EJPMR, 2026, 13(7), 161-165 **Research Article** **Impact Factor: 8.158**

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

ISSN (O): 2394-3211
ISSN (P): 3051-2573
Coden USA: EJPMAG

STUDY OF INDIGENOUS PLANT DERIVED (TAMARIND SEED AND KONJAC GUM) GELLING AGENT AS AN ALTERNATIVE TO GELATIN

Namha Akhter[1], Sujeet Pal[1], Syed Dilnawaz Hasan[1], Syed Mohammad Abdullah*[1]

[1]Department of Pharmaceutical Sciences, Jharkhand Rai University, Raja Ulatu, Namkum, Ranchi-834010, Jharkhand.

***Corresponding Author: Syed Mohammad Abdullah**

Department of Pharmaceutical Sciences, Jharkhand Rai University, Raja Ulatu, Namkum, Ranchi-834010, Jharkhand.

DOI: https://doi.org/10.5281/zenodo.21028702

How to cite this Article: Namha Akhter[1], Sujeet Pal[1], Syed Dilnawaz Hasan[1], Syed Mohammad Abdullah*[1] (2026). Study Of Indigenous Plant Derived (Tamarind Seed And Konjac Gum) Gelling Agent As An Alternative To Gelatin. European Journal of Pharmaceutical and Medical Research, 13(7), 161-165.

Article Received on 28/05/2026 **Article Revised on 18/06/2026** **Article Published on 01/07/2026**

ABSTRACT

Gelatin is derived from collagen which is a protein in nature found in connective tissue of animal (such as cow, pig, fish etc.). Soft gels or soft capsules are the second most used dosage form for pharmaceutical and nutraceuticals product after tablets. In recent days natural polysaccharides have gained significant attention in gelling film development for their non-toxicity, renewability, and excellent film-forming properties. Tamarind seed gum, natural polysaccharide from seeds of Tamarindus indica, has properties such as high viscosity, biocompatibility and strong mucoadhesive nature. The polysaccharide can also result in smooth, stable films with favorable gelling properties. In addition, konjac gum, which is obtained from the tubers of Amorphophallus konjac, is also a popular hydrophilic polymer for its superior gel forming ability, elasticity, and moisture retention capacity. The combination of tamarind seed gum and konjac gum may have synergistic benefits in improving mechanical strength, flexibility and gelling properties of the prepared films. However, hydroxypropyl methylcellulose (HPMC), a semi-synthetic cellulose derivative, is commonly preferred as a standard film-forming polymer due to its outstanding transparency, uniformity and stability. In the present study, HPMC is regarded as an alternative or comparative polymer against which the performances of natural gum-based gelling films were measured. Therefore, substituting expensive semi-synthetic cellulose by the combination of polysaccharides derived from indigenous plant such as tamarind seed gum and konjac gum could be proven a cost-cutting and sustainable alternative while producing desired film characteristics against gelatin and HPMC.

KEYWORDS: Tamarind seed gum, Konjac gum, Gelling agents, Polysaccharides and Biodegradable polymers.

INTRODUCTION

A gel film is a thin, soft, and flexible layer made by using a gelling polymer mixed with a solvent system. These films are widely used in pharmaceutical, food, cosmetic, and biomedical fields because they provide good flexibility, moisture retention, and controlled release properties.[1][2] Gel films are commonly used for wound dressings, edible coatings, drug delivery systems, and cosmetic preparations. Different natural and synthetic polymers are used to prepare gel films, among which gelatin, Hydroxypropyl Methylcellulose (HPMC), are important materials.[3] Gelatin is a protein based material obtained from collagen present in the skin, bones, and connective tissues of animals such as cattle, pigs, and fish. It is colourless, tasteless, and widely used because of its excellent gel-forming and stabilizing properties. Gelatin is commonly used in jelly, desserts, ice cream, candies, and pharmaceutical capsules. It also helps improve the texture and elasticity of products. However, gelatin has some disadvantages. Since it comes from animal sources, it is not suitable for vegetarians and vegans and may not satisfy certain religious dietary rules. Some people may also face allergies or digestive discomfort after consuming gelatin. In addition, gelatin melts at high temperatures and loses its gel structure easily.[4] So, in market there is already an alternative of gelatin is, available as hydroxypropyl methylcellulose (HPMC) a semi-synthetic polymer made from cellulose, a natural plant fibre. It is water-soluble and widely used as a thickener, stabilizer, and film-forming agent. HPMC is commonly used in gluten-free foods, bakery products, sauces, and vegetarian capsules as an alternative to gelatin. In pharmaceuticals, it is used in tablet coatings and controlled drug-release systems.[5] Although HPMC has many advantages, it is chemically processed and not fully natural, which may concern some consumers. It also provides little nutritional value and may sometimes cause mild digestive problems such as bloating.[6] So, there is an essential need to carried out a study of plant derived gelling agent to overcome these drawbacks of the currently available gelling agents.

MATERIAL AND METHODS

Sample Preparation

Tamarind seeds were taken and soaked for three days, then the seed coat was removed and kernels was dried in hot air oven for 40 mins by maintaining temperature between 50-100℃. After drying the seeds were grinded into fine powder. Similarly, fresh konjac tubers were collected and washed. The outer brown peel was removed and sliced. Sliced part was dried in hot air oven at 50-60℃ until it completely dried. Dried sliced were grinded into the fine powder. However, for the extraction of polysaccharide from the powder of test samples a hot water extraction method was carried out. Initially, took 25 grams of test sample powder and about 400 ml of distilled water was added to the samples. The mixture was boiled at 100℃ for 20 minutes until a slurry was formed. The slurry was kept overnight for sedimentation. After sedimentation, the mixture was filtered to obtain the filtrate. Then, 300 ml of ethanol was added to 150 ml of the filtrate, resulting in the formation of a precipitate. The precipitate was washed twice with ethanol to remove impurities. The obtained precipitate was dried in a hot air oven at 100℃ until completely dried. Finally, the dried material was ground into a fine powder.[7,8]

Film Casting

Test sample: 100 ml of distilled water taken in three separate beakers subsequently these were placed on hot plate and heated at 60-70°C. The sample solution (1%,1.5% and 2% w/v) was added slowly into the beaker by the continuous stirring and the mixture was heated up to 15-20 min till complete dissolution takes place. Further, 0.6-1.2ml of glycerol added and stirred for 10 minutes continuously further the solution kept for 15 minutes to remove the air bubbles. Uniformly, poured the solution into the petri dish, ensured that thickness of film remained same and uniform for all samples subsequently transferred to hot air oven where it was dried for 4 to 5 hours at 70°C.[9]

All the chemicals and reagents were procured of analytical grade. However, test products Tamarind seed was purchased from the Agros India (Ranchi, Jharkhand), Konjac powder was received from Labmate Pvt. Ltd., and standard product HPMC was obtained from Patco. Pharmaceuticals.

Pharmacognostic Evaluation: This evaluation includes organoleptic evaluation and polysaccharide confirmatory assay including Benedict’s test and Fehling’s test to detect active compound.[10]

Physiochemical Evaluation: This evaluation includes moisture content, pH determination, swelling index, solubility, viscosity these evaluations were necessary because it ensure the quality, purity, safety, and identity of the sample.[7]

Gel Strength Evaluation: Gel strength of the prepared gelling agent was measured by using a simple method as described by Shauli L, and Salomon E., with slight modification.[11] The gelling agent were placed within the petri plate and a square shaped hollow tube having aperture area of 1-cm^2, kept vertically on the top at the center of the gel content. Then we were added weight slowly into the hollow tube by sand. The point at which the gel sheath gets break and probe penetrate within the gel will be noted and the corresponding weight of sand will be expressed as total pressure (pascal) applied equivalent to gel strength calculating by using following formula. The test was repeated for both test samples and standard compound and the average value were derived as follows.

$$\frac{1gm}{cm^2} = 98\ pascal \quad [11]$$

RESULT AND DISCUSSION

Organoleptic Evaluation: The organoleptic evaluation of tamarind seed gum and konjac root gum was performed by visual inspection, smelling, and touch. The observed characteristics are summarized in Table 1.1.

Table 1.1: Organoleptic Properties of Tamarind Seed Gum and Konjac Tuber Gum.

Property	Tamarind seed gum	Konjac gum
Colour	Pale Yellow	Light Yellow
Odour	Mild-sour	Odourless
Taste	Slightly Acidic	Tasteless
Texture	Smooth	Smooth

Confirmatory Assay: The presence of polysaccharides (carbohydrates) in both extracted gums was confirmed by using standard chemical tests Benedict’s and Fehling's tests as shown in Table 1.2.

Table 1.2: Polysaccharide Confirmatory Test Results at Different Concentrations.

Test	Tamarind gum	Konjac gum	Observation
Benedict's Test	+ ve	+ve	Brick red precipitate
Fehling's Test	+ve	+ve	Reddish brown precipitate
Result	Polysaccharide confirmed	Polysaccharide confirmed	

Solubility Testing: Solubility of tamarind seed gum and konjac root gum was evaluated in hot and cold water at given below concentration and compared with HPMC (standard). Results are summarized in Table 1.3.

Table 1.3: Solubility of Tamarind Seed Gum, Konjac Root Gum and HPMC.

Concentration	Tamarind Seed Gum	Konjac Root Gum	HPMC (Standard)
1% w/v	Soluble in hot water only	Soluble in hot & cold water	Soluble in cold water

Konjac gum demonstrated the most versatile solubility profile, shows good solubility in both hot and cold water, Tamarind gum was found to be soluble only in hot water, whereas HPMC exhibited solubility primarily in cold water.

Moisture Content: It was determined by drying the sample in a hot air oven at 37°C until constant weight was achieved. The results are shown in Table 1.4.

Table 1.4: Moisture content of Tamarind Seed Gum, Konjac Root Gum and HPMC.

Sr. No.	Compound	Moisture Content
1	Tamarind Seed Gum	8.2 ± 0.3%
2	Konjac Root Gum	10.4 ± 0.3%
3	HPMC (Standard)	3.2 ± 0.2%

Konjac gum show higher moisture content than tamarind gum and apparently HPMC (standard) presented lowest moisture content among all three samples.

pH Value: The pH of 1% aqueous solution of each sample was measured using a calibrated digital pH meter at room temperature. Results are summarized in Table 1.5.

Table 1.5: pH values of Tamarind Seed Gum, Konjac Root Gum and HPMC.

Tamarind Seed Gum	Konjac Root Gum	HPMC (Standard)
5.9 ± 0.1	6.3 ± 0.1	6.8 ± 0.1

pH values of the formulations showed that HPMC (standard) had the highest pH (6.8), followed by konjac with a pH range of 6.0–6.3, while tamarind shows the lowest pH range of 5.6–5.9.

Swelling Index: It was carried out by placing 0.1g of each sample on butter paper (2.2 cm) dipped in 15ml water and measuring the weight change after 24 hours at 25 ± 1°C. Results are shown in Table 1.6.

Table 1.6: Swelling Index of Tamarind Seed Gum, Konjac Root Gum and HPMC.

Tamarind Seed Gum	Konjac Root Gum	HPMC (Standard)
68.4 ± 1.2%	112.5 ± 2.4%	54.2 ± 1.0%

Konjac gum showed the highest swelling index, indicating its superior water absorption and swelling capacity. This was followed by tamarind gum, which showed moderate swelling behavior, while HPMC (standard) demonstrated the lowest swelling index comparatively.

Viscosity: It was measured using an Ostwald viscometer at 1% (w/v) concentration at constant temperature. Flow time was recorded and viscosity calculated using the standard equation. Results are presented in Table 1.7.

Table 1.7: Viscosity of Tamarind Seed Gum, Konjac Root Gum and HPMC.

Concentration	Tamarind Seed Gum	Konjac Root Gum	HPMC (Standard)
1% w/v	82.4 ± 2.1 cP	145.2 ± 3.6 cP	95.0 ± 2.5 cP

Konjac gum shows the highest viscosity among these polymer study, indicating its superior of thickening and gel forming ability while HPMC shows the moderated viscosity and tamarind gum show the lowest viscosity.

Gel Strength: It was evaluated by measured using a simple method as described by Lilach Shauli and Eitan Salomon et al. with slight modification.[11] The corresponding weight of sand will be expressed as total pressure (pascal) applied equivalent to gel strength calculated by using following formula. HPMC was used as standard. Results are shown in Table 1.8.

Table 1.8: Gel Strength of Tamarind Seed Gum, Konjac Root Gum and HPMC.

Concentration	Tamarind Seed Gum	Konjac Root Gum	HPMC (Standard)
1% w/v	463 ± 1.5 Pascal	565 ± 2.0 Pascal	542 ± 1.6 Pascal

Konjac gum exhibits the highest gel strength, followed by HPMC and Tamarind gum shows lowest gel strength than HPMC.

DISCUSSION

The present study was carried out to compare the physicochemical, organoleptic, and functional properties of tamarind seed gum and konjac gum at different concentrations, using HPMC as a standard reference polymer. Natural gums are widely used in pharmaceutical and industrial fields because they are biodegradable, non-toxic, cheap, and easily available, making them good alternatives to synthetic polymers. In organoleptic evaluation, tamarind gum appeared pale yellow to yellow in colour with a slight sour smell and taste, and became thicker as concentration increased. In contrast, konjac gum was off-white, odourless, tasteless, and smooth in texture at all concentrations. This shows that konjac gum is more suitable for formulations where taste and smell neutrality are important, such as medicines and food products. Confirmatory tests using Benedict's and Fehling's solutions showed positive results for both gums, confirming the presence of polysaccharides, it indicates that both materials are carbohydrate-based and can act as good thickening, binding, and gelling agents**.** Moisture content analysis showed that konjac gum had the highest moisture content, followed by tamarind gum, while HPMC had the lowest. Higher moisture content means better water absorption, but it may slightly affect storage stability. However, it also improves swelling and gel formation, which is useful in controlled drug release systems. The pH of both gums was slightly acidic to near neutral. Tamarind gum showed pH between 5.6 and 5.9, while konjac gum ranged from 6.0 to 6.3. HPMC remained around 6.8. All values were within safe limits, showing that both natural gums are suitable for pharmaceutical use without causing irritation. Swelling index results showed that konjac gum had the highest swelling ability, followed by tamarind gum, while HPMC showed the lowest. This indicates that konjac gum absorbs more water and expands more, making it useful in tablets that require fast disintegration or controlled drug release. Viscosity studies showed that both gums increased in thickness with concentration. Konjac gum had the highest viscosity, followed by tamarind gum. At higher concentration, tamarind gum even performed better than HPMC, it means both gums can act as good thickening and suspending agents. Gel strength results followed the same pattern, where konjac gum formed the strongest gel, showing good network formation and water retention ability. This makes it useful in gels, controlled release systems, and semisolid formulations. Solubility testing showed that konjac gum dissolves in both hot and cold water, tamarind gum mainly in hot water, while HPMC dissolves in cold water. This difference is important for selecting suitable processing conditions during formulation. Overall, the study concludes that both tamarind seed gum and konjac root gum have strong functional properties. However, konjac gum showed better performance in most parameters. Therefore, both gums can be considered good, safe, eco-friendly, and low-cost alternatives to synthetic polymers like HPMC in pharmaceutical formulations.

CONCLUSION

Capsule shells are usually made from animal gelatin, but religious, ethical, and safety concerns have increased the need for plant-based alternatives. In this study, gums extracted from Tamarindus indica seeds and Amorphophallus konjac roots were evaluated and compared with the standard polymer hydroxypropyl methylcellulose (HPMC), as natural gelling agents for gel film. The gums were extracted using a simple hot water method, making the process economical and eco-friendly. Both test sample showed positive results against the standard HPMC in terms of gelling and film-forming potential. Konjac gum showed excellent swelling and water absorption properties, indicating its strong hydrophilic nature and excellent water-retention property, however excessive absorbability may adversely affect gel film preparation by producing overly viscous or unstable films. Tamarindus indica seed gum showed suitable gel forming ability with comparatively balanced swelling behavior and enhanced stability. According to the observations, it can be concluded that both test sample possess significant potential as eco-friendly, biodegradable, and non-animal-derived gelling agents. These study suggest that, the combination of tamarind seed gum and konjac gum may provide a synergistic effect, with balanced properties. Since plant-based gums overcome issues related to animal gelatin, such as dietary restrictions and contamination risks, these test sample polymers may serve as promising alternatives for developing capsule shells.

REFERENCES

1. Pavlath, A. E., & Orts, W. (2009). Edible films and coatings: Why, what, and how? In Edible Films and Coatings for Food Applications (pp. 1–23)
2. Ramos, M., Valdés, A., Beltrán, A., & Garrigós, M. C. "Gelatin-Based Films and Coatings for Food Packaging Applications." Coatings, 2016; 6(4): 41.
3. Mirghani, M. E. S., et al. (2014). "Tamarind seed polysaccharide.

4. Pharmaceutical Science Schrieber, R., & Gareis, H. (2007). Gelatin Handbook: Theory and Industrial Practice. Wiley-VCH.
5. Pharmaceutical Science Rowe, R. C., Sheskey, P. J., & Quinn, M. E. (2009). Handbook of Pharmaceutical Excipients (6th ed.). Pharmaceutical Press.
6. Slavin, J. (2013). "Fiber and prebiotics: mechanisms and health benefits." Nutrients, 5(4): 1417–1435.
7. Zhang, Y., etal.(2012). Extraction and characterization of plant polysaccharides.
8. Chen, J., Li, J., & Li, B.(2011). Extraction and characterization of glucomannan from konjac tubers.
9. Sanyang, M. L., Sapuan, S. M., Jawaid, M., Ishak, M. R., & Sahari, J. (2016). Tamarind seed polysaccharide-based edible films and coatings.
10. Kokate, C.K., Purohit, A.P., & Gokhale, S.B.(2010). Pharmacognosy (46th ed.). Nirali Prakashan.
11. Shauli L, Salomon E. A Simple method for measuring agar gel strength. Phycology 2025; 5,6.