



Designation: D8274 – 25a

Standard Test Method for Determination of Biodiesel (Fatty Acid Methyl Esters) Content in Diesel Fuel Oil by Portable Rapid Mid-Infrared Analyzer¹

This standard is issued under the fixed designation D8274; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope*

1.1 This test method covers the determination of the content of biodiesel (fatty acid methyl esters (FAME)) in diesel fuel oils for volume fractions of 0.1 % to 40.0 % by mid-infrared analyzer.

NOTE 1—ASTM and ISO specification fuels falling within the scope of this test method include Specifications: **D975** grades No. 1D and No. 2D, **D7467**, distillate grades of **D396**, MIL-DTL-16884, and distillate grades of marine fuel specification ISO 8217.

1.2 The accuracy of this test method is based on the molecular weight of C16 and C18 FAME species.

1.2.1 *Discussion*—Biodiesel contains a variety of species with different molecular weights. Typical market FAMES from North America and Europe, which are predominantly soy, rapeseed, and used cooking oil derived FAME were included in the pilot study. FAME derived from coconut, which predominantly contains C12, will over-read by approximately 30 %.

1.3 This method cannot distinguish between vegetable oils, animal fats, FAEE, compounds containing carbonyl groups, and FAME. For more information, see Section 6.

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

- D86** Test Method for Distillation of Petroleum Products and Liquid Fuels at Atmospheric Pressure
- D396** Specification for Fuel Oils
- D445** Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
- D975** Specification for Diesel Fuel
- D1298** Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D4052** Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4057** Practice for Manual Sampling of Petroleum and Petroleum Products
- D4175** Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
- D4177** Practice for Automatic Sampling of Petroleum and Petroleum Products
- D4307** Practice for Preparation of Liquid Blends for Use as Analytical Standards
- D6299** Practice for Applying Statistical Quality Assurance and Control Charting Techniques to Evaluate Analytical Measurement System Performance
- D6300** Practice for Determination of Precision and Bias Data for Use in Test Methods for Petroleum Products, Liquid Fuels, and Lubricants
- D6708** Practice for Statistical Assessment and Improvement of Expected Agreement Between Two Test Methods that Purport to Measure the Same Property of a Material
- D6751** Specification for Biodiesel Fuel Blendstock (B100) for Middle Distillate Fuels
- D7371** Test Method for Determination of Biodiesel (Fatty Acid Methyl Esters) Content in Diesel Fuel Oil Using Mid Infrared Spectroscopy (FTIR-ATR-PLS Method)

¹ This test method is under the jurisdiction of ASTM Committee **D02** on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee **D02.04.0F** on Absorption Spectroscopic Methods.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard

D7467 Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20)

D7797 Test Method for Determination of the Fatty Acid Methyl Esters Content of Aviation Turbine Fuel Using Flow Analysis by Fourier Transform Infrared Spectroscopy—Rapid Screening Method

D7806 Test Method for Determination of Biodiesel (Fatty Acid Methyl Ester) and Triglyceride Content in Diesel Fuel Oil Using Mid-Infrared Spectroscopy (FTIR Transmission Method)

D7963 Test Method for Determination of Contamination Level of Fatty Acid Methyl Esters in Middle Distillate and Residual Fuels Using Flow Analysis by Fourier Transform Infrared Spectroscopy—Rapid Screening Method

2.2 ISO Standards:³

ISO 4259-5 Petroleum and related products—Precision of measurement methods and results. Part 5: Statistical assessment of agreement between two different measurement methods that claim to measure the same property

ISO 8217 Petroleum products—Fuels (class F)—Specifications of marine fuels

2.3 Other Standards:

EN 14078 Liquid petroleum products. Determination of fatty acid methyl ester (FAME) content in middle distillates. Infrared spectrometry method

MIL-DTL-16884⁴ Specification for Naval distillate fuel (NATO designation F76)

3. Terminology

3.1 *Definitions*—For definitions of terms used in this test method, refer to Terminology **D4175**.

3.2 Abbreviations:

3.2.1 *FAME*, *n*—fatty acid methyl esters

4. Summary of Test Method

4.1 This test method describes a rapid procedure to determine the volume concentration of biodiesel in diesel. The test specimen is introduced into a liquid cell of a mid-infrared analyzer. The absorbance of the sample is measured in two spectroscopic bands. The amount of biodiesel is determined by the absorbance in a band which includes 1749 cm⁻¹, where the carbonyl stretching frequency is located. The second band, centered around 1890 cm⁻¹ is used to correct for the non-biodiesel matrix of the test specimen. The test takes less than one minute, including introducing the test specimen and removing the previous test specimen.

5. Significance and Use

5.1 Biodiesel is a fuel commodity primarily used as a blending component with diesel fuel. It is important to check the concentration of biodiesel in the diesel fuel in order to verify it is within limits or does not exceed the maximum allowable limit.

5.2 This test method is applicable for quality control in the production and distribution of diesel fuel and biodiesel blends.

5.3 This test is simple to run, completed in less than one minute, with no dilution of the test sample, no cleaning solvents are required, and the analyzer is portable and self-contained.

6. Interferences

6.1 *Undissolved Water and Particulates*—Samples containing undissolved water or particulates can result in erroneous results. If the sample is cloudy or water saturated after it has been equilibrated between 10 °C to 30 °C, filter the sample through a qualitative filter paper until clear prior to its measurement.

6.2 *Vegetable Oils*—This method cannot distinguish between vegetable oils, animal fats, and FAME. Measurements of vegetable oils and animal fats will give a similar response as that of FAME.

6.3 *Fatty Acid Ethyl Esters (FAEE)*—It is not possible to distinguish between FAEE and FAME by this test method. Measurements of FAEE and animal fats will give a similar response as that of FAME.

6.4 *Carbonyl Groups*—This method cannot distinguish FAME from compounds containing carbonyl groups, such as aldehydes and ketones. The results for samples containing volume fractions of these compounds less than 0.1 % would not be affected.

7. Apparatus⁵

7.1 *Mid-Infrared Analyzer*, comprising of a liquid cell, infrared emitter, detectors, a display, microprocessor, and a sample loading mechanism.

7.2 The apparatus is further described in **Annex A1**.

7.3 The apparatus is available in two configurations, Type 1 and Type 2. See **Annex A1** for more information. Type 1 apparatus is for use up to 40.0 % and Type 2 apparatus is for use up to 31.0 %. The precision for Type 2 apparatus is interim repeatability only (see **Annex A3**).

8. Reagents and Materials

8.1 *Absorbent paper towel*.

8.2 *Verification sample*, containing a known concentration of FAME up to 40 % (volume fraction). Refer to **Annex A2** on the preparation of verification samples.

8.3 *Calibration standards*, containing known concentrations of FAME. Refer to **Table A2.1** for values and **Annex A2** on the preparation of calibration samples.

9. Sampling

9.1 *General Requirements:*

³ Available from American National Standards Institute (ANSI), 1180 Avenue of the Americas, 10th Floor, New York, NY 10036, <http://www.ansi.org>.

⁴ Copies of these documents are available online at <https://assist.dla.mil/quicksearch/> or <http://assistdocs.com/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.

⁵ The sole source of supply of the apparatus, SetaCheck Bio (part number SA5550 (Type 1) and SA5500 (Type 2)), known to the committee at this time is Stanhope-Seta, Chertsey, Surrey, KT16 8AP, UK. If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,¹ which you may attend.