METHOD #: 202.1 Approved for NPDES (Editorial Revision 1974, 1978)

TITLE: Aluminum (Atomic Absorption, Direct Aspiration)

ANALYTE: CAS # Al Aluminum 7429-90-5

INSTRUMENTATION: AA

STORET No. Total 01105
Dissolved 01106
Suspended 01107

Optimum Concentration Range: 5-50 mg/L using a wavelength of 309.3 nm
Sensitivity: 1 mg/L
Detection Limit: 0.1 mg/L

1.0 Preparation of Standard Solution

1.1 Stock Solution: Carefully weigh 1.000 gram of aluminum metal (analytical reagent grade). Add 15 mL of conc. HCl and 5 mL conc. HNO_3 to the metal, cover the beaker and warm gently. When solution is complete, transfer quantitatively to a 1 liter volumetric flask and make up to volume with deionized distilled water. 1 mL = 1 mg Al (1000 mg/L).

1.2 Potassium Chloride Solution: Dissolve 95 g potassium chloride (KCl) in deionized distilled water and make up to 1 liter.

1.3 Prepare dilutions of the stock solution to be used as calibration standards at the time of analysis. The calibration standards should be prepared using the same type of acid and at the same concentration as will result in the sample to be analyzed either directly or after processing. To each 100 mL of standard and sample alike add 2.0 mL potassium chloride solution.

2.0 Sample Preservation

2.1 For sample handling and preservation, see part 4.1 of the Atomic Absorption Methods section of this manual.

3.0 Sample Preparation

3.1 The procedures for the preparation of the sample as given in part 4.1.1 throμgh 4.1.4 of the Atomic Absorption Methods section of this manual have been found to be satisfactory.

4.0 Instrumental Parameters (General)

4.1 Aluminum hollow cathode lamp
4.2 Wavelength: 309.3 nm
4.3 Fuel: Acetylene
4.4 Oxidant: Nitrous oxide
4.5 Type of flame: Fuel rich

5.0 Analysis Procedure

5.1 For analysis procedure and calculation, see "Direct Aspiration", part 9.1 of the Atomic Absorption Methods section of this manual.

6.0 Interferences

6.1 Aluminum is partially ionized in the nitrous oxide-acetylene flame. This problem may be controlled by the addition of an alkali metal (potassium, 1000 μg/mL) to both sample and standard solutions.

7.0 Notes

7.1. The following lines may also be used:
308.2 nm Relative Sensitivity 1
396.2 nm Relative Sensitivity 2
394.4 nm Relative Sensitivity 2.5

7.2 Data to be entered into STORET must be reported as μg/L.

7.3 For concentrations of aluminum below 0.3 mg/L, the furnace procedure (Method 202.2) is recommended.

7.4 The Eriochrome cyanine R colorimetric method may also be used. The optimum range for this method lies between 20 and 300 μg/L. (Standard Methods, 14th Edition, p. 171.) In the absence of fluorides and complex phosphates, a detection limit of 6 μg/L is possible.

8.0 Precision and Accuracy

8.1 An interlaboratory study on trace metal analyses by atomic absorption was conducted by the Quality Assurance and Laboratory Evaluation Branch of EMSL. Six synthetic concentrates containing varying levels of aluminum, cadmium, chromium, copper, iron, manganese, lead and zinc were added to natural water samples. The statistical results for aluminum were as follows:

Number of Labs	True values μg/liter	Mean Value μg/liter	Deviation μg/liter	Accuracy as %Bias
38	1205	1281	299	6.3
38	1004	1003	391	-0.1
37	500	463	202	-7.4
37	625	582	272	-6.8
22	35	96	108	175
21	15	109	168	626