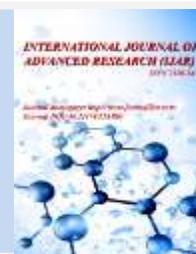




Journal Homepage: -www.journalijar.com
**INTERNATIONAL JOURNAL OF
 ADVANCED RESEARCH (IJAR)**

Article DOI:10.21474/IJAR01/6647
 DOI URL: <http://dx.doi.org/10.21474/IJAR01/6647>



RESEARCH ARTICLE

BENEFITS OF TAMARIND KERNEL POWDER – A NATURAL POLYMER.

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Manuscript Info

Manuscript History

Received: 02 January 2018
 Final Accepted: 04 February 2018
 Published: March 2018

Keywords:-

Tamarind kernel powder, TKP based gum, application, food industries, textile industries, pharmaceutical industries, and other application.

Abstract

Tamarind Kernel Powder or TKP is a polysaccharide obtained from the endosperm of the tamarind seed of the tamarind tree, botanically known as *Tamarindus indica* Linn. This TKP based gum is a valuable thickener and stabilizer, used in different industries. TKP is abundantly available and has a good economic viability. TKP is also known as Tamarind Xyloglucan.

TKP based thickeners have a wide range of application. In food industries it is used as additives, preservatives, gel forming agent, solidifying agent, binding agent and also as a stabilizer. In textile industries, it is abundantly used by the processors in printing of disperse dyes on polyester fabric. TKP is used in medical field as a substitute, stabilizer in ointments, coating agents for tablets. It has other applications like in leather industries, in preparation of pet food, paper industries, and brick industries.

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Introduction:-

Tamarind or *Tamarindus Indica* Linn) is a member of the dicotyledonous family fabaceae (Leguminosae). It grows in more than 50 countries of the world. The major areas of production are Asian countries like India, Bangladesh, Sri Lanka, Thailand, Indonesia, Africa, and America (Kumar and Bhattacharya 2008). Overall dry weight of TKP is 67-68 %, out of which Glucose 38 %, Xylose 35.5 %, and Galactose 22.2% are the main constituents with a small content of arabinose 4.3 % (Tepparin et al., 2011) .

Tamarind Kernel Powder is one of the natural hydrocolloid source produced from the byproduct of Tamarind pulp industries (Pulungan et al., 2001; Nagajothi et al.,2017). The viscous constituency of TKP paste has led to its applications in different industries like:

1. Thickener, useful in textile industries,
2. As a Binder in food and pharmaceutical industries, Paper industries, Cosmetics industries (Patel, 2013).
3. As a Stabilizer as well as a Gelling agent in allied industries.

Recently, newly identified properties of TKP are Non-carcinogenicity, Biocompatibility, High drug holding capacity and High thermal stability. In the new era, development of new excipients is time consuming, involves tedious procedures and also is highly expensive. Instead, identification of new uses for the naturally existing products is relatively inexpensive, less time consuming as well as its biodegradation is environmental friendly.

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Natural polymers like TKP, Guar gum, Karaya gum, Fenugreek gum have advantages over synthetic and semi synthetic polymers like low cost, natural origin, less side effects, locally available and better solubility (Satle and Dr. Agrawal, 2012)

Chemical Composition of TKP:-

Starch	0.24 - 0.54 %
Fat	2.39 - 3.19 %
Ash	2.45 - 3.30 %
Moisture	3.42 - 3.74 %
Protein	16.43 - 17.07 %
Crude fiber	1.20 - 1.68 % (Kumar, 2008)
Carbohydrates	65.1 - 72.2 % (Tepparin,2011)

Starch is the main constituent of TKP. More than 77 % of the component of TKP is a polysaccharide xyloglucan (kumar et al.,2008),(Williams and Phillips.,2009). Xyloglucan consists of pentose sugars constituting approximately 20% of the soluble sugars. Mannose (17-35 %) and glucose (11-80 %) are the principal soluble sugars (Tepparin et al., 2011). The monosaccharide residues of TKP are joined to each other by glycosidic linkages (Dea, 1989). They provide good mechanical properties for applications as binders, film formers, fibers, adhesives, rheology modifiers, hydrogels, emulsifiers, and drug delivery agent (Satle and Agrawal ,2012; Duane, 1978).

Preparation of TKP:-

Shorting:-

To make the kernel clean, and discarding all kind of dirt. Cleaner machine separates and throws off the small and large particulate dirt by its constant vibration and aspiration.

Roasting:-

Separation of the shell coating from kernel is a difficult process because the coating (testa) is firmly attached to the endosperm. This phase is very important for softening the shell coating, which leads to its separation from the endosperm, also helps in decreasing the water content of TKP.

Stripping or Separation:-

Stripping means removal of the undesirable coating or the shell from the kernel (cotyledon) as it does not play any role in imparting viscosity. It is also unfit for human consumption. This is easily done because the Tamarind shell and the kernel have different degrees of hardness. The dried shell is more brittle than the kernel.

Grinding:-

The kernels separated from the shell are ground in ball mills to convert it in to a smooth powder of a uniform micron size.

Screening:-

The powder thus obtained is screened through screens of less than 60 micron size, so that during the application stage a clog free uniform paste is obtained. This is necessary to ensure that the thickener does not clog the pores of the very fine 60 micron size print screen without any spreading on to the adjoining portion of the printed fabric.

Packing:-

Tamarind kernel powder is generally packed in water resistant polymer bags of net weight 50 Kg. Excessive heat and humidity should be avoided during storage. It is preferably stored in dry space for long duration preservation (Pulungan et al.,2001).

Properties of TKP:-

1. TKP is a neutral branched polysaccharide with high molecular weight, extracted from tamarind seeds consisting of cellulose, xylose and galactoxylose .
2. It being a natural polysaccharide is easily biodegradable.
3. It is preferred because of its natural origin and low cost of production, having less side effects. It is locally available and has better patient tolerance.

4. It is insoluble in organic solvents and dispersible in warm water to form a highly viscous gel with broad pH tolerance with good adhesive property (Satle and Agrawal, 2012),(Betlach et al., 1987).
5. It is non-toxic and non-irritant with hemostatic activity.
6. It possesses non-newtonian rheological behavior, mucoadhesive and pseudoplastic properties (Satle and Agrawal, 2012).
7. TKP powder exhibits high non-newtonian behavior with increased concentration as in consistency latex, by producing stress and imparting apparent viscosity (Pulungan et al.,2001; Satle and Agrawal, 2012).
8. These natural polysaccharides suffer with the drawbacks like purity, source and microbial contamination. If these factors can be identified and controlled, then this natural product will be a better alternative against using synthetic polymers.
9. It is used as binding agents, gelling agents, disintegrating agents, sustaining agent in matrix tablets, film forming agent, thickening agent, suspending agents, emulsifying agents and as a solubilizing agent.

Applications:-

There are many possible uses for Tamarind kernel powder in food and drug industries and also in textiles, paper production. After 1943 it came into commercial production in the Indian cotton industry by replacing starch as a sizing material (Gerad, 1980).

Food Industries:-

1. In food preparations, this natural polysaccharide TKP is also known as 'Jellose' or 'Polyose', being used as fruit preservatives and also in jelly preparations.
2. TKP used as emulsifier in production of essential oils, in heat resistant low acid emulsions, foods and salad dressings. TKP can form gel over wide range of neutral to basic pH.
3. It is used as gelling and thickening agent and bulking agent in the preparation of puddings, desserts, confectionery, sour milk gel, low water releasing gel, yoghurt, jelly, jams, pie fillings, sauces, vegetable pan cake, protein free food, acidic protein foods preparations.
4. It has a viscosity which is relatively higher than corn starch. TKP is also relatively cheaper and a small quantity is required compared to corn starch.
5. TKP is used as a coating material in sausage casings, protective coating, storage of pineapple and fried foods.
6. TKP is also used as preservatives in soybean curd, bread, boiled noodles and freshness maintaining agent for fruits, vegetables and meat.
7. TKP is used in the preparation of xyloglucan by enzyme treatment as a health beverage. It is also used in cakes and chewing gums.
8. A cellulose hydrolysate of tamarind polysaccharide is utilized as a substitute for a portion of metabolizable carbohydrates in processed foods to prepare reduced calorie food having excellent organoleptic quality.
9. TKP based gum is used as an antimicrobial agent in processed food, and also improves palatability in instant noodles.¹²
10. As an odor improver, glazing agent, filler, film forming gum, crystallization inhibitor in ice-cream, frozen food, freeze dried gel, yum, frozen food covered with jelly.
11. TKP is used as deformation preventing agent which is very essential in cooked food.

Pharmaceutical Industries:-

1. TKP is used as a medicine in the treatment of boils and dysentery, as anti-viral agent, agent for lowering blood sugar, as a curative against rheumatism, used in eye disease and ulcer, also used to prevent formation of pimples, chronic diarrhea and jaundice.
2. It is used as a substitute to production of penicillin, preparation of lather less saving creams, moisturizing creams.
3. It increases the shelf life of anti-oxidative components. It finds use as a stabilizer in preparation of capsules, dentures, solution for contact lens storage (Jani et al.,2009). It can prevent dental caries so it is also incorporated in tooth pastes.
4. As a dehydrating agent TKP is used in making and maintaining powdered products.
5. TKP gum is used as suppressant for the proliferation of gram negative bacterium. It also works as carrier and fixer in fixing beta-galactosidase, laxative action in dietary fiber composition (Jiayu, 2005).
6. TKP used in preparation of greaseless ointment, colloidal iodine jelly, mulching sheets,capsule, insecticides for delicate foliage. To clean oral cavity TKP is used as a oral cavity composition gel (Iwao and Shigezo,2004).
7. As an anti-obesity agent for the treatment of obesity (Kumar and Bhattacharya, 2008).

Textile Industries:-

1. TKP is widely used as a sizing material used in jute and textile industries.
2. Used as a thickener in textile processing industries in printing, dyeing and finishing of textiles.
3. TKP is useful for sizing spun viscose as it offers a distinct advantage over the use of starch being more easily removable from the spun fabric.

Other Applications:-

1. TKP is used as a tanning material in leather industries.
2. TKP is often used as a feed for cattle, pigs and pets. It is an excellent thickening agent used in manufacture of canned pet foods processed for cats and dogs. TKP powder is nutritious and contains fibers which help to improve digestion in the pets (Patel, 2013).
3. TKP boiled with water gives a very good paper adhesive.
4. It can also be used as a conditioner and stabilizer of soil during brick-making and as a binder in making sawdust briquettes(Kumar and Bhattacharya, 2008; Patel, 2013).

Conclusion:-

TKP is a natural polysaccharide with high molecular weight which gives good viscosity and adhesive property. It possesses wide range of applications in different type of industries like food industries, pharmaceutical, textile industries, as a stabilizer and emulsifier and in addition TKP is widely used in different kind of flavoring for sauces and for the purpose of thickening and stabilizing. It is cheap due to its abundant availability, is safe to handle, and is totally bio-degradable.

Acknowledgement:-

This work is a part of Minor Research Project sanctioned and sponsored by GUJCOST, Gandhinagar, Gujarat, India (GUJCOST/ MRP/2015-16/2602). The authors are extremely thankful to the authorities of GUJCOST for the financing this project in our Grant-in-Aid college: B. P. Baria Science Institute, Navsari, Gujarat, India.

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