

Biofuels – Coconut methyl ester (B100) – Specification

Foreword

This Philippine National Standard PNS/DOE QS 002:2021, Biofuels – Coconut methyl ester (B100) – Specification, was prepared by the Department of Energy through the Technical Committee on Petroleum Products and Additives (DOE/TCPPA) and was approved for adoption as Philippine National Standard by the Bureau of Philippine Standards.

This standard cancels and replaces PNS/DOE QS 002:2015 with the following revisions:

1. Inclusion of new property, the Cold soak filterability test (CSFT);
2. Inclusion of provision on good housekeeping; and
3. Updating / review of test methods.

This standard was made in line with the Department's thrust for the continuing development and utilization of various alternative fuels from indigenous and renewable energy sources towards energy interdependence consistent with the country's sustainable economic growth plan. This standard also supports the R. A. No. 9367, otherwise known as the "Biofuels Act of 2006", that complements initiatives in environmental protection and expands opportunities for livelihood in the agricultural sector.

Further, this is in line with the DOE's policy and program of updating the fuel quality specification of biodiesel in terms of the current requirements of the industry, its users, and manufacturers and by endeavoring to harmonize international/regional environmental standards for fuel quality. As a type of fuel, there is a need to standardize its quality to ensure its effectiveness when used whether in its pure state or as a blend based on local conditions as established through various test validations.

This standard is dynamic and is therefore entirely subject for review and/or revision, when necessary, especially to consider other types of indigenous biodiesel feedstocks such as jatropha, palm, algae, among others that will be found technically viable through research and development pursuant to Biofuels Act of 2006.

1 Scope

This standard specifies the requirements for coconut methyl ester (B100) suitable for blending to diesel fuel for use in various types of compression ignition engines and other similar types of engines.

2 References

The titles of the standard publications referred to in this standard are listed on the inside back cover.

3 Definition

For the purpose of this standard, coconut methyl ester is defined as fatty acid methyl esters (FAME) derived from coconut oil whose alkyl groups range in varying percentages from C₈ to C₁₈ suitable for compression ignition engines and other similar types of engines.

4 Requirements

4.1 Composition

Coconut methyl ester shall be fatty acid methyl esters whose alkyl groups range in varying percentages from C₈ to C₁₈.

4.2 Chemical and physical characteristics

Coconut methyl ester shall conform to the chemical and physical requirements specified in Table 1.

5 Sampling

Coconut methyl ester shall be sampled in accordance with PNS ASTM D4057.

6 Good Housekeeping

Addressing the potential of water contamination and existence of bacterial growth in the supply chain, good housekeeping practices must be observed by the oil companies and the biodiesel producers; from the refinery, terminal, or of any other supply facilities, including storage tanks, product tanks, supply barges and tanker truck deliveries. Oil companies and biodiesel producers should have in place adequate quality assurance and management procedures to ensure that the resultant product is PNS compliant and in good quality.

7 Test methods

Coconut methyl ester shall be tested in accordance with the methods specified in Table 1.

Table 1 – Chemical and physical requirements for coconut methyl ester

Property	Limit	Test Method
Appearance	Clear and bright, visibly free of suspended or precipitated contaminants	Visual
Acid number, mg KOH/g, max	0.50	PNS ASTM D664 PNS ASTM D974 EN 14104
Carbon residue on 10% Distillation residue, % mass, max.	0.3	PNS ASTM D4530 or PNS ISO 10370
Cetane number, min	55	PNS ASTM D613 or PNS ASTM D6890 or PNS ISO 5165 or IP 498/03
Cloud point, °C, max	5	PNS ASTM D2500
Cold soak filterability, seconds, max.	360	PNS ASTM D7501
Copper strip corrosion 3 hrs@ 50°C, max.	No. 1	PNS ASTM D130 or PNS ISO 2180
Density @ 15°C, kg/L	0.86 – 0.90	PNS ASTM D1298 or PNS ASTM D4052 or PNS ISO 3675
Distillation AET 90% recovered °C, max.	360	PNS ASTM D1160 or PNS ASTM D86
FAME content, % mass, min	96.5	PNS/DOE TM 01
Flash point, Pensky-Martens, °C, min.	100	PNS ASTM D93
Glycerin, % mass max. Free glycerin	0.02	AOCS Ea 6-94 (1997) PNS ASTM D6584 or EN 14105
Total glycerin	0.24	AOCS Ca 14-56 (1997) or PNS ASTM D6584 or EN 14105
Glyceride content, % mass, max. Monoglyceride	0.80	EN 14105 or PNS ASTM D6584
di-glyceride	0.20	
tri-glyceride	0.20	
Group Metals, mg/kg, max. Group I metals (Na+K)	5	EN 14108 EN 14109
Group II metals (Ca+Mg)	5	EN 14538
Iodine Number, g ₂ /100g, max	10	EN 14111
Methanol content, % m/m, max.	0.20	EN 14110
Methyl Laurate, % mass, min..	45	PNS/DOE TM 01

Table 1 (continued)

Oxidation stability, 110 °C, hours, min	10	EN 14112
Phosphorus, % mass, max	0.001	PNS ASTM D4951
Sulfated ash, % mass, max	0.020	PNS ASTM D874
Sulfur, % mass, max.	0.001	PNS ASTM D1266 or PNS ASTM D2622 or PNS ASTM D5453 or PNS ASTM D7039
Viscosity, Kinematic @ 40°C, mm ² /s	2.0-4.5	PNS ASTM D445
Water, % volume, max	0.05	PNS ASTM D6304 or PNS ISO 12937 or PNS ASTM E203
Water & sediments, % volume, max.	0.05	PNS ASTM D2709
NOTE: Cold Soak Filterability Test (CSFT) using ASTM D7501. Results to be reported by the biodiesel producer as part of the quality monitoring of Registered Biofuel Producer.		

References:

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

PNS ASTM D86:2020 (ASTM published 20__) Test Method for Distillation of Petroleum Products at Atmospheric Pressure

PNS ASTM D93:2020 (ASTM published 20__) Standard Test Methods for Flash Point by Pensky-Martens Closed Cup Tester

PNS ASTM D130: 2019 (ASTM published 20__), Standard Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

PNS ASTM D445:2021 (ASTM published 201__), Standard Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

PNS ASTM D613:2018ae1 (ASTM published 20__) Test Method for Cetane Number of Diesel Fuel Oil

PNS ASTM D664:2018ae2, (ASTM published 20__) Standard Test Methods for Acid Number of Petroleum Products by Potentiometric Titration

PNS ASTM D874:2013a (2018) (ASTM published 20__) Standard Test Method for Sulfated Ash from Lubricating Oils and Additives

PNS ASTM D974-2021 (ASTM published 20__) Standard Test Methods for Acid and Base Number by Color-Indicator Titration

PNS ASTM D1160-2018 (ASTM published 20__) Standard Test Methods for Distillation of Petroleum Products at Reduced Pressure

PNS ASTM D1266:2018 (ASTM published 20__) Standard Test Method for Sulfur in Petroleum Products (Lamp Method)

PNS ASTM D1298:2012b (2017) (ASTM published 20__) Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

PNS ASTM D2500:2017a (ASTM published 20__) Standard Test Method for Cloud Point of Petroleum Products

PNS ASTM D2622:2016 (ASTM published 20__) Standard Test Method for Sulfur in Petroleum Products by Wavelength Dispersive X-ray Fluorescence Spectrometry

PNS ASTM D2709:2016 (ASTM published 1996 reapproved 20__) Standard Test Method for Water and Sediment in Middle Distillate Fuels by Centrifuge

PNS ASTM D4052:2018a (ASTM published 20__) Standard Test Method for Density, Relative Density and API Gravity of Liquids by Digital Density Meter

PNS ASTM D4057:2019 (ASTM published 20__) Practice for Manual Sampling of Petroleum and Petroleum Products

PNS ASTM D4530:2015 (2020) (ASTM published 20__) Standard Test Method for Determination of Carbon Residue (Micro Method)

PNS ASTM D4951:2014 (2019) (ASTM published 20__) Standard Test Method for Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry

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PNS ASTM D5453:2019a (ASTM published 20__) Standard Test Method for Determination of Total Sulfur in Light Hydrocarbons, Spark Ignition, Engine Fuel, Diesel Engine Fuel, and Engine Oil by Ultraviolet Fluorescence

PNS ASTM D6304:2020 (ASTM published 20__) Test Method for Determination of Water in Petroleum Products, Lubricating Oils, and Additives by Coulometric Karl Fischer Titration

PNS ASTM D6584:2017 (ASTM published 201__) Standard Test Method for Determination of Total Monoglycerides, Total Diglycerides, Total Triglycerides, and Free and Total Glycerin in B-100 Biodiesel Methyl Esters by Gas Chromatography

PNS ASTM D6890:2021 (ASTM published 20__) Standard Test Method for Determination of Ignition Delay and Derived Cetane Number (DCN) of Diesel Fuels by Combustion in a Constant Volume Chamber

PNS ASTM D7039:2015a (2020) (ASTM published _____) Test Method for Sulfur in Gasoline, Diesel Fuel, Jet Fuel, Kerosine, Biodiesel, Biodiesel Blends, and Gasoline-Ethanol Blends by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry

PNS ASTM D7501:2018a (ASTM published _____) Test Method for Determination of Fuel Filter Blocking Potential of Biodiesel (B100) Blend Stock by Cold Soak Filtration Test (CSFT)

PNS ASTM E203:2016 (ASTM published 20__) Test Method for Water Using Volumetric Karl Fischer Titration

PNS ISO 2160:2012 (ISO published 1998) Petroleum Products – Corrosiveness to Copper – Copper Strip Test

PNS ISO 3675:2015 (ISO published 1998) Crude petroleum and liquid petroleum products – Laboratory determination of density – Hydrometer method

PNS ISO 5165:2015 (ISO published 1998) Petroleum products – Determination of the ignition quality of diesel fuels – Cetane engine method

PNS ISO 10370:2015 (ISO published 2014) Petroleum products – Determination of the carbon residue – Micro method – Technical Corrigendum 1

PNS ISO 12937:2012 (ISO published 2000) Petroleum Products – Determination of Water – Coulometric Karl Fischer Titration Method

PNS/DOE TM 01 – Determination of Ester and Lauric Acid Content in Fatty Acid Methyl Esters (FAME) by Gas Chromatography

EN 14104:2003: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of acid value

EN 14105:2003: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of free and total glycerol and mono-, di-, triglyceride contents (Reference Method)

EN 14108:2003: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of sodium content by atomic absorption spectrometry

EN 14109:2003: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of potassium content by atomic absorption spectrometry

EN 14110:2003: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of methanol content

EN 14111:2003: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of iodine value

EN 14112:2003: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of oxidation stability (accelerated oxidation test)

EN 14538:2006: Fat and oil derivatives. Fatty acid methyl esters (FAME). Determination of Ca, K, Mg and Na content by optical emission spectral analysis with inductively coupled plasma (ICP OES)

AOCS Ea 6-94 (1997), Test Method of Crude Glycerin, Titrimetric Method

AOCS Ca 14-56 (1997), Test Method for Determination of Total, Free and Combined Glycerol Iodometric-Periodic Acid Method

IP 498-03, Ignition Quality Tester

Abbreviations

PNS	-	Philippine National Standard
AOCS	-	American Oil Chemists' Society
ASTM	-	American Society for Testing and Materials
ISO	-	International Standard Organization
EN	-	Euro Norm (Regional Standard of European Countries)

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