

## FORMULATION AND DEVELOPMENT OF IMMEDIATE RELEASE TABLETS BY INCORPORATING NATURAL BIOPOLYMERS: A REVIEW

Ms. Nita R. Sid\*<sup>1</sup>, Ms. Nikita L. Chuyekar<sup>1</sup>, Ms. Sakshi G. Desai<sup>1</sup>, Mr. Swapnil S. Patil<sup>2</sup>

<sup>1</sup>Anandi Pharmacy College, Kalambe Tarf Kale, Kolhapur, Maharashtra, India.

<sup>2</sup>Assistant Professor, Anandi Pharmacy College, Kalambe Tarf Kale, Kolhapur, Maharashtra, India.



\*Corresponding Author: Ms. Nita R. Sid

Anandi Pharmacy College, Kalambe Tarf Kale, Kolhapur, Maharashtra, India.

DOI: <https://doi.org/10.5281/zenodo.19507728>

**How to cite this Article:** Ms. Nita R. Sid\*<sup>1</sup>, Ms. Nikita L. Chuyekar<sup>1</sup>, Ms. Sakshi G. Desai<sup>1</sup>, Mr. Swapnil S. Patil<sup>2</sup> (2026). Formulation And Development Of Immediate Release Tablets By Incorporating Natural Biopolymers: A Review. European Journal of Pharmaceutical and Medical Research, 13(4), 395–397.

This work is licensed under Creative Commons Attribution 4.0 International license.



Article Received on 15/03/2026

Article Revised on 05/04/2026

Article Published on 10/04/2026

### ABSTRACT

Immediate release (IR) drug delivery systems are widely preferred in oral pharmaceutical formulations due to their rapid disintegration and fast drug release, which result in quick therapeutic action and improved patient compliance. Natural biopolymers have emerged as promising excipients in IR tablet formulation owing to their biocompatibility, biodegradability, low toxicity, cost-effectiveness, and wide availability. These polymers can function as disintegrants, binders, diluents, and release modifiers, offering viable alternatives to synthetic excipients. The present review highlights formulation strategies for IR tablets, the role and mechanisms of action of natural biopolymers, their extraction and characterization techniques, evaluation parameters, and recent advancements in this field. Advantages, limitations, and future prospects of natural biopolymer-based immediate release tablets are also discussed.

**KEYWORDS:** Immediate release tablets; Natural biopolymers; Disintegrants; Tablet formulation; Fast drug release; Herbal excipients.

### INTRODUCTION

Oral drug delivery remains the most preferred route of administration due to its convenience, safety, patient compliance, and cost-effectiveness. Among various oral dosage forms, tablets represent more than 70% of marketed pharmaceutical products. Immediate release (IR) tablets are designed to disintegrate rapidly in gastrointestinal fluids and release the active pharmaceutical ingredient (API) without any intentional delay.

The performance of IR tablets is governed by the disintegration–dissolution–absorption sequence. According to the Noyes–Whitney equation, the dissolution rate is directly proportional to the surface area exposed to the dissolution medium. Rapid tablet disintegration increases surface area, thereby enhancing drug dissolution and absorption, resulting in a faster onset of therapeutic action.

In recent years, there has been growing interest in the use of natural biopolymers as pharmaceutical excipients. These polymers are derived from plant, microbial, algal, or animal sources and mainly include polysaccharides, proteins, gums, mucilages, and fibers. Natural biopolymers possess intrinsic swelling, hydration, and gelling properties, making them suitable for use as disintegrants, binders, diluents, stabilizers, and release modifiers.

The use of natural biopolymers aligns with the concept of “green pharmacy,” emphasizing sustainability, eco-friendly manufacturing, and biocompatibility. Polymers such as starch, guar gum, pectin, gum acacia, chitosan, xanthan gum, and isabgol husk have demonstrated excellent functionality comparable to synthetic disintegrants. Therefore, this review aims to compile and discuss the role of natural biopolymers in the formulation and development of immediate release tablets.

## IMMEDIATE RELEASE TABLETS: AN OVERVIEW

Immediate release tablets are solid oral dosage forms intended to disintegrate and dissolve rapidly after administration. According to pharmacopeial standards, IR tablets generally disintegrate within 5–15 minutes unless otherwise specified.

### Advantages of Immediate Release Tablets

- Rapid onset of therapeutic action
- Simple and economical manufacturing process
- Broad patient acceptability
- High stability and long shelf life
- Reduced complexity of formulation

### Formulation Requirements

An ideal IR tablet should exhibit:

- Adequate mechanical strength
- Rapid disintegration and dissolution
- Acceptable mouthfeel and ease of swallowing
- Stability under environmental conditions

## ROLE OF POLYMERS IN IMMEDIATE RELEASE TABLETS

Polymers play a critical role in determining the performance of IR tablets. Their major functions include.

### Disintegrants

Natural polymers promote tablet breakup by:

- Swelling
- Wicking (capillary action)
- Deformation recovery

### Binders

They provide cohesiveness and mechanical integrity to tablets.

### Diluents

Polymers increase bulk and improve powder flow properties.

### Release Modifiers

Certain polymers influence drug dissolution behavior. Synthetic disintegrants, although effective, may exhibit drawbacks such as higher cost, lack of biodegradability, and potential irritation. Natural biopolymers offer safer and economical alternatives.

## NATURAL BIOPOLYMERS USED IN IMMEDIATE RELEASE TABLETS

### Starch and Modified Starches

- Sources: Maize, potato, rice, cassava, *Amorphophallus* species
- Functions: Disintegrant, binder, filler
- Modified starches show improved swelling and compressibility

### Pectin

- Derived from citrus peels and apple pomace

- Exhibits excellent swelling and gelling properties
- Acts as binder and disintegrant

### Guar Gum

- Extracted from *Cyamopsis tetragonoloba*
- Highly hydrophilic, used in low concentrations

### Gum Acacia

- Obtained from *Acacia senegal*
- Acts as binder and stabilizer

### Xanthan Gum

- Microbial polysaccharide
- Improves disintegration and dissolution at low concentration

### Chitosan

- Obtained from chitin deacetylation
- Exhibits wicking action and biodegradability

### Isabgol (Psyllium Husk)

- Rich in mucilage
- Excellent swelling and superdisintegrant properties

### Locust Bean Gum

- Galactomannan polysaccharide
- Exhibits swelling and film-forming properties

## EXTRACTION AND CHARACTERIZATION OF NATURAL BIOPOLYMERS

### Extraction Methods

- Aqueous extraction
- Acid/alkaline treatment
- Solvent precipitation
- Dry milling

### Characterization Techniques

- Organoleptic evaluation
- Swelling index
- pH and solubility studies
- FT-IR analysis
- DSC/TGA
- XRD
- Viscosity measurement
- Microbial load testing

## MECHANISMS OF ACTION

- Swelling mechanism
- Wicking action
- Deformation recovery
- Binder-mediated disintegration

## FORMULATION APPROACHES

- Direct compression
- Wet granulation
- Dry granulation

## EVALUATION OF IMMEDIATE RELEASE TABLETS

### Pre-compression Parameters

- Angle of repose
- Bulk and tapped density
- Carr's index
- Hausner's ratio

### Post-compression Parameters

- Hardness
- Thickness
- Weight variation
- Friability
- Disintegration time
- Wetting time
- In-vitro dissolution studies

## ADVANTAGES OF NATURAL BIOPOLYMERS

- Biodegradable and biocompatible
- Economical and renewable
- Non-toxic and eco-friendly
- Excellent swelling efficiency

## LIMITATIONS

- Microbial contamination
- Batch-to-batch variability
- Lower flow properties
- Need for modification in some cases

## RECENT ADVANCES

- Cross-linked natural polymers
- Nano-based biopolymers
- Spray-dried mucilage powders
- Hybrid natural-synthetic systems
- Utilization of *Amorphophallus campanulatus* starch and other novel sources

## CONCLUSION

Natural biopolymers offer a sustainable and effective alternative to synthetic excipients in immediate release tablet formulation. Their biodegradability, safety, and functional versatility make them ideal candidates for modern pharmaceutical applications. Advances in extraction and modification techniques have further enhanced their performance, supporting their growing role in green and sustainable drug delivery systems.

## REFERENCES

1. Banker GS, Rhodes CT. *Modern Pharmaceutics*. 4th ed. Marcel Dekker; 2002.
2. Aulton ME, Taylor K. *Aulton's Pharmaceutics: The Design and Manufacture of Medicines*. 5th ed. Elsevier; 2018.
3. Nilima S, et al. Natural polymers as disintegrants in IR tablets. *Int J Pharm Sci Rev Res*, 2019; 57(1): 45–52.
4. Rowe RC, Sheskey PJ, Quinn ME. *Handbook of Pharmaceutical Excipients*. 6th ed. Pharmaceutical Press, 2009.

5. Jani GK, et al. Gums and mucilages as excipients in drug delivery systems. *Asian J Pharm Sci*, 2020; 15: 563–579.
6. Singh P, et al. Application of pectin in pharmaceutical formulations. *J Control Release*, 2017; 256: 10–21.
7. Patel M, et al. Natural disintegrants: an overview. *J Pharm Sci Biosci Res*, 2018; 8(3): 114–124.
8. Thakur VK, et al. Starch-based polymers in drug delivery. *Carbohydr Polym*, 2018; 173: 379–396.
9. Shirwaikar AA, et al. Herbal excipients in formulation development. *Indian J Pharm Sci*, 2008; 70(4): 415–422.
10. Upadhyay A, et al. Chitosan in oral drug delivery. *Int J Biol Macromol*, 2019; 126: 144–158.
11. Kamat V, et al. Guar gum-based excipients: properties and applications. *J Appl Pharm Sci*, 2021; 11(2): 1–7.
12. Pawar HA, et al. Natural superdisintegrants for fast dissolving formulations. *Pharm Development Tech*, 2018; 23(7): 610–622.