Designation: D 5234 – 92 (Reapproved 2002)

An American National Standard

Standard Guide for Analysis of Ethylene Product[1]

This standard is issued under the fixed designation D 5234; 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 guide provides direction for the analysis of ethylene product in a way that allows the analyst to know the possible test methods, the units of measure, and the potential concentrations range of possible components, so that the consistency of the analytical measurements is improved. This guide is not intended to be used, nor to be construed in any way, as a set of specifications for ethylene product.

1.2 The values stated in SI units are to be regarded as the standard.

1.3 *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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 2504 Test Method for Noncondensable Gases in C_2 and Lighter Hydrocarbon Products by Gas Chromatography[2]

D 2505 Test Method for Ethylene, Other Hydrocarbons, and Carbon Dioxide in High-Purity Ethylene by Gas Chromatography[2]

D 3246 Test Method for Sulfur in Petroleum Gas by Oxidative Microcoulometry[3]

D 4178 Practice for Calibrating Moisture Analyzers[3]

D 4468 Test Method for Total Sulfur in Gaseous Fuels by Hydrogenolysis and Rateometric Colorimetry[4]

F 307 Practice for Sampling Pressurized Gas for Gas Analysis[5]

3. Terminology

3.1 *Definition:*

3.1.1 *ethylene product, n*—hydrocarbon product containing at least 99.85 % mass ethylene.

3.2 *Symbols:*

3.2.1 *C4s, n*—saturated and unsaturated four carbon hydrocarbon compounds.

3.2.2 *COS, n*—carbonyl sulfide.

3.2.3 *GC, n*—gas chromatograph.

3.2.4 *FPD, n*—flame photometric detector.

3.2.5 *IC, n*—ion chromatograph.

3.2.6 *MeOH, n*—methanol.

3.2.7 *NO, n*—nitric oxide.

3.2.8 NO_2, *n*—nitrogen dioxide.

3.2.9 O_2, *n*—oxygen.

3.2.10 *sp. ion electrode, n*—specific ion electrode.

4. Significance and Use

4.1 When the various producers and users of ethylene product deal with the results obtained in analytical testing, inconsistency of units and test methods may cause major errors. This guide provides an overview of the typical concentrations of the possible components found in ethylene product, the methods used in analysis, and the units of measure. This overview is intended to be used to improve the consistency of methods and the units reported so that errors are minimized. Each producer and user of ethylene product should immediately review this guide to improve their awareness of the various analytical methods in use, the units of measure, and concentration levels of the possible components.

4.2 Although this guide is not to be used for specifications, it can provide a starting point for the various parties to develop mutually agreed upon specifications that meet their respective requirements. It can also be used as a starting point in finding suitable test methods for ethylene components.

5. Sampling

5.1 In general, sample ethylene product using Practice F 307, or a similar method. Do not take liquid ethylene samples in order to prevent over-pressuring of sample containers and elimination of fire and explosion hazards. Static electricity can develop when discharging excess hydrocarbon at a fairly rapid rate from a sample cylinder to ambient conditions. Use a grounding system or strap.

5.2 *Reactive and Polar Components*:

---

[1] This guide is under the jurisdiction of ASTM Committee D02 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.D0.02 on Ethylene.

Current edition approved Dec. 10, 2002. Published March 2003. Originally approved in 1992. Last previous edition approved in 1997 as D 5234 – 92(1997).

[2] *Annual Book of ASTM Standards*, Vol 05.01.

[3] *Annual Book of ASTM Standards*, Vol 05.02.

[4] *Annual Book of ASTM Standards*, Vol 05.06.

[5] *Annual Book of ASTM Standards*, Vol 15.03.

5.2.1 Determination of reactive components, such as certain sulfur compounds, is generally believed to require special sample containers, such as fluorocarbon lined cylinders, or containers that have been specially passivated.

5.2.2 It is very difficult to obtain a valid sample for determination of traces of polar compounds, such as water and ammonia, in the laboratory. On-line analyzers, if available, or adsorption of the analyte at the sample source for subsequent lab finish are believed to yield the most accurate results.

6. Composition and Test Methods

6.1 Table 1 indicates possible composition ranges and ASTM test methods for ethylene product.

6.2 Table 2 lists other test methods known or believed to be in use.

7. Keywords

7.1 ethylene; ethylene product concentration; ethylene test methods;

TABLE 1 Ethylene Test Methods (ASTM)

Component	Concentrations	Units	Test Methods
Ethylene	99.85 +	% mass	D 2505
Ethane	200 to 700	mg/kg	D 2505
Methane	<0.1 to 200	mg/kg	D 2505
Propylene	<0.1 to 10	mg/kg	D 2505
Propane	<0.1 to 5	mg/kg	D 2505
Hydrogen	<0.1 to 10	mg/kg	D 2504
Carbon monoxide	<0.1 to 5	mg/kg	D 2504
Carbon dioxide	<0.1 to 10	mg/kg	D 2504
Acetylene	<0.1 to 5	mg/kg	D 2505
Moisture	<0.1 to 5	mg/kg	See Table 2
Alcohols	<0.1 to 5	mg/kg	See Table 2
Total sulfur	<0.1 to 5	mg/kg	D 3246 or D4468
Oxygen	<0.1 to 3	mg/kg	D 2504 or O_2 meter
Nitrogen	<1 to 10	mg/kg	D 2504
Ammonia	<0.1 to 2	mg/kg	See Table 2
Hydrogen sulfide	<0.1 to 1	mg/kg	Online analyzer
Carbonyl sulfide	<0.1 to 1	mg/kg	See Table 2
Total oxygenates	<0.1 to 10	mg/kg	See Table 2
NO and NO_2	<0.1 to 10	mg/kg	See Table 2
Benzene	<0.1 to 10	mg/kg	See Table 2
C4s	<0.1 to 10	mg/kg	See Table 2
Methyl acetylene	<0.1 to 10	mg/kg	See Table 2
Propadiene	<0.1 to 10	mg/kg	See Table 2
Chlorides	<0.1 to 2	mg/kg	See Table 2

TABLE 2 Ethylene Test Methods (Non-ASTM)[A]

Components	Possible Test Methods
Methane, ethane propane, propylene, propadiene, methyl acetylene, acetylene	An adaptation of Test Method D 2505 is used by some labs. Others use a GC wide-bore capillary method. New technology offers narrow bore capillaries that separate all hydrocarbons in one analysis.
H_2, N_2, O_2, and CO	An adaptation of Test Method D 2504.
CO_2	An adaptation of Test Method D 2505.
NO and NO_2	Chemiluminescence.
Total sulfur	Some labs use an adaptation of Test Method D 3246; others use Test Method D 4468 with an oxy-hydrogen pyrolyzer.
Benzene	GC methods including wide bore capillary.
Moisture	Obtaining a valid sample for lab analysis is extremely difficult. Instead of a lab method, an ASTM study group developed, in 1982, a standard practice for calibrating moisture analyzers, Practice D 4178. Several types of portable and on-line analyzers are available.
C4s	GC methods including wide bore capillary.
Ammonia	Some methods in use are: Acid absorption/Nessler finish. Acid absorption/specific ion electrode. Acid absorption/IC finish.
Total oxygenates	GC methods.
Alcohols	GC methods in use. Wide bore capillary GC methods.
COS	GC—FPD method.
Chlorides	Hall conductivity detector.

[A] This table gives possible ethylene test methods or techniques that are believed to be in use in the industry for testing. Inclusion of any test method in this table is not to be construed as a recommendation by ASTM for its use. Some of the test methods in this list are ASTM test methods that are specified for other products, but are being used by some labs for ethylene analysis. However, use of ASTM test methods beyond their scope is not recommended by ASTM. Precision and bias may be adversely affected.