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ROLE OF TAMARIND SEED POLYSACCHARIDE AS A CARRIER IN NOVEL DRUG DELIVERY SYSTEM

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Abstract:

Now a day, natural material is widely used for novel and conventional dosage forms. Various excipients are included in novel dosage forms to satisfy desired functions due to the advancement in drug delivery technology. It is found that many natural polysaccharides use as potent carrier material for site specific drug delivery. Natural polysaccharide such as Tamarind seed Polysaccharide (TSP) is used as a carrier in hydrophilic drug delivery system. TSP is a widely used due to its high viscosity, broad pH tolerance and adhesively. It also possesses non carcinogenicity, biocompatibility, high thermal stability and drug holding capacity. These properties make TSP as a good natural excipient in hydrophilic drug delivery system. Natural polymers have several advantages over synthetic and semi-synthetic polymers like natural origin, less side effects, low cost, easy availability, better patient compliance, non-toxic, chemically inert etc. The main objective of this review article is to focus on the utility of TSP and modified TSP as an excipient in novel drug delivery systems.

Key Words: Tamarind Seed Polysaccharide, Drug delivery, Natural polysaccharide, Excipient

1. Introduction:

Nature and natural products are God gifted wise which help to maintain healthiness of all living thing straightforwardly or in roundabout way. There is a great demand for novel drug delivery systems in 21st century due to its various advantages over conventional way. In case of development of novel dosage form of drug delivery systems, there is need for excipients to support desired properties. Natural polysaccharides play a vital role in novel drug delivery systems.

So TSP is taken into account as a natural polysaccharide which acts as hydrophilic drug delivery carrier. It is a biodegradable polysaccharide isolated from Tamarind seed (*Tamarindus indica*). Polysaccharides are relatively complex carbohydrate. TSP are often administered in the design of controlled drug delivery by various mechanisms including coating granules, pellets, tablets with polysaccharides having pH dependent solubility or introducing non digestible polysaccharides that are degraded by the bacterial enzymes present in the colon. Here, drugs are targeted to a specific site in the gastrointestinal tract (GIT) [1].

TSP have advantages over synthetic and semi-synthetic polymers like low cost, easy availability, non-toxicity, natural origin, less side effects, better patient compliance etc. [3-5]. TSP faces some problems including purity, source and microbial contamination. If these drawbacks are identified and suitable steps taken then natural polysaccharide like TSP can be good alternative for synthetic and semi-synthetic polymers [6].

2. Methodologies adapted to isolate and extract TSP:

2.1. Method 1:

First thoroughly washing of the seeds of *Tamarindus indica* are carried out to remove the adhering materials. Then removal of the reddish testa of the seeds is done by heating seeds in sand in the ratio of 1:4 [seed: sand]. The testa is removed. After that, the seeds are crushed lightly. Soaking of the crushed seeds in water is done separately for 24h and then boiled for 1h. Then, it is kept aside for 2h for the release of mucilage into water. To remove marc from the filter the soaked

seeds are taken and squeezed in a muslin bag. Precipitation of mucilage is done by addition of equal quantity of acetone. Then mucilage is dried at temperature 50^0C. Then, it is powdered and passed through sieve number 80. Finally, the dried mucilage is powdered and kept in airtight container at room temperature [20^0C] [7].

2.2. Method 2:

The isolation of TSP is also performed by another method. Here, slurry is prepared by adding 20 gm. of tamarind kernel powder with 200ml cold distilled water. Then, the slurry is poured into 800ml of boiling distilled water. The solution is boiled for 20 min with continuous stirring. The resulting solution is stored overnight and centrifuged at 5000rpm for 20 mints. The supernatant liquid is separated and poured into a container which contains twice the volume of absolute alcohol with continuous stirring. Then, precipitation takes place. The precipitate thus obtained is then washed with absolute ethanol and air dried. Dried polysaccharide is milled and passed through sieve number 60. Then it is kept in a desiccator [8].

Various modification of TSP is also performed to increase its activity. They are as follows-

- Carboxymethylation of TSP
- Thiol-functionalization of TSP
- Grafting of TSP
- Crosslinking of TSP with epichlorohydrin [9-11].

3. Chemical Composition of TSP:

Tamarind kernel powder is a highly branched carbohydrate polymer. It has an average molecular weight 52350 Daltons. The backbone of this polymer consists of D-glucose units joined with [1-4] b-linkages [12].TSP contains a main chain of b-D [1-4]-galactopyranosyl unit through a b-D-[1-6] linkage [13].

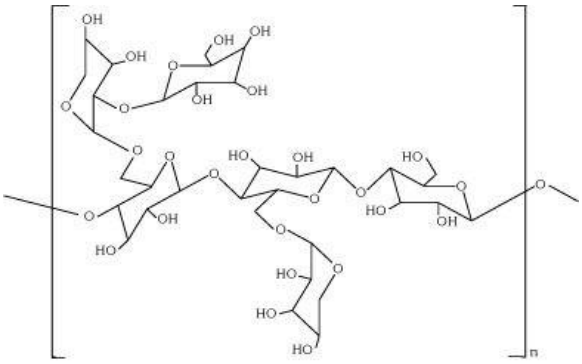

Figure 1
Structure of tamarind

4. Physical Poperties of TSP:

Dispersion of Tamarind kernel powder takes place quickly and hydrates quickly in cold water. It can't reach maximum viscosity unless it is heated for 20-30 mints. Like most of the natural polysaccharide this solution also exhibits typical Non-

Newtonian flow thixotropic properties. If the concentration will increase then Non-Newtonian behavior also increases. Apparent viscosity is about 7000cps [14-16].

5. Characterization of TSP:

By using NMR which used an AVANCE400 instrument in D_2O [Bruker, Karlsruhe, Germany] we can analyzed the structure of the TSP [1].

6. Application of TSP in Novel Drug Delivery System:

TSP is a promising candidate which is widely used in pharmaceutical industry. Due to its various uses and low drawbacks it is readily accepted by the industries. In novel drug delivery system TSP is used as a carrier or vehicle for variety of drugs for controlled release application. Many techniques have been adapted to prepare the TSP as well as modified TSP-based delivery system. This makes TSP an exciting and interesting excipient for the pharmaceutical industry for the present and future application [2].

6.1. In Sustained Drug Delivery:

Pani Kumar G.K et al studied sustained release matrix tablets of Lonoxican using Tamarind Seed Polysaccharide. The main objective of this study was to maintain therapeutic blood and tissue levels of drug for extend period of time with minimum adverse effects. Tablets with 20% TSP binder showed maximum drug release after 24 hours.

Sustain release matrix tablet of Acelofenac using hydrophilic natural polysaccharides like TSP studied by Parasuram Rajam Radhika et al.

The release behavior of drugs, Diclofenac sodium and Ketoprofen from isolated tamarind seed polysaccharide and cross-linked TSP was studied as release retardant. This study focus on the mechanism of drug release of Diclofenac sodium and Ketoprofen from both TSP and cross-linked TSP matrix tablets [R. Deveswara et al.].

6.2. Colon Targeting:

Due to TSPs biodegradable property and hydrophilic nature it is widely used in pharmaceutical industry for colon specific drug delivery. It also possesses low swellability and high viscosity. That also makes TSP as a good natural excipient in colon specific drug delivery system. TSP as a potential carrier for colonic drug delivery was demonstrated. **M.U Mishra** first evaluated TSP as a biodegradable carrier for

colon specific drug delivery. The main objective of this study was to develop matrix tablet based formulation using TSP. That protects the drug in upper GIT and release the major amount of drug in colon due to degradation by bacterial enzymes [17]. They prepared matrix tablets by wet granulation method. They used Ibuprofen as a model drug. In vitro release studies mimicking mouth to colon transit demonstrated the ability of TSP to release the drug at pH 6.8. TSP was significantly degraded in rat. That indicates that TSP can be used as a carrier for colonic drug delivery [12].

6.3. In Ocular Drug Delivery:

In recent times TSP is used to prepare thickened ophthalmic solutions. It has a pseudo plastic rheological behavior, mucoadehesive and mucomimetic properties. To prepare artificial tear and vehicle for sustained release ophthalmic drugs, this solution is used noticeably. Furthermore, to relief from several key subjective symptoms of dry eye syndrome namely trouble blinking, ocular burning and having sensation of having something in someone eye. Resident time of the drug to the cornea is also increased by TSP solutions e.g. Â-blockers [18]. The effect of ophthalmic preparation which contains timolol and TSP on intra-ocular pressure was evaluated in rabbits and found to decrease considerably. Biodegradable glycosaminoglycan and galactoxyoglucan polysaccharide which are isolated from tamarind seed polysaccharide have been wide range of application in pharmaceutical industries especially in ophthalmic applications [Sahoo Soumendra et al.].

7. Conclusion:

Although excipients traditionally were used as inert substances in pharmaceutical formulations, recently they are increasingly used in various dosage forms to fulfill specific functions for advanced drug delivery. Due to the degradable characteristic of most of the natural polysaccharides in the colon by intestinal micro-flora, there is a lot of scope for colon specific drug delivery. In novel drug delivery system natural polymers like TSP plays a crucial role. Development of new excipients is time consuming, involves tedious procedures and highly expensive. The demand of plant based products as excipients are increased day by day. Natural polymer TSP has advantages over synthetic and semi-synthetic polymers which make it as versatile excipients in novel drug delivery systems. To eliminate certain drawbacks

associated with TSP can be made. If these drawbacks are encountered and controlled, natural substances like TSP can be good substitute for synthetic polymers for novel drug delivery system.

Conflict of interest:

The authors report no conflicts of interest.

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