A Review on Tamarind Seed and Bitter Gourd Seed Extracted Oil

Divyanandan Vatas
Department of Food Technology & Nutrition,
Lovely Professional University, Phagwara, Punjab, India.

Abstract

The aim of this paper is to review the medicinal properties of bitter gourd and tamarind seeds oil. Bitter gourd (*Momordica charantia* L.) is an ancient vegetable that has been used as a medicinal food in tropical and subtropical countries, as well as on the peninsula, China, and India. It has many medicinal effects like anti-diabetic, anti-obesity, antitumor, antifungal, anti-viral and drug treatment activities. Tamarind, commonly called *Tamarindus indica*, is one of the most important fruit species. Basically tamarind fruit is used in food industry and known for its sour properties. A seed of fruits or vegetables contains oil which is rich in dietary lipids and have vast applications in the food and healthcare industry. Bitter gourd seed and tamarind seed oils stimulate great interest due to the right amount of fatty acids and bioactives (secondary metabolites) they contain. This review reveals the different characteristics and extraction process of these two seeds oil. Various uses of tamarind and bitter gourd products also mentioned throughout this paper.

Keywords: **Bitter Gourd, Tamarind, oil, medicinal effects, anti-diabetic, health.**

1. INTRODUCTION

Bitter gourd scientific name is '*Momordica Charantia*' and for many years, Asian and African medicinal systems have made use of bitter gourd. It has been adopted by Turkish people as a treatment of illness specifically stomach related problems and for therapy of diabetes, cough, ulcer, breathing related diseases, skin diseases etc. (Jia et al. 2017). It plays a crucial role in reducing cancer risks, HIV and been used for diabetic patients furthermore. Some more research is needed for its recommendation to be used for medicinal purposes as it has shown some possibility of clinical activity while analyzing in laboratory (Wang et al. 2019).

Hypoglycemia effect was observed for concentrated bitter gourd extracts while studying on animals and miniature-scale humans. According to a review paper in 2014, when bitter gourd is consumed in raw or juice form, it can lower the levels of glucose in blood. Although, in many review papers, it was found that it does not drastically decrease the blood glucose levels when bitter gourd was taken in a tablet or a capsule form. Bitter gourd is beneficial for diabetic patients but it also depends upon the method of intake or consumption of bitter gourd. To verify these effects, a greater number of studies should be performed. As concluded by a well-known cancer center, 'Memorial Sloan Kettering' bitter gourd is not suitable replacement of insulin therapy or drugs for hypoglycemia (Inayat et al. 2015).

In the sixteenth century, bitter gourd was introduced to Central America, United Mexican States and to some extent of South America, by the Portuguese & Spanish people, once that, it became a main ingredient for the cooking of those regions (Nunn et al. 2010).

Bitter gourd is a commonly occurring herb which is consumed as a vegetable for its medicinal benefits in all over the globe, including Africa, Asia, Central and South America. Many bioactive compounds are unit gift in bitter gourd, that has been found by several researchers, that plays a very important role within the treatment of the many ill health or diseases like protozoal infection, hypoglycaemia, discharge disorders, tumors, hemorrhoid, wounds, antiviral diseases like fevers and liver disease etc. it's been studied well and plenty of mechanisms are planned for the medicinal drug properties of it (Chunthorng-Orn et al. 2012).

Tamarindus indica was originated from tropical continent. Its cultivation is everywhere in the world however mostly in regions of tropical and semitropic lands. It grows wild in continent like Sudan, Nigeria, Cameroon, Somalia, Zambia, Kenya, Nyasaland and United Republic of Tanzania. It reached South Asia possible through cultivation and human transportation many thousand years agone. It's distributed throughout the tropics from continent to Asia, Australia, Oceanica and China (Caluw et al. 2010).

In present, the most important producer of tamarind is Republic of India. Tamarind is consumed by several countries because it plays a very important role within the cuisines of southern and Jap Asia, subcontinents of Republic of India, United Mexican States and also the America. Tamarind is understood in Republic of India since history and has been thought of as a multi-purpose plant. Several reports have already shown that within the addition to the already familiar uses of the pulp of tamarind as a food, its seeds,

flowers, wood, leaves, and tree bark may be used for several functions (Chacon et al. 2019). Tamarind different parts like leaves, pulp of the fruit are edible in nature and have several nutrients. The pulp has sweet-acidic flavor because of the presence of high content of reducing sugars and hydroxy acid. The most important natural supply of hydroxy acid is understood to be tamarind that is most ordinarily employed in Asian gastronomy. The tamarind pulp is appreciated for the characteristic flavor and generally praised as exotic, as quite sixteen volatile parts area unit found that contributes to its flavor (Chacon et al. 2019).

In several countries, tamarind pulp is consumed contemporary, yet as used for the flavoring and because the part of the food. In jams, juices, soft drinks, sweet sauce and sauce, it's additionally used as a very important ingredient. In most of the industries, the seed is disposed as a byproduct or residue with none worth. However, in some industries or countries, the seed is taken into account as a byproduct of the business within the method of the extraction of the pulp of the fruit, on the premise of that additional use has been found, acknowledging the assorted properties of the seeds (Kobayashi et al. 2016).

The presence of tannins in seeds and a few different pigmented materials in a very take a look at portion makes it tough or inadequate consumption for food, however heat treatments like soaking in plight and change of state in water build this product edible in the main for animals. Now a days, Industries like paper, textile and jute area unit victimization the tamarind seed powder as their material that is that the largest industrial product of tamarind seed (Chacon et al. 2019).

A carbohydrate familiar jellose, comes from the tamarind seeds that is employed because the adhesive in some product and for getting the tannins. It's some gelling properties and it's commercially used because the additive and as stabilizer in frozen dessert, cheese, mayo and different farm product, associate degreed as an agent for pharmaceutical product. To unleash the drug indefinite quantity forms, natural polymers or gums area unit used because of their nice properties like non-toxicity, biodegradability, biocompatibility in nature and once they area unit exposed to water or binary compound medium, they swell. Tamarind belongs to the *Fabaceae* family (Chacon et al. 2019).

The pulp of the fruit is that the main spoilage agent used for sauces, curries and a few beverages. Pod contains one to ten seeds, which might be planate, on an irregular basis formed, rhomboid; an oversized depression is formed on the individual flat facet of the seed. The seeds area of tamarind has been unit terribly robust, shiny, reddish, or purple brown in color. The seeds area unit embedded within the tamarind pulp, alongside parched membrane and joined to at least one another with tough fibers (Souza1 et al. 2007).

Tamarind seed is taken into account as a byproduct of tamarind pulp industries. The full seed is taken into account as unsuitable for human consumption because of the presence of the tannins within the seed coat and additionally different coloring compounds gift in it. The most industrial product derived from tamarind seeds is, tamarind kernel powder (TKP) or tamarind seed powder that is employed as a very important filler material within the jute, textile, paper, and different industries. Tamarind seeds and pulp area unit wide accepted as a less expensive supply of material for industrial functions. Although, at present, the export and production has been proscribed to few countries. The process techniques, particularly the removing of the pulp from the seeds or the pods from the pulp, handling and storage of seed and pulp area unit has been worn out a standard method or manner of the growing country or region (Kumar and Bhattacharya, 2008).

1.1 History

Tamarind fruit was originally thought to supply Indian palm, because the name tamarind comes from the Persian word 'tamar-i-hind', which means 'Indian day'. Its name 'amlika' in Indo-Aryan indicates its ancient existence within the world. As reported, discussed in the Indian Brahmasamhita texts between 1200 and 200 BC, traced their origins to India, but some consider it indigenous to the arid tropical regions of Africa, from Sudan, Ethiopia, Kenya and Tanzania, in the southwestern Sahelian Africa in Senegal (Saideswara and Mathew, 2012).

In some regions the red flesh is separated from the common brown selection and is taken into account to be of prime quality. There are additional delicious tamarind varieties than most. One in Kingdom of Thailand is understood as 'Makhamwaan'. One distributed by the US. Department of Agriculture's climatic zone husbandry analysis Unit, Miami, is understood as 'Manila Sweet' (Saideswara and Mathew, 2012).

1.2 Production

Important and growing major provinces square measure geographical region, Gujarat, Rajasthan, Punjab, Tamil Nadu, Kerala, Karnataka, province, state, Odisha, state province and Bihar. It's a heat season crop that's wide fully grown in tropical and semitropical climates. They're exposed to light-weight snow and are given partial protection once fully grown throughout the winter months. Temperatures of 24-27ºC square measure thought-about favourable for the expansion of vines. Seeds germinate best once temperatures square measure over 18ºC. High wetness throughout vegetable growth makes the crop vulnerable to varied plant life diseases. Client preferences for a bitter style vary by region looking on the scale, color, presence or absence of tubercles / ridges and fruit bitterness (Saideswara and Mathew, 2012). Equally a spread of species square measure being developed in India and details square measure has been given in *table 1.1*.

Table 1.1 Different varieties of Bitter Gourd and their special features.

Developing institution	**Variety**	**Special features**
IIHR, Bangalore	ArkaHarit	Fruits short, spindle shaped, green coloured with smooth regular ribs and moderate bitterness. Yield 9-12 t/ha.
IARI, New Delhi	PusaVishesh	Selection from a local collection and suitable for growing during summer. Fruits glossy green medium long and thick.
	Pusa Do Mausami	Fruits dark green, club like with 7-8 continuous ribs. Fruit weight 100-120 g. Yield 12-15 t/ha.
	Pusa Hybrid 1	Fruits medium thick, long and gloss green, yield 20 t/ha in 120 days
Kerala Agricultural University	Priya (VK1)	Extra-long green spiny fruits with white tinge at stylar end, av. Fruit length 39 cm. av. Fruit weight 235 g. productivity 24.5 t ha-1
	Preethi (MC 4)	Medium sized white fruits with spines, av. Fruit length 30 cm, av. Fruit girth 24 cm, av. Fruit weight 0.31 kg. productivity 15.0 t/ha-1
	Priyanka	Large white spindle shaped fruits with smooth spines, thick flesh and less seeds. Av. Fruit length 25 cm. av. Fruit girth 20 cm. av. Fruit weight 0.30 kg. Productivity 28.0 t/ha-1
Tamil Nadu Agricultural University	CO.1	Fruits dark green with medium length (20-25 cm) and weight (100-120 g). Yield 14 t/ha.
	Coimbatore Long Green	Extra-long fruits (60 cm) with dark green colour.
	MDU.1	Fruit weight 300-450 g. yield 15-18 t/ha. Induced mutant with long (30-40 cm) greenish white fruits, fruit length 30-40 cm, yield 30-35 t/ha.
	Coimbatore Long White	Extra-long fruits (60-65 cm) with white colour, yield 15 t/ha.
	COBgH 1	F1 hybrid developed by crossing MC 84 x MDU1. Fruits are light green in colour, plumply with more warts, each weighs 200g.-300g. Yields 44.40 t/ha in 115-120 days. It is rich in momordicin (2.99 mg per 100g).
Konkan Krishi Vidya Peeth, Dapoli	Konkan Tara	Fruits green, prickly, medium long (15-16 cm) and spindle shaped. Yield 24 t/ha.
PAU, Ludhiana.	Punjab 14	Plants bushy and bear light green fruits with average weight of 35 g. Yield 14 t/ha.
CSAUA &T, Kanpur	KalyanpurBaramasi	Fruits long (30-35 cm), light green, thin and tapering, tolerant to fruit fly and mosaic, yield 20 t/ha in 120 days.
MPKV, Rahuri.	Hirkani	Fruits dark green, 15-20 cm long, spindle shaped with warts and prickles, yield 14 t/ha in 160 days.
	Phule Green	Fruits dark green, 25-30 cm long, prickled, tolerant to downy mildew, yield 23n t/ha in 160-180 days.

The tree is native to geographic area, together with elements of Madagascar's arid forests. The tree grows wild, though it's cultivated to a lesser extent. It found in most tropical and semitropical regions of the planet and has become quite common in several places, particularly India, South East Asia, Tropical America, the Pacific Islands, and therefore the Caribbean. India is that the world's largest producer of tamarind with a mean production of 191,750 tons for the year 2015-2016. In India the tree is endemic to Madhya Pradesh, Bihar, province, Chhattisgarh, Karnataka, Tamil Nadu and state regions. Tamarind is a vital Indian crop and ranks sixth in terms of export earnings (Isa et al. 2018).

The major manufacturing countries square measure Brazil, Bahamas, Costa Rica, Bangladesh, Cuba, Burma, Egypt, Cambodia, Guatemala, Dominican, Republic, India, Fiji, Indonesia, Gambia, Mexico, Kenya, Nicaragua, Pakistan, Puerto law, Senegal, Philippines, Tanzania , Sri Lanka, Vietnam, Thailand, Zambia, Republic of Venezuela and island. However, tamarind is fully grown as a serious cultivation space solely in a very few countries like India and Asian nation. India is that the largest producer of tamarind product within the world. Tamarind is principally found within the Indian state of Madhya Pradesh, Bihar, province, Karnataka, Tamil Nadu, state, state and Kerala (Isa et al. 2018).

India exports about 98,160 metric tons of tamarind annually, its seeds being about 30-34% of the total fruit. The opportunity to export tamarind from India over the past five years shows a good market for tamarind, especially in the Gulf countries and Europe. The internal value of raw tamarind can be further enhanced by value-added activities and there is a good market for these products used in both home and outdoor circuits (Saideswara and Mathew, 2012).The export data can be seen in *table 1.2.*

Table 1.2: Export data of Tamarind from India.

Year	2017-18		2018-19		2019-20	
Country	Qty	Rs. Lacs	Qty	Rs. Lacs	Qty	Rs. Lacs
UAE	2,083.21	2,282.38	2,686.73	3,054.66	2,445.55	2,625.53
Saudi Arab	1,070.49	1,056.00	1,552.21	1,447.28	2,207.30	1,794.33
Iraq	1,171.00	678.57	1,659.20	978.26	2,499.02	1,332.45
Egypt	956	923	1,329.55	1,149.28	1,276.36	945.62
Vietnam	1,350.00	734.59	29	17.52	1,900.40	908.86
U S A	540.31	790.36	452.62	777.74	561.72	897.63
Turkey	698	484.71	2,388.47	1,986.55	1,124.24	804.79
U K	374.39	442.13	454.5	642.88	422.64	533.39
Singapore	204.12	344.61	299.63	593.7	253.28	459.92
Bangladesh	190	17.3	576.95	406.55	2,244.00	361.28
Oman	258.95	305.72	322.75	414.42	315.42	353.19
Qatar	245.43	270.24	354.98	419.89	287.18	307.66
Jordan	495	420	402.5	342.26	440.85	285.3
Kuwait	253.28	282.23	381.01	454.34	224.02	275.69
Yemen Republic	448.47	296.7	611.86	501.36	454.4	275.55
Somalia	12	6.42	90	43.78	377.05	214.43
Pakistan	1,950.00	651.69	0	0	450.62	172.41
Australia	91.5	172.08	120.21	207.89	105.28	167.44
Djibouti	155	141.76	241.72	209.79	193.19	137.01
Baharain	119.46	152.86	144.71	182.22	95.55	117.5
Netherland	14.5	16.24	44.58	69.6	57.08	72.84

Canada	63.99	101.37	24.92	43.06	50.68	69.33
Malaysia	821.6	387.19	57.54	27.77	87.16	52.37
Belgium	7.3	10.53	4.16	9.24	43.64	46.33
New Zealand	29.73	42.4	25.18	49.13	24.64	41.03

2. PROBLEM BACKGROUND

Tamarind seeds and spicy sorghum seeds are the most widely used product as many people are unaware of its health benefits. Both tamarind seeds and bitter gourd seeds are not widely used in India or any other country as very few people know their health benefits. Tamarind seeds are an unused product of the tamarind pulp industry only a tiny low fraction of the seed, within the type of tamarind kernel powder (TKP), is employed as a measuring material within the textile, paper and jute industries. Though several applications for these seeds square measure potential, there are not any alternative uses that involve mistreatment it as a supplement in food production. The superb adhesive properties of gelling seed powder for isolated seeds will result in many applications within the food and pharmaceutical industries characterized by variety of analysis papers and patent applications (Kumar and Bhattacharya, 2008). This article therefore focuses on seed use opportunities in a number of non-food and non-food industries mainly with regard to physical and engineering, hydration performance, rheological properties, functional and nutritional properties, and tamarind seed processing for a wide range of applications (Kumar and Bhattacharya, 2008).

Bitter gourd (*Momordica charantia*) has attracted the eye of researchers thanks to its glorious anti-diabetic action. The positive result of balsam pear on the guts has been reported by in vitro and in vivo studies. However, the increasing toxicity or potential danger of *M. Charantia* in fetal heart development is less well known. This study was therefore designed to detect the developmental effects of *M. Charantia* using zebra fish embryos (Khan et al. 2019). Herbs have been used in traditional medicine for centuries to treat various ailments, including diabetes. Sour bitterness is a popular vegetable in East Asian, South Asian, and Southeast Asian cuisines, and its fruits are often eaten as food cooked in its green or early yellow phase. One of the most common uses of *M. charantia* is as an anti-diabetic agent (Khan et al. 2019).

3. CHARACTERIZATION OF OIL

3.1 Tamarind seed oil

Tamarind seeds produce useful amber oil as a lamp and as a special varnish to paint dolls and pictures. The oil is said to be delicious and in good cooking quality. Tannin-rich seed coat (testa) is investigated as a material used such as wood paste and dyeing and tanning, although it is minimal and gives a reddish color to the skin (Dhamija and Parle, 2012).

Seeds contain a seed coat or testa (20-30%) and a kernel or endosperm (70-75%). Unlike ginger, tamarind seeds are rich in protein (13-20%) and fat (4.5-16.2%). The seed coat is rich in fiber (20%) and tannins (20%) as well (Saideswara and Mathew, 2012). Whole tamarind seeds contain 131.3 g / kg crude protein, 67.1 g / kg crude, 48.2 g / kg crude oil, 56.2 g / kg of tannins and trypsin inhibitor (TIA) activity -10.8, with high carbohydrate sugar. The activity of a trypsin inhibitor is much higher in pulp than in seeds, but both are a temperature label. Seeds contain 63% starch and 4.5-6.5% of slightly drying oil. The seeds also contain 47 mg / 100 g of phytic acid, which has a lower impact than its nutritional value (Saideswara and Mathew, 2012). The composition of fatty acids is given in Table 3.1.

The chemical composition and nutrition worth of tamarind seeds and grains are determined by many employees. The carboxylic acid composition of tamarind kernel has been according by many employees. Among the fatty acids, linoleic acid, monounsaturated fatty acid and hexadecanoic acid were the most important constituents. Discarded tamarind seeds are found to be a fashionable supply of cellulose, a jelly-forming part of the many fruits, vegetables, seeds, etc. (Saideswara and Mathew, 2012).

3.2 Bitter gourd seed oil

Sour salt is one amongst the few edible fruits that contain conjugated omega-6 in its seeds that may be a processed product. The macromolecule profiles of seed oil have received special attention thanks to its high content of unsaturated fatty acids (PUFAs) and different bioactive compounds. Recent studies have found that spicy seed oil (BSO) contains 30-60% α-eleostearic acid, PUFA (ω-5) with long fibers with double bonds (Yoshime et al. 2016). CLnAs are gaggle of point and geometric octadecadienoic carboxylic

acid isomers with 2 Trans and cis covalent bond. The chemical and physical properties of CLnAs and their many potential health edges, as well as anti-oxidant, medicinal drug, anti-atherosclerotic, anti-tumor, and in vitro and in vivo serum lipid-reducing activity, have raised interest in science (Yoshime et al. 2016).

The fatty acids in BSO and LSO (linseed oil) are regenerate into methyl group esters exploitation NaOCH3 in wood alcohol. Samples were conducted beneath outlined action conditions. Fatty acids are known by examination their finish times and commerce standards. Combined fatty acids are obtained by examination their storage times with those according within the literature (Yoshime et al. 2016).Results were expressed as percentages of total fatty acids, which can be seen in *table 3.1.*

Table 3.1. Composition of various fatty acids in tamarind and bitter gourd seeds.

Fatty Acid Compositions	Oil Seeds	
	Tamarind	Bitter Gourd
Linoleic Acid	46.5%	5.4-6.9%
Linolenic Acid	5.6%	~
Stearic Acid	6.6%	27-32%
Palmitic Acid	14.8%	~
Oelic Acid	27.2%	16%
Archidic Acid	12.2%	~
Lignoceric Acid	22.3%	~
Eleosteric Acid	~	62%

(Source: Yoshime et al. 2016 & Pitke et al. 1977)

4. BENEFITS OF OIL

4.1 Tamarind Seed Oil

Tamarind seed oil is used to promote healthy teeth and gums. It helps to promote digestion as it heals ingestion and increases bile production. It is rich in dietary fiber, which leads to lower cholesterol. It lowers bad cholesterol and raises good cholesterol. It prevents infection as it contains antibodies and protects against skin, intestinal, and urinary tract infections. Helps to manage diabetes, It protects the pancreas from increasing the size of insulin-producing cells, which in turn improves insulin sensitivity. It also helps control blood sugar levels naturally (Yadav et al. 2016). Its heart is friendly as it contains potassium which can be helpful for patients with high blood pressure and other heart diseases. Also, it contains linoleic acid which prevents cardiovascular disease. It also treats dry eye as its direct use of oil can cure blinking, ocular heat and sensation in the human eye. It is also used in the treatment of hypercholesterolemia. It has a high phenolic content and antioxidant activity (Yadav et al. 2016). It also lowers high blood pressure and alters vascular atherosclerosis. It also helps in the importance of cell counting and signaling and is good for cell membranes. It contains polyphenols like flavonoids, some of which can help control cholesterol levels. One study of high-cholesterol hamsters found that the tamarind fruit released total cholesterol, LDL "bad" cholesterol and triglycerides (Yadav et al. 2016). The antioxidants in this fruit can help reduce oxidative damage to LDL cholesterol, which is a key driver of heart disease.

Tamarind is also high in magnesium. One ounce (28 grams), or less than 1/4 cup of flour, brings about 6% of RDI. Magnesium has many health benefits and plays a role in over 600 body functions. It can also help lower blood pressure and have anti-inflammatory and anti-diabetic effects (Yadav et al. 2016).

4.2 Bitter Gourd Seed Oil

Used for the treatment of atherosclerosis. Also, it helps diabetic patients as it helps control blood sugar levels. It is also used to treat liver problems and ulcers. Also, it is used to eliminate intestinal parasites. It regulates high cholesterol levels in the blood as it contains high levels of healthy polyunsaturated fats and lowers high levels of bad cholesterol leading to increased good cholesterol levels which means it prevents heart attack and is good for cardiovascular diseases (Paulina et al. 2019). It is also helpful in treating abdominal pain. It heals wounds and is helpful in preventing vomiting. It has antibacterial properties and because of these properties, it is recommended for patients with cancer and hepatitis.

Regular use of bitter cane incorporates a positive result on internal organ health. Not solely is GI disorder like constipation and abdominal pain however conjointly equally helpful for Irritable bowel Syndrome (IBS) because it helps kill parasites that enter the system a digestorium. Additionally, it contains antioxidants that facilitate stimulate biological process enzymes and support digestion (Paulina et al. 2019). Attributable to its natural anti-depressant properties and high fiber content, spicy drugs is usually recommended

by doctors for maintaining sensible biological process health. Anyone diagnosed with polygenic disorder is condemned to eat bitter gourds. This can be one among the foremost vital health advantages of the herb that's best-known to all or any. It contains 3 active anti-diabetic substances, particularly polypeptide-p, vicine, and *M. charanti*, that have insulin-like effects and lowering glucose levels. These compounds work along or one by one to assist lower glucose levels (Paulina et al. 2019). Additionally, the bitter gourd was found to contain glycoprotein that helps to cut back aldohexose levels within the body by suppressing appetence and forming borderline tissue. In line with specialists, glycoprotein is accountable for the hypoglycaemic result, which suggests that glucose levels haven't born. Each meat and seeds are helpful during this regard. Intake bitter juice each morning on Associate in Nursing empty abdomen will assist you keep your polygenic disorder in restraint (Paulina et al. 2019).

5. NUTRITIONAL PROFILE

5.1 Bitter Gourd

(a) Macro nutrients per 100 grams (in grams):-

Fat – 0.2 g

Carbohydrate – 3.7 g

Dietary fiber – 2.8 g

Protein – 1 g

(b) Micro nutrients per 100 grams (in %age RDA):-

Vitamin A - 48%

Vitamin C - 92%

Calcium - 4%

Iron - 5%

Vitamin B6 - 40%

Magnesium - 23%

(c)Fatty acid composition of bitter gourd seed oil (%)

Linoleic Acid - 5.4-6.9%

Stearic Acid - 27-32%

Oelic Acid - 16%

Eleosteric Acid - 62%

(Source: Yoshime et al. 2016)

5.2 Tamarind

(a) Macro nutrients per 100 grams (in grams)

Fat – 1 g

Fiber – 6 g

Protein – 3 g

Carbohydrates – 55 g

(b) Micro nutrients per 100 grams (%) RDA

Magnesium: 28%, Potassium: 22%, Iron: 19%, Calcium: 9% , Phosphorus: 14%, Vitamin B1: 34%, Vitamin B2: 11% , Vitamin B3: 12%

Trace amounts of vitamin C, vitamin K, vitamin B6 (pyridoxine), folate, vitamin B5, copper and selenium were found.

(c)Fatty acid composition of tamarind seed oil (%)

Palmitic acid - 14–20%, Stearic acid - 6–7%, Oleic acid - 15–27%, Linoleic acid - 36–49%, Arachidic acid - 2–4%, Behenic acid - 3–5%, Lignoceric acid - 3–8%, Beta sitosterol of total sterols - 66–72%, Campesterol 16–19%, Stigma sterol - 11–14%

(Source: Pitke et al. 1977)

6. USES

6.1 Uses of tamarind

There are many possible uses of tamarind seed in food and non-food industries. Tamarind seed or kernel could be a product of the Tamarind pulp trade. Tamarind seed kernels area unit usually accustomed get tamarind kernel powder (TKP). TKP began business production in 1943 as a staple within the cotton trade as a benchmark within the Indian textile market (Marathe et al. 2002).

Its pulp has been utilized in several ancient medicines like laxative, digestive, and as a remedy for biliousness and digestive fluid disorders. This spice is additionally used as AN emulsifying agent in syrups, decoctions, etc., in numerous meditative products. Separated seeds of Tamarind contain 46 to 48% of the gel-forming substance (Marathe et al. 2002). Tamarind seed polysaccharide is called "jellose" or "polyose" and is found to be higher than other fruit storage methods. The sugar extract concentrates on sugar and in cold water or milk. The name jellose is recommended by this carbohydrate because it describes each its jelly and saccharide properties. In contrast to the fruit cellulose, tamarind seed carbohydrate will type gels of varied pH, as well as neutral and basic conditions. Tamarind polysaccharides don't seem to be plagued by boiling sturdy neutral solutions, notwithstanding they need been stewed for a protracted time (Marathe et al. 2002). Cellulose fruits become degraded in boiling and fall to common fraction of the initial price when one hour of boiling. Therefore, tamarind carbohydrate will facilitate as a gel-forming agent, and may get replaced with fruit cellulose. Tamarind carbohydrate doesn't contain galacturonic acid and methyluronate and is so thought-about true pectin; henceforward it's referred to as jellose. Jellose will be ready on an oversized scale by adding TKP thirty to forty times its weight of boiling water, that contains acid or hydroxy acid at a level of 0.2% (Marathe et al. 2002). Then stir vigorously and boil for another 30-40 minutes. The resulting solution is stored overnight to be deposited and the excess liquid is extracted and concentrated under the machine, transferred to a filter and then dried in a drum dryer. The lead product is placed in a ball mill. A good sample of jellose should have a relative viscosity much higher than that of corn starch. Jellose is much cheaper than corn starch and is only needed in small quantities. Jellose can be used to prepare confectionery products, salad dressings such as mayonnaise - for frozen desserts such as ice cream and ice cream (Kumar and Bhattacharya, 2008). Polyose has excellent filming and gelling properties. Currently, refined TKP is manufactured and approved in Japan in the trade name "Glyloid" as a stabilizing, stabilizing, and saturating agent in the food industry. It is often used with great success in combination with other gums such as guar gum and alginate. Proteins are concentrated and made with TKP. Unsaturated proteins or TKP from cooked TKP is accustomed create jelly, and fortified bread and biscuits (Kumar and Bhattacharya, 2008). Tamarind kernel powder is supplemented with alternative legume seeds to arrange a diet. TKP is used as a dehydration agent in pulverized merchandise associated as an emulsifying agent for essential oils.

Numerous studies show that victimization eye drops containing tamarind seeds extract 4-5 times daily improves the symptoms of dry eye (Kumar and Bhattacharya, 2008). The drops used contain up to a quarter of the extract and typically contain another substance known as mucopolysaccharide (Visine Intensive I Chronicles EDO and Xiloialmonodose).Tamarind seed oil is brightly colored, fragrant, and delicious to taste. It can be used to make varnishes, paints, and to burn oil lamps. The oil is also used to make varnish for painting pictures. Oil is said to be attractive and of good cooking quality. Tamarind seeds are removed from the grass and dropped on a roller beater machine. Tamarind seeds are moistened and scattered on a hammer mill with a perforated curtain (1.6 mm). Moist grains are open and air is dry (Kumar and Bhattacharya, 2008). The seeds are cooked in a kettle cook and transferred to a vendor to supply the cake as goods. Used seeds are charged at the collection point. Hexane is applied and mixed well. The mixture is allowed to stand overnight. The miscella is drawn with a sluice valve at the bottom of the discharge. The solvent can be obtained by distillation desolventized oil is not diluted with 16◦Be alkali. The oil is purified and mixed. Seeds cooked and transferred to the exporters provide a higher yield of oil (about 7%) than canned and packaged (6.4%) (Kumar and Bhattacharya, 2008).

Tamarind pulp is wide employed in South and geographic region, Mexico, the center East and therefore the Caribbean. Seeds and leaves are eaten. It’s employed in sauces, marinades, chutneys, drinks and desserts. And it's one among the ingredients of Worcester sauce.

Tamarind paste is additionally employed in preparation. It are often changed from pods or purchased as a block. Noodles area unit usually mixed with sugar to create candy. Tamarind can even be wont to build condoms like condiment. Additionally, it's frozen, sugar-free flat or syrup kind is often used for preparation. The fruit are often wont to add a bitter note to sweet dishes, rather than lemon (Kumar and Bhattacharya, 2008).

6.2 Uses of bitter gourd

Bitter drugs is wealthy in vitamin C, a very important matter concerned in sickness bar, bone formation, and wound healing. It conjointly contains high fat-soluble vitamin, a vitamin that promotes skin health and correct vision. It provides folate, which is essential for growth and development, as well as small amounts of potassium, zinc, and iron. Sour salt is a good source of catechin, gallic acid, epicatechin, and chlorogenic acid are also powerful antioxidant chemicals that can help protect cells from damage (Fang and Ng, 2016). Also, it has low calories currently high in fiber, filling about 8% of the daily requirement of fiber in one cup (94-gram) serving. Peels of gourd can be used in soups and medicinal stews. It is rich in vitamins and minerals such as iron, copper and potassium which make it a great way for diabetics to have it. Bitter tikkis are another such healthy option. These tikki are made with peas, a low-fat paneer and other vegetables, cooked with very little fat, which makes them very healthy (Fang and Ng, 2016). It is important to have juices in our diet but no one thinks of the bitter wormwood juice. It is very easy to make, just mix the spicy salt and strain it and you can be enriched with lemon juice and salt according to its taste and texture.

Sour salt is a favourite ingredient in many Asian kitchens. The inner pulp of the red ripe fruit can be eaten directly (Fang and Ng, 2016). In Taiwan, spicy white juice (BGJ) mixed with honey is an acceptable beverage. In addition to being a nutritious and healthy food, bitter reed is also widely used in medical practice. Through the use of transcriptomic analysis, cell biology, epidemiological, and preoperative research, various therapeutic activities of herbal medicine have been revealed, such as antitumor, anti-diabetic, anti-obesity, and anti-HIV (Fang and Ng, 2016).

The antitumor activity of the bitter gourd is extremely promising. For instance, M. charantia glycoprotein, a kind II cell organ inactivating super molecule (RIP), has shown apoptosis-inducing activity in human cavity malignant neo-plastic disease cells in each in vitro and in vivo study. The RIP MAP30 citron from bitter seed confirmed the antitumor therapeutic potential for cancer of the liver in vitro and in vivo by activating each the external controlled peptidase eight and therefore the caspase-9 controlled container cassettes (Fang and Ng, 2011).

Bitter gourd drugs contain a sharp style that works well in several dishes. To organize it, initial wash the fruit so cut it into lengths. Then use a bowl to get rid of the seeds from the middle, and cut the fruit into little items. Bitter drugs will be enjoyed raw or barbecued in an exceedingly type of recipes. In fact, it will be cooked in an exceedingly pan, steamed, baked, extracted and served with a filling of your selection (Fang and Ng, 2011).

7. NUTRACEUTICAL APPLICATIONS

7.1 Tamarind

Tamarind products are normally used as health product throughout Asia and America. Tamarind product, leaves, fruits and seeds are wide employed in Indian Ayurvedic medication and ancient African medication. The healthful worth of tamarind is mentioned in ancient Sanskrit language texts. Tamarind fruits are well-known in Europe for its healthful properties, and need to be introduced to Arab traders from India (Saideswara and Mathew, 2012).

The medicinal uses of tamarind in Africa include anthelminthic (worm), antimicrobial, antiseptic, antiviral, sunscreen and astringent and promote wound healing in the following conditions: asthma, bacterial skin infections, abscesses, chest pain, cholesterol metabolism, colds, colic, conjunctivitis, constipation (chronic or acute), diabetes, diarrhea, dry eyes, diarrhea, eye inflammation, fever, gall bladder, gastrointestinal disorders, gingivitis, hemorrhoids, constipation, jaundice, keratitis, leprosy, liver disorders, nausea and vomiting (related to pregnancy), saliva production, disinfection of the skin/offspring, throat, ulcers, dizziness, inflammation (joints) and Urinary stones (Saideswara and Mathew, 2012). It was urged that the utilization of enough amounts of 'poha beer' a preferred tamarind aide in North African nation in continent, might facilitate scale back the rise in iron deficiency anemia. This was supported the water-soluble vitamin content of it which boosts the supply of non-haem iron. Tamarind fruit is

usually used throughout geographical area as a poultice for fever-ridden foreheads. In ancient Thai medication, tamarind fruit is employed as a biological process aid, carminative, laxative, medication and blood tonic. The laxative properties of the pulp and therefore the abortion properties of the leaf are confirmed by trendy bioscience (Saideswara and Mathew, 2012). Tamarind has been wont to treat several ailments, as well as thermic fever reduction, genus Datura poisoning and therefore the intoxicating effects of alcohol and 'ganja' (Cannabis sativa L.). It used as an inflammatory disease, to appease wounds and is alleged to assist restore emotions in cases of dysfunction. Tamarind is additionally a foresaid to be useful in treating protozoal infection. In geographical area, reproductive organ warts are restricted to the extremes of chaulmugra (*Hydnocarpusanthelmintica pierre*), a leper, and in Mauritius, reproductive organ warts are used as a mask for rheumatism (Saideswara and Mathew, 2012). Tamarind seeds are employed in Kampuchea and Bharat, as a fine-grained kind, to treat boils and diarrhea. Boiled, processed seeds are reportable to cure ulcers and different stones and fine-grained husks wont to treat polygenic disease.

Tamarind seeds contain seven-membered -9% oil, the colour is golden yellow. Amber oil extracted from tamarind seeds is additionally used as a lightning and varnishing agent. Tamarind seed oil is bright coloured, fragrant, and delicious to style. It is wont to create varnishes, paints, and to burn oil lamps. The oil is additionally wont to create varnish for painting footage. Oil is alleged to be enticing and of excellent preparation quality (Saideswara and Mathew, 2012).

Several healthful properties are required for preparations containing tamarind gourd, leaves, flowers, bark and roots. These embody its use as associate degree anti-inflammatories in geographical area, its use as associate as a flavorer remedy in land, its use within the fight against leucorrhoea and skin disorders and human consumption in Bharat. Findings of medication medicine victimisation tamarind xyloglucan are reportable. Fruit juices are shown to enhance the supply of isobutylphenyl propionic acid in humans moreover. In mice, tamarind xyloglucan was found to indicate a robust anti-diabetic result (Saideswara and Mathew, 2012). There's a current medical interest within the use of refined xyloglucan from tamarind in eye surgery for mucosa cell adhesion, healing of membrane ulceration. Tamarind carbohydrate seeds appear as if a promising cluster as a vehicle for topical treatment of microorganism redness, a heavy ocular communicable disease. Different clinical trials have shown that the diet of tamarind slows the progression of pathology by increasing halide unleash. additionally to fruit, tamarind leaves are wont to treat rubor, throat infections, coughs, colds, enteric worms, urinary and liver issues, heart and force per unit area medications, ulcers, and external applications for abscesses, rheumatism and external inflammation. Its use has been within the treatment of diseases of the canal and canal in Kampuchea, Bharat and therefore the Philippines (Saideswara and Mathew, 2012). Bark as associate degree astringent was used as a tonic and lotions or poultices to alleviate sores, ulcers, abscesses and outbreaks within the Philippines and East Sudan. The burnt ashes of ripe fruit shells are used as alkalescent substances and different alkalescent ashes within the preparation of the 'Abayalavana' tree in Bharat, to treat enlarged dandruff. The flowers are used for the treatment of eye diseases within the Philippines moreover as for pigeons and much of harm. The 'Irula' tribes in Tamil Nadu, India, use tamarind root bark to abort and forestall physiological state. In some countries, the bark is reportable to be discontinuing from respiratory disease, amenia and as a tonic and medicinal drug. Medication use and pharmaceutical performance are updated. Recent studies have shown a decrease in plasma and bone F levels within the introduction of one hundred mg tamarind water extract in rabbits (Saideswara and Mathew, 2012).

7.2 Bitter Gourd

Thanks to its powerful healthful properties, bitter herbs have long been utilized by native peoples round the world to assist treat diabetes-related conditions. In recent years, many studies have confirmed the role of fruit in control blood glucose. A three-month study in twenty four diabetic adults showed that taking two, 2000 mg of a painful pill daily down blood glucose and Hb A1c, a check accustomed live blood glucose management over 3 months (Wang et al. 2019). Another study of forty folks with polygenic disorder found that taking two, 2000 mg every day of bitter drugs for four weeks resulted in a very slight reduction in blood glucose levels. Also, the supplement has considerably reduced fructosamine levels, another mark of long blood glucose management. Bitter drugs are believed to boost the means sugar is employed in your muscles and to stimulate hormone secretion, an endocrine accountable for control blood glucose levels (Wang et al. 2019). However, analysis in humans is restricted, and large, high-level studies area unit required knowing however bitter drugs will have an effect on blood glucose levels within the general population.

Research suggests that the bitter pill contains some anti-cancer properties. As an example, different test-tube studies show that the extraction of bitter corn was effective in killing cancer cells of the abdomen, colon, lungs, and bodily cavity, the realm found behind the nose behind the throat. Another test-tube study found an equivalent, it absolutely was rumored that the discharge of a bitter pill was ready to inhibit the expansion and unfold of carcinoma cells whereas conjointly promoting neo-plastic cell death (Wang et al. 2019). These studies were performed employing a fastened quantity of hot worm cells in every of the laboratory cells. Additional analysis is required to see however bitter reeds will have an effect on cancer growth and development in humans once consumed within the traditional diet.

High steroid alcohol will cause fatty deposits to make up within the arteries, forcing the guts to figure more durable to pump blood and increasing the chance of cardiovascular disease (Wang et al. 2019). Many animal studies have found that bitter pepper will lower steroid alcohol levels to support overall heart health. Another study performed in mice on a high-cholesterol diet noted that managing the secretion of spicy cereals semiconductor diode to a major decrease in total steroid alcohol levels, "bad" LDL cholesterol, and triglycerides (Wang et al. 2019). One study suggests that giving mice bitter drugs considerably reduces steroid alcohol levels compared with placebo. The high concentration of spicy maize showed a major decrease. However, current analysis on the cholesterol-lowering properties of the bitter drugs is especially restricted in animal studies exploitation massive amounts of bitter corn extract. Additional studies area unit required to see if these same effects apply to people that eat reeds as a part of a healthy diet (Wang et al. 2019).

Sour salt makes a wonderful addition to a weight loss diet, because it has low calories nevertheless high in fibre. Fibre passes through the duct slowly, that helps keep it full longer and reduces hunger and craving. Therefore, work high-calorie ingredients with a spicy wille can facilitate increase fibre intake and cut calories to market weight loss. Some studies conjointly counsel that a bitter style will have useful effects on fat burning and weight loss. One study found that employing a capsule containing four.8 grams of gourd extract every day resulted in a very important reduction in abdominal fat (Wang et al. 2019). Participants lost a mean of zero.5 cm (1.3 cm) from their area once seven weeks. Similarly, studies in mice on a high-fat diet have found that the discharge of bitter style helped scale back weight loss compared to placebo. These studies were conducted exploitation supplements of high-quality spicy drugs. It’s not continually clear that intake spicy reeds as a part of an everyday diet will have similar health advantages (Wang et al. 2019).

Bitter drugs have been joined to lowering blood glucose. This is often as a result of bitter drugs contains substances that act like hormone that helps to bring aldohexose to the cells for energy. The employment of bitter reeds will facilitate cells to method aldohexose and transport it to the liver, muscles, and fat. The bitter gourd may also facilitate the body retain nutrients by obstruction its conversion to aldohexose that ends in blood circulation (Wang et al. 2019).

Bitter isn't associate degree approved treatment or treatment for polygenic disorder or diabetes even supposing there's proof that it will management blood glucose. Varied studies have evaluated bitterness and polygenic disorder. Most advocate doing tons of analysis before exploitation any form of anti-diabetic medication (Wang et al. 2019).

Other studies on acute polygenic disorder embrace, a report within the 'Cochrane information of Systematic Reviews' all over that additional studies area unit required to live the consequences of anti-malarial drug on kind two polygenic disorder. It conjointly highlighted the necessity for additional analysis into however it is utilized in the treatment of nutrition (Wang et al. 2019).

& research in the 'Journal of Ethno pharmacology' compared the efficacy of a bitter reed to a current diabetic. The study concluded that a bitter diet lowered fructosamine levels by two types of diabetics. However, it has done little more than the minimum required dose. There is no prescriptive drug that will stop the flow of emotions, such as diabetes (Wang et al. 2019). Sprinkle wormwood can be used as food as part of a healthy and varied diet. Eating a spicy spice on the side of a plate can cause accidents.

8. EXTRACTION PROCESS

Oilseed process processes and oil extraction processes are designed to get prime quality oil with lowest contaminants, to realize high extraction yields and to supply a high-value meal. There are many ways in which to extract oil from oil seeds. The two common

strategies of oil extraction solvent extraction and mechanical extraction employing a pressure pump. These days within the se, mechanical oil processing isn't wide used because of low oil discovery (Rakhee et al. 2018). However, the employment of screw press is most well-liked by smaller processors because of its low value. Dissolving agent solvent extraction could be a common follow in fashionable oil process facilities. The plant's solvent-extraction capability ranges from one hundred to 9000 metric tons per day. Dehydration processes used for deep liquids, liquids and enzymes (Rakhee et al. 2018).

The effect of heat dissipation on the oil crop can be seen as oil production rises with increasing temperature, and obtains a higher temperature at 40 ◦C, and then decreases with a further increase in temperature. Such changes in oil yields and temperatures are due to two types of effects. On the other hand, an increase in temperature led to a decrease in the solvent volume, thereby reducing the melting of seed flour in the solvent. On the other hand, the pressure of solute saturation in the solvent has been increases with increasing temperature and improves melting (Rakhee et al. 2018).

8.1 Solvent Extraction

Solvent extraction refers to a special oil extraction by contact with an oil solvent containing a liquid solvent. This is the most effective way to get oil from oil seeds. Efficiency depends on oil preparation prior to extraction, temperature, operating mode (batch vs. continuous and in line with current performance) and mechanical construction. The fossil oil within the diet is anticipated to be but one-hundredth when the discharge of solvent (Rakhee et al. 2018).

The choice of solvent kind is predicated on the reduction of oil within the selected solvent, value and safety. Low particles of paraffin, petrol, pentane (boiling purpose 88-97 °F), alkane series (boiling purpose 146-156 °F), alkane series (boiling purpose 194-210 °F) and hydrocarbon (boiling purpose 215-264 °C) are often wont to extract oil. Alkane series is presently wide wont to extract oil. The most important disadvantage of those solvents is that they'll burn simply. Strict measures should be taken to forestall fires and cut back the chance of explosions on exhaust plants (Rakhee et al. 2018). The Clean Air Act of 1990 listed alkane series as a dangerous air waste. The industry is fraught to change to dangerous chemicals like alcohol or water. Low melting oil and high solvent-only and dry-drying power issues square measure major issues with alcohol and water extraction. Additionally, alcohol lowers the activity of soy proteins.

The solubility of the oil within the solvent will increase with the background temperature. High temperatures even have a positive impact on the body and distribution of oil (Rakhee et al. 2018). The body decreases whereas the diffusivity will increase because the discharge temperature will increase, resulting in shorter discharge times. The energy needed to get the solvent is reduced once victimization high extraction temperatures. However, high temperatures will cause degradation and corrosion of some oil and food elements. Therefore, the selection of temperature is predicated on the kind of oil and therefore the necessary definitions of the ultimate product. There square measure 3 main steps in ancient solvent extraction, oil extraction, food and desolventizing oil, and oil processing (Rakhee et al. 2018).

8.1.1 Soxhlet Extraction

Soxhlet extraction has been wide wont to extract vital bioactive chemicals from numerous natural sources. During this extraction, a tiny low quantity of dried sample is placed during a tube that is placed during a food flask containing a solvent of a specific interest. Once reaching the extent of overflow, the answer of the thimble holder is desired by a siphon that introduces the answer back to the distillation flask. This answer carries solids extracted from most liquids. The matter remains at the rear of the food fluid, and therefore the solvent passes into a solid sample bed. The method is recurrent till it's utterly removed (Rakhee et al. 2018).

8.1.2 Folch's Extraction

Folch's approach is one in every of the most important contributions to the sphere of macromolecule organic chemistry by Catalan chemist and eminent neurochemistry individual Jordi Folch-Pi (1911-1979). Before Folch's technique there was no effective technique of mass-separating lipids in body tissue samples. The foremost common technique of macromolecule extraction up to Folch was Bloor's technique that used multiple consecutive extracts mistreatment alcohol, ether, and chloroform and/or petrol ether. This method was time overwhelming and macromolecule emissions weren't freed from non-lipid contamination (Rakhee et al. 2018).

Soxhlet extraction (40% w / w) resulted in higher production of spicy seed oil than Folch extract (16% w / w). In each case, α-eleostearic acid (56 and 58%) was the most important macromolecule in bitter vegetable oil, followed by saturated fatty acid (C18: 0; thirty two and 27%). Fats show high phytosterol content (886 mg / one hundred g), particularly, with low acidity and peroxide levels (Rakhee et al. 2018).

8.2 Mechanical Oil Extraction

Lever and wedge printing presses were the primary oil presses wont to method oil. The primary cork mill created within the U. S. within the 1920's used a press. The seeds within the filter luggage were loaded by hand in perforated, horizontal boxes between the top block and therefore the machine ram. The boxes were then ironed along victimization force to press them against the ram. The oil was ironed into a filter bag. At that time the filter bag containing the used cake was removed by hand from the press. The most recent versions of hydraulic machines have used cages rather than filter luggage. Hydraulic machines were in use till the 1950's (Rakhee et al. 2018). It replaces continuous compression instrumentation and continuous solvent extraction plants, that square measure less economical. The oil trade still uses hydraulic presses nowadays.

The screw machine consists of a vertical feeder and a horizontal screw with a growing body breadth to use pressure to the oil seeds because it progresses with the length of the machine. The barrel round the screw has slots in its length, permitting accrued internal pressure to 1st exhale and move oil to the barrel (Rakhee et al. 2018). The oil is collected in a very instrumentation below a screw and therefore the oil-coated cake is far from the top of the screw. The good advantage of the screw is that the majority of the oil seeds is processed with negligible work, and permits for continuous oil extraction.

Maintenance of printing equipment is a challenge. Moving parts with high pressure and heat produced in newspapers are increasingly wearable (Rakhee et al. 2018). A major breakthrough in the design of the screw press was the invention of building materials that extend the life of the wearable parts. Parts of equipment that used to last three months before needing replacement can now take up to two years (Rakhee et al. 2018).

9. FUTURE PROSPECTS

Based on long-term biochemical, epidemiological, and clinical studies, we think that bitter seed oil is beneficial to human health because of its anti-diabetic, anti-tumor, and other functions. We therefore propose that the clinical community begin clinical trials with spicy corn and tamarind seed flour to carefully address safety and health issues.

10. CONCLUSION

Tamarind pulp has been utilized in ancient medication to treat ailments and symptoms. Tamarind seed, associate degree industrial product of the tamarind pulp, could be a common material. Though there are industrial uses for classified seeds as less costly within the jute and textile industries, there aren't any alternative uses that embody victimization it as a supplement in food production. The wonderful options of the gelling and adhesion of used seed powder have several applications within the food and pharmaceutical industries that are mirrored in several analysis papers and application. It is desirable that more research work be done on the processing features of this seed to make it more useful to food processors. The results of current research have shown that the seeds of the bitter gourd fruit are an extremely high source of lycopene. Formal analysis is needed for the industrial production of gourd carotenoid and oil. These findings conjointly create the bitter gourd terribly engaging as its seed oil are often used for edible functions. Its high content of α-eleostearic acid and phytosterol, on the opposite hand, promotes its medicative use as results of these compounds have shown doubtless helpful health effects.

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