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Standard Practice for Calculation of Gas Chromatographic Response Factors[1]

This standard is issued under the fixed designation D4626; 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~~ Scope*

1.1 This practice covers a procedure for calculating gas chromatographic response factors. It is applicable to chromatographic data obtained from a gaseous mixture or from any mixture of compounds that is normally liquid at room temperature and pressure or solids, or both, that will form a solution with liquids. It is not intended to be applied to those compounds that react in the chromatograph or are not quantitatively eluted. Normal C_6 through C_{11} paraffins have been chosen as model compounds for demonstration purposes.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *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]

D2268 Test Method for Analysis of High-Purity *n*-Heptane and *Iso*octane by Capillary Gas Chromatography
D2427 Test Method for Determination of C_2 through C_5 Hydrocarbons in Gasolines by Gas Chromatography (Withdrawn 2023)[3]
D2804 Test Method for Purity of Methyl Ethyl Ketone By Gas Chromatography
D2998 Test Method for Polyhydric Alcohols in Alkyd Resins (Withdrawn 2004)[3]
D3329 Test Method for Purity of Methyl Isobutyl Ketone by Gas Chromatography
D3362 Test Method for Purity of Acrylate Esters by Gas Chromatography (Withdrawn 2011)[3]
D3465 Guide for Purity of Monomeric Plasticizers by Gas Chromatography
D3545 Test Method for Alcohol Content and Purity of Acetate Esters by Gas Chromatography
D3695 Test Method for Volatile Alcohols in Water by Direct Aqueous-Injection Gas Chromatography
D4175 Terminology Relating to Petroleum Products, Liquid Fuels, and Lubricants
D4307 Practice for Preparation of Liquid Blends for Use as Analytical Standards

[1] This practice is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.04.0L on Gas Chromatography Methods.

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

[3] The last approved version of this historical standard is referenced on www.astm.org.

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

E260 Practice for Packed Column Gas Chromatography
E355 Practice for Gas Chromatography Terms and Relationships

3. Terminology

3.1 *Definitions:*

3.1.1 This test method makes reference to common gas chromatographic procedures, terms, and relationships. Detailed definitions of these can be found in Practices E260, E355 and/or Terminology D4175.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *response factor (R)*—a constant of proportionality used to convert the observed chromatographic response of specific compounds to either mass or volume percent composition. The observed response may be measured as peak areas or peak heights. Depending on the calculation formula, the response factor (*R*) is applied by either multiplying or dividing the observed response by the determined factor.

3.2.2 In this practice, the response factors determined are multiplying factors.

4. Summary of Practice[4]

4.1 Individual C_6 to C_{11} *n*-paraffins are precisely weighed and combined in an inert, tight-sealing glass vial. Different concentration levels of the blend components to cover concentration ranges of interest may be obtained by dilution with a suitable solvent. As diluent, a *n*-paraffin, such as *n*-dodecane, that is, higher boiling than the blend components is suitable. The quantitative blends are analyzed, in duplicate, by gas chromatography using either thermal conductivity, flame-ionization or other forms of detection. From the mass or volume composition of the blend and the raw area or peak height measurements, mass or volume response or relative response factors for each blend component are calculated.

5. Significance and Use

5.1 ASTM standard gas chromatographic methods for the analysis of petroleum products require calibration of the gas chromatographic system by preparation and analysis of specified reference mixtures. Frequently, minimal information is given in these methods on the practice of calculating calibration or response factors. Test Methods D2268, D2427, D2804, D2998, D3329, D3362, D3465, D3545, and D3695 are examples. The present practice helps to fill this void by providing a detailed reference procedure for calculating response factors, as exemplified by analysis of a standard blend of C_6 to C_{11} *n*-paraffins using *n*-C_{12} as the diluent.

5.2 In practice, response factors are used to correct peak areas to a common base prior to final calculation of the sample composition. The response factors calculated in this practice are “multipliers” and prior to final calculation of the results the area obtained for each compound in the sample should be multiplied by the response factor determined for that compound.

5.3 It has been determined that values for response factors will vary with individual installations. This may be caused by variations in instrument design, columns, and experimental techniques. It is necessary that chromatographs be individually calibrated to obtain the most accurate data.

6. Apparatus

6.1 *Chromatograph*—Any gas chromatograph equipped with either a flame ionization, thermal conductivity or other detector may be used that meets the performance requirements of the method for which calibration is being performed.

6.2 *Recorder*—A recording potentiometer with a full-scale response time of 1 s or less may be used.

6.3 *Integrator or Computer*—Means must be provided for determining the detector response. Peak heights or areas can be measured by computer, electronic integration or manual techniques.

[4] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: D02-1200. Contact ASTM Customer Service at service@astm.org.