



Standard Test Method for Determination of Metal Cyanide Complexes in Wastewater, Surface Water, Groundwater and Drinking Water Using Anion Exchange Chromatography with UV Detection¹

This standard is issued under the fixed designation D 6994; 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 metal cyanide complexes of iron, cobalt, silver, gold, copper and nickel in waters including groundwaters, surface waters, drinking waters and wastewaters by anion exchange chromatography and UV detection. The use of alkaline sample preservation conditions (see 10.3) ensures that all metal cyanide complexes are solubilized and recovered in the analysis **(1-3)**.²

1.2 Metal cyanide complex concentrations between 0.20 to 200 mg/L may be determined by direct injection of the sample. This range will differ depending on the specific metal cyanide complex analyte, with some exhibiting greater or lesser detection sensitivity than others. Approximate concentration ranges are provided in 12.1. Concentrations greater than the specific analyte range may be determined after appropriate dilution. This test method is not applicable for matrices with high ionic strength (conductivity greater than 500 meq/L as Cl) and TDS (greater than 30 000 mg/L), such as ocean water.

1.3 Metal cyanide complex concentrations less than 0.200 mg/L may be determined by on-line sample preconcentration coupled with anion exchange chromatography as described in 11.3. This range will differ depending on the specific metal cyanide complex analyte, with some exhibiting greater or lesser detection sensitivity than others. Approximate concentration ranges are provided in 12.1. The preconcentration method is not applicable for silver and copper cyanide complexes in matrices with high TDS (greater than 1000 mg/L).

1.4 The test method may also be applied to the determination of additional metal cyanide complexes, such as those of platinum and palladium. However, it is the responsibility of the user of this standard to establish the validity of the test method for the determination of cyanide complexes of metals other than those in 1.1.

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 and health practices and determine the applicability of regulatory limitations prior to use. For specific hazard statements, refer to Section 9.

2. Referenced Documents

2.1 ASTM Standards:³

- D 1129 Terminology Relating to Water
- D 1192 Specification for Equipment for Sampling Water and Steam in Closed Conduits
- D 1193 Specification for Reagent Water
- D 2777 Practice for Determination of Precision and Bias of Applicable Methods of Committee D-19 on Water
- D 3370 Practices for Sampling Water from Closed Conduits
- D 3856 Guide for Good Laboratory Practices in Laboratories Engaged in Sampling and Analysis of Water
- D 5810 Guide for Spiking into Aqueous Samples
- D 5847 Practice for Writing Quality Control Specifications for Standard Test Methods for Water Analysis
- D 6696 Guide for Understanding Cyanide Species

3. Terminology

3.1 *Definitions*—For a definition of terms used in this method, refer to Terminology D 1129.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *anion exchange chromatography*—a type of liquid chromatography in which anionic analytes are separated by differential retention on an anion exchange resin and detected by an appropriate detection mechanism.

3.2.2 *eluent*—the liquid mobile phase used in anion exchange chromatography to transport the sample through the chromatography system.

3.2.3 *analytical column*—the chromatography column that contains the stationary phase for separation by ion exchange. The column is packed with anion exchange resin that separates the analytes of interest based on their retention characteristics prior to detection.

¹ This test method is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.05 on Inorganic Constituents in Water.

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² The boldface numbers in parentheses refer to the list of references at the end of this standard.

³ 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.