WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
Coden USA: WJPRAP Impact Factor 8.63
Volume 15, Issue 14, 635-644. Review Article ISSN 2277–7105

A REVIEW OF TAMARIND AND FENUGREEK SEED POLYSACCHARIDE-BASED SUSTAINED RELEASE MATRIX TABLETS

***Dr. Sanjay Kumar Kushwaha**

Director (Professor), Abhinav Tripathi, Prem Prasad, Sanjay Kumar Kushwaha Bhavdiya Institute of Pharmaceutical Sciences and Research Faizabad, Uttar Pradesh, India.

Article Received on 15 June 2026,
Article Revised on 05 July 2026,
Article Published on 16 July 2026,

https://doi.org/10.5281/zenodo.21367668

***Corresponding Author**

Dr. Sanjay Kumar Kushwaha

Director (Professor), Abhinav Tripathi, Prem Prasad, Sanjay Kumar Kushwaha Bhavdiya Institute of Pharmaceutical Sciences and Research Faizabad, Uttar Pradesh, India.

How to cite this Article: *Dr. Sanjay Kumar Kushwaha. (2026). Director (Professor), Abhinav Tripathi, Prem Prasad, Sanjay Kumar Kushwaha Bhavdiya Institute Of Pharmaceutical Sciences And Research Faizabad, Uttar Pradesh, India. World Journal of Pharmaceutical Research, 15(14), 635–644.

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 non toxic, 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 are having 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.

1. INTRODUCTION

The most common route of administration of drug is oral. In this method of administration patient can take large quantities of 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 obtained from plant and plants products. Natural derived polysaccharides become more popular due to their less toxicity, easily availability, degradable, economic and natural acceptability etc.

Tamarind seed polysaccharide and fenugreek seed polysaccharides are more popular in controlled release dosage formulations like oral and topical due to their outstanding swelling and gel-forming properties. A 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 standardization and scientific validation for obtain global acceptance.[1-8]

2. Tamarind Seed Polysaccharide (TSP)

2.1 Source and Composition[9-13]

Tamarindus indica seeds are used to polysaccharide, firstly need to separate tamarind seed polysaccharide. Then after uncoated seed of tamarind coarsely grinded and soaked in distilled water and subsequently precipitated with ethanol or acetone. The precipitated materials separated by centrifuged and dry, grinded, sieved and store. It is chemically, it is a part of xyloglucan, a glucose backbone and xylose/galactose side chains, xyloglucan is a branching polysaccharide. The process of isolation is shown in below diagrematic form Fig 1.

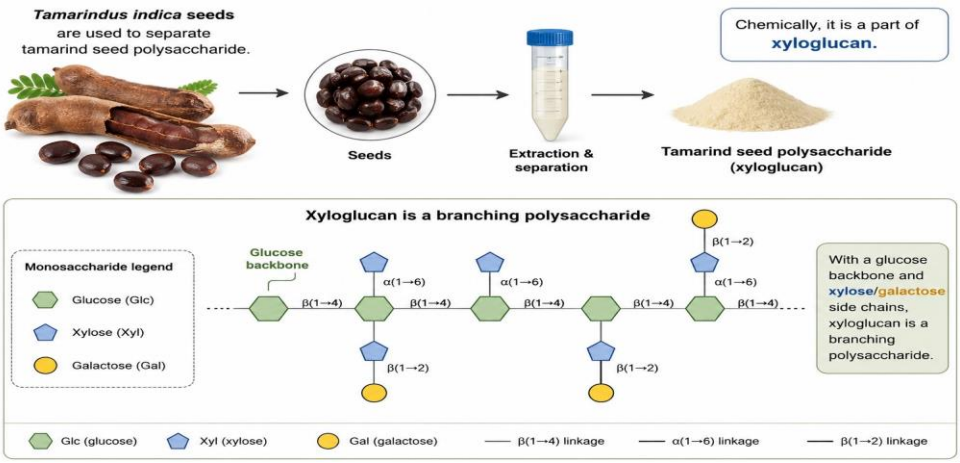

Fig 1: Isolation of polysaccharide from tamarind seed.

2.2 Properties of Tamarind seed polysaccharide

Table 1: Nature of Tamarind seed polysaccharide.

S.N.	Nature of Tamarind seed polysaccharide
1	Non-ionic, hydrophilic polymer
2	High viscosity and swelling capacity
3	Biocompatible and biodegradable
4	Mucoadhesive behavior

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

2.3 Ideal properties of Tamarind seed polysaccharide in sustained Release

1. It is forms a viscous layer when come in contact in water
2. It is hydrophilic in nature, after swelling release of drug through the diffusion and erosion
3. It is exhibits the drug zero-order 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 is depending on polymer modification.[14-16]

3. Fenugreek Seed Polysaccharide (FSP)

3.1 Source and Composition

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

3.2 Properties

Table 2: Nature of Tamarind seed polysaccharide.[17]

S.N.	Nature of *Trigonella foenum-graecum* seeds
1	High swelling index
2	Excellent water retention
3	Biodegradable and non-toxic
4	Good binding and matrix-forming ability

3.3 Pharmaceutical Applications[18]

Fenugreek seed polysaccharide is another most common natural polymer due to following reasons such as

1. Fenugreek seed polysaccharide is used as film forming agent in sustained release matric tablets formulation**.**

2. It is used as binder and natural disintegrant

3. It is used as used as bioadhesive agent, gelling agent, viscosity enhancing agent and environmental sustainable agent etc.

4. Extraction and Isolation[17-19]

4.1 Tamarind Seed Polysaccharide

Steps include:

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

Fig 1: Isolation process of TSP from tamarind seed.

4.2 Fenugreek Seed Polysaccharide[17-19]

Steps include:

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

Fig. 2: Isolation process of FSP from fenugreek seed.

Yields of TSP and FSP are approximately **47% and 17%**, respectively.

5. Formulation of Sustained Release Matrix Tablets[20-23]

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

- Direct compression of granules
- Wet granulation

5.2 Excipients Used[24-27]

- 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.

5.3 Evaluation Parameters[28]

Sustained release matrix tablet evaluations utilizing the following criteria

Prior to 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

6. Mechanism of Drug Release[29]

Drug release from the surface of TSP and FSP matrix tablets through the following mechanism:

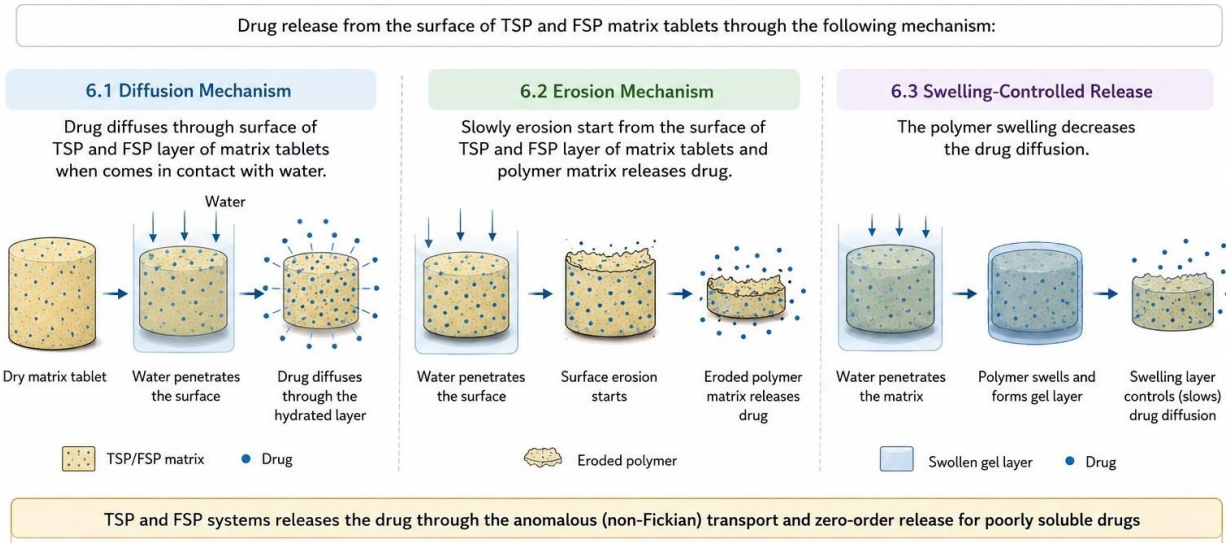

Fig 2: Mechanism releases drugs from the surface of TSP and FSP matrix tablets.

7. Factors Affecting Drug Release[30-35]

A numerous factors are affecting drug release from the formulation such as

1. Nature and concentration of polymer
2. Solubility nature of drug
3. Modification or crosslinking of polymers, enhance retardation of release of drug
4. Particle size of polymers and drug
5. Excipients materials like diluents properties.

8. Comparative Advantages of TSP and FSP[17]

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.

9. Applications in Drug Delivery[30-36]

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

1. Tamarind and fenugreek seed polysaccharides used in sustained release tablets (e.g., metformin, nifedipine)
2. Tamarind and fenugreek seed polysaccharides used in controlled release coatings (e.g., nifedipine)
3. Tamarind and fenugreek seed polysaccharides used in mucoadhesive formulations
4. Tamarind and fenugreek seed polysaccharides used in nanoparticles and hydrogels

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

10. 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 for purification process
- Tamarind and fenugreek seed polysaccharides limited regulatory acceptance at worldwide.

11. FUTURE PERSPECTIVES

Development of synthesis or modification of tamarind and fenugreek seed polysaccharides is through the 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 work 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.

12. CONCLUSION

The natural polysaccharides found in fenugreek and tamarind seeds show promise for the development of oral 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 study, standardization, 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.

REFERENCES

1. Shukla AK, Bishnoi RS, Dev SK, Kumar M, Fenin V. Biopharmaceutical classification system: tool-based prediction for drug dosage formulation. Adv Pharm J., 2017; 2(6): 204-209. https://www.apjonline.in/uploaded/p58.pdf
2. Shukla AK, Kumar M, Bishnoi RS, Kachawa VS, Jain CP. Dosage form design of sustained release drug delivery systems: An overview. Asian J Biomater Res., 2017; 4(3): 1-7.
3. Guntaka PR, et al. Formulation and evaluation of sustained release matrix tablets of glimepiride using natural polymers tamarind seed mucilage and guar gum. J Pharm Negat Results, 2022; 13(Suppl 9): 5256-5267. doi:10.47750/pnr.2022.13.S09.645.
4. Tiwari V, Sharma M, Yadav VK, Kanujia KA, Yadav VP, Bharti V, et al. Solubility enhancement and estimation of paracetamol and domperidone by hydrotropic agents. Biochem Cell Arch., 2024; 24(2): 2783-2793. DOI: 10.51470/BCA.2024.24.2.2783
5. Alfatih TM, et al. Tamarind seeds polysaccharide (TSP) as sustained release polymer in diclofenac sodium tablets. Drug Des., 2022; 11: 217.
6. Basavaraj B, et al. Design and characterization of sustained release aceclofenac matrix tablets containing tamarind seed polysaccharide. Asian J Pharm Tech., 2011; 1(1): 17-21.

7. Dubey RS, Naidu MA, Shukla AK, Shukla AK. Application of bioactive molecules in the treatment and management of type-1 diabetic disease: An overview. Sci Temper., 2022; 13(2): 264-280. doi:10.58414/SCIENTIFICTEMPER.2022.13.2.40.
8. Jain R, Tiwari R, Dubey RS, Tiwari A, Shukla AK. Controlled drug release rate and contemporary issues in oral drug delivery formulations. Adv Pharm J., 2021; 6(2): 29-36. DOI: 10.31024/apj.2021.6.2.1.
9. Shukla AK, Bishnoi RS, Kumar M, Fenin V, Jain CP. Applications of tamarind seed polysaccharide-based copolymers in controlled drug delivery: an overview. Asian J Pharm Pharmacol., 2018; 4(1): 23-30. https://doi.org/10.31024/ajpp.2018.4.1.5.
10. Shukla AK, Bishnoi RS, Kumar M, Jain CP, Tiwari R, Jain R. Bioavailability enhancement and dissolution rate of poor water-soluble drug by solid dispersion technique. Indian J Nov Drug Deliv., 2020; 12(4): 201-207.
11. Durai RD, Rajalakshmi G, Joseph J, Kanchalochana SN. Tamarind seed polysaccharide: a promising natural excipient for pharmaceuticals. Int J Green Pharm., 2012; 6(4): 270-278. https://doi.org/10.22377/ijgp.v6i4.273.
12. Garg A, Garg S, Kumar M, Dev SK, Shukla AK, Kaushik SPC. Applications of natural polymers in mucoadhesive drug delivery: an overview. Adv Pharm J., 2018; 3(2): 38-42.
13. Geethalaxmi M, Sunil CK, Venkatachalapathy N. Tamarind seed polysaccharides, proteins, and mucilage: extraction, modification and applications. Sustain Food Technol., 2024; 2: 1670-1685. doi:10.1039/D4FB00224E.
14. Pal D, Nayak AK. Novel tamarind seed polysaccharide-alginate mucoadhesive microspheres for oral gliclazide delivery: in vitro-in vivo evaluation. Drug Deliv., 2012; 19(3): 123-131. doi:10.3109/10717544.2012.657717.
15. Mehta S, Garg A, Garg S, Shukla MKA. Concise report on standardization of herbal drugs and its products. Adv Pharm J., 2018; 3(3): 83-89. DOI: 10.31024/apj.2018.3.3.3.
16. Kosuru SK, et al. Formulation and evaluation of metformin controlled release tablets using tamarind seed gum powder as a natural polymer. J Clin Pharm Res., 2024; 4(4): doi:10.61427/jcpr.v4.i4.2024.146.
17. Shukla AK, Kumar M, Bishnoi RS, Jain CP. Isolation and characterization of natural and modified seed gum. Asian J Pharm Pharmacol., 2019; 5(2): 409-418. doi:10.31024/ajpp.2019.5.2.27.
18. Nayak AK, Pal D, Santra K. Screening of polysaccharides from tamarind, fenugreek and jackfruit seeds as pharmaceutical excipients. Int J Biol Macromol., 2015; 79: 756-760. doi:10.1016/j.ijbiomac.2015.05.018.

19. Kumar M, Trivedi V, Shukla AK, Dev SK. Effect of polymers on the physicochemical and drug release properties of transdermal patches of atenolol. Int J Appl Pharm., 2018; 10(4): 68-73. DOI: https://doi.org/10.22159/ijap.2018v10i4.24916.
20. Shukla AK, Yadav A, Vishwakarma RK, Mishra SK. Applications, isolation and characterization of fenugreek seed gum as pharmaceutical excipient. J Med Pharm Allied Sci., 2020; 9(2): 2484-2491. DOI: 10.22270/jmpas.v9i2.920.
21. Shukla AK, Yadav VK, Kumar P, Tiwari A, Tiwari J: Use of natural gum in poorly water-soluble drug solid dispersion and solubility enhancement. Res J Pharm Technol., 2025; 18(8): 3995-4000. doi:10.52711/0974-360X.2025.00574.
22. Shukla AK, Kumar M, Bishnoi RS, Jain CP: Development of natural gum based sustained release tablets of propranolol hydrochloride. Res J Pharm Technol., 2019; 12(7): 3295-300. DOI: 10.5958/0974-360X.2019.00546.8.
23. Shukla A, Pandey V, Shukla R, Bhatnagar P, Jain S: Herbosomes: a current concept of herbal drug technology – an overview. J Med Pharm Allied Sci., 2012; 1: 39-56. DOI: 10.55522/jmpas.v1i1.0003.
24. Mourya P, Shukla A, Jain AP, Garg S: Nanotechnology in diabetes: an overview. J Med Pharm Allied Sci., 2014; 3(1): 34-45. DOI: 10.55522/jmpas.v3i1.0037.
25. Shukla AK, Kumar M, Bishnoi RS, Jain CP: Application of fenugreek seed gum in novel drug delivery: a review. Asian J Biomater Res., 2017; 3(6): 1-10. DOI: 10.22270/jmpas.v9i2.920.
26. Shukla A, Garg A, Garg S: Application of microsponge technique in topical drug delivery system. Asian J Biomater Res., 2016; 2(4): 120-6.
27. Shukla AK, Sharma M, Dev SK, Kumar M: Microspheres as suitable drug carrier in sustained release drug delivery: An overview. Asian J Pharm Pharmacol., 2018; 4(2): 102-108. https://doi.org/10.31024/ajpp.2018.4.2.2.
28. Kumar S, Verma G, Saxena C, Paul P, Arora K, Shukla AK: Formulation and evaluation of clarithromycin bilayer floating tablets. Nanotechnol Percept., 2024; 20(S14): 3038-51.
29. Sumathi S, Ray AR: Release behaviour of drugs from tamarind seed polysaccharide tablets. J Pharm Pharm Sci., 2002; 5(1): 12-18. https://pubmed.ncbi.nlm.nih.gov/12042114/.
30. Mishra SK, Monika, Bhardwaj P, Singh R, Shukla AK: Formulation, optimization and evaluation of buccal films of diclofenac sodium. Adv Pharm J., 2019; 4(4): 103-7. DOI: 10.31024/apj.2019.4.4.3.

31. Sharma M, Dev SK, Kumar M, Shukla AK: Microspheres as suitable drug carrier in sustained release drug delivery: an overview. Asian J Pharm Pharmacol., 2018; 4(2): 102-8. https://doi.org/10.31024/ajpp.2018.4.2.2.
32. Shukla AK, Kaujia KA, Yadav VK, Verma M, Jaiswal A, Gupta V: Expert systems in preformulation and formulation development with special reference to SeDeM system: an innovative, problem solving, intelligent and optimization algorithm tool, 2024; 2(1): e2210299X338978. DOI: 10.2174/012210299X338978241015155050.
33. Shukla AK, Kumar M, Bishnoi RS, Jain CP: Development of natural and modified gum based sustained-release film-coated tablets containing poorly water-soluble drug. Asian J Pharm Clin Res., 2019; 12(3): 266-271. doi:10.22159/ajpcr.2019.v12i3.30296.
34. Shukla AK, Kumar M, Bishnoi RS, Jain CP: Development of natural gum based sustained release tablets of propranolol hydrochloride. Res J Pharm Technol., 2019; 12(7): 3295-3300. doi:10.5958/0974-360X.2019.00546.8.
35. Shukla AK, Singh SK, Mishra SP, Sarthi AS, Dewangan E, Bharti VR, Sonkar SK: Development and characterization of natural polymer based nifedipine sustained release matrix tablet. J Pharm Negat Results, 2022; 13(8): 3663-3668. doi:10.47750/pnr.2022.13.S08.454.
36. Shukla AK, Singh SK, Mishra SP, Sarthi AS, Dewangan E, Bharti VR, et al: Development and characterization of natural polymer-based nifedipine sustained release matrix tablet. J Pharm Negat Results, 2023; 13(8): 3663-8. DOI: https://doi.org/10.47750/pnr.2022.13.S08.454.
37. Shukla AK, Yadav VK, Yadav VP, Shukla A, Yadav OP: Preformulation and compatibility study of propranolol hydrochloride and herbal excipients. Adv Pharm J., 2025; 10(4): 61-69. DOI: https://doi.org/10.31024/apj.2025.10.4.1.