*APEC Project No: EWG 20 2016A*
*Guidelines toward High Biodiesel Blend Diesel (eg B20)*
*Specification in the APEC Region, Bangkok, 13-14 Dec 2017*

# STATUS OF BIODIESEL IMPLEMENTATION IN MALAYSIA AND BIODIESEL SPECIFICATIONS

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# Biodiesel in Malaysia

- Lab scale R&D – 1982
- Pilot plant built and commissioned – 1985
- Produces palm biodiesel for engine testing and market seeding
- Preliminary Field Trial (July 1984 – May 1985) : 8 taxis
- Exhaustive Field Trial (Phase I): 1986- 1989 : 31 diesel engines of different makes
- Exhaustive Field Trial (Phase II): 1990 – 1994: 36 buses
- Fully established palm biodiesel as diesel substitute in 1995

**MPOB Palm Biodiesel Pilot Plant (3,000 TPA)**

# Palm Biodiesel and Phytonutrients Plants Built using MPOB Technologies

## (A) Biodiesel Plants in Malaysia – 8 plants

Normal Grade Palm Biodiesel Plant (Pour Point 12 to 18 deg. C)

Johor, Malaysia (2006)

Selangor, Malaysia (2008)

Johor, Malaysia (2008)

Selangor, Malaysia (2009)

Sarawak, Malaysia (2014)

**Winter Grade Palm Biodiesel Plant (Pour Point 0 to -21 deg. C)**

Johor, Malaysia (2006)

Selangor, Malaysia (2007)

Selangor, Malaysia (2008)

## (B) Biodiesel Plants Overseas – 4 plants

**Normal Grade Palm Biodiesel Plant (Pour Point 12 to 18 deg. C)**

South Korea (2007)

Thailand (2008)

Thailand (2015)

Colombia (2015)

## (C) Phytonutrients Plants in Malaysia – 2 plants

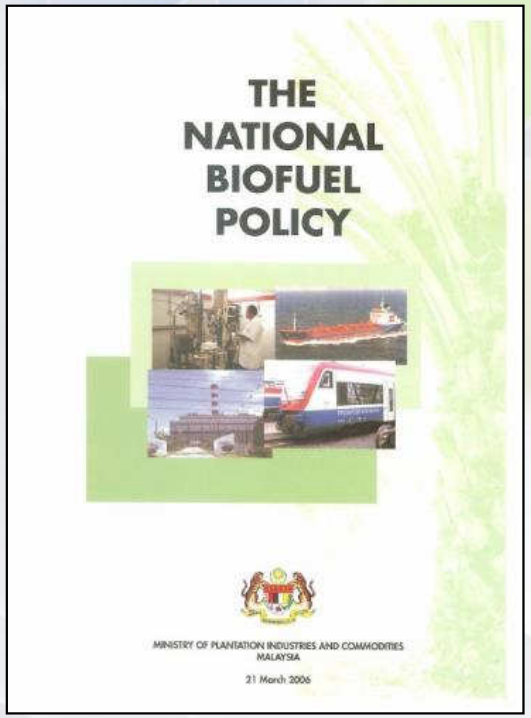
Johor, Malaysia (2009)

Sarawak, Malaysia (2016)

# Beginning of biodiesel industry: Launching of The World First Integrated Palm Biodiesel Plant (15 August 2005)

# National Biofuel Policy

The National Biofuel Policy launched in March 2006.




Five (5) strategic thrusts :-

**Thrust 1: Biofuel for Transport**

Thrust 2: Biofuel for Industry

Thrust 3: Biofuel Technologies

Thrust 4: Biofuel for Export

Thrust 5: Biofuel for Cleaner Environment

# Installation of Biodiesel In-line Blending Facilities at 35 Petroleum Depots Throughout Malaysia (2011-2015)

PME storage tanks

Blending facilities

Unloading area

Pumps area

# Biodiesel Mandates in Malaysia

| Implementation Date | % of Blending | State Involved | Sector |
|---|---|---|---|
| June – October 2011 | B5 | Putrajaya, Selangor, Kuala Lumpur, Negeri Sembilan and Melaka | Transportation and other subsidised sector |
| July 2013 | B5 | Johor | |
| October 2013 | B5 | Penang, Kedah, Perak and Perlis | |
| January 2014 | B5 | Pahang, Kelantan and Terengganu | |
| November – December 2014 | B7 | Whole Peninsular Malaysia | |
| January 2015 | B7 | Nationwide (Including Sarawak, Sabah and Labuan) | |

# Malaysian Biodiesel Plants and Capacity (June 2017)

| Status | No. of Plants | Biodiesel Production Capacity (Tonnes/Year) |
|---|---|---|
| Commercial Production* | 22 | 2,678,000 |
| Not in commercial production** | 9 | 675,740 |
| **Total** | **31** | **3,353,740** |

Note:

* On / off production.

** Biodiesel plants which have completed but yet to commence production, and also includes those licensees in other stages and still valid under the Biofuel Industry Act, MPIC.

# Malaysian Biodiesel (Production, Exports and Export Earnings)

| Year | Biodiesel Production (Tonnes) | Biodiesel Exports (Tonnes) | Biodiesel Export Earnings (RM Million) |
|---|---|---|---|
| June - Dec 2006 | 54,981 | 47,986 | 120.89 |
| 2007 | 129,706 | 95,013 | 253.20 |
| 2008 | 171,555 | 182,108 | 610.70 |
| 2009 | 222,217 | 227,457 | 605.75 |
| 2010 | 117,173 | 89,609 | 266.53 |
| 2011 | 173,220 | 49,999 | 179.72 |
| 2012 | 249,213 | 28,983 | 98.44 |
| 2013 | 472,129 | 175,032 | 502.61 |
| 2014 | 602,334 | 87,356 | 257.37 |
| 2015 | 673,532 | 178,942 | 483.57 |
| 2016 | 500,833 | 83,581 | 247.70 |

# Malaysian Biodiesel Industry Capacity Utilization (2016)

| No. | Subjects | |
|---|---|---|
| 1. | No. of plants in operation | 17 |
| 2. | Total production capacity (tonnes/year) | 2,068,000 |
| 3. | Total biodiesel production in 2016 (tonnes) | 500,833 |
| 4. | Biodiesel production capacity utilisation (%) | 24.2 |

Note :

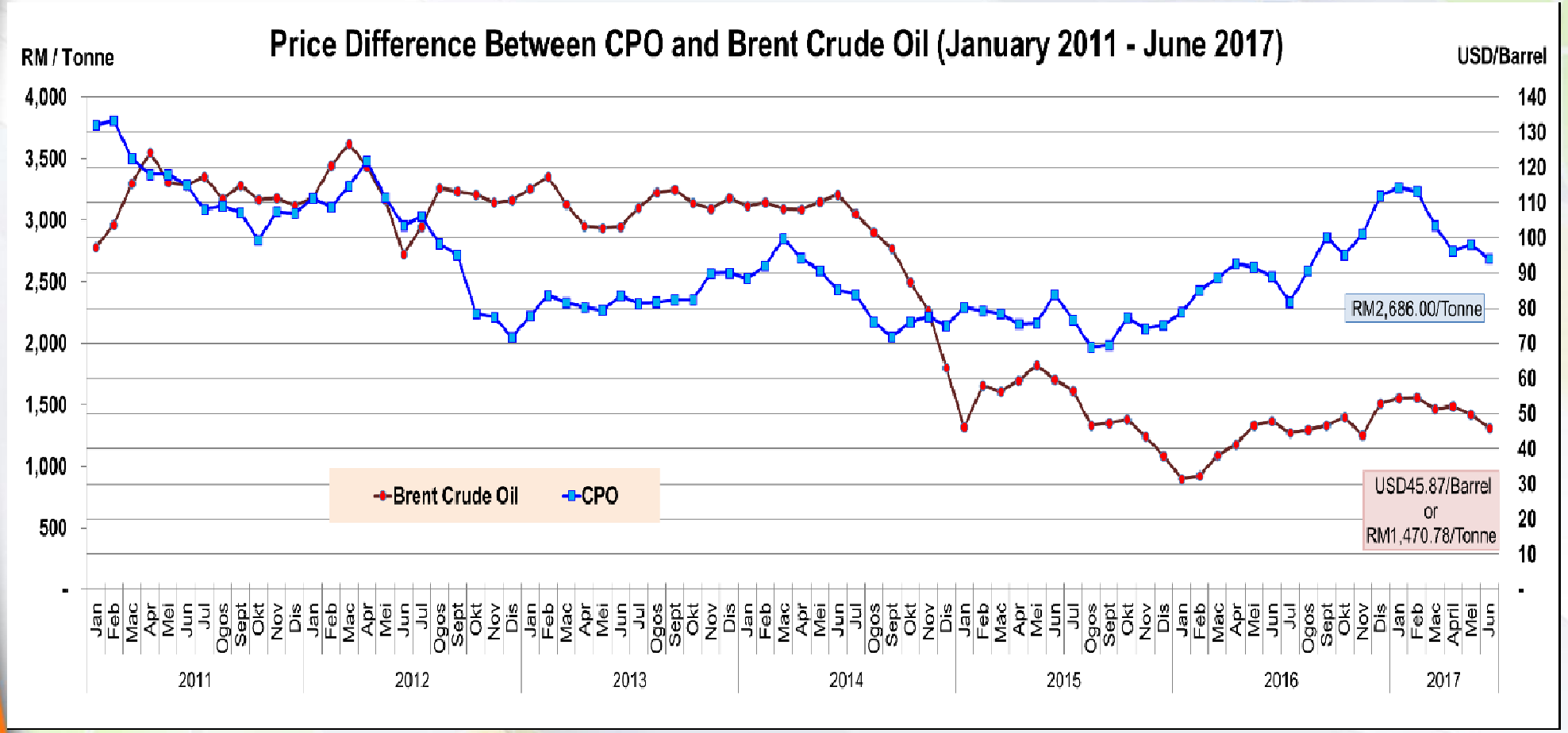
- Total no. of established biodiesel plants as end December 2016 was 34 (3.30 mil. tonnes/year of production capacity).

# Cabinet Decision on Implementation of B10 for Transportation Sector (June 2016)

- Exemption for retail stations at highlands to continue supplying B7
- Exemption for Euro 5 diesel to be blended with 7% biodiesel

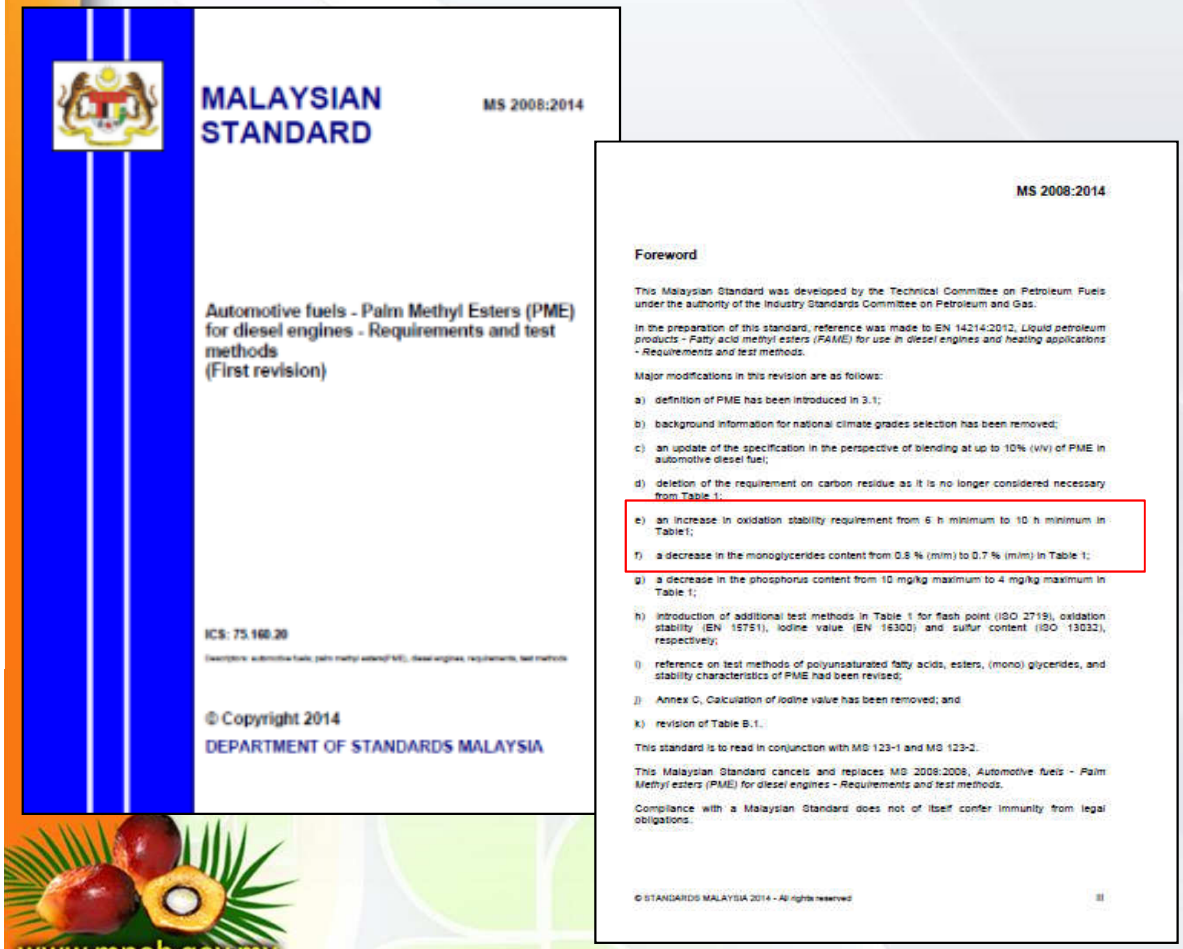
Currently there are about 10% of retail stations in Malaysia are selling both Euro 2M (B7) and Euro 5 diesel (B7).

# Due to huge price gap between Brent crude oil and palm oil, the government decided to defer the B10 implementation plan.



# Malaysian Standard of Palm Methyl Ester (MS 2008)

- The first national PME standard published in 2008
- Developed based on EN 14214
- Adopted both ASTM and EN / ISO standard as test methods
- 1st revision published in 2014



MALAYSIAN STANDARD

MS 2008:2014

Automotive fuels - Palm Methyl Esters (PME) for diesel engines - Requirements and test methods
(First revision)

ICS: 75.160.20



DEPARTMENT OF STANDARDS MALAYSIA

MS 2008:2014

Foreword

This Malaysian Standard was developed by the Technical Committee on Petroleum Fuels under the authority of the Industry Standards Committee on Petroleum and Gas.

In the preparation of this standard, reference was made to EN 14214:2012, *Liquid petroleum products - Fatty acid methyl esters (FAME) for use in diesel engines and heating applications - Requirements and test methods.*

Major modifications in this revision are as follows:

a) definition of PME has been introduced in 3.1;

b) background information for national climate grades selection has been removed;

c) an update of the specification in the perspective of blending at up to 10% (v/v) of PME in automotive diesel fuel;

d) deletion of the requirement on carbon residue as it is no longer considered necessary from Table 1;

e) an increase in oxidation stability requirement from 6 h minimum to 10 h minimum in Table1;

f) a decrease in the monoglycerides content from 0.8 % (m/m) to 0.7 % (m/m) in Table 1;

g) a decrease in the phosphorus content from 10 mg/kg maximum to 4 mg/kg maximum in Table 1;

h) introduction of additional test methods in Table 1 for flash point (ISO 2719), oxidation stability (EN 15751), iodine value (EN 16300) and sulfur content (ISO 13032), respectively;

i) reference on test methods of polyunsaturated fatty acids, esters, (mono) glycerides, and stability characteristics of PME had been revised;

j) Annex C, *Calculation of iodine value* has been removed; and

k) revision of Table B.1.

This standard is to read in conjunction with MS 123-1 and MS 123-2.

This Malaysian Standard cancels and replaces MS 2008:2008, *Automotive fuels - Palm Methyl esters (PME) for diesel engines - Requirements and test methods.*

Compliance with a Malaysian Standard does not of itself confer immunity from legal obligations.





Major modification in this revision is as follows:

- Deletion of the requirement on carbon residue
- An increase in oxidation stability requirement from 6 h minimum to 10 h minimum
- A decrease in the monoglycerides content from 0.8 % (m/m) to 0.7 % (m/m)
- A decrease in phosphorus content from 10ppm to 4 ppm

# Specifications in MS 2008:2014

Table 1. General applicable requirements and test methods

| Property | Unit | Limits | | Test methods[a] |
|---|---|---|---|---|
| | | Minimum | Maximum | |
| FAME content | % (m/m) | 96.5[b] | - | EN 14103 |
| Density at 15 °C[c] | kg/m$^3$ | 860 | 900 | ISO 3675[d]<br>ISO 12185<br>ASTM D 4052<br>ASTM D 1298 |
| Viscosity at 40 °C | mm$^2$/s | 3.50 | 5.00 | ISO 3104[d]<br>ASTM D 445 |
| Flash point[e] | °C | 120 | - | ISO 2719[d]<br>ISO 3679[f]<br>ASTM D 93 |
| Sulfur content | mg/kg | - | 10.0 | ISO 20846[d]<br>ISO 20884<br>ISO 13032<br>ASTM D 5453 |
| Cetane number[e,g] | | 51.0 | - | ISO 5165[d]<br>ASTM D 613<br>ASTM D 6890 |
| Sulfated ash content | % (m/m) | - | 0.02 | ISO 3987[d]<br>ASTM D 874 |
| Water content | mg/kg | - | 500 | ISO 12937[d]<br>ASTM E 203<br>ASTM D 6304 |
| Total contamination | mg/kg | - | 24 | EN 12662[h] |
| Copper strip corrosion (3 h at 50 °C) | rating | Class 1 | | ISO 2160[d]<br>ASTM D 130 |
| Oxidation stability, 110 °C | hours | 10.0 | - | EN 14112[d]<br>EN 15751 |
| Acid value | mg KOH/g | - | 0.50 | EN 14104[d]<br>ASTM D 664 |
| Iodine value | g iodine/ 100 g | - | 110 | EN 14111[d]<br>EN 16300 |
| Linolenic acid methyl ester | % (m/m) | - | 12.0 | EN 14103 |
| Polyunsaturated (≥4 double bonds) methyl esters | % (m/m) | - | 1 | EN 15779 |
| Methanol content | % (m/m) | - | 0.20 | EN 14110 |
| Monoglyceride content | % (m/m) | - | 0.70 | EN 14105[d]<br>ASTM D 6584 |

# Specifications in MS 2008:2014

**Table 1. General applicable requirements and test methods** *(continued)*

| Property | Unit | Limits | | Test methods[a] |
|---|---|---|---|---|
| | | Minimum | Maximum | |
| Diglyceride content | % (m/m) | - | 0.20 | EN 14105[d]<br>ASTM D 6584 |
| Triglyceride content | % (m/m) | - | 0.20 | EN 14105[d]<br>ASTM D 6584 |
| Free glycerol | % (m/m) | - | 0.02 | EN 14105[d]<br>EN 14106<br>ASTM D 6584 |
| Total glycerol | % (m/m) | - | 0.25 | EN 14105[d]<br>ASTM D 6584 |
| Group I metal (Na + K) [f] | mg/kg | - | 5.0 | EN 14108[d]<br>EN 14109<br>EN 14538 |
| Group II metals (Ca + Mg) | mg/kg | | 5.0 | EN 14538 |
| Phosphorus content | mg/kg | - | 4.0 | EN 14107[d]<br>ASTM D 4951 |
| CFPP | °C | - | 15 | EN 116 |

[a] See 6.4.1

[b] The addition of non-PME components other than additives is not allowed, see 6.2.

[c] Density may be measured by ISO 3675 over a range of temperatures from 20 °C to 60 °C. Temperature correction shall be made according to the formula given in Annex C.

[d] See 6.4.2.

[e] See Annex B for precision data.

[f] A 2 ml sample and apparatus equipped with a thermal detection device shall be used.

[g] See 6.4.3.

[h] This test method developed for diesel fuel may show analytical problem when applied to PME. A more suitable test method in under development by CEN.

# MS 123:2014 – Standard Revision on Diesel Fuel Part 1: Euro2M

MALAYSIAN STANDARD

MS 123-1:2014

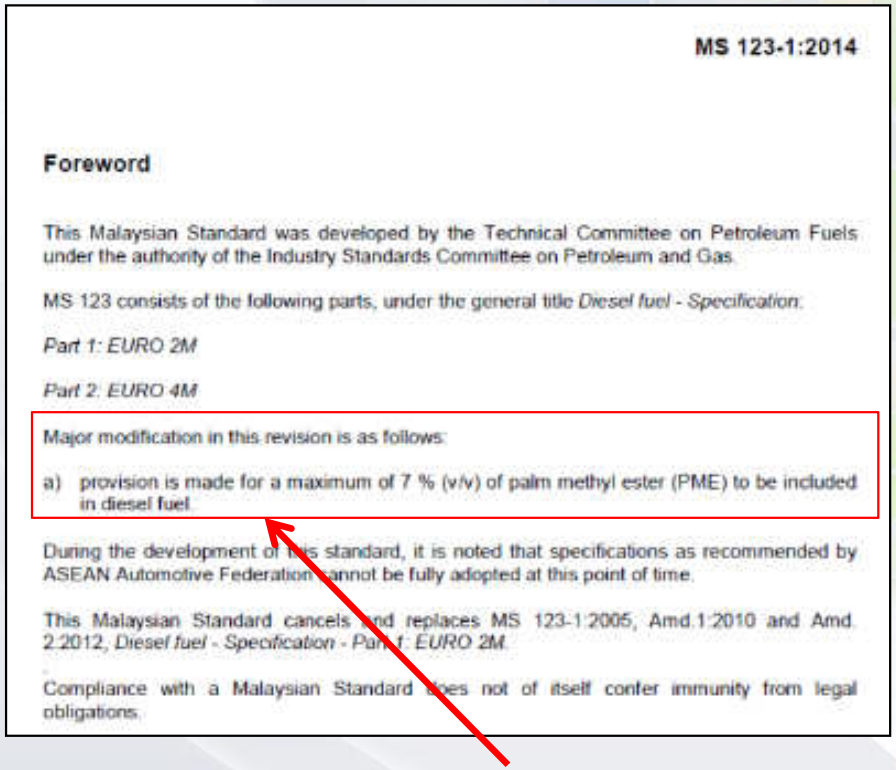
Diesel fuel - Specification - Part 1: Euro 2M (Fourth revision)

ICS: 75.080

Descriptors: diesel, EURO 2M, specifications, test method



DEPARTMENT OF STANDARDS MALAYSIA





**Foreword**

This Malaysian Standard was developed by the Technical Committee on Petroleum Fuels under the authority of the Industry Standards Committee on Petroleum and Gas.

MS 123 consists of the following parts, under the general title *Diesel fuel - Specification*:

*Part 1: EURO 2M*

*Part 2: EURO 4M*

Major modification in this revision is as follows:

a) provision is made for a maximum of 7 % (v/v) of palm methyl ester (PME) to be included in diesel fuel.

During the development of this standard, it is noted that specifications as recommended by ASEAN Automotive Federation cannot be fully adopted at this point of time.

This Malaysian Standard cancels and replaces MS 123-1:2005, Amd.1:2010 and Amd. 2:2012, *Diesel fuel - Specification - Part 1: EURO 2M*.

Compliance with a Malaysian Standard does not of itself confer immunity from legal obligations.

***Major modification in this revision is as follows:***

***a) provision is made for a maximum of 7 % (v/v) of palm methyl ester (PME) to be included in diesel fuel.***

# Specifications in MS123:2014 (Part 1)

**Table 1. General requirements for diesel fuel**

| Properties | Minimum | Maximum | Referee test method |
|---|---|---|---|
| Colour (ASTM) | - | 2.5 | ASTM D1500 |
| Ash, mass % | - | 0.01 | ASTM D482 |
| Cloud point, °C | - | 19.0 | ASTM D2500 |
| Flash point, °C | 60 | - | ASTM D93 |
| Kinematic viscosity at 40 °C, $mm^2/s$ | 1.5 | 5.8 | ASTM D445 |
| Copper corrosion (3 h at 100 °C) | - | 1 | ASTM D130 |
| Water by distillation, vol % | - | 0.05 | ASTM D95 |
| Sediment by extraction, mass % | - | 0.01 | ASTM D473 |
| Carbon residue on 10 % bottoms, mass % | - | 0.20 | ASTM D189 |
| Density at 15 °C, kg/L | 0.810 | 0.870 | ASTM D1298 |
| Acid number, mg KOH/g | - | 0.25 | ASTM D664 |
| Electrical conductivity, pS/m | 50 | - | ASTM D2624 |
| Cetane index<br>or<br>Cetane number | 49<br><br>49 | -<br><br>- | ASTM D976<br><br>ASTM D613 |
| Physical distillation at 95 % recovered volume, °C<br><br>or<br><br>Simulated distillation at 95 % recovered mass, °C | -<br><br><br><br>- | 370<br><br><br><br>399 | ASTM D86<br><br><br><br>ASTM D2887 |
| Lubricity, µm | - | 460 | ASTM D6079 |
| Total sulphur, mg/kg | - | 500 | ASTM D2622 |

NOTES:
1. No intentional additions of metallic additives are allowed.

2. Other test methods as specified in Annex B for determining the properties may be used, provided that they have been demonstrated to give the same degree of accuracy as the test methods listed. In the event of a dispute, the test method listed in this table is to be the referee method.

3. A suitable method for the separation and identification of Fatty acid methyl ester (FAME) is given in EN 14331.

# MPOB B10/B20 Trial Projects

B10 Peugeot Car

B10 & B20 MPOB Vehicles

B10 with Alam Flora

B10 for DBKL vehicles

Transfer of skid tank to Alam Flora Transfer station, Taman Beringin for the use of extension B10 trial project for 10 trucks

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# B10 / B20 MPOB Vehicles (since 2013): Breakdown of brand of vehicles in B10 Project

| Model | Type | No. of Vehicles | Engine Maker |
|---|---|---|---|
| Mitsubishi | 4 wheel drive | 5 | Japan |
| Ford | 4 wheel drive | 3 | USA |
| Toyota | 4 wheel drive | 9 | Japan |
| Hyundai | 4 wheel drive | 1 | Japan |
| Ssangyong | 4 wheel drive | 1 | Korea |
| Mercedes Benz | Passenger | 1 | Germany |
| Peugeot | Passenger | 5 | Germany |
| Mazda 6 (2017) | Passenger | 1 | Japan |
| Total | | 26 | |

# List of 50 KL City Hall Diesel Vehicles Involved in B10 Programme (2014)

| No. | Registration No | Type of Vehicles | Model |
|---|---|---|---|
| 1 | WWT2270 | Excavator & Backhoe, Wheeled | Case 580N |
| 2 | WWS8562 | Tractor Shovel, Wheeled | Komatsu WA200-5 |
| 3 | WSD0371 | Excavator, Wheeled | Hitachi ZX210W-3 |
| 4 | WSR7809 | Excavator & Backhoe, Wheeled | Case 580M |
| 5 | WSN3014 | Tractor Shovel, Wheeled | Komatsu WA250-3A |
| 6 | WRV4893 | Excavator & Backhoe, Wheeled | JCB 3CX |
| 7 | WPY9079 | Tractor Shovel, Wheeled | TCM L20-3 |
| 8 | WJM9072 | Tractor Shovel, Wheeled | Dressta 515C |
| 9 | WRF7421 | Transporter (Vehicle Carrier) | Hicom MTB170UV |
| 10 | WWJ1787 | Flatbottom Lorry with Taillift | Hino GD1JLPA |
| 11 | WRP4169 | Tipper, End with High Side | Hino GD1JLPA |
| 12 | WRN7045 | Flatbottom Lorry with Taillift | Nissan LKC214N |
| 13 | WRK3697 | Tipper, End with High Side | Hino GD1JLPA |
| 14 | WRG6221 | Patching Lorry | Nissan LKC214N |
| 15 | WPA9372 | Tipper, End with High Side | Nissan LKA211N |
| 16 | WMT2813 | Tipper, End with High Side | Nissan LKA211N |
| 17 | WMT3847 | Tipper, End with High Side | Nissan LKA211N |
| 18 | WKT4002 | Tipper, 3-way 5-ton | Isuzu FSR33H |
| 19 | WKN4023 | Tipper, End with High Side | Nissan LKA211N |
| 20 | WKC2762 | Flatbottom Lorry, 2.5 ton with Taillift | Hicom Perkasa MTB150DX |
| 21 | WKA3235 | Tipper, End 5 ton with Crane | Isuzu FSR33L |
| 22 | WJX7265 | Tipper, 3-way 5-ton | Nissan LKA211N |
| 23 | WJF1941 | Tipper, 3-way 5-ton | Nissan LKA211N |
| 24 | WJD4302 | Tipper, 3-way 5-ton | Nissan LKA211N |
| 25 | WHX7665 | Tipper, 3-way 5-ton | Nissan LKA211N |
| 26 | WHT4136 | Tipper, End 5 ton | Nissan LKA211N |
| 27 | WND8796 | Aerial Platform | Hicom Perkasa MTB170UV |
| 28 | WSL3715 | Aerial Platform | Nissan-Bizzocchi Autel NU41H5/187HP 18.0M |
| 29 | WSL3708 | Aerial Platform | Nissan-Bizzocchi Autel NU41H5/187HP 18.0M |
| 30 | WSK4209 | Tanker, Water | Nissan LKC214N(UBS) |
| 31 | WQX5295 | Tanker, Water | Nissan LKC214N(UBS) |
| 32 | WNT1074 | Tanker, Water | Nissan LKA211N |
| 33 | WMU6791 | Tanker, Water | Isuzu FSR33H |
| 34 | WKH8583 | Recovery Truck | Volvo FM10 6x2 |
| 35 | WNG0180 | Tow Truck with Axle Lift | Nissan NU41H5 |
| 36 | WVX8040 | Pick-up Truck with Crew Cab | Nissan Frontier |
| 37 | WPP8657 | Pick-up Truck with Crew Cab | Ford Ranger UT5L |
| 38 | WPP8659 | Pick-up Truck with Crew Cab | Ford Ranger UT5L |
| 39 | WNP1847 | Pick-up Truck with Crew Cab | Ford Ranger UT5K FM1 |
| 40 | WNP1866 | Pick-up Truck with Crew Cab | Ford Ranger UT5K FM1 |
| 41 | WMP6511 | Pick-up Truck | Toyota Hilux Single Cab (M) |
| 42 | WML8253 | Pick-up Truck with Crew Cab | Mazda B2500 |
| 43 | WLJ5425 | Pick-up Truck with Crew Cab | Isuzu Rodeo TFS 55HDRP |
| 44 | WXK3642 | Pick-up Truck with Crew Cab | Nissan Frontier |
| 45 | WXK3673 | Pick-up Truck | Nissan Navara |
| 46 | WXK3764 | Pick-up Truck | Nissan Navara |
| 47 | WPM3004 | Van | Kia Pregio |
| 48 | WRG4055 | OKU Van | Weststar LDV Maxus 2.5 |
| 49 | WKN7910 | Tractor Shovel, Wheeled | TCM L20 |
| 50 | WYC5958 | Flatbottom Lorry 3 ton with Taillift | Nissan NU41T5 |

# Conclusion

- Malaysian government is committed to implement high blend of biodiesel as greener fuel in the future.
- Short term goal is to implement B15 in 2020 as stipulated in the 11th Malaysian Plan.
- Plans to conduct joint research with JAMA and local universities using high biodiesel blends are being discussed.

# Thank you

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