



Designation: E 1615 – 00

## Standard Test Method for Iron in Trace Quantities Using the FerroZine Method<sup>1</sup>

This standard is issued under the fixed designation E 1615; 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 iron in the range from 0.05 to 10 µg/L using FerroZine<sup>2</sup> reagent solution. The range may be extended through the use of a 1- or 10-cm cell or by suitable dilution of the sample solution.

1.2 This test method is intended to be general for the final steps in the determination of iron and does not include procedures for sample preparation.

1.3 Review the current material safety data sheets (MSDS) for detailed information concerning toxicity, first-aid procedures, and safety precautions.

1.4 *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.* For specific hazards statements, see 7.4.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

D 1193 Specification for Reagent Water<sup>3</sup>

E 60 Practice for Photometric and Spectrophotometric Methods for Chemical Analysis of Metals<sup>4</sup>

E 200 Practice for Preparation, Standardization, and Storage of Standard and Reagent Solutions for Chemical Analysis<sup>5</sup>

### 3. Summary of Test Method

3.1 This test method is based upon a photometric determination of the FerroZine complex with the iron (II) ion.<sup>6,7</sup> The

sample is dissolved in a suitable solvent and the iron is reacted with FerroZine reagent solution which will convert the dissolved iron compounds to form a magenta color iron (II) complex. The iron content of the sample solution is determined by measurement of the magenta color at 560 nm using a suitable photometer.

### 4. Significance and Use

4.1 This test method is suitable for determining trace concentrations of iron in a wide variety of products, provided that appropriate sample preparation has rendered the iron and sample matrix soluble in water or other suitable solvent. Each sample matrix must be investigated for suitability using this test method.

4.2 This test method assumes that the amount of color developed is proportional to the amount of iron in the test solution. The calibration curve is linear over the specified range.

### 5. Interferences

5.1 Any ion that absorbs light at 560 nm will interfere with the determination. Anionic interferences include oxalate in concentrations over 500 ppm, cyanide, and nitrate.<sup>6</sup>

5.2 Of copper, cobalt, calcium, magnesium, lead, silver, molybdenum, aluminum, nickel, zinc, arsenic, manganese, hexavalent chromium, trivalent chromium, divalent cobalt, and monovalent copper are the only metals other than iron that form colored species with FerroZine under test conditions. At least 1000 mg/L of the alkali metals and the alkaline earths had no effect on the determination. Many heavy metals will react with FerroZine in competition with iron, but with the excess reagent used in the test there is no effect on the results.<sup>6</sup>

5.3 The pH range of the final solution should be from 4 to 9 to give the best test results.<sup>6,7</sup>

5.4 All glassware used in this test method must be iron-free and scrupulously clean by precleaning with dilute hydrochloric acid and FerroZine reagent solution followed by a water rinse.

### 6. Apparatus

6.1 *Photometer*, capable of measuring light absorption at 560 nm and holding a 5-cm or larger cell.

6.2 *Absorption Cells*, 5-cm light path.

<sup>1</sup> This test method is under the jurisdiction of ASTM Committee E15 on Industrial and Specialty Chemicals and is the direct responsibility of Subcommittee E15.01 on General Standards.

Current edition approved April 10, 2000. Published July 2000. Originally published as E 1615 – 94. Last previous edition E 1615 – 94.

<sup>2</sup> FerroZine is a trademark of Hach Chemical Company.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 11.01.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 03.05.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 15.05.

<sup>6</sup> Stookey, L. L., "FerroZine—A New Spectrophotometric Reagent for Iron," *Analytical Chemistry*, Vol 42, No. 7, June 1970, pp. 779 – 781.

<sup>7</sup> Gibbs, C. R., "Characterization and Application of FerroZine Iron Reagent as a Ferrous Iron Indicator," *Analytical Chemistry*, Vol 48, No. 8, July 1976, pp. 1197–1201.