Naturally occurring polymers are presently of major importance among that polysaccharides occupy larger position due to their easy use, eco-friendly and non-toxic nature. Gums are naturally occurring constituents in plants, which are basically cheap and abundant. The development of delivery systems using natural polymers such as, gums offers different advantages, such as, biocompatibility, biodegradability and cost efficiency. The modifiers of drug release in pharmaceutical dosage forms require diverse uses as thickeners, emulsifiers, viscosities and sweeteners etc. It should be compatible, non-toxic, stable, commercial, when it affects the drug release. The gum deed as virtuous mucoadhesive polymer, disintegrating agent and binder. For manufacturing applications the gum illustrate great potential mainly in nutrients, knits and therapeutic trades. To modify the physicochemical properties the need of the gum is amended. Few resins in their putative forms are well functioned as drug release modernizers in dosage forms owed toward their excessive swelling index/solubility at acidic pH. This appraisal is expected to provide the indication about the amendment about the gum through derivatization of functional groups, grafting with polymers and cross-linking with ions. Hence, gums need to be modified to change their physicochemical properties.

**Keywords:** Moringa gum; Physicochemical properties; Functional properties; Mucoadhesive polymer; Disintegrating agent.

**Introduction**

In the development of new preparations the natural occurring and modified gums are mostly used. The additives which are used in the advancement of pharmaceutical dosage forms are gum acacia, tragacanth, agar, starch, etc (Patil et al., 2011). The selection of the origin of natural excipient is based upon the synthetic and semi-synthetic ones. This is mainly due to the lack of toxicity, low price, calming action, accessibility and non-irritant nature of the excipients (Deogade et al., 2012). These polysaccharides are obtained from natural origin which is capable to increase in a solution’s viscosity. It has various other advantages and applications like as thickening agents, gelling agents, emulsifiers, stabilizers (Choudhary et al., 2014), etc. Moreover, certain industrial applications which include its use as adhesives, binding agents, crystal inhibitors, encapsulating agents, clarifying agents and as foam stabilizers. The gums procured from herbal resources are now used in many newly developed drug delivery systems which in turn results in better stability and processing. Examples of such delivery systems are like microspheres, Nano spheres, nanoparticles, liposomes, hydrogels, Aquasomes, etc. Also, by altering the chemical entity by use of reagents or by enzymes help in promoting the better characteristics of the delivery system. However, uses of naturally procured gums are much more advantageous than chemically modified/ synthesized gums. Natural gums are easy to obtain and are non-toxic in nature, less expensive than synthetically modified gums. Oral delivery systems are more supporting while formulating delivery systems via use of natural gums. In food industry, these natural gums are usually implemented as food additives and as drug molecule carrier in case of delivery systems. Many types of higher plants under stressed conditions like drought, cell wall lysis, formation of gummosis, leads to release of a gum which in turn is the metabolic output of their pathological changes (Bhosale et al., 2014). Herbal gums are emerged as major multi-disciplinary and extensive research application with a broad variety of bioactive molecules which includes insecticides, pesticides, etc. Newly developed natural gums are used as biodegradable and biocompatible, and if it is not converted into biodegradable then they are incorporated with biodegradable component. The major advantages of gum based drug delivery systems includes as: The enhanced drug utilization has the superior selectivity in targeting of drug with a pharmacological activity. It improves the patient compliance and prevents the overloading of drugs which is due to the decrease in toxicity.

Some recently investigated natural gums are as follows:

1. **Abelmoschus Gum:**

The okra gum (also known as Abelmoschus gum) which is found from the fresh fruits of the plant *Abelmoschus esculentus* (family Malvaceae). In this polymer the tablets are prepared by using the gum mucilage and HPMC E15 and also used for the expansion of a gastric dosage form. It was seen that the formulation also containing gum mucilage which has a poor floating capacity but it also showed a sustained release action. However, the formulation containing polymer (HPMC) had better floating properties but has a poor sustained release effect of the drug (Chodavarapu et al., 2011). The aim of this study was to determine the extracted gum of *Abelmoschus esculentus* by using ultrasonic method. The okra fruit gum has wide application in medicine and health care (Nagpal et al., 2017) and which is acquired after the lyophilization and it is further determined by Tapped density, Bulk density, Car’s index, Angle of repose, Hausner’s ratio.

2. **Albizia Gum:**

Albizia gum is found from the incised trunk of the tree *Albizia zygia* (Family- Leguminosae). It comprises of β-1-3-
linked D Galactose units with certain β1-6-linked D-Galactose units. The promising substitute for the gum Arabic which is used as natural emulsifier in pharmaceutical (Ashton et al., 1975; US National Academy of Sciences., 1979) and manufacturing industry. Moreover, it is used as coating material, binding agent in tablet formulation and also in food industry (Odeku et al., 2005). The current studies of gums are used in the tablet formulation by using binding agent which have quicker onset of action and improved the properties which is associated with gelatin BP. This gum used in the tablet manufacturing which improve the dissolution times and have a high mechanical strength in rate release of drug delivery system (Oluwatoyin et al., 2005).

3. Carob gum

Locust bean gum (LBG) (also known as carob gum) is found from the developed endosperm of seeds from the carob tree Ceratonia siliqua (family: Leguminosae). The gum contains D-galactose, D-mannoglycan pentane, proteins and cellulose. In this research, Locust Bean Gum (LBG) is used for the controlled drug delivery system and by using various extraction techniques LBG were removed from seeds. The physicochemical properties were evaluated for gums. The ash content was found to be 1.94% and protein content around 6.65% when determined by water extraction gum. Also the value of acid-insoluble ash was around 3.58% and 44.17 and of foreign substances by HCL extraction gum method. Thus it was concluded that the H2SO4 extraction technique was much more considerable and effective than water and HCl extraction method. The quality of gum obtained by H2SO4 was good and functional (Küçüköner et al., 2015).

4. Honey Locust Gum

The gum is found from the seeds of the plant Gleditsia triacanthos (family: Leguminosae). The constituents of this gum involve the seed which consist of the fibers, vitamins, proteins, carbohydrates and fats. By the wet granulation method the honey locust gum formed by the matrix tablets at different concentrations as (5% and 10%) (Unerand et al., 2004).

5. Tara Gum

The biological source of this Tara gum is Caesalpinia spinosa which is obtained from the endosperm of seed (family: Leguminosae or Fabaceae). The gum mainly contains galactomannans. The major application of the gum is that it acts as carrier in the formulation of emulsions, gastro retentive system for the controlled release of the tablets which mainly occur due to the swelling of the gum (Zeng et al., 2007).

6. Almond Gum

Almond gum is procured from the tree Prunus amygdalus (family: Rosaceae). The main chemical constituents of this gum consist of D-mannose, aldobionic acid, L-arabinose and L-galactose and further contains the dissimilar components which have the pharmaceutical agents such as the coagulating agent, glazing agent, binding agent, stabilizers, gelling agent, thickening agent, suspending agent, epoxy resin, etc. Moreover,

The objective of this following research site is oral drug delivery system in which the almond gum is much more beneficial for the tablet formulation. The current study revealed that the gums are used for the preparation of uncoating dosage form (Sarojini et al., 2010) and particularly the drug used cepodoxime proxetil which enhances the bioavailability. Different parameters were evaluated for the formulated globules which comprise of particle size, surface topology, buoyancy properties, micrometric properties, percentage drug efficiency, and invitro drug release studies. This study concluded that the invitro drug release (68.12%) enhanced the gum formulation and its bioavailability with specific time of 12 hours (Sarojini et al., 2016).

7. Cashew Gum

Cashew gum is the exudate from the stem bark of Anacardium occidentale (family: Anacardiaceae). The chemical constituents of the gum includes glucose, rhamnose, galactose, glycolic acid, arabinose with additional residues such as sugar, which comprises of glucuronic acid, D-galactose, L-arabinose, L-rhamnose etc. The research is intended at generating gum from cashew tree latex, which can act as auxiliary for gum Arabic. The technique used contain drying and size decrease of the exudates gum, sieving of the gum to eliminate impurities, dissolution of the gum in distilled water, filtration to eliminate polysaccharide surplus and finally concentration and stability of the gum. The pH and Viscosity on adding of various percentage concentration of stabilizing agent were determined. The gum can be recycled as an alternative for synthetic adhesive used presently for stamps and packets (Lima et al., 2002).

8. Moi Gum

Moi gum is obtained from the leaves, stems, fruits, and bark of the stem Lannea coromandelica (family: Anacardiaceae). The morphological characteristic of gum occurs as fresh in yellowish white color and dark color is obtained when it dries. The gum has various forms which exist as stem, leaves, seeds, flower and fruits (Venkaiah et al., 1984). Moreover, Moi gum is formulated as microsphers by the solvent evaporation method which in further have standard morphology and size and help as carrier in the drug delivery as sustained release.

9. Kondagogu Gum

The natural polysaccharide Kondagogu gum is derived from the exudates of Cochlospermum religiosum with family (Bixaceae) and commonly called by name Hupu gum. The main constituents of the Hupu gum comprises of the galactose, fructose, rhamnose, glucuronic acid, α and β-D-glucose, arabinose, mannos, glucose uronic acid which impacted the polymer metropolol succinate tablet dosage form as the rate controlling to assent with a sustained drug release dosage form. However, such tablets have an enteric coating of shellac which is further used in the manufacturing.

10. Gum Copal

Gum Copal is biologically obtained as natural tacky substance from plant Bursera bipinnata Family: Burseraceae. The main constituents of Copal resin includes Agathalic acid, Sandarakopimarc acid, Transcommun nic acid, Ciscommunic acid, Mono-Methyl Ester Agatholic acid, Polycommunic acid and Acetoxy Agatholic acid (Cortina et al., 2005). For sustaining drug delivery system the gum is assessed as the matrix forming agent.

11. Hakea Gum

Hakea gum is a dried exudate which is naturally obtained from the plant Hakea gibbosa, Family: Proteaceae.
Main constituents of the gum consist in the ratio of 12:43:32:5:8 as Glucuronic acid, Galactose, Arabinose, Mannose and Xylose and it is partially soluble in water of the oozed gum (Okafor et al., 2001). Similarly its application is in the formulated buccal tablets as Mucoadhesive and Sustained release of drug delivery.

12. Grewia Gum

Grewia gum is a polysaccharide derivative which is obtained from the inner bark of the ripe plant Grewia mollis (family: Tiliaceae). The gum as core monosaccharide comprises of Galactose, Glucose, Rhamnose and Galactouronic acid (Martins et al., 2008). The pharmaceutical application of Mollis gum in tablet preparation is evaluated as diluent, binder as PCM, stabilizing agent and also investigated in enhancement of the fluidity of granules when compared with PVP. Similarly, the binder formulation of the Grewia mollis which contains PVP has dignified onset. Grewia gum has been evaluated as a binder in paracetamol which has benefits in tablet preparations (Gowthamarajan et al., 2012).

Some of the modifications of the gums with respect to their dosage form are listed in Table 1:

<table>
<thead>
<tr>
<th>S.No</th>
<th>Gums</th>
<th>Modification</th>
<th>Dosage form</th>
<th>Year</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cashew gum</td>
<td>Grafting</td>
<td>Buccal tablets</td>
<td>2012</td>
<td>Aminabhavi et al., 2004</td>
</tr>
<tr>
<td>2.</td>
<td>Guar gum</td>
<td>Grafting</td>
<td>Matrix tablet</td>
<td>2013</td>
<td>Castro et al., 2014</td>
</tr>
<tr>
<td>3.</td>
<td>Guar gum</td>
<td>Carboxymethylation</td>
<td>Microspheres</td>
<td>2014</td>
<td>Lazzari et al., 2018</td>
</tr>
<tr>
<td>4.</td>
<td>Moringa gum</td>
<td>Carboxymethylation</td>
<td>Matrix tablet</td>
<td>2016</td>
<td>Huanbutta et al., 2017</td>
</tr>
<tr>
<td>5.</td>
<td>Guar gum</td>
<td>Grafted</td>
<td>Matrix tablet</td>
<td>2016</td>
<td>Ghosh et al., 2015</td>
</tr>
<tr>
<td>6.</td>
<td>Xanthium gum</td>
<td>Grafted Carboxymethylation</td>
<td>Matrix tablet</td>
<td>2016</td>
<td>Morkhade et al., 2017</td>
</tr>
<tr>
<td>7.</td>
<td>Tamarindus indica and cassia fistula gum</td>
<td>Carboxymethylation</td>
<td>Thai cordial tablet</td>
<td>2016</td>
<td>Rana et al., 2015</td>
</tr>
<tr>
<td>8.</td>
<td>Locust bean gum</td>
<td>Crosslinking</td>
<td>Microspheres</td>
<td>2016</td>
<td>Rani et al., 2012</td>
</tr>
<tr>
<td>9.</td>
<td>Gellan gum</td>
<td>Crosslinking</td>
<td>Microspheres</td>
<td>2017</td>
<td>Bhattacharya et al., 2008</td>
</tr>
<tr>
<td>10.</td>
<td>Mastic gum</td>
<td>Microencapsulation and matrix forming material.</td>
<td>Matrix tablets</td>
<td>2017</td>
<td>Silva et al., 2007</td>
</tr>
</tbody>
</table>

Natural or herbal gums obligate the epoxy resin, aperients and used in diverse pharmaceutical application and dental measures. On the other side gum has firm complications which are associated with the solubility, pH reliant, unrestrained proportions of hydration, drop fall in viscosity, improper storage and the risk of microbial contamination.

For drug delivery, various natural gums were modified to formulate best product and that can be compete with synthetic and semi-synthetic polymers which are easily available in the market. There are different types of modification but the chemically modified gums permit the particular use for drug delivery system (Pandey et al., 2015). Although these gum are soluble in water due to the occurrence of an extreme amount of hydroxyl group (-OH) moieties which forms the hydrogen bonds (H) (Sutirman et al., 2016). Generally, gums are pathological products and have wide applications in food and pharmaceutical industries which considered as enhanced and non-toxic for human consumption.

Grafting

Certain types of copolymers have different geometrical arrangement and crystalline arrangements in their molecular level, like some single polymers consists of a very large arrangement of the molecules in it geometry having multiple branches as well. Such singularly arranged graft polymers can be synthesized to provide free radical spaces or sites providing the ability to be aided as external agents. Also, such free spaces help to give many free radical sites for further chain formation and branching.

However, while formation of free radical sites there may be chances of rupture or tear down of the structural basement. So it is important to monitor the effectiveness of such agent to prevent any teardown or disruption. The reason for grafting is to bring changes or to modify the characteristics of gum like swelling capability, ability to form film and also to enhance or promote the release of the drug from the formulation when put in the fluid or body matrix (Sorour et al., 2013). Also the natural polysaccharides can be modified to retain the polymerizing properties in form of hybrid features applicable for certain kinds of uses and application. This it becomes clear that chemical modification in gum by grafting creates a link bridge between naturally occurring and synthetic polymers having hybrid properties of both natural and synthetic. Hybrid gum possesses polymer chains attached to it which act as a backbone to the polymer. Grafting is achieved by linking of the polymer chains with certain functional groups like ester groups and Methyl alcohol, etc. In return the grafted gum obtained helps in formation of compound having drug release profile as desired. Also grafted polymer due to hybrid nature does not have any influence on the backbone polymers due to side chain linking mainly (Zhang et al., 2000).

For the synthesis of graft copolymerization several techniques are used in general which compromises of the free radical which act on the performed polymer for the utilization of the chemical free radicals which further consist of the conventional method (Pandey et al., 2011; Zheng et al., 2005; Singh et al., 2009; Barsbay et al., 2009; Geresh et al., 2004; Huang et al., 2003; Helin et al., 2008; Deng et al., 2009; Shamugharaj et al., 2006; Pandey et al., 2016), radiations of high energy such as electron beam ray and gamma rays (Pandey et al., 2016; Pandey et al., 2012), UV-radiations which in the presence of photo sensitization (Singh et al., 2010; Singh et al., 2007; Singh et al., 2006) and not more the least is microwave methods (Singh et al., 2006; Salahelddeen et al., 2014; Kalia et al., 2013; Singh et al., 2006; Salahelddeen et al., 2014; Al-husnan et al., 2016). The copolymerization grafting method has the specific two techniques which are not as much effective and efficient which consist of UV-radiation and high energy radiation
process. Moreover, radiation of high energy happens because of more chances of the vandalism of polysaccharide radiolysis which is not suitable for owing to the synthesis of copolymer due to enhancement of penetrating power. In addition to this the UV-radiation power makes the surface grafting restricted only for the UV-rays of low penetrating power. Most of the effective methods used for the synthesis of graft copolymerization, now these days are the Microwave irradiation and the conventional method and has powerful impact on the initiation of developing a homogenous mixture. Microwave irradiation has many advantages over the grafting copolymerization as follows:

a) Depletion of lethal solvents.

b) Enhancement in the product yield.

c) Lessons the reaction time (Singh et al., 2006).

In comparison of Conventional Method over the Microwave Irradiation technique conveys that the microwave radiation method doesn’t required the inert atmospheric condition which further implicated its qualities as highly reproducible, cheap, easy of accessibility, reliable process, easy to operate, highly developed with equified advancement, fast, most superior in the grafted copolymer synthesis.

**Moringa olifera gum**

*Moringa olifera* is a natural polymer which is characterized to mono-generic family (Moringaceae) and includes 13 sorts which is mainly distributed and originated from India, Africa several other tropical and arid countries (Al_husnan et al., 2016; Arora et al., 2013; Mehta et al., 2011). Generally Moringa gum is a quick emergent tree of small genus which is well-known by Horseradish tree, Ben oil and Drumstick (Panda et al., 2008). It is originated from Western and the Sub Himalayan tracts, Africa, India, Asia, and Pakistan (Patel et al., 2011) and further dispersed in Central America, Cambodia, Caribbean Islands, Philippines, and North and South America (Dekker et al., 2002). In the preparation of glucuronic acid as 10:7:2 this further includes polyuronic which consist of an arabinose with 26.9%, rhamnose 5.6%, galactose 41.5% and xylose with 25.9% (Alam et al., 1971).

Moringa gums are also used as food vegetables and also as an Indian Tradition medicine for treatment of illness and infections. Its scientific name is *Moringa olifera* which is locally known as Zogallagandi (Hausa), OkweOyibo (Igbo) and Yoruba. Its vegetable features are most common in regions of East Nigerian tribes. Moringa gum is exudate product of the stems of *Moringa olifer*. The gum released from stem is initially white in color which on long exposures turns to reddish brown color or brownish black in color. The pharmaceutical and other industrial applications of the gum gauged as Stabilizers, Binders, Mucoadhesive, disintegrates, Sustained and Controlled Release Matrix (Wang et al., 2005) and moreover, globally it has been esteemed as Nutraceutics, Therapeutic and Cost-effective properties. In other countries such as Africa the *Moringa olifer* is commonly called by the name as the “Miracle Tree” or “Never Die Tree” and this has been honored as “Botanical of The Year-2017” through the National Institute of Health (NIH) which cures MT 300 diseases.

**Advantages of Natural Gums:**

**Biodegradable**

These polysaccharides signify the accessibility of biodegradable polymers which naturally have no adverse effect on the natural resources such as humans, environmental health factor. Example: Eye and skin irritation

**Biocompatible and non-toxic**

The naturally occurring plant materials compromises of vitamins, fatty acids, minerals and carbohydrates which tranquil the repeating sugar units as polysaccharides, lactose, glucose, rhamnose, fructose, monosaccharaides and sucrose and therefore, are innocuous.

**Low cost**

The synthetic material when compared over the natural polymers the most preference is given to the natural resources due to the easy accessibility, economic in nature and the production cost is much cheaper.

**Environmental-friendly processing**

Gums from different sources are easily collected in different seasons in large quantities due to the simple production processes involved (Mehta et al., 2011).

**Local availability**

The wide bids in developing country for a diverse nature of applications in industries, manufacturing, RandD the worldwide management helps in the production of naturally occurring sources as plant materials like tragacanth, guar gum, xanthum gum, cashew gum, etc (Seshadri et al., 2003).

**Better patient tolerance**

When natural resources compared with the synthetic materials there is few gamble of adverse events/ effects and side effects seen.

Example: Cross-povidone, PMMA and Povidone, etc.

**Pharmaceutical Applications**

**Food industry**

Polysaccharides have a broad application in various types of gums which includes the stabilizing agent such as (Carob gum and Guar gum), immediate Pudding (Carrageenan’s), Stabilizers for ice-cream, Food and Beverages, Baked products, Confectionaries, water retention, meat (agar) and dairy stuffs and sauces (Xanthum gum, Alginites, Pectin, Moi gum, Tragacanth, Gum Arabic) (Morton et al., 1991).

**Binder**

Moringa olifer gum is mined from the bark exudate which is used for the evaluation and manufacturing of tablets and capsules for its binding properties (Mahmood et al., 2010).

**Detoxification or water purification**

*Moringa olfera* is mined from the seeds which consist of the water soluble proteins have the ability to remove the harmful ingredients and deeds as effective coagulants for the purification of water. For purifying water the natural polymers have charged molecules of proteins which are able
to settle the organics, mineral particles and allow the seeds for coagulation effect to alum. This is able to flocculate the bacterial cells as gram positive and negative and also used as biosorbant for the abstraction of cadmium (Ramachandran et al., 1980).

Cosmetic use

The main chiefly parts of *Moringa olifera* have two components Purisoft TM and Puricare TM are based on the botanical peptides which helps in purifying the skin, hair and protection against the pollution and dirt. This mainly used as carrier oil in the preparation and well-known by the name Behn oil (Mahmood et al., 2010).

Nutritional value

The olifera gum in nutrition plays a lead role in the dietary supplements due to its high amount of the nutrition, vitamins (B2, B6 and C), magnesium, calcium, proteins, iron, carotenoids, provitamin A (Mehta et al., 2011; Pandey et al., 2012). The olive oil is the refined seed oil obtained from *Moringa olifera* which has essential fatty acids in it and the lipid composition of these seeds are even greater than that of soybean which makes it more nutritionally significant (Abdull et al., 2014).

This tree serves as a sustainable and economically nutrient rich food supplement, for those who are suffering from malnutrition.

**Table 2: Comparison of nutrient content in Moringa and other food (Jarald et al., 2012)**

<table>
<thead>
<tr>
<th>Content of</th>
<th>Moringa</th>
<th>Other Food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>6,780 mg</td>
<td>Carrot- 1,890 mg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>220 mg</td>
<td>Orange- 30 mg</td>
</tr>
<tr>
<td>Calcium</td>
<td>440 mg</td>
<td>Cow milk- 120 mg</td>
</tr>
<tr>
<td>Potassium</td>
<td>259 mg</td>
<td>Banana- 88 mg</td>
</tr>
<tr>
<td>Protein</td>
<td>6.6 g</td>
<td>Cow milk- 32 g</td>
</tr>
</tbody>
</table>

From ancient times the *Moringa olifer* is used for numerous purposes as these compromises of the nutritional content which includes the Proteins, Calcium, Potassium, Vitamins such as Vitamin A and C which are in the human consumption. Different nutrition plays different role in human life to cure the illness, disorders. This includes calcium which helps in preventing the osteoporosis and makes the teeth strong where potassium is the essential content for the functioning of the brain and nerve cells. Similarly vitamin A deed protection against the diarrhea, skin rashes, orthopedics disease and heart ailment as well vitamin C act as antibiotic which fight against the flu and cold (Jarald et al., 2012).

Pharmaceutical value

Since primeval times the medicinal merits of *M. oleifera* are well recognized over its usage as a traditional remedy for a number of syndromes and ailments (Panda et al., 2013). This tree has been popularly used as a folk medicine for anemia, arthritis and rheumatism, asthma, constipation, diarrhea, stomach pain, ulcers, intestinal spasms, headache and sore gums (Panda et al., 2008; Patel et al., 2012) also possess abortifacient, anti-inflammatory, bactericidal, diuretic activities and also serves as antidote, emetic, purgative, stimulant, tonic, vermifuge (anthelmintic medicine). In drug delivery the gum mined not only treats various chronic disorders, but also being used as a prospective ancillary to binders, stabilizers, foaming and suspending agents (Basawaraj et al., 2010; Si et al., 2004; Shah et al., 2011; Bhende et al., 2012). There are different types of preformulation studies were performed for the suitability of oleifera gum as mucoadhesive properties, disintegrant and binding agent (Cáceres et al., 1992). Several physicochemical parameters were improved which include the dissolution rate, disintegration and stabilities studies were evaluated for the safety and efficacy of the olifer gum comprise of in-vitro assay for both topical and non-topical preparation (Ruckmani et al., 1998; Araújo et al., 2013; Onsare et al., 2015; Rajesh et al., 2012) by this we render that this gum is non-toxic. Moreover, the formulated gum enhances the therapeutic efficiency such as ibuprofen, meloxicam and felodipine (Kumar et al., 2012).

Therapeutic uses

*Moringa* contains a range of fairly unique phytochemicals containing the simple sugar, rhamnose, and it is rich in a fairly unique group of compounds called glucosinolates and isothiocyanates. A variety of detoxication and antioxidant enzymes and biomarkers as a result of treatment with *Moringa* or with phytochemicals isolated from this have shown, antitumor, effect on immune response, spasmylocytic activities, hypcholesterolemic effects, antibacterial activity.

Pharmacological applications

In blindness and eye sight

Beneficality of *Moringa olifer* is that by eating the leaf powder, pods and the leaves encloses the high amount of Vitamin A which preclude the darkness, night blindness in children (Morton et al., 1991).

Cardic and circulatory stimulant

Moringine acts on the sympathetic nervous system and a cardiac stimulant (Morton et al., 1991).

Antihypertensive, diuretic and cholesterol lowering activities

The activities of olifera gum comprises of the numerous parts which are beneficial in various ways such as the roots, leaves, flowers, seeds, fruit and leaf juice all these have specific role. The compounds Thiocarbamate glycoside, Mustard oil found the molifer leaves to be liable in blood lowering effect as well leaf juice of the *Moringa* have a stabilizing effect. All these measures of *Moringa olifer* subpart plays a harmonizing effects in retaining the diuretic activity [76, 91], lowers the phospholipids, serum cholesterol, Very Low Density Lipoproteins (VLDL), Low Density Lipoproteins (LDL), Atherogenic Index Lipid, reduction in lipid profile of heart where all these are the functions of fruits and the seeds of the this plant have the diuretic property.

Antispasmodic, antiulcer and hepatoprotective activities

The hepato-protective and antispasmodic activities have the significant role which is due to the presence of querctin which is a well-known flavonoid found in the Moringa roots (Mahajan et al., 2007).

Antibacterial and antifungal activities

Antibacterial activity has been potently observed with the help of the morgania roots, substituting as a potent anti-
microbial agent. Petrygospermin is the principle compound helping it to be anti-microbial agent and anti-fungal properties (Gupta et al., 2012).

**Antitumor and anticancer activities**

Anti-tumor and anti-malignancy cytotoxicity behavioural activity could be observed in the extract derived from the stems and seeds (Anwar et al., 2007; Sreelatha et al., 2011; Atawodi et al., 2010). Accompanying, the activity against the tumors and the malignant cells could also be seen from the extract of Moringa leaves. Moringa seed’s extract actively affects hepatic carcinogenesis, metabolism of enzymes and antioxidant parameters.

**Antioxidant activity**

Different aerial and root system parts of *M. oleifera* mainly attributes to chemical constituents like ascorbic acid (Vit. C), β-carotene (Chaoresin et al., 2014; 2012), quercetin, kaempferol (Ogbunugah et al., 2012), and phenolic acids (Singh et al., 2003; Vongsak et al., 2013; Satish et al., 2013). Different extract solvent system’s like ethanol, methanol and acetone has been investigated for its α-phenolic acids (Siddhuraju et al., 2011). Different enzymes and antioxidant parameters.

**Antimicrobial activity**

A wide activity against the different bacteria has been reported previously reported for the different parts of plant have been done by the researchers.

**Antimicrobial activity**

A wide activity against the different bacteria has been reported previously reported for the different parts of plant including leaves (Rahman et al., 2009; Thilza et al., 2010; Thilza et al., 2010) and pods (Arora et al., 2014). Different bacteria includes some examples like *E. coli*, *S. typhi*, *P. aeruginosa*, *E. cloace*, *P. vulgaris*, *S. aureus*, *M. kristinae*, *E. aerogenes*, *Shigella*, *B. cereus*, *Streptococcus-Haemolytica*, *B. subtilis*, *K. pneumonia*, *B. megaterium*, *S. lutea*, *B. stertthermphalus*, *S. pyogenes*, *V. cholera*, *S. entridins*, *enteropathogens* and wound bacteria. In addition, the antiviral activities of seeds against HSV-1 (Ali et al., 2004; Lipipun et al., 2003; Nwora et al., 2013; Sudha et al., 2010; Stols et al., 2015) and that of leaves against Epstein Barr Virus (EBV), HIV and HSV-1 (Waterman et al., 2014; Coppin et al., 2013; Cheenprachra et al., 2010; Inbathamizh et al., 2012;) have also been tested successfully.

**Anti-inflammatory activity**

Playing an important role as anti-inflammatory agents including 4-[(α-L-ramnosyloxy) benzyl] isoioxyocanate, 4-[(4-O-acetyl-α-L-ramnosyloxy)benzyl]isoioxyocanate (Maheshwari et al., 2014; Pandey et al., 2012.;), quercetin, kaempferol glucosides, 4-[(2-O-acetyl- α-L-ramnosyloxy) benzyl]isoioxyocanate, 4-[(3-O-acetyl-α-ramnosyloxy) benzyl]isoioxyocanate, 3,5-di-hydroxy-6-methyl-2,3-dihydro-4H-pyran-4-1, 9-octadeconamide, aurantiamide acetate and 1,3-dibenzylo urea (Sulaiman et al., 2008; Lee et al., 2013; Muangoi et al., 2012; Farooq et al.2012) in different parts of *M. oleifera* have been reported. Further investigation in references to the anti inflammatory activity of leaves of *M. oleifera* has been reported. Further (Bose et al., 2007; Dangi et al., 2002; Kumar et al., 2012), it was concluded that the anti inflammatory activity could be seen at molecular level by inhibiting the inflammation signaling pathways. The role of leaf and root extracts in treatment of inflammation and that of pod extracts in amelioration of inflammation associated disorders have been extensively studied (Nandave et al., 2009).

**Cardio-protective activity**

As a potent cardio protective drug it actively alters the circulatory system/capillaries and reduce mortality and morbidity as a consequence of coronary heart diseases which is due to the presence of goossypetin, quercetagenin and proanthocyanidins (Rachmawati et al., 2014; Gupta et al., 2012). Main components responsible for the cardio protective action are O-[[2-hydroxy-3′-(2′-heptenyl)loxy]-propyl undecanolate, O-ethyl-4-[(α-L (ramnosyloxy)-benzyl] carbamate, methyl p-hydroxybenzoate [130, 124], and 4-[(α-L-ramnosyloxy benzyl)-O-methyl thio carbamate (Sudha et al.,2010; Hannan et al., 2014) (correspond to the hypotensive nature of the plant as a whole, while N-α-L-ramnoppyranosyl vincosamide from the bark is reported to exhibit cardioprotective effects. The hypotensive and bradycardiac activities of leaves are attributed to niazinin, niazimicin, niaziminin, niazimin, niazipin, niazipirnin, niazipirnin, 4-[(4-O-acetyl-α-hamnosyloxy) benzyl] isoioxyocanate (Ganguly et al., 2008; Divi et al., 2012; Jain et al., 2010) and gucomorin. Due to the presence of alkaloids and Flavonoids it potently affects the blood pressure and AGE (angiotensin converting enzymes).

**Immunomodulatory activity**

Immunomodulators activity is observed mainly by the leaves of the plant as it doesn’t only exhibit the immunomodulators activity it does also possess immune stimulatory activities. The activity of the plant is mediated the reduction of cyclophosphamide which is responsible for the immunosuppression as it mediates the cellular and Humoral immunity (Jaiswal et al., 2009).

**Neuroprotective Effect**

Ashok et al., 2003 revealed that leaves exert a neuroprotective effect by promoting neuronal survival and outgrowth. The extracts of leaves reported to exhibit a protective effect against Alzheimer’s disease by altering the brain monoamine levels and electrical activity.

**Treatment of Metabolic disorders**

Plant leaf extracts are reported to possess hypcholesterolemic, antihyperglycemic, anti hyperlipidemic and hepatoprotective activities (Ndong et al., 2007; Pari et al., 2002). It was affirmed the occurrence of anti hyperthyroidism and anti-atherosclerotic activities in leaves (Chumark et al., 2008).

For the treatment of diabetes, different studies revealed the presence of hypoglycaemic agent such as plant proteins in leaf extracts. The study has been recently rumored for treatment of polygenic disorder (Paula et al., 2017). This rumored the presence of a unique compound niaziridin which supports the canal absorption of vitamins and nutrients.

**Other activities**

Natural plants comprises of different parts like leaves, seeds and roots etc. *Moringa oleifera* has been testified to have wound remedial actions. Ready wound therapeutic mediators such as vicenin-2, quercetin, kaempferol and phytosterols are also described as mining of leaves from ethyl acetate. These plants require various supplementary
actions, such as schizonticidal, antiulcerogenic (Hukkeri et al., 2006; Dahiru et al., 2006), antiurolithiatic and anti-ulcerative colitis (Patel et al., 2010; Gholap et al., 2012; Karadi et al., 2006).

**Future potential**

Numerous studies are accompanied for diverse portions of Moringa oleifera. There is a need to isolate and identify of new compound from various parts of plant which having the hindering properties. In future prospective, it is well estimated that natural polymers will be used as additional end product into the new expansion of novel drug delivery system, which is owing to various agents such as, coating agent, gel forming agents, controlled release and sustained release matrix. The Moringa oleifera is most expensive and reliable substitute intended for not individually provided the good nourishment and cure formerly, it prevents several diseases. There are desirable properties of this gum as the mucoadhesion, permeation enhancer which will improve the oral bioavailability of a drug.

**Conclusions**

The review potentially focuses on the modified gums named as morgina gum. This would potentially tell you the modifications and the application of modified morgina gum. As it also tell you in a comprehensive way all the applications and its physiochemical properties.

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There are no conflicts of interest.

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