



# Standard Practices for Digestion of Water Samples for Determination of Metals by Flame Atomic Absorption, Graphite Furnace Atomic Absorption, Plasma Emission Spectroscopy, or Plasma Mass Spectrometry<sup>1</sup>

This standard is issued under the fixed designation D 1971; 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 Most atomic absorption and plasma emission spectroscopy, and plasma-mass spectrometric test methods require that the metals of interest be dissolved in a liquid phase before being introduced into the spectrophotometer. These practices describe digestion or dissolution procedures whereby analyte metals associated with the solid fraction of a sample can be brought into solution for subsequent analysis. The following practices are included:

|                                                                             |                          |
|-----------------------------------------------------------------------------|--------------------------|
| Practice A—Digestion with Mineral Acids and Elevated Pressure               | Sections<br>8 through 13 |
| Practice B—Digestion with Mineral Acids and Heating at Atmospheric Pressure | 14 through 19            |
| Practice C—In-bottle digestion with Mineral Acids                           | 20 through 25            |

1.2 These practices have been demonstrated to be applicable to a wide variety of sample types and sample matrices, and in many cases, will give complete dissolution of the analyte metals of interest. They are by no means the only digestion procedures available.

1.3 The user of these practices should be cautioned that these practices may not completely dissolve all portions of a sample's solid phase and may not give complete recovery of the desired analyte metals. In these cases, other digestion techniques are available that will effect complete dissolution of a sample. It is the user's responsibility to ensure the validity of these practices for use on their particular sample matrix, for their metals of interest.

1.4 This practice assumes that the criteria established in Guide D 3856 can be met.

1.5 These digestion procedures have been selected for their wide application, low cost, and ease of use.

1.6 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.7 *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.* Specific hazard statements are given in Section 6.

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 511 Test Methods for Calcium and Magnesium in Water<sup>2</sup>
- D 857 Test Methods for Aluminum in Water<sup>2</sup>
- D 858 Test Methods for Manganese in Water<sup>2</sup>
- D 1068 Test Methods for Iron in Water<sup>2</sup>
- D 1129 Terminology Relating to Water<sup>2</sup>
- D 1192 Specification for Equipment for Sampling Water and Steam in Closed Conduits<sup>2</sup>
- D 1193 Specification for Reagent Water<sup>2</sup>
- D 1687 Test Methods for Chromium in Water<sup>2</sup>
- D 1688 Test Methods for Copper in Water<sup>2</sup>
- D 1691 Test Methods for Zinc in Water<sup>2</sup>
- D 1886 Test Methods for Nickel in Water<sup>2</sup>
- D 1976 Test Method for Elements in Water by Inductively-Coupled Argon Plasma Atomic Emission Spectroscopy<sup>2</sup>
- D 3370 Practices for Sampling Water from Closed Conduits<sup>2</sup>
- D 3372 Test Method for Molybdenum in Water<sup>2</sup>
- D 3557 Test Methods for Cadmium in Water
- D 3558 Test Methods for Cobalt in Water<sup>2</sup>
- D 3559 Test Method for Lead in Water<sup>2</sup>
- D 3645 Test Method for Beryllium in Water<sup>2</sup>
- D 3856 Guide for Good Laboratory Practices in Laboratories Engaged in Sampling and Analysis of Water<sup>2</sup>
- D 3866 Test Methods for Silver in Water<sup>2</sup>
- D 3919 Practices for Measuring Trace Elements in Water by Graphite Furnace Atomic Absorption Spectrophotometry<sup>2</sup>
- D 4190 Test Method for Elements in Water by Direct-Current Argon Plasma Atomic Emission Spectroscopy<sup>2</sup>
- D 4191 Test Method for Sodium in Water by Atomic

<sup>1</sup> These practices are 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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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 11.01.