Guar Gum

1 Nonproprietary Names

BP: Guar galactomannan
PhEur: Guar galactomannanum
USPNF: Guar gum

2 Synonyms

E412; *Galactosol*; guar flour; jaguar gum; *Meprogat*; *Meyprodor*; *Meyprofin*; *Meyproguar*.

3 Chemical Name and CAS Registry Number

Galactomannan polysaccharide [9000-30-0]

4 Empirical Formula and Molecular Weight

$(C_6H_{12}O_6)_n$

≈220 000

See Section 5.

5 Structural Formula

Guar gum consists of linear chains of (1→4)-β-D-mannopyranosyl units with α-D-galactopyranosyl units attached by (1→6) linkages. The ratio of D-galactose to D-mannose is between 1 : 1.4 and 1 : 2. *See also* Section 8.

6 Functional Category

Suspending agent; tablet binder; tablet disintegrant; viscosity-increasing agent.

7 Applications in Pharmaceutical Formulation or Technology

Guar gum is a galactomannan, commonly used in cosmetics, food products, and pharmaceutical formulations. It has also been investigated in the preparation of sustained-release matrix tablets in the place of cellulose derivatives such as methylcellulose.[1]

In pharmaceuticals, guar gum is used in solid-dosage forms as a binder and disintegrant,[2–4] *see* Table I, and in oral and topical products as a suspending, thickening, and stabilizing agent, and also as a controlled-release carrier. Guar gum has also been examined for use in colonic drug delivery.[5,6]

Therapeutically, guar gum has been used as part of the diet of patients with diabetes mellitus.[7,8] It has also been used as an appetite suppressant, although its use for this purpose, in tablet form, is now banned in the UK;[8–10] *see* Section 14.

Table I: Uses of guar gum.

Use	Concentration (%)
Emulsion stabilizer	1
Tablet binder	Up to 10
Thickener for lotions and creams	Up to 2.5

8 Description

The USPNF 20 describes guar gum as a gum obtained from the ground endosperms of *Cyamopsis tetragonolobus* (L.) Taub. (Fam. Leguminosae). It consists chiefly of a high-molecular-weight hydrocolloidal polysaccharide, composed of galactan and mannan units combined through glycoside linkages, which may be described chemically as a galactomannan. The PhEur 2002 similarly describes guar galactomannan as being obtained from the seeds of *Cyamopsis tetragonolobus* (L.) Taub. by grinding the endosperms and subsequent partial hydrolysis.

The main components are polysaccharides composed of D-galactose and D-mannose in molecular ratios of 1 : 1.4 to 1 : 2. The molecule consists of a linear chain of β-(1→4)-glycosidically linked manno-pyranoses and single α-(1→6)-glycosidically linked galacto-pyranoses. *See also* Section 18.

Guar gum occurs as an odorless or nearly odorless, white to yellowish-white powder with a bland taste.

9 Pharmacopeial Specifications

See Table II.

Table II: Pharmacopeial specifications for guar gum.

Test	PhEur 2002	USPNF 20
Identification	+	+
Characters	+	—
pH (1% w/w solution)	5.5–7.5	—
Apparent viscosity	+	—
Microbial contamination	+	—
Loss on drying	⩽15.0%	⩽15.0%
Ash	⩽1.8%	⩽1.5%
Acid-insoluble matter	⩽7.0%	⩽7.0%
Arsenic	—	⩽3 ppm
Lead	—	⩽0.001%
Heavy metals	—	⩽0.002%
Protein	⩽5.0%	⩽10.0%
Starch	—	+
Galactomannans	—	⩾66.0%
Organic volatile impurities	—	+
Tragacanth, sterculia gum, agar, alginates, and carrageenan	+	—

10 Typical Properties

Acidity/alkalinity: pH = 5.0–7.0 (1% w/v aqueous dispersion)
Density: 1.492 g/cm^3
Solubility: practically insoluble in organic solvents. In cold or hot water, guar gum disperses and swells almost immediately to form a highly viscous, thixotropic sol. The optimum rate of hydration occurs at pH 7.5–9.0. Finely milled powders swell more rapidly and are more difficult to disperse. Two to four hours in water at room temperature are required to develop maximum viscosity.
Viscosity (dynamic): 4.86 Pa s (4860 cP) for a 1% w/v dispersion. Viscosity is dependent upon temperature, time,

concentration, pH, rate of agitation, and particle size of the guar gum powder. Synergistic rheological effects may occur with other suspending agents such as xanthan gum; *see* Xanthan Gum.

11 Stability and Storage Conditions

Aqueous guar gum dispersions have a buffering action and are stable between pH 4.0 and 10.5. However, prolonged heating reduces the viscosity of dispersions.

The bacteriological stability of guar gum dispersions may be improved by the addition of a mixture of 0.15% methylparaben and 0.02% propylparaben as a preservative. In food applications, benzoic acid, citric acid, sodium benzoate, or sorbic acid may be used.

Guar gum powder should be stored in a well-closed container in a cool, dry place.

12 Incompatibilities

Guar gum is compatible with most other plant hydrocolloids such as tragacanth. It is incompatible with acetone, alcohol, tannins, strong acids, and alkalis. Borate ions, if present in the dispersing water, will prevent the hydration of guar gum. However, the addition of borate ions to hydrated guar gum produces cohesive structural gels and further hydration is then prevented. The gel formed can be liquefied by reducing the pH to below 7, or by heating.

Guar gum may reduce the absorption of penicillin V from some formulations by a quarter.[11]

13 Method of Manufacture

Guar gum is obtained from the ground endosperm of the guar plant, *Cyamopsis tetragonolobus* (L.) Taub. (Fam. Leguminosae), which is grown in India, Pakistan, and the semiarid southwestern region of the USA.

The seed hull can be removed by grinding, after soaking in sulfuric acid or water, or by charring. The embryo (germ) is removed by differential grinding, since each component possesses a different hardness. The separated endosperm, containing 80% galactomannan is then ground to different particle sizes depending upon final application.

14 Safety

Guar gum is widely used in foods and oral and topical pharmaceutical formulations. Excessive consumption may cause gastrointestinal disturbance such as flatulence, diarrhea, or nausea. Therapeutically, daily oral doses of up to 25 g of guar gum have been administered to patients with diabetes mellitus.[7]

Although it is generally regarded as a nontoxic and nonirritant material, the safety of guar gum when used as an appetite suppressant has been questioned. When consumed, the gum swells in the stomach to promote a feeling of fullness. However, it is claimed that premature swelling of guar gum tablets may occur and cause obstruction of or damage to the esophagus. Consequently, appetite suppressants containing guar gum in tablet form have been banned in the UK.[10] However, appetite suppressants containing microgranules of guar gum are claimed to be safe.[9] The use of guar gum for pharmaceutical purposes is unaffected by the ban.

In food applications, an acceptable daily intake of guar gum has not been specified by the WHO.[12]

LD_{50} (hamster, oral): 6.0 g/kg[13]
LD_{50} (mouse, oral): 8.1 g/kg
LD_{50} (rabbit, oral): 7.0 g/kg
LD_{50} (rat, oral): 6.77 g/kg

15 Handling Precautions

Observe normal precautions appropriate to the circumstances and quantity of material handled. Guar gum may be irritating to the eyes. Eye protection, gloves, and a dust mask or respirator are recommended.

16 Regulatory Status

GRAS listed. Accepted for use as a food additive in Europe. Included in the FDA Inactive Ingredients Guide (oral suspensions, syrups, and tablets). Also included in nonparenteral medicines licensed in the UK.

17 Related Substances

Acacia; tragacanth; xanthan gum.

18 Comments

Synthetic derivatives of guar gum such as guar acetate, guar phthalate, guar acetate phthalate, oxidized guar gum, and sodium carboxymethyl guar, have also been investigated for their pharmaceutical applications. In particular, sodium carboxymethyl guar gives a transparent gel and, when poured over a pool of mercury, produces a flexible, clear, transparent film. Sodium carboxymethyl guar has been used as a polymer matrix in transdermal patches.[14]

The EINECS number for guar gum is 232-536-8.

19 Specific References

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20 General References

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21 Author

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22 Date of Revision

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