020. Studi deskriptif ini dilakukan dengan pendekatan kuantitatif yang menunjukkan bahwa produsen bahan bakar harus mematuhi kewajiban pencampuran dan standar bahan bakar untuk mendapatkan subsidi BBN. Namun hanya terdapat satu laboratorium terakreditasi untuk mendukung pengendalian mutu bahan bakar. Laporan verifikasi kualitas bahan bakar menjadi subjektivitas pemerintah dan tidak dipublikasikan. Untuk memastikan penerimaan spesifikasi BBN yang baru, Pemerintah Indonesia mengadakan uji jalan dan uji coba penerapan. Asosiasi industri otomotif Indonesia yang didominasi oleh Pabrikan Jepang menerima perkembangan spesifikasi baru biofuel. Kualitas produksi BBN telah menjadi perhatian Pemerintah Indonesia, tetapi model bisnis penerapan campuran bahan bakar perlu dikaji lebih jauh karena penerapan BBN di Indonesia sangat bergantung pada subsidi.

Kata kunci*: campuran bahan bakar nabati, kebijakan bahan bakar nabati, kualitas biodiesel, biodiesel kelapa sawit*

1. INTRODUCTION

The reduction of Indonesia's dependence on oil began to appear in 2008 when Indonesia left OPEC (Organization of the Petroleum Exporting Countries) membership. Indonesia has become an oil importer since 2003 (Faisol et al., 2020). Those forced Indonesia to look at other energy alternatives as a substitute for oil. Through Presidential Decree number 1 in the year 2006, Indonesia began to develop biofuel as an alternative fuel, followed by the issuance of law number 30 in the year 2007 about energy. It also began of energy transition era in Indonesia. However, in 2019 Indonesia's dependence on fossil fuels still looks quite large, namely in the amount of 835 million BOE or 51.5% of the primary energy mix (MEMR, 2020).

Meanwhile, biofuels have started to develop since 2005, starting with a jatropha

planting program. However, the biofuel program using jatropha was discontinued in 2008 because the price was not feasible for sale compared to the diesel fuel price (Simandjuntak, 2014). On the other hand, biodiesel from palm oil was growing. In 2006, Indonesia already had a biodiesel production capacity of 70 million L per year (Santosa, 2008). The rapid development of biodiesel occurred in 2016. When the demand for crude palm oil (CPO) for exports decreased and the government issued a mandatory policy of blending biofuels to 20% or B20, there was an increase in biodiesel production capacity to 6.9 million kL per year. At that time, Indonesia has also given an incentive to support the B20 program through the Palm Oil Fund Management Agency (BPDPKS) (President of Indonesia, 2015).

In national energy planning, Indonesia is pursuing a biofuel production target of 13.9 million kL in 2025 and 52.3 million kL in 2050 (President of Indonesia, 2017). The production of biofuels in 2020 is up to 8.6 million kL which only comes from biodiesel. Although bioethanol is also included in the government program, bioethanol has not been produced yet. This is due to the high price of bioethanol and the absence of incentives from the government. There is a need to develop a bioethanol market structure, update technology, and improve the role of the government (Gaol et al., 2018). Acceptable price and engine compatibility may drive the use of biofuels (Ogunkunle and Ahmed, 2019). Policy targets, blending mandates, and tax incentives also can stimulate the development and adoption of biofuels (Kumar et al., 2013).

Indonesia as one of the largest archipelago countries has challenges in fuel distribution. The distribution of raw material sources, biodiesel refineries, and locations for mixing biodiesel with diesel are separated far apart. It makes a problem in maintaining the quality of B30 for end-users. Worldwide Fuel Charter (WWFC) indicates the risk of quality will decrease before biodiesel reaches the end-user due to the location of the biodiesel producer being far from fuel blending locations and needing to transport by freight (WWFC, 2009). The dominant characteristic of biodiesel in B30 requires special handling in its handling, both from the shipping, mixing, and storage processes. In addition, the quality of biodiesel (B100) and diesel oil (B0) before being mixed into B30 must meet the fuel specification. Until the implementation of B30, Indonesia does not have a biofuel quality certification system yet. Fuel quality monitoring is only ruled by the Directorate General of Oil and Gas (MIGAS). But there are issues with fuel quality monitoring such as the independence of conformity assessment institutions, monitoring scale, and the transparency of fuel quality monitoring reports (Hirota and Kashima, 2020). As of 2020, there are 9 accredited laboratories in Indonesia capable to test the quality of biodiesel, but there is only 1 laboratory that has full specification test capabilities, namely PPTMGB "Lemigas" (NAC, 2021). To keep fuel quality, a study by Hirota and Kashima (2020) suggests the design of Fuel Quality Monitoring (FQM) operations such as trace causes, sample size, frequency of inspection, and strict punishment.

A good quality product of B30 will raise acceptance from the end-user. Until 2020, Indonesia is the only country that implements a high blending of biofuel B30 with CPO as feedstock. The harmonization of diesel fuel quality by the Worldwide Fuel Committee only covers biodiesel blends for 5% or B5 (WWFC, 2019). This paper aims to investigate the quality system of petroleum diesel-biodiesel blends in Indonesia after implementing B30 in 2020.

2. LITERATURE STUDIES

The implementation of the standards in regulation or a process is related to aspects of sustainability development. Standardization, metrology, and conformity assessment are aspects of sustainability development. They can improve production, health, consumer protection, environment, security, and quality. The implementation of standardization, metrology, and conformity assessment supports social welfare and facilitates trade (ISO, 2006). The conformity assessment scheme is a process to prove a product meets the reference requirements. In the National Standardization and Conformity Assessment System, the conformity assessment scheme is defined as the applicable rules, procedures, and management to carry out the Conformity Assessment of Goods, Services, Systems, Processes, and/or Personal with Reference Requirements (President of Indonesia, 2018). The conformity assessment scheme is not applied nationally but also regionally and internationally (SNI ISO/IEC 17000:2009).

The nationally applicable biodiesel conformity assessment scheme in Indonesia is issued by the National Standardization Agency of Indonesia (BSN) containing the scope, certification requirements, certification procedures, requirements for the Conformity Assessment Institute, certification stages, use of the Indonesian National Standard (SNI) mark, and critical stages of the biodiesel production process

(NSA, 2019). In addition, other biodiesel conformity assessment schemes, such as Biodiesel Production AGQM Certified (BPAC) issued by Association Quality Management Biodiesel (AGQM) and BQ-9000 issued by Clean Alliance America. AGQM refers to the biodiesel standard DIN EN 14214 (agqm-biodiesel.de). Meanwhile, BQ-9000 refers to the biodiesel standard ASTM D6751 (bq-9000.org). In conformity assessment schemes, there are generally referenced standards, administrative procedures, conformity assessment techniques, evidence of conformity assessment, and supervision by the Conformity Assessment Agency (President of Indonesia, 2018).

3. RESEARCH METHODS

By focusing on the quality assurance system and the sustainability of the implementation of biofuel blending policies in Indonesia, this descriptive study was conducted with a quantitative approach through policy review and analysis for: stakeholders, production supply chains, reference standards and conformity assessments, handling and storage mechanisms, user acceptance, accessibility, and aspects of biofuel sustainability. Data was obtained through literature study, Focus Group Discussion, and biodiesel sample testing. Literature study data comes from official government publications, standard documents, and scientific publications. Focus Group Discussion (FGD) and biodiesel sampling were conducted in 2019. The FGD involved the Ministry of Energy & Mineral Resources (MEMR), Indonesian Biofuel Producers Association (APROBI), Indonesian Automotive Industries Association (GAIKINDO), and the Lemigas Laboratory. Meanwhile, biodiesel sample testing was carried out in an accredited laboratory on 10 companies (10 samples) representing 19 biodiesel refineries or all companies in Indonesia that had been appointed to supply B20 in 2019 (Ministry of Energy & Mineral Resources, 2018). The sample test parameters refer to the B30 road test parameter which is intended for the development of biodiesel standards for B30.

4. RESULT AND DISCUSSION

Supply and demand for biofuel

Using biofuels, it is necessary to have raw materials that are available sustainably, of good quality, and meet the economy. In the implementation of B30, Indonesia uses palm oil (CPO) as raw material in the production of biodiesel. The biodiesel refineries are mostly owned by palm oil companies. In 2019 Indonesia was able to produce 51.8 million tons of CPO and Palm Kernel Oil (PKO) with an area of 14.3 billion hectares of oil palm plantations of which 72% was exported, while 28% was for domestic needs (Directorate General of Estate Crops, 2020) (Indonesian Palm Oil Association, 2020). Indonesia has 19 biodiesel refineries with a biodiesel production capacity in 2019 of 12 million kL per year. The refinery only produces biodiesel from CPO. CPO, which is an edible oil, apart from being used for biodiesel, is also widely used in the food and oleochemical industries. Besides CPO, Indonesia has other first-generation biofuel raw material resources such as sugar cane, cassava, corn, sago, sugar palm, sorghum, and molasses. In addition, Indonesia also has the potential for second-generation biofuel raw materials frorem forest residues, sugar cane baggage, rice straw, wood chips, grass, jatropha, *Reutealis trisperma*, and *Calophyllum inophyllum L*, *Pongamia*, and waste cooking oil (Silalahi et al., 2020). With the existence of other alternative biofuel raw materials, Indonesia has the potential to reduce dependence on one type of raw material derived from edible oil where palm oil is the raw material for the first generation of biofuel. Currently, Palm Oil was chosen due to the security of supply (Naimah and Morgunova, 2018).

Looking at MEMR regulation number 12 in the year 2015, 4 sectors must use biofuels namely transportation, industry, commercial, and electrical power. The transportation sector is the largest demand with 45%. Energy demand in the transportation sector is 67.96 million kL, dominated by gasoline with 35.33 million kL or 52% of fuel sales and diesel with 27.57 million kL or 41% of fuel sales. Currently, only diesel with cetane number 48 is mixed with biodiesel to produce B30.

Quality assurance and subsidy of biodiesel

The B30 funding scheme mostly comes from BPDPKS. BPDPKS itself manages the funds obtained by Levy from exporting CPO and its derived products. The amount of levy obtained depends on the volume of exports and market prices (MEF, 2020). In addition to B30 funding, BPDPKS funds are also used for Human Resources (HR) development, research & development, campaigns, replanting programs, infrastructure development, food use, and development of derivative products (President of Indonesia, 2018). Other countries such as India also have a policy of financial incentives and subsidies for the use of biofuels. China also applies financial incentives in the form of

discounted taxes and fix subsidies (Saravanan et al., 2020).

Before BPDPKS disburses the B30 subsidy, BPDPKS appoints surveyors to conduct verification. Verification is carried out on biodiesel quality from biodiesel producers and B30 quality from fuel marketers, as well as the volume distributed. In conducting quality testing, surveyors must have or cooperate with an accredited laboratory. Sampling time is done per month or every 2 months or as needed. Verification results are submitted to MIGAS and BPDPKS confidentially (not disclosed to the public) (DGOG, 2018). This is different from the Fuel quality monitoring system which is carried out in Germany through AGQM certification and in North America and Canada which uses the BQ-9000 certification, where the results of quality verification are presented to the public, although all company names, plant locations, and dates were scrubbed. For the frequency of sampling, the AGQM is collected 3 times a year, namely in winter, intermediate, and summer, while in the BQ-9000 sampling is carried out every month (Alleman, 2020). The B30 quality monitoring system also shows that it is not independent enough. This can be seen from the role of surveyors who are assisted by accredited laboratories only to report on quality testing, while supervisory actions are carried out by the government. This is also due to the sustainability of the B30 market which relies on subsidies from the government through BPDPKS so the B30 quality verification report is also government subjectivity because it is not published.

There is only one accredited biofuel laboratory involved in the implementation of biofuels in Indonesia. This is very different from North America and Canada involving 10 laboratories (BQ-9000.org, 2021). Thus, the PPTMGB "Lemigas" laboratory is a vital part of biofuel quality assurance where Indonesia is one of the world's main biodiesel producers with production reaching 7.9 million tons in 2020, thus becoming a national quality infrastructure issue (OECD/FAO, 2020). In addition, the PPTMGB "Lemigas" laboratory is under the auspices of MEMR so there is an issue of neutrality as the study conducted by Hirota and Kashima (2020). In the principle of an accredited laboratory according to ISO/IEC 17025:2017, having only one accredited laboratory will also hinder the proficiency test because no comparison laboratory is equally capable of testing the full specifications of biodiesel and B30 with the required test methods (ISO, 2017). In addition, the location of biodiesel producers and fuel marketers spread across Indonesia also creates the potential for disputes on test results, because test samples must be sent to a laboratory located in Jakarta. Thus, the handling and storage of test samples must consistently follow procedures and be traceable.

Handling and storage of biodiesel

There are 18 marketers of B30 in Indonesia (MEMR, 2020). Especially PERTAMINA as the largest fuel marketeer that distributes B30 in Indonesia has 34 blending points spread across 20 provinces from western Indonesia to eastern Indonesia as shown in Table 1. While the location of the biodiesel refinery is in 19 locations, most of which are in western Indonesia. The large distance between the location of the biodiesel refinery and the location of the biodiesel blending point increases the risk of changing the quality of biodiesel before the blending process becomes B30. Biodiesel easily increases its water content in an environment that is in direct contact with air and contains water because biodiesel is hygroscopic so the handling and storage processes affect the quality of biodiesel (Sundus et al., 2017). There are 3 methods to distribute biodiesel in Indonesia, namely ships, tanker trucks, and pipes. For the location of the biodiesel refinery which is close to the mainland and the fuel blending terminal, it is distributed by pipes and trucks. Meanwhile, the location of the inter-island biodiesel refinery uses a fleet of ships. The method of shipping biodiesel using ships requires a journey time of about 2 – 29 days including loading and unloading. The length of the ship's journey depends on the distance and conditions of the loading and unloading dock. The length of delivery can increase the risk of changing the parameters of acid content, density, and water content in biodiesel (Komariah et al., 2019).

Table 1 Locations of Pertamina's fuel blending station for B30.

No	Fuel blending stations	Biodiesel suppliers	Transportation
1	Jakarta group*	Dumai, Riau	Waterway
2	Plaju*	Dumai, Lampung, Medan	Waterway, Inland
3	Boyolali*	Gresik	Inland
4	Panjang*	Lampung	Waterway, Inland
5	Kasim*	Bitung	Waterway
6	Medan Group*	Medan	Inland, Waterway
7	Rewulu*	Bekasi, Gresik	Inland

No	Fuel blending stations	Biodiesel suppliers	Transportation
8	Balikpapan group*	Balikpapan, Riau, Dumai, Gresik	Waterway, Inland
9	Tanjung Gerem	Dumai	Waterway
10	Kotabaru	Dumai, Riau, Kotabaru	Waterway
11	Tanjung Wangi	Dumai	Waterway
12	Dumai	Dumai	Waterway
13	Tanjung Uban Group	Medan, Batam	Waterway, Inland
14	Pulau Laut	Dumai, Riau, Kotabaru	Waterway
15	STS Kotabaru	Dumai, Riau, Kotabaru	Waterway
16	Sek Pening/Siak	Riau	Inland
17	Teluk Kabung	Dumai	Inland
18	Cikampek	Bekasi	Inland
20	Balongan	Bekasi	Inland
21	Pengapon	Gresik	Inland
22	Cepu	Gresik	Inland
23	Surabaya	Gresik	Inland
24	Makassar	Riau	Waterway
25	Bitung	Bitung	Inland
26	Kupang	Bitung	Waterway
27	Pontianak	Dumai	Waterway
28	Tuban	Gresik	Inland
29	Cilacap group	Bekasi, Gresik	Inland
31	Padalarang	Bekasi	Inland
32	Ujung Berung	Bekasi	Inland
33	Tasikmalaya	Bekasi	Inland
34	Manggis	Kotawaringin Timur	Waterway

*Locations for implementation test of B30

In carrying out fuel distribution, PERTAMINA involves more than 2000 fuel tank trucks, more than 250 vessels (tankers), more than 300 jetties, and more than 1500 km of pipeline facilities (Wachyudi et al., 2020). The occupancy rate at PERTAMINA's jetty is also quite high due to the queue of crude oil unloading (Adrian and Simatupang, 2014). Currently, loading and unloading ports in Indonesia have an average load factor of 82.5% with a dwelling time of 6.2 days (Syafaaruddin, 2015). With the long dwelling time, there is a need for consistent quality monitoring and the development of supporting facilities at the biofuel delivery point. The length of the dwelling time process will create a dispute between biodiesel producers and fuel marketers if there is a significant decrease in quality during the handover of biodiesel which results in fuel marketers not wanting to accept biodiesel.

The Indonesian oil transport fleet uses tanker and barge types. There has been no compatibility study on these vessels operating in transporting biodiesel in Indonesia. The incompatibility of storage tank materials on ships for the transportation of biodiesel also increases the risk of damaging the oxidation stability of biodiesel. The use of metal containers can increase the oxidation process (Amaral et al., 2020). In addition, before transporting biodiesel the storage tank must be clean of water and protected from direct contact with air (Sundus et al., 2017). Even biodiesel producers add a nitrogen blanket to reduce biodiesel contact with free air. The condition of the ocean environment in the voyage of biodiesel transport vessels also increases the potential for increasing acid numbers (Wahyudi et al., 2021).

In addition to the risk of quality changes in biodiesel delivery, the homogeneous blending of biodiesel also affects maintaining quality at the time of delivery. Biodiesel which has a higher density than diesel will tend to go to the bottom of the tank if the blending process is not good. This also results in the dominant characteristics of biodiesel (Benjumea et al., 2008). In mixing biodiesel with diesel there are 3 methods, namely in-tank blending, splash blending, and in-line blending. In the in-tank blending and splash blending methods, both biodiesels are poured into a tank that already contains diesel. The difference between the two blending methods is that in-tank blending is only poured directly with a certain pressure, while splash blending is poured with splashes. The mixing method with in-line blending is more accurate and versatile than the two blending methods because biodiesel and diesel are mixed in a pressure pipe that has a static mixer in it (Rymsha, 2007). The B30 blending method used by PERTAMINA the largest fuel marketer in Indonesia uses two methods, namely, in-tank blending and in-line blending methods. The in-line blending method is only used at fuel terminals that have New Gantry System facilities.

In testing the homogeneity and quality of the blending results, sample B30 was tested. Test sampling was carried out using the all-level sample for the full specification test and the bottom sample for the critical test (MEMR, 2018). The specification for biodiesel supplied as a B30 mixture refers to the General Directorate of New, Renewable, and Conservation Energy (EBTKE)

decree number 189K/10/DJE/2019, while the diesel specification refers to SNI 8220:2017 (MEMR, 2019). The results of the B30 mixture refer to the General Directorate of Oil and Gas (MIGAS) decree number 0234.K/10/DJM.S/2019 (MEMR, 2019). Full parameter B30 testing is only carried out during verification. Meanwhile, in daily operations, testing is carried out only for critical quality parameters such as fatty acid methyl esters (FAME), density, viscosity, water content, flash point, and acid value. Several studies state viscosity, density, cetane number, heating value, flash point, and pour point are the significant properties of the fuel (Hasan and Rahmana, 2017; Sitko et al., 2011). The determination of FAME in diesel fuel blends is an important aspect of the production and blending process as well as quality control of distribution operations. In addition, critical tests are also carried out based on PERTAMINA's operational considerations, such as the availability of storage tanks and lead time targets.

Acceptance of petroleum diesel-biodiesel blends

Energy consumption in Indonesia is dominated by the transportation sector, which is 43.87%. Most biofuel users are also dominated by the transportation sector, which is 92% although the government also requires it in the commercial, industrial, and power generation sectors. For biofuels to be accepted by users, it is necessary to prove the quality of the fuel when used in operations. Before the implementation of the biofuel blending policy, MEMR conducted tests on vehicles through a road test scheme. Road tests are carried out to test the suitability of fuel specifications to weather conditions and road terrain in Indonesia. Road tests also involve automotive manufacturers to determine the performance of their vehicles after using biofuel blends. The B30 road test has only been tested on-road vehicles, while on trains and ships it has not been carried out. Road tests for road vehicles are carried out for 5 months with a vehicle mileage of 40000 km. In other countries such as the US, a road test initiated by General Motors has also been carried out with a mileage of up to 120,000 miles with the B20 (Lopes and Cushing, 2012). Before implementing B30 in 2020, Indonesia has used B20 since 2016. The results of the road test will evaluate the comparison between the use of B20 and B30. Moreover, in the B30 specification, there are changes in fuel specifications, namely flashpoint, sulfur, acid value, oxidation stability, monoglyceride, water content, and cold filter plugging point (CFPP). The results of the B30 road test compared to the previous use of the B20 showed an impact on power and NO^x emission. This also confirms studies related to the impact of biodiesel on power in diesel engines conducted by Ghazanfari et al. (2017) and the impact of biodiesel on increasing NO_x emissions by Varatharajan and Cheralathan (2012). While the impact of B30 on the fuel filter only occurs at the beginning of the test (10000 km), after that, it returns to normal (MEMR, 2019).

In the process of running the road test, in this study, biodiesel samples were tested based on the proposed revision of the biodiesel standard to be mixed in B30. Tests are carried out to determine the quality of biodiesel products before adjustments are made to the new biodiesel specifications. In addition, the test results can also be an evaluation for biodiesel producers to improve the quality of their products, in addition to being a recommendation in the development of standards by the technical committee for developing bioenergy standards.

The biodiesel samples tested came from 10 biodiesel plants representing all group companies that have biodiesel plants in Indonesia. The test sample obtained from the biodiesel plant was then tested at PPTMGB Lemigas as the only laboratory capable of testing all parameters of the proposed standard revision. As shown in Table 2 of the 24 parameters tested, the test results showed a discrepancy in the quality of the test sample product on the acid value, water content, and total contamination parameters. Acid value and water content are critical parameters that are tested by fuel marketers. Meanwhile, total contamination is only tested during verification by MIGAS. Of the 10 samples tested, it also shows that there is a large standard deviation of the water content parameter, and exceeds the proposed limit, which is a maximum of 350 ppm. It is possible that the quality of biodiesel already has a water content of standard limit values and/or due to the journey of biodiesel samples from the refinery location to the laboratory in Jakarta. Therefore, the determination of biodiesel specifications, especially water content parameters, need to pay attention to changes in biodiesel properties due to biodiesel storage as studies have been carried out by Komariah et al. (2019), Wahyudi et al. (2021), and Amaral et al. (2020).

In addition to the road test, MEMR also conducted a trial of the implementation of B30. The trial of the implementation of B30 was carried out for 2 months at 8 fuel blending station locations spread from western Indonesia to eastern Indonesia as shown in Table 1. The purpose of this B30 implementation test is to determine the suitability of water content parameters, the readiness of logistics and

handling infrastructure, as well as improvements that need to be made. With the spread of the test locations, the test results can also describe the conditions of shipping by land and sea, namely by modes of transportation of ships, tankers, and pipes. In the trial for the implementation of B30, the biodiesel specification refers to the MEMR decree number 227K/10/MEM/2019, while the B30 specification refers to the MIGAS decree number 0234.K/10/DJM.S/2019 (MEMR, 2019) (DGOG, 2019). The location of the implementation test is shown in table 1. When B30 starts to be implemented in 2020, biodiesel specifications refer to EBTKE decree number 189K/10/DJE, while B30 specifications still refer to MIGAS decree number 0234.K/10/DJM.S/2019.

Table 2 Biodiesel test results during the B30 road test.

No	Biodiesel test parameter	Test Result					
		Minimum	Maximum	Average	Median	Standard Deviation	Proposed Standard
1	Density at 40 °C, kg/m^3	858	861	859	858	1	850-890
2	Kinematic viscosity at 40 °C, mm2/s (cSt)	4.4	4.6	4.5	4.5	0.1	2.3-6.0
3	Cetane number	52	53	53	53	1	min. 51
4	Flashpoint, °C	159	174	167	167	5	min. 130
5	Cloud Point, °C	13	16	14	14	1	max. 18
6	Copper strip corrosion (3 hours at 50 °C)	1a	1a	1a	1a	-	max. level 1
7	Carbon residue in a sample, %-mass	null	null	null	Null	-	max. 0.1
8	Distillate temperature at 90%, °C	325	350	341	342	7	max. 360
9	Sulfated ash content, %-mass	0	0	0	0	0	max. 0.02
10	Sulfur content, mg/kg	3	4	4	3	0	max. 10
11	Phosphorus content, mg/kg	0.3	0.4	0.4	0.4	0.0	max. 4
12	Acid value, mg-KOH/g	0.1	0.5	0.3	0.3	0.1	max. 0.4
13	Free Glycerol, %-mass	0.001	0.008	0.002	0.001	0.002	max. 0.02
14	Total Glycerol, %-mass	0.06	0.15	0.12	0.13	0.03	max. 0.2
15	Methyl esters, %-mass	98.5	99.3	98.8	98.8	0.24	min. 96.5
16	Iodine value, g-I2/100 g	47	52	49	49	1	max. 115
17	Oxidation stability, minutes	616	1579	1131	1136	309	min. 600
18	Monoglyceride content, %-mass	0.52	0.23	0.44	0.48	0.11	max. 0.55
19	Color	1	1	1	1	0	max. 3
20	Water Content, ppm	132	416	283	286	79	max. 350
21	Cold Filter Plugging Point, °C	13	15	14	14	1	max. 15
22	Na+K, mg/kg	1.4	1.4	1.4	1	0	max. 5
23	Ca+Mg, mg/kg	4.5	4.5	4.5	4.5	0	max. 5
24	Total Contamination, mg/liter	12.1	21.1	16.3	14.5	4.2	max. 20

The journey of developing the B30 specification was accepted by GAIKINDO as representing the largest user of biofuel in the transportation sector and a member of the bioenergy standard development committee (NSA, 2020). The number of new diesel vehicles marketed by GAIKINDO in 2019 was 240279 units, of which 98% came from Japan Manufacturers (GAIKINDO, 2020). However, JAMA has not recommended more than 20% biodiesel blending yet (JAMA, 2020). The Worldwide Fuel Charter Committee, of which JAMA is one of the members, has also not included the harmonization of B30 quality with world vehicle manufacturers yet. Worldwide Fuel Charter 6th edition only states the biofuel blend acceptance for 5% or B5. Indonesia as the only which implements B30 will be referenced by other countries if there are no quality issues. Harmonization of fuel quality is important for the implementation of higher biofuel blends. The biodiesel test method on the Indonesian standard also refers to other standards such as ASTM and EN as shown in appendix D. Harmonization of biodiesel standards can expand market access

and give reference to automotive manufacturers to develop engines that are compatible with biodiesel. Other countries and international automotive manufacturers will be easily adopted the new biofuel blends (Oguma et al., 2012).

Accessibility and quality issues

Indonesia is an archipelagic country with a land area of 1.81 million km^2 consisting of 34 provinces and 16056 islands, with a population of 273 million (World Bank, 2020; GIA, 2019). With this area coverage, PERTAMINA as the majority provider of B30 in Indonesia distributes to 4670 fuel stations that already have a fuel sale license (BPH Migas, 2019). Thus, the density of fuel stations in the distribution of B30 in Indonesia is 3 units of fuel station per 1000 km^2 or 17 fuel stations per million population. With this density, it can be said that access to obtain B30 requires effort. Someday, there is a lack of fuel supply in several locations. It can be caused by transportation delays and distribution quotas (Laksminarti and Riyanti, 2018). PERTAMINA, which received 84% of the B30 allocation volume, only distributed B30 through official fuel stations. PERTAMINA has a micro fuel station with the trademark “Pertashop” but only distributes gasoline. The accessibility problem of B30 creates many unofficial micro fuel supply depots. Although an official fuel station is prohibited to distribute to an unofficial micro fuel supply depot, B30 will be found there. The problem is not only the legality but also both risks of safety and decreasing fuel quality of B30. It also may make them difficult to trace the compliance of B30 if the user of B30 claims the engine problems to the dealers or manufacturers.

5. CONCLUSION

Biodiesel standardization is quite a concern for Indonesia in the implementation of biodiesel in Indonesia, especially biodiesel. The quality of biodiesel that does not meet the specified specifications will not receive subsidies from the government and cannot be marketed in Indonesia. However, the biodiesel quality assurance system in Indonesia is only supported by one accredited laboratory. In addition, quality control measures are also not independent and open enough because the government carries them out, and quality control results are not communicated to the public. Therefore, The Government of Indonesia needs to develop a more independent and traceable biodiesel quality certification system such as BQ-9000 and AGQM.

To ensure the quality and increase the acceptability of biodiesel, the government conducts road tests on the use of B30 in vehicles. It is also intended to confirm the biofuel specifications proposed by the Committee for the Development of Bioenergy Standards coordinated by MEMR. This study also conducted testing of the proposed biofuel standard to evaluate the readiness of producers and recommendations in the process of developing biofuel standards. Harmonization of biofuel standards is also a concern in vehicle engine compatibility because automotive manufacturers for diesel-engine vehicles in Indonesia are dominated by Japanese manufacturers.

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