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Aluminum Monostearate

Aluminum, dihydroxy(octadecanoato-*O*-)-;
Dihydroxy(stearato)aluminum
CAS RN®: 7047-84-9.

DEFINITION

Aluminum Monostearate is a compound of aluminum with a mixture of solid organic acids obtained from sources of vegetable or animal origin, and consists mainly of variable proportions of aluminum monostearate ($C_{18}H_{37}AlO_4$) and aluminum monopalmitate ($C_{16}H_{33}AlO_4$). The content of stearic acid in the fatty acid fraction is NLT 40.0% of the total content. The sum of stearic acid and palmitic acid in the fatty acid fraction is NLT 90.0% of the total content. Aluminum Monostearate contains the equivalent of NLT 14.7% and NMT 16.7% of aluminum oxide (Al_2O_3) on the dried basis. Additionally, it contains small amounts of the aluminum salts of other fatty acids.

IDENTIFICATION

• **A. Identification Tests—General ⟨191⟩, *Chemical Identification Tests, Aluminum***
Sample: 1 g
Analysis: Heat the *Sample* with a mixture of 25 mL of water and 5 mL of hydrochloric acid for 1 h, replacing the water as it evaporates.
Acceptance criteria: Fatty acids are liberated, floating as an oily layer on the surface of the liquid, and the water layer meets the requirements.

• **B.** The retention times of the two major peaks of the *Sample solution* correspond to those of the *Standard solution*, as obtained in the *Content of Stearic Acid and Palmitic Acid* test in the *Assay*.

ASSAY

• **Content of Aluminum**
Sample: 5 g
Analysis
Sample: *Sample*
Weigh the *Sample* in a covered platinum crucible that previously has been ignited for 20 min, cooled over anhydrous magnesium perchlorate, and weighed. Heat the open crucible gently, without allowing the *Sample* to burst into flame, and gradually increase the heat until the ash is white. Ignite the ash for 20 min after the organic matter is removed, and cool. Add 15 mL of water, cover the crucible with a small watch glass, and boil gently for 5 min, using a small stirring rod to break up any large lumps of ash. Decant the solution through ashless filter paper, retaining most of the ash in the crucible. Repeat the extraction with water twice, passing the solutions through the same filter. Transfer the ash to the filter by means of a fine stream of water, and wash the crucible and the residue three times with warm water. Transfer the filter paper and the residue to the crucible, dry, and ignite for 20 min after the filter paper has burned away. Following the ignition period, cover the crucible, cool over anhydrous magnesium perchlorate for 15 min, and weigh the residue of aluminum oxide (Al_2O_3) rapidly. Repeat the ignition until constant weight is attained, using 20-min ignition periods and 15-min cooling periods. From the weight of the residue remaining in the crucible, calculate the content of aluminum oxide (Al_2O_3).
Acceptance criteria: 14.7%–16.7% on the dried basis

• **Content of Stearic Acid and Palmitic Acid**
Boron trifluoride–methanol solution: 140 g/L of boron trifluoride in methanol
Sample solution: Dissolve 100 mg of Aluminum Monostearate in a small conical flask fitted with a suitable reflux attachment with 5 mL of *Boron trifluoride–methanol solution*. Boil under reflux for 10 min. Add 4.0 mL of *n*-heptane through the condenser, and boil again under reflux for 10 min. Allow to cool. Add 20 mL of a saturated solution of sodium chloride. Shake, and allow the layers to separate. Dry the organic layer over 0.1 g of anhydrous sodium sulfate. Dilute 1.0 mL of this solution with *n*-heptane to 10.0 mL.
Standard solution: Prepare as directed in the *Sample solution* using 50 mg each of USP Stearic Acid RS and USP Palmitic Acid RS.
Chromatographic system
(See *Chromatography ⟨621⟩, System Suitability*.)
Mode: GC
Detector: Flame ionization
Column: 30-m × 0.32-mm; coated with a 0.5-µm film of phase G16
Temperatures

Injection port: 220°

Detector: 260°

Column: See *Table 1*.

Table 1

Initial Temperature (°)	Temperature Ramp (°/min)	Final Temperature (°)	Hold Time at Final Temperature (min)
70	—	70	2
70	5	240	5

Carrier gas: Helium, passed through a bed of molecular sieve for drying, if necessary

Flow rate: 2.4 mL/min

Injection volume: 1 µL

System suitability

Sample: *Standard solution*

[NOTE—The relative retention times for methyl palmitate and methyl stearate are about 0.9 and 1.0, respectively.]

Suitability requirements

Resolution: NLT 5.0 between the methyl palmitate and methyl stearate peaks

Relative standard deviation: NMT 3.0% for the methyl stearate and methyl palmitate peaks (from six replicate injections of the *Standard solution*); NMT 1.0% for the ratio of the peak areas of methyl palmitate to the peak areas of methyl stearate (from six replicate injections of the *Standard solution*)

Analysis

Sample: *Sample solution*

Calculate the percentage of stearic acid ($C_{18}H_{36}O_2$) in the fatty acid fraction of the sample taken:

$$\text{Result} = (r_{U1}/r_T) \times 100$$

r_{U1} = peak area due to methyl stearate

r_T = sum of all the peak areas, excluding the solvent peak

Calculate the percentage of palmitic acid ($C_{16}H_{32}O_2$) in the fatty acid fraction of the sample taken:

$$\text{Result} = (r_{U2}/r_T) \times 100$$

r_{U2} = peak area due to methyl palmitate

r_T = sum of all the peak areas, excluding the solvent peak

Acceptance criteria

Stearic acid: NLT 40.0%

Sum of stearic acid and palmitic acid: NLT 90.0%

IMPURITIES

Change to read:

• ▲**ARSENIC ⟨211⟩, *Procedures, Procedure 1*** ▲ (CN 1-JUN-2023)

Test preparation: To 3.75 g of Aluminum Monostearate add 12.5 mL of hydrochloric acid and 0.5 mL of bromine TS, and heat on a steam bath until a transparent layer of melted fatty acid forms. Add 50 mL of water, heat on a hot plate until the volume is about 25 mL, and filter while hot. Cool, dilute the filtrate with water to 50 mL, and to a 10-mL aliquot of this solution add 2.5 mL of hydrochloric acid, then dilute with water to 55 mL.

Acceptance criteria: NMT 4 µg/g; the *Test preparation* meets the requirements, omitting the addition of 20 mL of 7 N sulfuric acid specified for *Procedure*.

SPECIFIC TESTS

• **LOSS ON DRYING ⟨731⟩**

Analysis: Dry at 105° for 3 h.

Acceptance criteria: NMT 3.0%

• **ACIDITY AND ALKALINITY**

Sample solution: To 1.0 g of Aluminum Monostearate add 20 mL of carbon dioxide-free water and boil on a steam bath for 1 min with continuous shaking. Cool and filter. To 10 mL of the filtrate add 0.05 mL of bromothymol blue TS.

Analysis: Titrate with 0.01 N hydrochloric acid or 0.01 N sodium hydroxide.

Acceptance criteria: NMT 0.5 mL of 0.01 N hydrochloric acid or 0.01 N sodium hydroxide is required to change the color of the indicator.

Add the following:

Fats and Fixed Oils ⟨401⟩, *Procedures, Acid Value, Method I*

Sample: 1.0 g

Analysis: Dissolve the *Sample* in 50 mL of a mixture of equal volumes of alcohol and ether (which has been neutralized to phenolphthalein with 0.1 N potassium hydroxide or 0.1 N sodium hydroxide). Pass the suspension through dry filter paper, wash the vessel and the filter paper with a small amount of a mixture of neutralized ethanol and diethyl ether (1:1), and combine the filtrate and the washings. Proceed as directed in the chapter starting with “Add 1 mL of phenolphthalein TS”.

Acceptance criteria: NMT 11

• **Bacterial Endotoxins Test** ⟨85⟩**:** If labeled for use in preparing parenteral dosage forms, it also meets the following requirements. The level of bacterial endotoxins is such that the requirement in the relevant dosage form monograph(s) in which Aluminum Monostearate is used can be met. Where the label states that Aluminum Monostearate must be subjected to further processing during the preparation of injectable dosage forms, the level of bacterial endotoxins is such that the requirement in the relevant dosage form monograph(s) in which Aluminum Monostearate is used can be met.

ADDITIONAL REQUIREMENTS

• **Packaging and Storage:** Preserve in well-closed containers.

• **Labeling:** Label it to indicate the content of stearic acid and the sum of stearic acid and palmitic acid content in the fatty acid fraction and to indicate the fatty acids used to produce Aluminum Monostearate are from sources of vegetable or animal origin. Where Aluminum Monostearate must be subjected to further processing during the preparation of injectable dosage forms to ensure acceptable levels of bacterial endotoxins, it is so labeled.

• **USP Reference Standards** ⟨11⟩

USP Palmitic Acid RS

USP Stearic Acid RS

Auxiliary Information - Please check for your question in the FAQs before contacting USP.

Topic/Question	Contact	Expert Committee
ALUMINUM MONOSTEARATE	Documentary Standards Support	CE2020 Complex Excipients

Chromatographic Database Information: Chromatographic Database

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