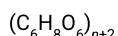
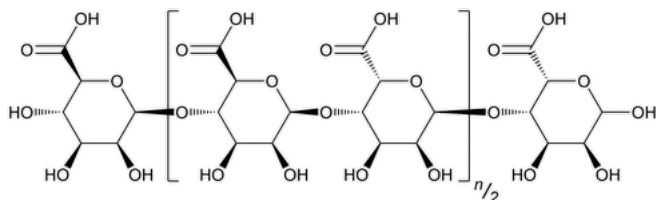


Status: Currently Official on 13-Feb-2025
 Official Date: Official as of 01-May-2023
 Document Type: NF Monographs
 DocId: GUID-B6DCB2C8-F5FF-4E71-9ED1-741F5E8F8102_5_en-US
 DOI: https://doi.org/10.31003/USPNF_M1380_05_01
 DOI Ref: kam7o

© 2025 USPC
 Do not distribute

Alginate Acid



Alginate acid

CAS RN[®]: 9005-32-7.

DEFINITION

Alginate Acid is a hydrophilic colloidal carbohydrate extracted with dilute alkali from various species of brown seaweeds (Phaeophyceae).

Alginate Acid is a linear, unbranched copolymer of β -D-mannuronic acid (M) and α -L-guluronic acid (G) linked to each other by 1→4 glycosidic bonds. The M and G units in the Alginate Acid may be randomly or non-randomly arrayed as heterogeneous or homogeneous sequences. The typical average molecular weight for Alginate Acid is in the range of 10,000–600,000 g/mol.

IDENTIFICATION

• **A. [SPECTROSCOPIC IDENTIFICATION TESTS \(197\)](#), [Infrared Spectroscopy](#):** 197K or 197A

• **B.**

Analysis 1: To 5 mL of a 1-in-150 solution in [0.1 N sodium hydroxide](#) add 1 mL of [calcium chloride TS](#).

Acceptance criteria 1: A voluminous, gelatinous precipitate is formed.

Analysis 2: To 5 mL of a 1-in-150 solution in [0.1 N sodium hydroxide](#) add 1 mL of 4 N sulfuric acid.

Acceptance criteria 2: A heavy, gelatinous precipitate is formed.

• **C.**

Analysis: To 5 mg in a test tube add 5 mL of water, 1 mL of a freshly prepared 1-in-100 solution of [1,3-naphthalenediol](#) in alcohol, and 5 mL of hydrochloric acid. Heat the mixture to boiling, boil gently for 3 min, then cool to 15°. Transfer the contents of the test tube to a 30-mL separator with the aid of 5 mL of water, and extract with 15 mL of isopropyl ether.

Acceptance criteria: The isopropyl ether extract exhibits a deeper purplish hue than that from a blank, similarly prepared.

IMPURITIES

Delete the following:

▲ **[ARSENIC \(211\)](#), [Procedures, Method II](#)** ▲ (NF 1-May-2023)

Delete the following:

▲ **[LEAD \(251\)](#)** ▲ (NF 1-May-2023)

Add the following:

▲ **Limit of Lead and Arsenic**

[NOTE—When [water](#) is specified as the diluent, use deionized ultra-filtered [water](#). Use of glass volumetric flasks is discouraged.]

Diluent: Weigh about 3.5 g of sodium nitrate in a 1000-mL volumetric flask. Add 500 mL of [water](#) to dissolve. Add 170 mL of nitric acid, ultratrace, and mix. Cool to room temperature and dilute with water to volume.

Standard stock solution: Into a 10-mL volumetric flask, transfer 100 μ L of a standard solution containing 1000 mg/L of arsenic¹ and 500 μ L of a standard solution containing 1000 mg/L of lead.² Add 1–2 drops of nitric acid, ultratrace. Dilute with water to volume.

Internal standard solution: Transfer 1.0 mL of a standard solution containing 10,000 mg/L of yttrium³ to a 100-mL volumetric flask. Add 1–2 drops of nitric acid, ultratrace, and dilute with [water](#) to volume. [NOTE—The concentration of the *Internal standard solution* can be adjusted if a high number of signal counts from the *Internal standard solution* causes an artifact.]

Calibration standard solution A: Into a separate 100-mL volumetric flask, prepare a solution containing 0.01 μ g/mL of arsenic and 0.05 μ g/mL of lead from the *Standard stock solution*. To each flask, add 100 μ L of the *Internal standard solution* and 20 μ L of a standard solution containing 1000 mg/L of gold.⁴ Dilute with *Diluent* to volume.

Calibration standard solution B: Into a separate 100-mL volumetric flask, prepare a solution containing 0.02 µg/mL of arsenic and 0.1 µg/mL of lead from the *Standard stock solution*. To each flask, add 100 µL of the *Internal standard solution* and 20 µL of a standard solution containing 1000 mg/L of gold. Dilute with *Diluent* to volume.

Calibration standard solution C: Into a separate 100-mL volumetric flask, prepare a solution containing 0.04 µg/mL of arsenic and 0.2 µg/mL of lead from the *Standard stock solution*. To each flask, add 100 µL of the *Internal standard solution* and 20 µL of a standard solution containing 1000 mg/L of gold. Dilute with *Diluent* to volume.

Blank solution: In a 100-mL volumetric flask, add 100 µL of the *Internal standard solution*. Add 20 µL of a standard solution containing 1000 mg/L of gold. Dilute with *Diluent* to volume, and mix well.

Sample solution: Weigh about 0.50 g of Alginic Acid in a Teflon pressure vessel. Add 10 mL of nitric acid, ultratrace. Add 10 µL of a standard solution containing 1000 mg/L of gold. Screw the cap of the pressure vessel and commence digestion in a microwave digester per the program given in [Table 1](#).

Table 1

Sequence	Temperature (°)	Power (W)	Time (min)
Ramp to	80	400	5
Hold at	80	400	5
Ramp to	150	800	10
Hold at	150	800	10
Ramp to	170	800	10
Hold at	170	800	10
Cool	—	0	—

Once completed, allow it to cool. Rinse the vessel using [water](#) and transfer the rinsate to a separate 50-mL volumetric flask. Add 50 µL of the *Internal standard solution*. Dilute with [water](#) to volume, and mix well.

Instrumental conditions

(See [Plasma Spectrochemistry \(730\)](#).)

Mode: ICP–OES

Emission wavelengths: 189.042 nm for arsenic, 220.353 nm for lead, and 224.306 nm for yttrium. Set the sample read time and other instrument parameters as appropriate or as recommended by the instrument manufacturer.

System suitability

Samples: *Calibration standard solutions A–C, Blank solution, and Sample solution*

Suitability requirements

[NOTE—Instrument performance must be verified to conform to the manufacturer's specifications for resolution and sensitivity. Before analyzing samples, the instrument must pass a suitable performance check. Additional system suitability parameters can be used per the instrument manufacturer's recommendations, along with the internal quality requirements.]

Correlation coefficient: NLT 0.999, determined from the *Calibration curve* constructed in the *Analysis*

Analysis

Samples: *Calibration standard solutions A–C, Blank solution, and Sample solution*. [NOTE—The following analysis is described for one type of ICP–OES instrument. If a different ICP–OES instrument is used, follow the instrument manufacturer's recommendations for operation.] Take 3 replicate scans with the integration set as recommended by the instrument manufacturer. Follow the instrument manufacturer's recommendations for delivering the sample. Flush the samples through the system before analysis. Program a read delay into the sampling routine to allow for fluid flow equilibration after the high-speed flush, before the first analytical read of the sample. Between samples, wash the pumping system by flushing the *Blank solution*. Analyze the *Sample solution* on the ICP.

Calibration curve: Generate the calibration curve using the *Blank solution* and *Calibration standard solutions A–C* as follows. Scan the *Internal standard solution* while running the *Blank solution* to measure the intensity of the yttrium emission. Hold this value constant throughout the remainder of the test. Separately scan the *Blank solution*, *Calibration standard solution*, and *Internal standard solution*. Normalize the yttrium intensity to the value of the *Internal standard solution*. Apply this normalization factor to the intensity of the respective elements, which is then referred to as the corrected intensity. Obtain the concentration of arsenic and lead (C), in µg/mL, in the *Sample solution* through the calibration curve. Plot the corrected intensity versus the known concentrations, in µg/mL, of arsenic and lead.

Calculate the content in µg/g (ppm) of arsenic and lead in the portion of Alginic Acid taken:

Result = (C × v)/W

C = concentration of arsenic/lead in the *Sample solution* obtained from the *Calibration curve* ($\mu\text{g/mL}$)

V = volume of the *Sample solution* (mL)

W = weight of Alginic Acid taken to prepare the *Sample solution* (g)

Acceptance criteria: NMT 3 $\mu\text{g/g}$ of arsenic and 10 $\mu\text{g/g}$ of lead ▲ (NF 1-May-2023)

SPECIFIC TESTS

• **MICROBIAL ENUMERATION TESTS (61)** and **TESTS FOR SPECIFIED MICROORGANISMS (62)**: The total aerobic microbial count does not exceed 2×10^2 cfu/g. The tests for *Salmonella* species and *Escherichia coli* are negative.

• **pH (791)**: 1.5–3.5, in a 3-in-100 dispersion in water

• **LOSS ON DRYING (731)**

Analysis: Dry at 105° for 4 h.

Acceptance criteria: NMT 15.0%

• **ARTICLES OF BOTANICAL ORIGIN (561), Methods of Analysis, Total Ash**

Sample: 4 g of Alginic Acid

Analysis: Proceed as directed in the chapter, carefully igniting the *Sample* in a tared platinum dish, until the residue is thoroughly carbonized (5 min). Then ignite in a muffle furnace at a temperature of $800 \pm 25^\circ$ until the carbon is completely burned off (20–35 min).

Acceptance criteria: NMT 4.0% of ash

• **FATS AND FIXED OILS (401), Procedures, Acid Value**

Sample: 1 g of Alginic Acid

Analysis: Suspend the *Sample* in a mixture of 50 mL of water and 30.0 mL of calcium acetate solution (11 in 250). Shake thoroughly, allow the mixture to stand for 1 h, and add phenolphthalein TS. Titrate the liberated acetic acid with 0.1 N sodium hydroxide VS.

Perform a blank determination, and calculate the *Acid Value*:

$$\text{Result} = [(V_s - V_b) \times N \times F] / W$$

V_s = volume of 0.1 N sodium hydroxide VS consumed in the titration of the *Sample* (mL)

V_b = volume of 0.1 N sodium hydroxide VS consumed in the titration of the blank (mL)

N = normality of sodium hydroxide VS (mEq/mL)

F = equivalency factor of potassium hydroxide, 56.11 (mg/mEq)

W = weight of Alginic Acid taken (g)

Acceptance criteria: NLT 230 on the dried basis.

ADDITIONAL REQUIREMENTS

• **PACKAGING AND STORAGE:** Preserve in well-closed containers.

• **USP REFERENCE STANDARDS (11)**

USP Alginic Acid RS

¹ Arsenic ICP standard solutions are commercially available. A suitable ICP standard is available from LGC (www.lgcstandards.com) or Millipore Sigma (www.sigmaaldrich.com).

² Lead ICP standard solutions are commercially available. A suitable ICP standard is available from LGC (www.lgcstandards.com) or Millipore Sigma (www.sigmaaldrich.com).

³ Yttrium ICP standard solutions are commercially available. A suitable ICP standard is available from LGC (www.lgcstandards.com) or Millipore Sigma (www.sigmaaldrich.com).

⁴ Gold standard solutions are commercially available. A suitable ICP standard is available from LGC (www.lgcstandards.com) or Millipore Sigma (www.sigmaaldrich.com).

Auxiliary Information - Please [check for your question in the FAQs](#) before contacting USP.

Topic/Question	Contact	Expert Committee
ALGINIC ACID	Documentary Standards Support	CE2020 Complex Excipients

Most Recently Appeared In:

Pharmacopeial Forum: Volume No. 47(4)

Current DocID: GUID-B6DCB2C8-F5FF-4E71-9ED1-741F5E8F8102_5_en-US

DOI: https://doi.org/10.31003/USPNF_M1380_05_01

DOI ref: [kam7o](#)

OFFICIAL