Acacia

1 Nonproprietary Names

BP: Acacia
JP: Acacia
PhEur: Acaciae gummi
USPNF: Acacia

2 Synonyms

Acacia gum; arabic gum; E414; gum acacia; gum arabic; gummi africanum; gummi arabicum; gummi mimosae; talha gum.

3 Chemical Name and CAS Registry Number

Acacia [9000-01-5]

4 Empirical Formula Molecular Weight

Acacia is a complex, loose aggregate of sugars and hemicelluloses with a molecular weight of approximately 240 000–580 000. The aggregate consists essentially of an arabic acid nucleus to which are connected calcium, magnesium, and potassium along with the sugars arabinose, galactose, and rhamnose.

5 Structural Formula

See Section 4.

6 Functional Category

Emulsifying agent; stabilizing agent; suspending agent; tablet binder; viscosity-increasing agent.

7 Applications in Pharmaceutical Formulation or Technology

Acacia is mainly used in oral and topical pharmaceutical formulations as a suspending and emulsifying agent, often in combination with tragacanth. It is also used in the preparation of pastilles and lozenges, and as a tablet binder, although if used incautiously it can produce tablets with a prolonged disintegration time. *See* Table I.

Acacia is also used in cosmetics, confectionery, and food products.

See also Section 18.

Table I: Uses of acacia.

Use	Concentration (%)
Emulsifying agent	10–20
Pastille base	10–30
Suspending agent	5–10
Tablet binder	1–5

8 Description

Acacia is available as white or yellowish-white thin flakes, spheroidal tears, granules, powder, or spray-dried powder. It is odorless and has a bland taste.

9 Pharmacopeial Specifications

The PhEur 2002 provides monographs on acacia and spray-dried acacia, while the USPNF 20 describes acacia in a single monograph that encompasses tears, flakes, granules, powder, and spray-dried powder. The JP 2001 also has monographs on acacia and powdered acacia. *See* Table II.

Table II: Pharmacopeial specifications for acacia.

Test	JP 2001	PhEur 2002	USPNF 20
Identification	+	+	+
Characters	+	+	+
Microbial limit	—	$\leqslant 10^4$/g	+
Water	⩽17.0% ⩽15.0%[a]	⩽15.0% ⩽10.0%[b]	⩽15.0% —
Total ash	⩽4.0%	⩽4.0%	⩽4.0%
Acid-insoluble ash	⩽0.5%	—	⩽5.0%
Insoluble residue	⩽0.2%	⩽0.5%	⩽50 mg
Arsenic	—	—	⩽3 ppm
Lead	—	—	⩽0.001%
Heavy metals	—	—	⩽0.004%
Starch, dextrin, and agar	+	+	+
Solubility and reaction	—	—	+
Tannin-bearing gums	+	+	+
Tragacanth	—	+	—
Sterculia gum	—	+	—
Glucose and fructose	—	+	—
Organic volatile impurities	—	—	+

[a] Powdered acacia.
[b] Spray-dried acacia.

10 Typical Properties

Acidity/alkalinity: pH = 4.5–5.0 (5% w/v aqueous solution)
Acid value: 2.5
Hygroscopicity: at relative humidities of 25–65%, the equilibrium moisture content of powdered acacia at 25°C is 8–13% w/w, but at relative humidities above about 70% it absorbs substantial amounts of water.
Solubility: soluble 1 in 20 of glycerin, 1 in 20 of propylene glycol, 1 in 2.7 of water; practically insoluble in ethanol (95%). In water, acacia dissolves very slowly, although almost completely after two hours, in twice the mass of water leaving only a very small residue of powder. The solution is colorless or yellowish, viscous, adhesive, and translucent. Spray-dried acacia dissolves more rapidly, in about 20 minutes.
Specific gravity: 1.35–1.49
Viscosity (dynamic): 100 mPa s (100 cP) for a 30% w/v aqueous solution at 20°C. The viscosity of aqueous acacia solutions varies depending upon the source of the material,

processing, storage conditions, pH, and the presence of salts. Viscosity increases slowly up to about 25% w/v concentration and exhibits Newtonian behavior. Above this concentration, viscosity increases rapidly (non-Newtonian rheology). Increasing temperature or prolonged heating of solutions results in a decrease of viscosity owing to depolymerization or particle agglomeration. *See also* Section 12.

11 Stability and Storage Conditions

Aqueous solutions are subject to bacterial or enzymatic degradation but may be preserved by initially boiling the solution for a short time to inactivate any enzymes present; microwave irradiation can also be used.[1] Aqueous solutions may also be preserved by the addition of an antimicrobial preservative such as 0.1% w/v benzoic acid, 0.1% w/v sodium benzoate, or a mixture of 0.17% w/v methylparaben and 0.03% propylparaben. Powdered acacia should be stored in an airtight container in a cool, dry place.

12 Incompatibilities

Acacia is incompatible with a number of substances including amidopyrine, apomorphine, cresol, ethanol (95%), ferric salts, morphine, phenol, physostigmine, tannins, thymol, and vanillin.

An oxidizing enzyme present in acacia may affect preparations containing easily oxidizable substances. However, the enzyme may be inactivated by heating at 100°C for a short time; *see* Section 11.

Many salts reduce the viscosity of aqueous acacia solutions, while trivalent salts may initiate coagulation. Aqueous solutions carry a negative charge and will form coacervates with gelatin and other substances. In the preparation of emulsions, solutions of acacia are incompatible with soaps.

13 Method of Manufacture

Acacia is the dried gummy exudate obtained from the stems and branches of *Acacia senegal* (Linné) Willdenow or other related species of *Acacia* (Fam. Leguminosae) that grow mainly in the Sudan and Senegal regions of Africa.

The bark of the tree is incised and the exudate allowed to dry on the bark. The dried exudate is then collected, processed to remove bark, sand, and other particulate matter, and graded. Various acacia grades differing in particle size and other physical properties are thus obtained. A spray-dried powder is also commercially available.

14 Safety

Acacia is used in cosmetics, foods, and oral and topical pharmaceutical formulations. Although it is generally regarded as an essentially nontoxic material, there have been a limited number of reports of hypersensitivity to acacia after inhalation or ingestion.[2,3] Severe anaphylactic reactions have occurred following the parenteral administration of acacia and it is now no longer used for this purpose.[2]

The WHO has not set an acceptable daily intake for acacia as a food additive because the levels necessary to achieve a desired effect were not considered to represent a hazard to health.[4]

LD_{50} (hamster, oral): >18 g/kg[5]
LD_{50} (mouse, oral): >16 g/kg[5]
LD_{50} (rabbit, oral): 8.0 g/kg
LD_{50} (rat, oral): >16 g/kg

15 Handling Precautions

Observe normal precautions appropriate to the circumstances and quantity of material handled. Acacia can be irritant to the eyes and skin and upon inhalation. Gloves, eye protection, and a dust respirator are recommended.

16 Regulatory Status

GRAS listed. Accepted for use in Europe as a food additive. Included in the FDA Inactive Ingredients Guide (oral preparations and buccal or sublingual tablets). Included in nonparenteral medicines licensed in the UK.

17 Related Substances

Tragacanth.

18 Comments

Concentrated aqueous solutions are used to prepare pastilles since on drying they form solid rubbery or glasslike masses depending upon the concentration used.

The EINECS number for acacia is 232-519-5.

19 Specific References

1 Richards RME, Al Shawa R. Investigation of the effect of microwave irradiation on acacia powder. *J Pharm Pharmacol* 1980; **32**: 45P.

2 Maytum CK, Magath TB. Sensitivity to acacia. *J Am Med Assoc* 1932; **99**: 2251.

3 Smolinske SC. *Handbook of Food, Drug, and Cosmetic Excipients*. Boca Raton, FL: CRC Press, 1992: 7–11.

4 FAO/WHO. Evaluation of certain food additives and contaminants. Thirty-fifth report of the joint FAO/WHO expert committee on food additives. *World Health Organ Tech Rep Ser* 1990; No. 789.

5 Lewis RJ, ed. *Sax's Dangerous Properties of Industrial Materials*, 10th edn. New York: Wiley, 2000: 291.

20 General References

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Anderson DM, Douglas DM, Morrison NA, Wang WP. Specifications for gum arabic (*Acacia Senegal*): analytical data for samples collected between 1904 and 1989. *Food Add Contam* 1990; **7**: 303–321.

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21 Author

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22 Date of Revision

20 August 2002.