Food and Agriculture Organization of the United Nations

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

TAMARIND SEED POLYSACCHARIDE

Chemical and Technical Assessment (CTA)

Prepared by Jannavi R. Srinivasan, Ph. D., and reviewed by Eugenia Dessipri, Ph. D.

1. Summary

This Chemical and Technical Assessment (CTA) summarises data and information on tamarind seed polysaccharide submitted to the 84th meeting of the Joint FAO/WHO Expert Committee on Food Additives (Committee) upon request by the 48thCodex Committee on Food Additives (CCFA). At the present meeting, the Committee was asked to evaluate all data necessary for the assessment of safety, dietary intake and specifications related to the use of tamarind seed polysaccharide as a thickener, stabilizer, emulsifier and gelling agent in a variety of food categories. This document discusses published information relevant to tamarind seed polysaccharide, the production methodologies, and manufacturing specifications.

2. Description

Tamarind seed polysaccharide (CAS No. 39386-78-2) is a xyloglucan obtained from the seeds of the tamarind tree, *Tamarindus indica* Linné. *Tamarindus* is a monotypic genus and belongs to the subfamily *Caesalpinioideae* of the family *Leguminosae* (Fabaceae), *Tamarindus indica* L. is also commonly known as *Tamarind*. The tamarind tree is a large evergreen widely distributed in subtropical and tropical zones; it is one of the most important multipurpose tropical fruit tree species in the Indian subcontinent (Williams, 2006). The seeds of the tamarind fruit are smooth, glossy and flattened oblongs (Duke et al., 1981). Tamarind seed polysaccharide is also known as tamarind seed gum, tamarind gum, tamarind xyloglucan, tamarind seed xyloglucan, and tamarind galactoxyloglucan.

Every part of the *T. indica* tree is used in food or in traditional medicine in most tropical countries (De Caluwé, 2010). Uses in food include aroma and flavouring properties of the tamarind fruit; in particular, as a seasoning in food preparations in its fresh or dried form. It is also used in herbal medicinal therapies (Williams, 2006).

3. Method of Manufacture

Tamarind seed polysaccharide is produced from tamarind seeds that are sieved and roasted to remove the black testa (seed coat). The light brown tamarind kernel obtained is then pulverized and sieved to obtain tamarind kernel powder. Tamarind seed polysaccharide is extracted from tamarind kernel powder with methanol treatment, and pH adjustment. The residue from the methanol treatment contains mainly tamarind seed polysaccharide and this is physically separated from the supernatant that carries soluble protein, fat and minerals. The polysaccharide is dried, pulverized, sieved, and

mixed with food-grade bulking agents such as sugars (sucrose, glucose, lactose, galactose and maltose), dextrin or maltodextrin to standardize the quality of the product for desired viscosity. Different pH treatments and downstream processing with food-grade materials allow for the manufacture of tamarind seed polysaccharide products of varying viscosities.

Tamarind seed polysaccharide is a white to light brown powder; it is odourless or with slight characteristic odour.

4. Chemical Characterization

4.1 Composition

Tamarind seed polysaccharide is a xyloglucan, composed of a linear chain of β(1-4)-linked D-glucose residues. About 75% of the D-glucose units of the backbone are attached to D-xylose units via α(1-6) bonds. Some of the xylose units are further attached to D-galactose units through β(1-2) bonds that makes up the final xyloglucan structure. The molar ratio of glucose:xylose:galactose is about 4:3:1,calculated based on the molar ratio of 2.8:2.25:1 as reported by Gidley et al., 1991. The general structural formula of tamarind seed polysaccharide is depicted in Figure 1.

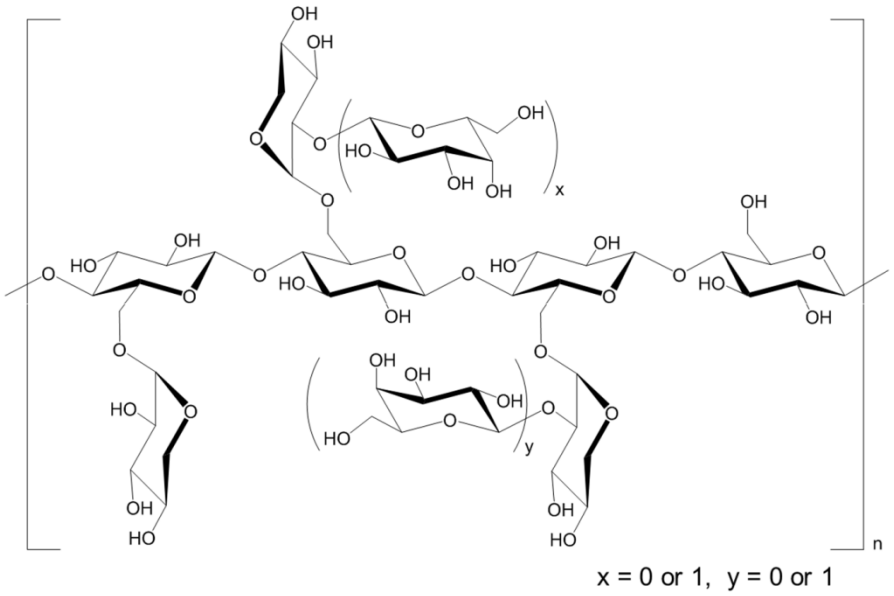

Figure 1: Structural formula of tamarind seed polysaccharide (Muller et al, 2011)

The reported range of the molecular weight of tamarind seed polysaccharide is wide: 470 kDa (Kato, 2000; Muller et al., 2011), 880 kDa (Gidley et al., 1991), 1,160 kDa (Dentini et al., 2001), 2,500 kDa (Lang and Kajiwara, 1993), and 400 kDa–5,870 kDa (Lang and Buchrad, 1993). The wide range of molecular weights reported can be influenced by variations in sample preparation procedures as well as by the tendency of xyloglucans to self-associate (Nishinari et al., 2009).

The final product consists of not less than 75% of xyloglucan on a dry matter basis. The sponsor provided non-consecutive batch analyses for four commercial tamarind seed polysaccharide products to support the consistency of the manufacturing processes.

A typical nutritional analysis profile of tamarind seed polysaccharide shows it to contain 85% of dietary fibre, 10% of available carbohydrate, ≤ 3% of protein, and < 1% of fat. Data provided by the sponsor that supported the proposed specifications include colour, odour, precipitate formation, and solubility. Purity specifications include limits for residual extraction solvents of ≤ 200 mg/kg of methanol and ≤ 1,000 mg/kg of 2-propanol, a limit for lead at ≤ 2 mg/kg, certain microbiological limits including *E. coli* (negative in 1g), *Salmonella* (negative in 5g), total plate counts (≤ 5000cfu/g), and yeasts and moulds (≤ 500cfu/g), a limit for moisture (loss on drying) at ≤ 14%, a limit for ash at ≤ 1%

on a dry matter basis, a limit for protein at ≤ 3%, in addition to the method of assay for tamarind seed polysaccharide content at not less than 75% on a dry matter basis.

4.2 Possible impurities (including degradation products)

Possible impurities of tamarind seed polysaccharide are (i) residues of solvents used during manufacturing (i.e., methanol and 2-propanol, (ii) any inorganic impurities and heavy metals, (iii) microorganisms from the source tamarind seed, (iv) pesticide residues from the plant raw material, and (v) proteins.

The sponsor provided results from the analyses of residual levels of methanol and 2-propanol from two lots of commercial tamarind seed polysaccharide. Based on the data provided, the levels of methanol and 2-propanol are below the specifications proposed by the sponsor. Since the commercial products are further processed and diluted with food-grade carriers, the levels of residual methanol and 2-propanol are expected and demonstrated to be well below the limits set in the finished product.

The sponsor also provided analyses of tamarind seed polysaccharide starting material for potential pesticide residues periodically and confirms absence of any pesticide residue in the final commercial product.

4.3. Analytical methods

The proposed assay method for the determination of polysaccharide content in the tamarind seed polysaccharide is based on a solution of xyloglucan interacting with iodine to give a specific greenish colour, the intensity of which is dependent on the concentration of xyloglucan in the tamarind seed polysaccharide sample.

All the other analytical methods proposed in the specifications for tamarind seed polysaccharide, namely, residual solvents, solubility, loss on drying, and heavy metal analysis are standard methods, published in the Combined Compendium of Food Additive Specifications FAO JECFA Monographs 1, Vol 4 (JECFA, 2006).

4.4. Rationale for proposed specifications

The identity assay for tamarind seed polysaccharide is intended to define the products of commerce as verified by visual inspection and solubility.

The purity of the final product of commerce is established by determination of loss on drying, levels of residual extraction solvents (methanol and 2-propanol), presence of protein, presence of microbiological contaminants, and presence of inorganic matter, including arsenic and lead.

At the 14th meeting, the Committee evaluated the safety of methanol and concluded that its use as an extraction solvent needed to be limited only by good manufacturing practice (GMP). The Committee also noted that residues resulting from the use of methanol under conditions of GMP are unlikely to have any significant toxicological effects (JECFA, 1970).

5. Functional uses

5.1. Technological function

The tamarind seed polysaccharide is intended for use as a thickener, stabilizer, emulsifier, and gelling agent in various food and beverage applications.

5.2. Food categories and use levels

Tamarind seed polysaccharide contain xyloglucans, a type of hemicellulose contained in the cell wall of higher plants. Xyloglucans are found in abundance in the primary cell walls of higher plants (Fry,

1992). Tamarind seed polysaccharide has been available as a food additive for more than 50 years in Japan, with its use permitted by the Ministry of Health, Labour and Welfare (MHLW) for use as a thickener, stabilizer, emulsifier, and gelling agent in ice cream, sauces/condiments, dressings/mayonnaise, fruit preserves, desserts, beverages, pickles, tsukudani (boiled foods in sweetened soy sauce), spreads/fillings, flour products, and soup. Tamarind seed polysaccharide is included in the regulatory agency's compendium of food additives in South Korea and China. It is included in the regulatory agency's list of raw materials for food products in Taiwan, and it is Generally Recognized As Safe (GRAS) in the US since 2014.

The Committee reviewed the data provided for tamarind seed polysaccharide proposed for use as a thickener, stabilizer, emulsifier, and gelling agent in various food and beverage applications at a maximum use level of 1.5%; this use level is based on both use experience and results of tamarind seed polysaccharide in food in Japan, as well as levels expected for future use based on the GRAS monograph that received a 'no objections' letter from US FDA. The proposed use levels are considered maximum levels required to achieve the desired technical effect since the viscosity of tamarind seed polysaccharide increases with increasing concentration, putting limitations on the levels used.

6. References

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