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# Tamarind Seed Polysaccharide: A Novel Pharmaceutical Excipient with Promising Application

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## ABSTRACT

***Numerous plant polysaccharides are presently being investigated for their wide-ranging applications as excipients, These diverse functions make tamarind seed powder a valuable ingredient in various pharmaceutical dosage forms, The use of natural excipients for the delivery of bioactive agents has faced challenges due to the prevalence of synthetic materials, but natural excipients offer significant benefits, including non-toxicity, cost-effectiveness, and widespread availability. This chapter provides an in-depth and valuable discussion of the pharmaceutical applications of tamarind seed polysaccharides, highlighting key aspects such as their source, isolation methods, chemical composition, and properties. Notably, tamarind seed polysaccharide is becoming recognized as a promising excipient.***

**Keywords: -** *Numerous Polysaccharides, Tamarind Seed, Natural Excipients, Widespread Availability*

## 1. INTRODUCTION

The significance of plant polysaccharides is increasing due to their renewability, which is ensured through sustainable harvesting or farming methods, providing a consistent supply of raw materials[1]. Traditionally, plant polysaccharides have played a supportive role in formulations, but they are now taking on a more active role in pharmaceutical applications, where they enhance stability, drug release, target specificity, and bioavailability, ultimately improving medication performance.[2] A substantial number of plant polysaccharides have been derived from numerous easily accessible local plant sources, and these polysaccharides have been utilized as excipients in the production of various medicinal products. Among the diverse range of plant polysaccharides, tamarind seed polysaccharide is a particularly promising biopolymer. This galactoxylan, extracted from tamarind kernels, has demonstrated potential and broad applications in the pharmaceutical industries.[3]

## 2. BIOLOGICAL SOURCE

The biological source of tamarind is the tamarind tree Tamarindus indica, which is native to tropical Africa and Asia.

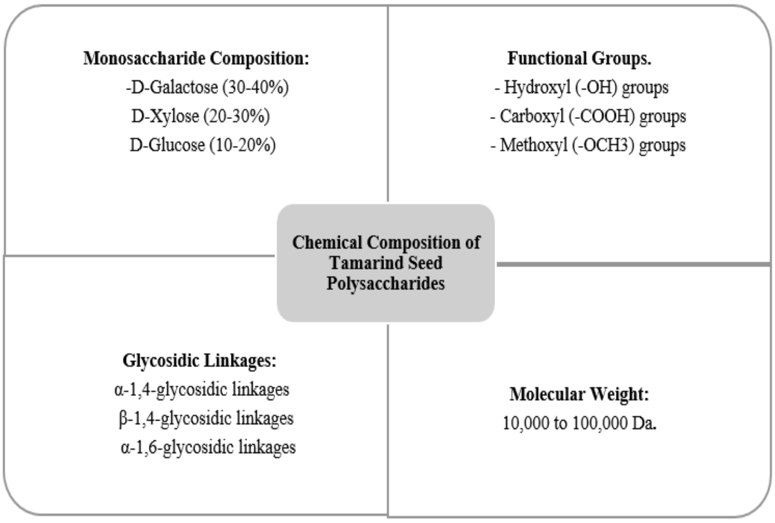
## 3. FAMILY

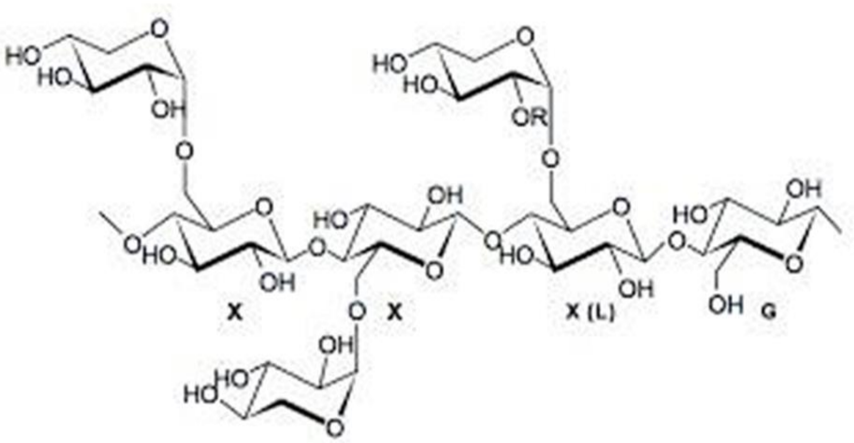
Fabaceae (Leguminosae).

## 4. SOURES AND ISOLATION

The first laboratory-scale method for isolating tamarind seed polysaccharide was developed by Rao et al. in 1946. This pioneering work laid the foundation for subsequent improvements and modifications to the technique.[4]
Chemical and Enzymatic Isolation Techniques
Tamarind seed isolation techniques can be broadly categorized into two approaches:
**Chemical Method:**
Immerse tamarind kernel powder in boiling water to produce mucilage.
Filter the mucilage to remove impurities.
Precipitate the tamarind seed polysaccharide by adding acetone to the filtered mucilage
Dry and concentrate the precipitated polysaccharide.[4,5]

**Enzymatic Method:**
Treat tamarind kernel powder with protease enzyme in ethanol.
Centrifuge the mixture to separate the supernatant.
Add ethanol to the supernatant to induce precipitation.
Separate and dry the precipitated polysaccharide. [6,7,8]
Chemical composition and properties.
Tamarind seed polysaccharides are complex carbohydrates composed of various monosaccharide units. The chemical composition of tamarind seed polysaccharides can be broken down into: [9,10,11,12,13]



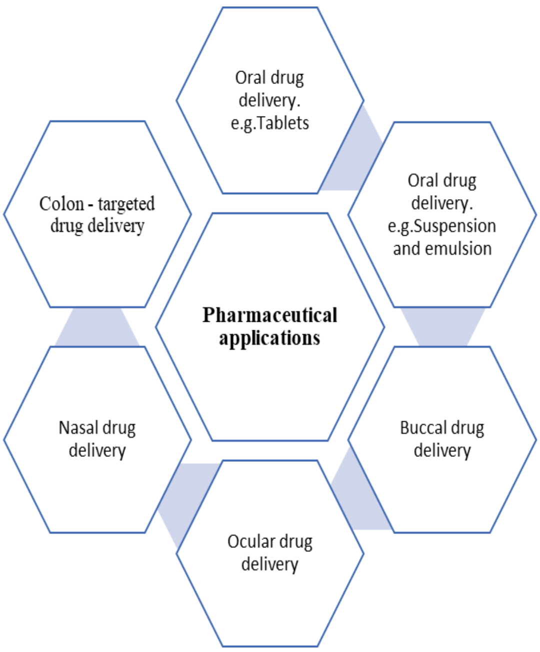



***Fig: Structure of tamarind seed polysaccharide.***

## 5. PHARMACEUTICAL APPLICATION

### 5.1 Tablets

Tamarind seed polysaccharide has been extensively studied for its excipient properties in pharmaceutical tablet formulations, where it has been found to be a successful binder, matrix former, and release modulator.[16] Its hydrophilic nature, viscosity, and swelling capabilities make it an ideal candidate for use in both wet granulation and direct compression procedures.[14] Research has shown that tablets made with tamarind seed polysaccharide exhibit delayed drug release patterns, making it a useful tool for creating prolonged or controlled release formulations. Additionally, the polysaccharide has been investigated as a matrix former in the creation of matrix tablets for various medications, where it has been used as a matrix forming and release retardant due to its hydrophilic properties. [15]

The use of tamarind seed polysaccharide in matrix tablets has also been found to impart mucoadhesive qualities, in addition to sustained drug release profiles, which can improve gastro retentive drug delivery. Examples of its applications as a mucoadhesive, matrix forming, binder, and release retardant are numerous, and modified forms of the polysaccharide have also been investigated as matrix materials in the production of matrix tablets. For instance, polyacrylamide-grafted tamarind seed polysaccharide has been used to formulate aspirin matrix tablets, resulting in a controlled drug release profile that follows zero-order kinetics.[17]

The potential of tamarind seed polysaccharide as a pharmaceutical excipient is vast, and its use in various formulations has shown promising results. Its ability to act as a binder, matrix former, and release modulator makes it a versatile tool in the development of sustained release formulations. Furthermore, its mucoadhesive properties make it an attractive candidate for use in gastro retentive drug delivery systems. [18]

### 5.2 Suspension and emulsion

Tamarind seed polysaccharide has been explored as a potential suspending ingredient in various medicinal solutions, and research has shown that it is effective in creating stable suspensions.19 Its ability to significantly slow down the settling rate of solid particles and facilitate the redispersion of any settled particles makes it a suitable candidate for use as a suspending agent. [20] A study comparing the suspending properties of tamarind seed polysaccharide to those of commonly used agents such as gelatin, tragacanth, and Arabica gum found that the polysaccharide has potential as a suspending agent in pharmaceutical formulations.[21]

Additionally, tamarind seed polysaccharide has been investigated as an emulsifier in the production of emulsions. A study by Kumar et al. demonstrated that a 2% w/v concentration of tamarind seed polysaccharide was effective as an emulsifier in castor oil emulsions, comparable to gum acacia. This suggests that tamarind seed polysaccharide could be a viable alternative to traditional emulsifiers in the manufacture of emulsions.[22]

The use of tamarind seed polysaccharide as a suspending agent and emulsifier offers several advantages, including its natural origin, biocompatibility, and potential for improved stability and bioavailability of medicinal formulations. Further research is needed to fully explore the potential of tamarind seed polysaccharide in pharmaceutical applications, but the existing evidence suggests that it is a promising excipient with a range of uses. [23]

### 5.3 Buccal drug delivery

Tamarind seed polysaccharide has been widely used as a buccoadhesive polymeric agent in various buccal medication delivery systems, including buccal tablets, films, and patches.[24] In buccal tablets, tamarind seed polysaccharide has been used as a buccoadhesive agent in nifedipine buccoadhesive tablet formulations, demonstrating notable mucoadhesivity with goat buccal mucosa and a sustained release profile for nifedipine.[25] Additionally, mucoadhesive buccal films containing rizatriptan benzoate were created using tamarind seed xyloglucan and carbopol 934 P, which showed a prolonged and consistent release of the medication.[26] Furthermore, epichlorohydrin cross-linked tamarind seed polysaccharide mucoadhesive patches were developed for metronidazole, exhibiting good ex-vivo mucoadhesivity with buccal mucosa and extended drug penetration.[27] In comparison with other polymers, tamarind seed polysaccharide has shown better mucoadhesive properties than HPMC and Na CMC in nifedipine buccoadhesive tablet formulations, and better mucoadhesive properties than polysaccharides from Ziziphus mauritiana in nitrendipine buccoadhesive tablets. These findings highlight the potential of tamarind seed polysaccharide as a versatile and effective buccoadhesive agent in various buccal drug delivery systems, offering sustained release and improved bioavailability of medications.[28]

### 5.4 Ocular drug delivery

Tamarind seed polysaccharide has been explored as a potential excipient in ocular medication delivery systems, including ocular gels and nanoparticles, due to its mucoadhesive properties and high viscosity. These characteristics make it an ideal candidate for extending the duration of medication residence on the cornea. A novel in situ gelling ocular dosage form of pilocarpine was developed using tamarind gum, and its miotic effects were evaluated.[29] The results showed that a combination of tamarind seed polysaccharide with alginate and chitosan achieved a sustained release of 80% pilocarpine over 12 hours.[30] The tamarind seed polysaccharide formulations demonstrated a well-tolerated and non-irritating profile, and in vivo studies on miotic response and ocular irritation revealed a significant and persistent reduction in pupil width in rabbits.[31]

The mucoadhesive ingredient tamarind seed polysaccharide prolonged the duration of medication absorption and excretion for both formulations.[32] Additionally, the effectiveness of tamarind seed polysaccharide in administering rufloxacin and ofloxacin to treat experimentally induced bacterial keratitis in rabbits caused by Pseudomonas aeruginosa and Staphylococcus aureus was investigated. The results demonstrated a significant increase in intra-aqueous drug penetration in both infected and uninfected eyes, highlighting the potential of tamarind seed polysaccharide as a useful excipient in ocular medication delivery systems.[33]

### 5.5 Nasal drug delivery

Tamarind seed polysaccharide was used as a mucoadhesive agent to create a nasal medication delivery system for diazepam. It outperformed synthetic polymers like HPMC and carbopol 934 in terms of pH, viscosity, and gelling properties.[35]

Ex-vivo mucoadhesivity studies using a bovine nasal membrane showed that tamarind seed polysaccharide had higher mucoadhesive strength than HPMC and carbopol 934.[34]
In-vitro drug release studies using a Franz-diffusion cell with excised bovine nasal membrane also demonstrated that tamarind seed polysaccharide was a more effective mucoadhesive agent than HPMC and carbopol 934, both with and without the addition of a permeation enhancer. [36]

**5.6 Colon-targeted drug delivery**
Colon-targeted drug delivery is essential to protect the medication during its passage through the upper gastrointestinal tract and facilitate its release in the colon. Tamarind seed polysaccharide has been investigated as a biodegradable transporter for this purpose. Ibuprofen matrix tablets were prepared using a wet granulation technique with varying amounts of tamarind seed polysaccharide to ensure the drug's protection in the upper gastrointestinal system.[38]
The tablets showed significant in vitro release of ibuprofen in simulated stomach fluid, intestinal fluid, and colonic fluid, both before and after enzyme induction.[37] Additionally, in vitro biodegradation studies demonstrated that the tamarind seed polysaccharide was efficiently broken down in the presence of rat feces. [39]

## 6. CONCLUSION
The main objective of searching for new excipients is to overcome the shortcomings of traditional excipients, including high processing costs, limited availability, toxicity, and compatibility issues. In recent years, tamarind seed polysaccharide has increase its emergingness in various pharmaceutical applications in various dosage form, offering a alternative natural excipient in pharmaceutical industry

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