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Review article

A Review of tamarind and fenugreek seed polysaccharide-based sustained release matrix tablets

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ABSTRACT

The sustained release oral dosage formulations are continuous releases drugs for extend period of time when the formulation come in contact with water. These oral dosage formulations enhance the patient compliance and therapeutic response and reduced the frequency of drug dose. The natural polysaccharides are nontoxic, biodegradable and less economic as compare to synthetic polymers. Therefore, natural polymers become very popular and smart choice now days. A numerous plants are sources of natural polysaccharides, which are easily available everywhere such as tamarind seed and fenugreek seed etc. Tamarind seed and fenugreek seed polysaccharides have ideal physical and chemical properties of polymer such as solubility, binding strength, mucous adhesive properties etc. In this review article under covered and discussed the sources, physical properties, application in pharmaceutical fields and future prospects.

Keywords: Sustained release drug delivery systems, Natural polysaccharides, Tamarind seed polysaccharide, Fenugreek seed polysaccharide, Natural polymers, Advanced drug delivery systems.

INTRODUCTION

The most common route of administration of a drug is oral. In this method of administration, the patient can take large quantities of the drug. This method is most common due to the ease of administration and patient acceptability. However, the oral sustained-release dose type frequently causes the drug concentration in plasma to fluctuate. By offering limited medication release over prolonged periods of time, oral sustained-release dosage devices eliminate these limitations.

Natural hydrophilic matrix systems are widely used for oral sustained-release dosage delivery. Natural polymers are obtained from plants and plant products. Natural-derived polysaccharides are becoming more popular due to their lower toxicity, easy availability, degradability, economic and natural acceptability, etc.

Tamarind seed polysaccharide and fenugreek seed polysaccharides are more popular in controlled-release dosage formulations, such as oral and topical, due to their outstanding swelling and gel-forming properties. Numerous research articles have been published on applications of Tamarind seed polysaccharide and fenugreek seed polysaccharides, but still need to do more research work for standardisation and scientific validation to obtain global acceptance [1-8].

Tamarind seed polysaccharide (TSP)

Source and composition

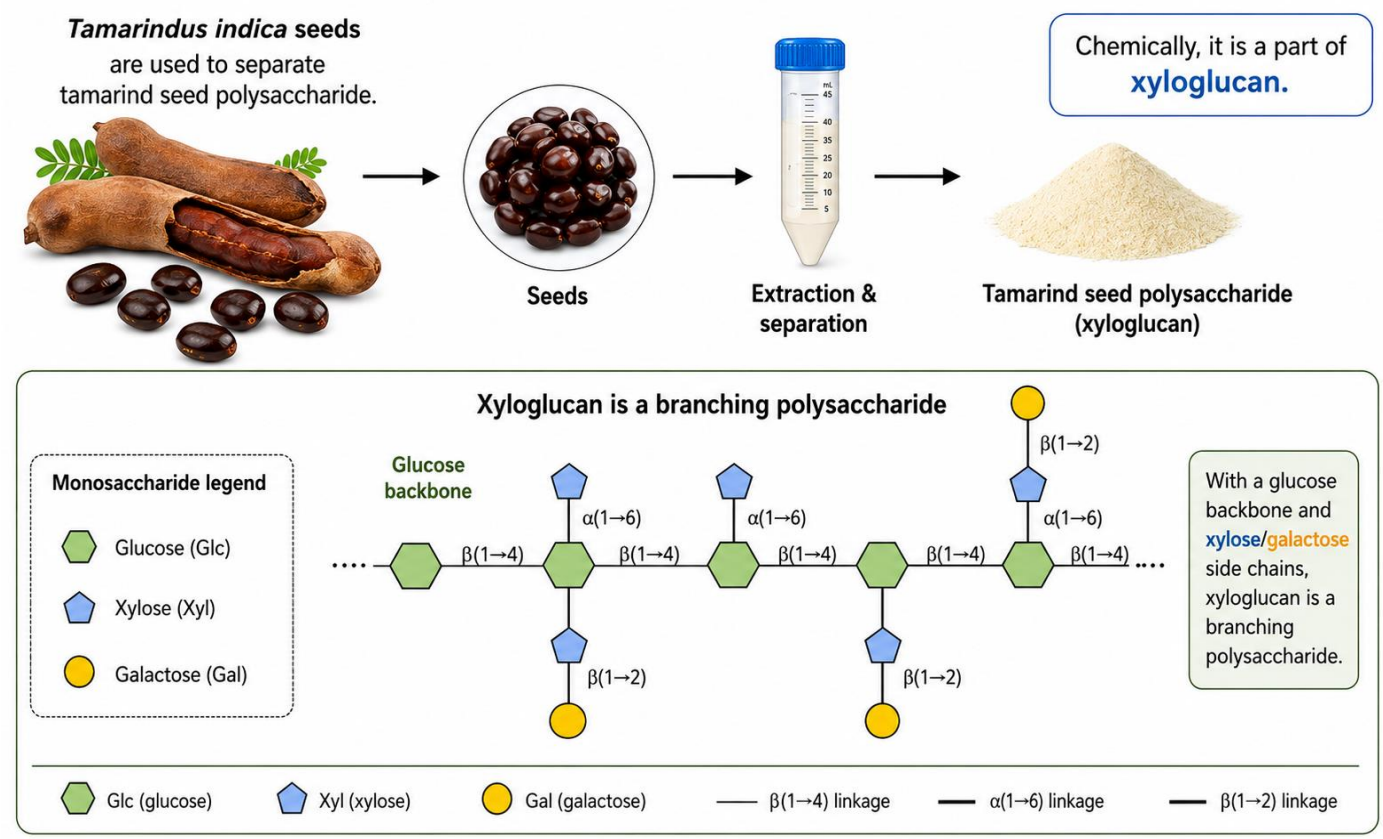
Tamarindus indica seeds are used to polysaccharide, firstly need to separate tamarind seed polysaccharide. Then, after the uncoated tamarind seeds are coarsely ground and soaked in distilled water and subsequently precipitated with ethanol or acetone. The precipitated materials were separated by centrifuging, ground, sieved and stored. It is chemically, it is a part of xyloglucan, with a glucose backbone and xylose/galactose side chains. Xyloglucan is a branching polysaccharide. The process of isolation is shown in the diagram below, diagrematic form Figure1 [9-13].

Properties of tamarind seed polysaccharide

Table 1: Nature of Tamarind seed polysaccharide

Nature of Tamarind seed polysaccharide
Non-ionic, hydrophilic polymer
High viscosity and swelling capacity
Biocompatible and biodegradable
Mucoadhesive behavior

Figure 1: Isolation of polysaccharide from tamarind seed



Tamarind seed polysaccharide has been broadly used in the development of oral sustained-release dosage forms due to its gel-forming ability and stability [14-16].

Ideal properties of tamarind seed polysaccharide in sustained release

It is forms a viscous layer when come in contact with water

It is hydrophilic in nature. After swelling, the release of the drug **occurs** through diffusion and erosion

It exhibits zero-order drug release kinetics depending on concentration

Therefore, tamarind seed polysaccharide has been most commonly used in the formulation and development of controlled-release dosage forms. It depends on polymer modification [14-16].

Fenugreek seed polysaccharide (FSP)

Source and composition

Fenugreek seed polysaccharide is another example of a natural polymer obtained from *Trigonella foenum-graecum* seeds. It is an excellent source of galactomannan.

Properties

Table 2: Nature of Tamarind seed polysaccharide

Nature of *Trigonella foenum-graecum* seeds
High swelling index
Excellent water retention
Biodegradable and non-toxic
Good binding and matrix-forming ability

Pharmaceutical applications

Fenugreek seed polysaccharide is another of the most common natural polymers due to the following reasons:

Fenugreek seed polysaccharide is used as a film-forming agent in sustained-release matrix tablet formulations.

It is used as a binder and a natural disintegrant

It is used as used as bioadhesive agent, gelling agent, viscosity-enhancing agent and environmentally sustainable agent, etc.

Extraction and Isolation

Tamarind Seed Polysaccharide

Steps include:

Figure 1: Isolation process of TSP from tamarind seed

1. Seed cleaning and roasting
2. Dehulling and kernel separation
3. Grinding and aqueous extraction
4. Filtration and precipitation (ethanol/acetone)
5. Drying and pulverization

Fenugreek seed polysaccharide

Steps include:

Figure 2: Isolation process of FSP from fenugreek seed

1. Soaking seeds in water
2. Heating and mucilage extraction
3. Filtration
4. Precipitation using alcohol
5. Drying and milling

Yields of TSP and FSP are approximately 47% and 17%, respectively [17-19].

Formulation of sustained-release matrix tablets

The common methods of formulation of sustained-release matrix tablets are

Direct compression of granules

Wet granulation

Excipients used

Diluents, binders, lubricants, and polymers are used in the creation of sustained-release matrix tablets.

Microcrystalline cellulose is an example of a diluent.

PVP is one type of binder.

Magnesium stearate is one type of lubricant.

TSP/FSP (5–30%) are examples of polymers [20-27].

Evaluation parameters

Sustained-release matrix tablet evaluations utilising the following criteria

Before pre-compression: angle of repose and flow characteristics

Following compression:

Hardness test

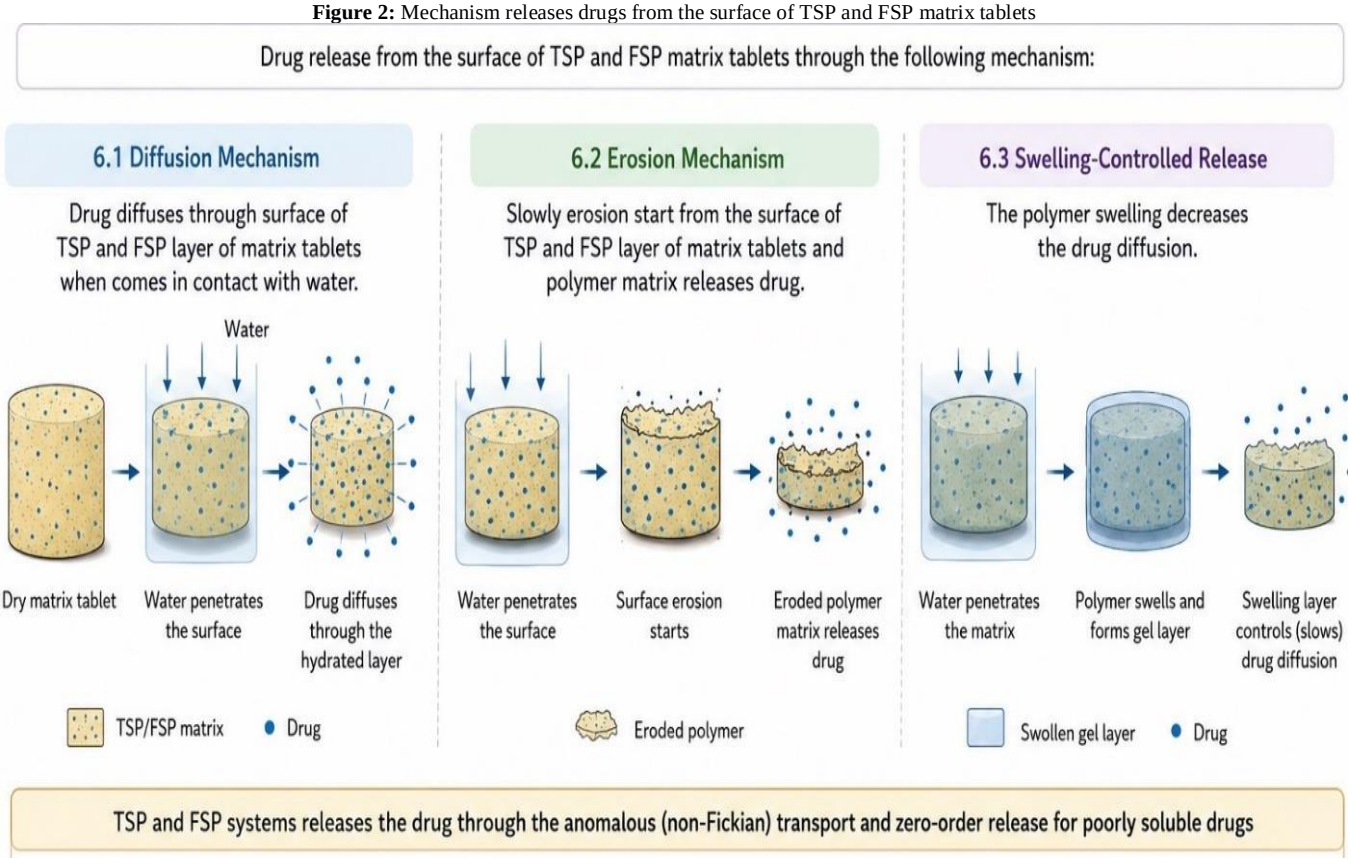
Testing for friendliness and estimating drug content

Determination of the swelling index and dissolution studies

Mechanism of drug release

Drug release from the surface of TSP and FSP matrix tablets through the following mechanism: [28, 29].

Figure 2: Mechanism releases drugs from the surface of TSP and FSP matrix tablets



Factors affecting drug release

Numerous factors affect drug release from the formulation, such as

Nature and concentration of polymer

Solubility nature of the drug

Modification or crosslinking of polymers enhances the retardation of the release of the drug

Particle size of polymers and drugs

Excipient materials like diluents have properties.

Comparative advantages of TSP and FSP

Table 3: Comparative advantages of TSP and FSP

Property	Tamarind Polysaccharide	Fenugreek Polysaccharide
Chemical nature	Xyloglucan	Galactomannan
Swelling ability	High	Very high
Release control	Excellent	Moderate to good
Mucoadhesion	Strong	Moderate
Chemical nature	Xyloglucan	Galactomannan

Both polymers are effective alternatives to synthetic polymers like HPMC.

Applications in drug delivery

Tamarind and fenugreek seed polysaccharides have been used in the formulation for the development of numerous controlled-release formulations, oral, topical, etc. Some are discussed in below.

Tamarind and fenugreek seed polysaccharides are used in sustained-release tablets (e.g., metformin, nifedipine).

Tamarind and fenugreek seed polysaccharides are used in controlled-release coatings (e.g., nifedipine).

Tamarind and fenugreek seed polysaccharides are used in mucoadhesive formulations.

Tamarind and fenugreek seed polysaccharides are used in nanoparticles and hydrogels.

TSP-based formulations have shown sustained drug release for 12 hours or more.

Global challenges

Tamarind and fenugreek seed polysaccharides: batch-to-batch unpredictability.

Tamarind and fenugreek seed polysaccharides enhance in chances of microbial contamination.

Tamarind and fenugreek seed polysaccharides need a purification process.

Tamarind and fenugreek seed polysaccharides have limited regulatory acceptance worldwide.

Future perspectives

The development of synthesis or modification of tamarind and fenugreek seed polysaccharides is through crosslinking and grafting techniques. These techniques are used to improve their mechanical strength and reduce water penetration, making them more effective for controlled drug delivery applications. In further research work need more research is needed to evaluate the compatibility, stability, and safety of these natural polysaccharides when combined with synthetic polymers. The use of tamarind and fenugreek seed polysaccharides in nanotechnology-based drug delivery systems has gained more attention in recent years due to their potential to enhance therapeutic efficacy. To promote their commercial use in pharmaceutical formulations, it is also necessary to investigate the industrial use and large-scale manufacture of these natural polymers. Additionally, recent developments show that tamarind seed polysaccharide (TSP) is a biomaterial with great promise for use in tissue engineering and medication delivery [30-34].

CONCLUSION

The natural polysaccharides found in fenugreek and tamarind seeds show promise for the development of orally controlled release formulations, such as prolonged release matrix tablets. Excellent swelling, gel-forming, and biocompatibility properties are possessed by TSP and FSP. Although TSP and FSP are suitable alternatives to synthetic excipients, more studies, standardisation, and assessment are required in the future. The availability, acceptance, cost, and isolation technique of TSP and FSP natural polymers make them highly promising for widespread medicinal applications.

Conflicts of Interest: No conflict of interest

REFERENCES

1. Shukla AK, Kumar M, Bishnoi RS, et al, 2017. Dosage form design of sustained release drug delivery systems: An overview. Asian J Biomater Res. 2017;4(3):1–7.
2. Purnachandra reddy guntaka , Sriram N, Sarad Pawar Naik Bukke, et al, 2022. Formulation and evaluation of sustained release matrix tablets of glimepiride using natural polymers tamarind seed mucilage and guar gum. J Pharm Negat Results. 13(Suppl 9), Pages 5256–5267. Doi:10.47750/pnr.2022.13.S09.645.
3. Tiwari V, Sharma M, Yadav VK, et al, 2024. Solubility enhancement and estimation of paracetamol and domperidone by hydrotropic agents. Biochem Cell Arch. 24(2), Pages 2783-93. Doi: 10.51470/BCA.2024.24.2.2783.
4. Basavaraj B, Pramod Patil, Chetan Surpur, et al, 2011. Design and characterization of sustained release aceclofenac matrix tablets containing tamarind seed polysaccharide. Asian J Pharm Tech. 1(1), Pages 17–21.
5. Dubey RS, Naidu MA, Shukla AK, 2022. Application of bioactive molecules in the treatment and management of type-1 diabetic disease: An overview. Sci Temper. 13(2), Pages 264–280. Doi:10.58414/SCIENTIFICTEMPER.2022.13.2.40.
6. Jain R, Tiwari R, Dubey RS, et al, 2021. Controlled drug release rate and contemporary issues in oral drug delivery formulations. Adv Pharm J. 6(2), Pages 29–36. Doi: 10.31024/apj.2021.6.2.1.
7. Shukla AK, Bishnoi RS, Kumar M, et al, 2018. Applications of tamarind seed polysaccharide-based copolymers in controlled drug delivery: an overview. Asian J Pharm Pharmacol. 4(1), Pages 23-30. Doi: https://doi.org/10.31024/ajpp.2018.4.1.5.
8. Shukla AK, Bishnoi RS, Kumar M, et al, 2020. Bioavailability enhancement and dissolution rate of poor water-soluble drug by solid dispersion technique. Indian J Nov Drug Deliv. 12(4), Pages 201-207.
9. Durai RD, Rajalakshmi G, Joseph J, et al, 2012. Tamarind seed polysaccharide: a promising natural excipient for pharmaceuticals. Int J Green Pharm. 6(4), Pages 270–278. Doi: https://doi.org/10.22377/ijgp.v6i4.273.
10. Garg A, Garg S, Kumar M, et al, 2018. Applications of natural polymers in mucoadhesive drug delivery: an overview. Adv Pharm J. 3(2), Pages 38-42. Doi: 10.31024/apj.2018.3.2.1.
11. Geethalaxmi M, Sunil CK, Venkatachalapathy N, 2024. Tamarind seed polysaccharides, proteins, and mucilage: extraction, modification and applications. Sustain Food Technol. 2, 1670–1685. Doi:10.1039/D4FB00224E.
12. Pal D, Nayak AK, 2012. Novel tamarind seed polysaccharide-alginate mucoadhesive microspheres for oral gliclazide delivery: in vitro-in vivo evaluation. Drug Deliv. 19(3), Pages 123–131. Doi:10.3109/10717544.2012.657717.
13. Mehta S, Garg A, Garg S, et al, 2018. Concise report on standardization of herbal drugs and its products. Adv Pharm J. 3(3), Pages 83-89. DOI: 10.31024/apj.2018.3.3.3.
14. Kosuru SK, 2024. Formulation and evaluation of metformin controlled release tablets using tamarind seed gum powder as a natural polymer. J Clin Pharm Res. 4(4), Doi: 10.61427/jcpr.v4.i4.2024.146.
15. Shukla AK, Kumar M, Bishnoi RS, 2019. Isolation and characterization of natural and modified seed gum. Asian J Pharm Pharmacol. 5(2), Pages 409–418. Doi: 10.31024/ajpp.2019.5.2.27.
16. Nayak AK, Pal D, Santra K, 2015. Screening of polysaccharides from tamarind, fenugreek and jackfruit seeds as pharmaceutical excipients. Int J Biol Macromol. 79, Pages 756–760. Doi: 10.1016/j.ijbiomac.2015.05.018.
17. Kumar M, Trivedi V, Shukla AK, 2018. Effect of polymers on the physicochemical and drug release properties of transdermal patches of atenolol. Int J Appl Pharm. 10(4), Pages 68-73. Doi: https://doi.org/10.22159/ijap.2018v10i4.24916.

18. Shukla AK, Yadav A, Vishwakarma RK, 2020. Applications, isolation and characterization of fenugreek seed gum as pharmaceutical excipient. J Med Pharm Allied Sci. 9(2), Pages 2484-91. Doi: 10.22270/jmpas.v9i2.920.

19. Shukla AK, Yadav VK, Kumar P, et al, 2025. Use of natural gum in poorly water-soluble drug solid dispersion and solubility enhancement. Res J Pharm Technol. 18(8), Pages 3995–4000. Doi:10.52711/0974-360X.2025.00574.

20. Shukla AK, Kumar M, Bishnoi RS, 2019. Development of natural gum based sustained release tablets of propranolol hydrochloride. Res J Pharm Technol. 12(7), Pages 3295-300. DOI: 10.5958/0974-360X.2019.00546.8.

21. Shukla A, Pandey V, Shukla R, et al, 2012. Herbosomes: a current concept of herbal drug technology – an overview. J Med Pharm Allied Sci. Pages 1:39-56. Doi: 10.55522/jmpas.v1i1.0003.

22. Mourya P, Shukla A, Jain AP, 2014. Nanotechnology in diabetes: an overview. J Med Pharm Allied Sci. 3(1), Pages 34-45. Doi: 10.55522/jmpas.v3i1.0037.

23. Shukla AK, Kumar M, Bishnoi RS, 2017. Application of fenugreek seed gum in novel drug delivery: a review. Asian J Biomater Res. 3(6), Pages 1-10. Doi: 10.22270/jmpas.v9i2.920.

24. Shukla A, Garg A, Garg S, 2016. Application of microsponge technique in topical drug delivery system. Asian J Biomater Res. 2(4), Pages 120-126.

25. Shukla AK, Sharma M, Dev SK, 2018. Microspheres as suitable drug carrier in sustained release drug delivery: An overview. Asian J Pharm Pharmacol. 4(2), Pages 102–108. https://doi.org/10.31024/ajpp.2018.4.2.2.

26. Sumathi S, Ray AR, 2002. Release behaviour of drugs from tamarind seed polysaccharide tablets. J Pharm Pharm Sci. 5(1), Pages 12–18.

27. Mishra SK, Bhardwaj P, Singh R, 2019. Formulation, optimization and evaluation of buccal films of diclofenac sodium. Adv Pharm J. 4(4), Pages 103-107. Doi: 10.31024/apj.2019.4.4.3.

28. Sharma M, Dev SK, Kumar M, 2018. Microspheres as suitable drug carrier in sustained release drug delivery: an overview. Asian J Pharm Pharmacol. 4(2), Pages 102-108. Doi: https://doi.org/10.31024/ajpp.2018.4.2.2.

29. Shukla AK, Kaujia KA, Yadav VK, et al, 2024. Expert systems in preformulation and formulation development with special reference to SeDeM system: an innovative, problem solving, intelligent and optimization algorithm tool. 2(1), Pages e2210299X338978. Doi: 10.2174/012210299X338978241015155050.

30. Shukla AK, Kumar M, Bishnoi RS, 2019. Development of natural and modified gum based sustained-release film-coated tablets containing poorly water-soluble drug. Asian J Pharm Clin Res. 12(3), Pages 266–271. Doi:10.22159/ajpcr.2019.v12i3.30296.

31. Shukla AK, Kumar M, Bishnoi RS, 2019. Development of natural gum based sustained release tablets of propranolol hydrochloride. Res J Pharm Technol. 12(7), Pages 3295–3300. Doi:10.5958/0974-360X.2019.00546.8.

32. Shukla AK, Singh SK, Mishra SP, et al, 2022. Development and characterization of natural polymer based nifedipine sustained release matrix tablet. J Pharm Negat Results. 13(8), Pages 3663–3668. Doi: 10.47750/pnr.2022.13.S08.454.

33. Shukla AK, Singh SK, Mishra SP, et al, 2023. Development and characterization of natural polymer-based nifedipine sustained release matrix tablet. J Pharm Negat Results. 13(8), Pages 3663-3668. Doi: https://doi.org/10.47750/pnr.2022.13.S08.454.

34. Shukla AK, Yadav VK, Yadav VP, et al, 2025. Preformulation and compatibility study of propranolol hydrochloride and herbal excipients. Adv Pharm J. 10(4), Pages 61-69. Doi: https://doi.org/10.31024/apj.2025.10.4.1.