COEI-1-GOMARA Gum arabic

Gumme arabicum

Acaciae gummi

SIN No.414

1. Objective, origin and scope of application

Gum arabic is a gummy exudation which hardens in air and flows naturally or through cuts made in tree trunks and branches of the L. *Acacia senegal* L. Willdenow and other African *Acacia* species. It is composed of spherical tear drop-shaped globules, or sometimes irregular oval shapes with a diameter of 1-3 cm.

Gum arabic exists in powder form or in colloidal solution.

The product is used to improve the stability of bottled wine.

Gum arabic is composed of a polysaccharide rich in galactose and arabinose along with a small protein fraction which gives its stabilizing power with respect to the precipitation of coloring substances and iron or copper breakdown.

There are limits imposed on the quantity of gum arabic used in wine.

2. Labelling

The label should indicate the gum arabic solution concentration and sulfur dioxide content (there are limits imposed on the sulfur dioxide content in wine), as well as its safety and storage conditions.

3. Properties

Gum arabic tear drops are relatively friable and break cleanly into fragments. Whole tear drops often have a small cavity in the center.

Powdered gum arabic is odorless, tasteless, and has a white or yellow transparent color and glassy luster. It dissolves slowly in twice its weight and leaves only a slight residue of vegetable debris. It is insoluble in alcohol.

Gum arabic in solution is a yellowish-white viscous, translucent liquid which is slightly acidic. It precipitates abundantly when an equal volume of ethanol is added.

4. Tests

4.1. Desiccation loss

4.1.1. Powdered gum arabic

Place 5 g of gum arabic in a silica dish with a diameter of 70 mm. Place in a n oven at 100-105 °C for 5 hours. Weight loss should be no greater than 15 pp 100.

4.1.2. Gum arabic in solution

Place 10 g of gum arabic solution in a silica dish with a diameter of 70 mm. Place in a water bath at 100 °C for 4 hours, then in an oven set to 100-105° C for 3 hours. The quantity of dry residue should be at least 10 pp 100.

The limiting values indicated below are for dry product.

4.2. Ash

Incinerate the dry residue at 550-600 °C. Ash content should not be greater than 4 pp 100.

4.3. Preparing the Solution for Tests

The ash from 5 g of powdered gum arabic or from a weight of solution corresponding to 5 g of solid gum arabic are taken up by 2 ml of concentrated hydrochloric acid (R). Place in a 100 °C water bath with a stirring apparatus to ensure solubilizing. Decant in a 50 ml volumetric flask and bring the volume to 50 ml using wash water from the dish used during incineration.

4.4. Iron

Add 1 drop of 1 pp 100 potassium permanganate (R), 1 ml of concentrated hydrochloric acid (R) and 2 ml 2 ml of 5 pp 100 potassium thiocyanate to 10 ml of the solution prepared for tests under paragraph 4.3. The resulting coloration should be less intense than that of a control prepared with 6 ml of an iron (III) solution with 10 mg of iron per liter (R), 4 ml of water, 1 ml of concentrated hydrochloric acid (R) and 2 ml of 5 pp 100 potassium thiocyanate (R). (Iron content should be less than 60 mg/kg).

Iron content can also be quantified by atomic absorption spectometry using the technique explained in the Compendium.

4.5. Cadmium

Using the techniques described in the annex, determine the cadmium content in the test solution prepared in accordance with Par. 4.3. (Content should be less than 1 mg/kg.)

4.6. Lead

Using the techniques described in the Compendium, determine the lead content in the test solution prepared in accordance with Par. 4.3. (Content should be less than 5 mg/kg.)

4.7. Mercury

Using the techniques described in the annex, determine the mercury content in the test solution prepared in accordance with Par. 4.3. (Content should be less than 1 mg/kg.)

4.8. Arsenic

Mineralize 0.5 g of dry gum arabic using the nitrosulfuric method and test for arsenic using the method described in the Annex. (Arsenic content should be less than 3 mg/kg).

4.9. Total nitrogen

Place 5 g of gum arabic in a 300 ml mineralization cucurbit with 15 ml of concentrated sulfuric acid (R) and 2 g of mineralization catalyst. Proceed with the quantitative analysis as indicated in the annex.

For gum arabic in solution, weigh an amount corresponding to 5 g dry residue. Evaporate until almost dry, then proceed as described before.

(Nitrogen content should be less than 4 g/kg).

Nitrogen content should be between:

- 0.25% and 0.4% (m/m) for Senegal Acacia gum and
- 0.10% and 0.20% (m/m) for Seyal Acacia gum.

4.10. Starch and Dextrin

Bring 20 ml of solution containing 2 g of dry gum arabic to a boil. Cool. Add 0.2 ml of 0.05M iodine. No blue or red-brown coloration should appear.

4.11. Tannin

Add 0.1 ml of iron (III) sulfate (R) to 10 ml of solution containing 1 g of dry gum arabic. A gelatinous precipitate will form, but neither the precipitate nor the liquid should become dark blue.

4.12. Rotatory power

Specific rotatory power is measured at 589 nm (sodium line) and for a solution with 1 g/ml of gum and a length of 1 dm.

$-26° \leq [\alpha]_D^{20°C} \leq -34°$, for Senegal Agacia gum
$40° \leq [\alpha]_D^{20°C} \leq 50^{\circ\circ}$, for Senegal seya gum

4.13. Salmonella

A 1 g sample must be free from salmonellosis (determination procedure described in the annex).

4.14. Escherichia coli

A 1 g sample must be free from *Escherichia coli* (determination procedure described in the annex).

4.15. Hydrolytic Products

Mannose, xylose, and glacturonic acid should not be present (as determined by chromatography).

4.16. Efficacy Test for Gum Arabic

4.16.1. Principle

Determine the quantity of gum arabic required to prevent flocculation of a colloidal iron (III) hexacyanoferrate (II) solution in an aqueous-alcoholic medium by calcium salt.

4.16.2. Products

- Crystallized tartaric acid: Molar weight = 150.05
- Purified potassium sulfate (K_2SO_4): Molar weight = 174.25
- Dihydrous calcium chloride ($CaCl_2,2H_2O$): Molar weight = 143.03
- Crystallized iron (III) chloride ($FeCl_3,6H_2O$): Molecular weight = 270.32
- Potassium hexacyanoferrate (II) ($K_4[Fe(CN)_6]$): Molecular weight = 422.4
- Metatartaric acid
- 1M sodium hydroxide solution
- Ethanol, 95% by volume
- 20 volumes hydrogen peroxide solution

3. Protocol

Gum arabic solution in a concentration of 5 g/l (A)

Dissolve 5 g of gum arabic in 100 ml of distilled water, then dilute this solution to 1/10 strength using distilled water.

Iron (III) solution in a concentration of 2.5 g iron/l (B)

Weigh exactly 1.21 g of iron (III) chloride and place it in a 100 ml volumetric flask. Fill to 3/4 with distilled water and add 0.1 ml of hydrogen peroxide solution at 20 volumes. Adjust to the flask mark with distilled water.

Calcium chloride solution in a concentration of 27 g/l (C)

Dissolve exactly 2.7 g of dihydrous calcium chloride in 100 ml of distilled water.

Hydro-alcoholic Matrix (D)

Fill a 1 liter volumetric flask half way with distilled water, then dissolve the following in order:

Tartaric acid: 2.5 g

K_2SO_4: 1 g (complete dissolution before proceeding to the following)

Metatartaric acid: 50 mg

Ethanol, 95% by volume: 120 ml

1M NaOH: 10 ml

Adjust the pH of the matrix to 3.5 by adding 1M NaOH (1-2 ml). Homogenize and top off with distilled water.

Potassium hexacyanoferrate (II) solution in a concentration of 12.5 g/l (E)

Weigh exactly 0.25 g of potassium hexacyanoferrate and place it in a 20 ml volumetric flask. Top off with distilled water.

This preparation should be made extemporaneously.

4.16.4. Test

Place the liter of matrix (D) in a flask and add exactly 2 ml of potassium hexacyanoferrate (II) solution (E). Place a stopper in the flask and shake. Next, add 1 ml of iron (III) chloride solution (B). Shake and let sit one-half hour. Solution S (blue in color).

In a series of test tubes (capacity > 50 ml), pour increasing volumes of gum solution in concentrations of 5 g/l (A): 0 - 0.25 - 0.5 - 0.75 - 1.0 - 1.25 - 1.5 - 1.75 - 2.0 - 2.5 - 3.0 ml.

These volumes correspond to final gum concentrations of 0 - 25 - 50 - 75 - 100 - 125 -

150 - 175 - 200 - 250 and 300 mg/l.

Place 50 ml of solution S to each test tube. Shake and let sit 5 minutes.

Next, pour 1 ml of calcium chloride solution (C) into each tube. Place a stopper in the tube and agitate.

Store the tubes at ambient temperature (≈ 25 °C) and out of the light.

After 3 days, read:

The control tube should have a deep blue deposit with a nearly colorless surfactant. This deposit will be more or less significant in the other tubes depending on the efficacy and dose of gum added.

In one tube, a solution with a homogeneous color and no blue deposit at the bottom will be seen. This corresponds to the quantity in mg/l of efficacious gum arabic to use in the wine.

5. Storage

Solid gum arabic has a very long shelf life if stored in a dry, temperate place in sealed packages. Solutions have a limited shelf life due to the presence of sulfur dioxide.