Food and Agriculture Organization of the United Nations

84th JECFA - Chemical and Technical Assessment (CTA), 2017

GUM GHATTI

Chemical and Technical Assessment (CTA)

Prepared by Atsuko Tada, Ph. D., and reviewed by Jannavi R. Srinivasan, Ph. D.

1. Summary

This Chemical and Technical Assessment (CTA) summarises data and information on gum ghatti submitted to the 84th meeting of the Joint FAO/WHO Expert Committee on Food Additives (Committee) by Flavour and Extract Manufacturers Association, in a dossier dated December 1, 2016 (FEMA, 2016) upon request by the 48th Codex Committee on Food Additives (CCFA). At the present meeting, the Committee was asked to evaluate all data necessary for the re-evaluation of safety, dietary intake and specifications related to the use of gum ghatti as a thickening agent, stabilizer, emulsifier and carrier in a variety of food categories. This document discusses published information relevant to gum ghatti, the production methodologies, and manufacturing specifications. Gum ghatti is also known as Indian gum, ghatti gum, and gum ghati.

2. Description

Gum ghatti (CAS No. 9000-28-6) is the exudate produced when wounds are introduced into the bark of *Anogeissus latifolia*, a large deciduous tree, mostly found in certain Asian countries, e.g. India and Sri Lanka (Al-Assaf et al., 2009). Gum ghatti has been permitted as a food additive in Japan (the Ministry of Health, Labour and Welfare (MHLW), 2009) and the United States (21 C.F.R. § 184.1333 2016). It is principally composed of complex polysaccharides (Ido et al., 2008).

Gum ghatti was first evaluated at the 26th meeting of the Joint FAO/WHO Expert Committee on Food Additives, and then again at its 29th meeting (JECFA, 1982; JECFA, 1986). At its 29th meeting, the Committee noted that some vegetable gums such as gum ghatti are produced in developing countries, and that international organizations should provide assistance in producing the data necessary for safety evaluation. Given the need for additional data, no Acceptable Daily Intake (ADI) was established by JECFA (JECFA, 1986).

The initial JECFA specifications for gum ghatti were prepared at the 29th meeting. These were revised to incorporate updated specifications for heavy metals at the fifty-seventh meeting (JECFA, 2001). Based on an evaluation of current market qualities and updated identification information, the specifications monograph was updated at the 84th JECFA.

Gum ghatti is a dried gummy exudate obtained from *Anogeissus latifolia* Wallich. (Combretaceae). It consists mainly of a calcium salt (may on occasions occur as a magnesium salt) of high molecular weight complex polysaccharides, such as arabinogalactan, which on hydrolysis yields arabinose, galactose, glucuronic acid, mannose, xylose, and rhamnose.

Unground gum ghatti occurs as both amorphous tears of various sizes, or as broken irregular pieces. It is light-to-dark brown, available commercially also in the form of brown tears or grey to reddish-grey powder; it has little or no odour. Items of commerce may sometimes contain extraneous materials such as pieces of bark which must be removed before use in food.

3. Method of Manufacture

Gum ghatti is manufactured by collecting the dried exudate from the bark of *Anogeissus latifolia* Wallich (Combretaceae). The translucent exudate is partially dissolved with water, filtered, and sterilized. The final product is either prepared directly as the gummy, lump form after sterilization, or as a powder, after a further spray-drying processing step.

4. Chemical Characterization

4.1 Composition

Gum ghatti consists of a complex, water-soluble, acidic polysaccharide composed of calcium and magnesium salts of L-arabinose, D-galactose, D-glucuronic acid, D-mannose, D-xylose, and L-rhamnose. (Pitthard and Finch, 2001; Akiyama et al., 2011; Kang et al., 2012; Sakai et al., 2013). The structures of the main polysaccharides of gum ghatti are discussed in various reports (Al-Assaf et al., 2009; Kang et al., 2011a, 2011b).

Kang et al. reported that the major fraction of gum ghatti has a 1,6-β-galactose backbone with branches at *O*-3 and *O*-4 positions, which can be regarded as the "hairy region," while the "smooth region" consists of →2)-Ara*f*-(1→4)-Glc*p*A-(1→6)-Gal*p*-(1→6)-Gal*p*-(1→. The terminal side chains are reported to be arabinofuranosyl (Ara*f*) and occasionally rhamnopyranosyl (Rha*p*), arabinopyranosyl (Ara*p*), galactopyranosyl (Gal*p*) or glucopyranosyl (Glc*p*A) residues (Kang et al, 2011a). The sponsor provided levels of sugar composition from five lots of commercial gum ghatti. Based on the data provided (Sakai et al., 2013), the total sugar levels are 82.4-86.5 % of gum ghatti. Arabinose, galactose and glucuronic acids are the main sugars, while mannose, rhamnose and xylose were also quantified. The sponsor reported for L-arabinose, D-galactose and D-glucuronic acid to be 34.0-38.0%, 21.0-24.6% and 15.4-18.6%, respectively. D-mannose, L-rhamnose and D-xylose were present at 5.3-7.9%, 0.8-1.2% and 0.8-1.2%, respectively. The reported average molar ratio of the various units is L-arabinose:D-galactose:D-glucuronic acid:D-mannose:D-xylose:L-rhamnose = 40:25:20:7:1:1 (Sakai et al., 2013).

Gum ghatti also contain protein bound to arabinogalactan units similar to gum arabic (Kang et al., 2012, 2015a). Covalently bound protein at ~4%, to arabinogalactan is reported as a constituent of gum ghatti (Kang et al., 2012), and has been shown to have effective emulsifying properties. A model structure proposed contains 1,6-linked galactose backbone with various kinds of side chains, and an occasional xylose or mannose on the backbone. The proteins or polypeptides are attached directly to the core polysaccharide (Kang et al., 2012). The ratio of hydrophobic amino acids of the main peptide fragments from gum ghatti are reported to be higher than gum arabic (Kang et al., 2015a). The hydrophobic amino acid sequences have been proposed (Kang et al., 2015a) to provide oil binding capacity at the interface between the oil and water. Gum ghatti contains 2.7–3.6% protein, 0–0.1% fat, 4.9-8.3% moisture (loss on drying) and 0.041-0.092% tannins are reported.

The reported molecular weights for gum ghatti are wide: 12 kDa to 89,400 kDa (Hanna et al., 1939, Kang et al., 2015b and Kaur et al., 2009). Among these reports, molecular weights of several fractions of gum ghatti were investigated in the latest report (Kang et al. 2015b) and the average molecular weight of the constituents is in the order of several hundred kDa.

4.2 Possible impurities (including degradation products)

Possible impurities of gum ghatti are (i) any inorganic impurities and heavy metals, and (ii) any microorganisms from the source, *Anogeissus latifolia* Wallich. The sponsor provided results for lead,

ash and acid-insoluble ash from five lots of commercial gum ghatti. The levels of lead, ash and acid-insoluble ash are below the specifications proposed by the 57th JECFA (2001). The sponsor also provided levels of microorganisms for five lots of commercial gum ghatti. The levels of *Salmonella* spp. and *E. coli* are also below the specifications proposed by the 57th JECFA.

4.3. Analytical methods

The sponsor provided data based on an HPLC method to replace the TLC method described in the specifications proposed at the 57th JECFA. The HPLC method is capable of detecting monosaccharides previously not detected by the existing TLC method. The specifications for gum ghatti from the 57th JECFA proposed two methods for identity (precipitate formation). The method using "Million's TS" includes mercury, and was deleted.

4.4. Rationale for proposed specifications

L-rhamnose is added as one of the compositional saccharide of gum ghatti, because the presence of L-rhamnose was revealed in several reports (Akiyama et al., 2011; Kang et al., 2012; Sakai et al., 2013). The formula weight specification for gum ghatti was deleted because it was written based on an old report (Hanna et al., 1939) and molecular weights of water-soluble polysaccharides are described to be on the order of several hundred kDa based on new data (Kang et al. 2015b).

Additional functional uses (emulsifier, carrier) were added based on the dietary exposure data provide and published data (Ido, 2008).

5. Functional uses

5.1. Technological function

The gum ghatti is intended for use as a thickening agent, stabilizer, emulsifier, and carrier in various food and beverage applications.

5.2 Food categories and use levels

Gum ghatti is approved for use in several countries, including China, India, USA, Brazil, Ecuador, Guatemala, Iran, Japan, Mexico, Russia, Saudi Arabia, Singapore, South Africa, South Korea, Syria, Uruguay, and Venezuela. Except for USA, no maximum use levels have been reported for other countries. Gum ghatti has been available as a food additive for more than 30 years in Japan, for use as a thickener, stabilizer, emulsifier, and gelling agent in foods and beverages without limitation.
In the United States, gum ghatti is permitted for use in foods at the following Maximum Usage Levels:

Food (as served)	Percent (in final food product)	Function
Beverages and beverage bases, non-alcoholic	0.2	Emulsifier and emulsifier salt
All other food categories	0.1	Emulsifier and emulsifier salt

Gum ghatti is also used as a flavouring ingredient in the United States (FEMA 2519), although at significantly lower use levels (Burdock, 2009). The Codex Alimentarius Commission does not have maximum permitted levels (MPL) of gum ghatti noted in the General Standard for Food Additives (GSFA).

6. References

Akiyama, T. et al., 2011; Analysis of thickening polysaccharides by the improved diethyldithioacetal derivatization method; Shokuhin Eiseigaku Zasshi; 52, 40-46.

Al-Assaf, S., et al., 2009; Handbook of Hydrocolloids (2nd Edition): A volume in Woodhead Publishing Series in Food Science, Technology and Nutrition, pp 477–494.

Burdock, G.A., 2009; Fenaroli's Handbook of Flavor Ingredients (6th Edition): Ghatti gum, CRC Press, pp 138; FEMA 2519.

Hanna, D. et al., 1939; Preliminary report on the chemistry of gum ghatti. Acad. Sci. 19, 130-132.

Ido, T. et al., 2008. Emulsification properties of GATIFORIA (gum ghatti) used for emulsions in food products; Food & Food Ingredients J Jpn; 213, 365-371.

JECFA, 1982; Evaluation of certain food additives and contaminants (Twenty-sixth report of the Joint FAO/WHO Expert Committee on Food Additives), WHO Technical Report Series, No. 683.

JECFA, 1986; Evaluation of certain food additives and contaminants (Twenty-ninth report of the Joint FAO/WHO Expert Committee on Food Additives), WHO Technical Report Series, No.733, and corrigendum.

JECFA, 2001; Evaluation of certain food additives and contaminants (Fifty-fifth report of the Joint FAO/WHO Expert Committee on Food Additives), WHO Technical Report Series, No. 901.

Kang. J., et al., 2011a; New studies on gum ghatti (*Anogeissus latifolia*) Part II. Structure characterization of an arabinogalactan from the gum by 1D, 2D NMR spectroscopy and methylation analysis; Food Hydrocolloids 25, 1991-1998.

Kang. J., et al., 2011b; New studies on gum ghatti (*Anogeissus latifolia*) Part I. Fractionation, chemical and physical characterization of the gum; Food Hydrocolloids 25, 1984-1990.

Kang. J., et al., 2012; Structural investigation of a glycoprotein from gum ghatti; Carbohydrate Polymers 89, 749-758.

Kang. J., et al., 2015a; New studies on gum ghatti (*Anogeissus latifolia*) Part 6. Physicochemical characteristics of the protein moiety of gum ghatt;. Food Hydrocolloids 44, 237-243.

Kang. J., et al., 2015b; New studies on gum ghatti (*Anogeissus latifolia*) Part 5. The conformational properties of gum ghatti; Food Hydrocolloids 43, 25-30.

Kaur, L., et al., 200; Characterization of Gum ghatti (*Anogeissus latifolia*): A structural and rheological approach; J. Food Sci. 74, E328-E332.

The Ministry of Health, Labour and Welfare (MHLW), 2009: Specifications and Standards for Food Additives; 8th Edition.

Sakai, E., et al., 2013; Identification of *Anogeissus latifolia* Wallich and analysis of refined gum ghatti. J. Nat. Med; 67, 276-280.

Pitthard, V. and Finch, P., 2001; GC-MS analysis of monosaccharide mixtures as their diethyldithioacetal derivatives: Application to plant gums used in art works; Chromatographia Supplement 53, S-317-S-321.

United States Code of Federal Regulations, 2016; Title 21, Part 184.1333.