International Journal of Phytopharmacology
Review Article

www.onlineijp.com

e- ISSN 0975 – 9328
Print ISSN 2229 – 7472

RESINS, GUMS, AND MUCILAGES: THERAPEUTIC POTENTIAL AND PHARMACEUTICAL USE

Sai Neha Sri N[1]*, Naga Greeshma M[1], Divya Sri N[1], Lahari B[1], Dr Shireesha K[2]

[1]Pharm. D, V Year Student, Department of Pharmacy Practice, KLR Pharmacy College, Paloncha, Telangana, India.
[2]Assistant Professor, Department of Pharmacy Practice, KLR Pharmacy College, Paloncha, Telangana, India.

ABSTRACT

Natural polymers with great therapeutic and pharmaceutical potential include resins, gum, and mucilage. These natural resources and their various properties are important in contemporary drug preparations and traditional medicine. Excipients that are employed to make tablets, capsules, controlled-release systems, and topical preparations are resins, gums, and mucilages. They have been studied as anti-inflammatory, antimicrobial, antioxidant, gastroprotective and immunomodulatory in the management of several conditions such as arthritis, gastrointestinal diseases and wound healing. In addition, they are biocompatible, biodegradable, and are sustainably sourced, among other qualities that present them as alternatives to synthetic polymers. Such obstacles as fluctuation in natural sources and the necessity of standardization, however, persist. The developments in structural modifications, artificial intelligence modeling and applications in regenerative medicine and 3D-printed systems are very promising in the improvement of their application in drug delivery and tissue engineering. This review explains the classification, treatment characteristics, and applications of such natural polymers in industries and their future in other fields.

Key words: Resins, Gums, Mucilages, Drug Delivery, Regenerative Medicine

Corresponding Author: N Sai Neha Sri **E-mail: sainehasrinarala@gmail.com**

Access this article online	
Home Page: http://onlineijp.com/	Quick Response code

Received:21.02.2026	**Revised**:25.02.2026	**Accepted**:13.03.2026

INTRODUCTION

Plant-based resins, gums, and mucilages are naturally occurring materials that are known to have structural, functional and therapeutic value. (Shiam MAH, *et al*., 2025& Martinotti S *et al* 2025) Resins are nonvolatile amorphous substances that are usually released by plants in response to injury and that dissolve in organic solvents but are insoluble in water. Plant exudates which are pathological or physiological and mostly made of complex polysaccharides that dissolve or swell easily in water to create viscous solutions are called gums. Mucilages on the contrary are normal products of metabolism that are present in plant cells and they are defined by its high hydrophilicity and its ability to develop gels. These are natural polymers, which are mostly derived by the use of trees, shrubs, seeds, leaves and the sea which means that they are biodegradable and can be renewed which is why they are seen as an attractive alternative to synthetic excipients Medicinal Resin Ancient civilizations use resins, gums and mucilages, which were highly important in traditional medicine systems like Ayurveda, Unani, Traditional Chinese Medicine and Greco-Arab medicine.(Fernández-Martínez MC *et al.,* 2024 & Van Rooyen B *et al.,* 2024) Both myrrh and frankincense had antiseptic, anti-inflammatory, and wound-healing properties and gums and mucilages were widely used as demulcents, laxatives, and anti-inflammatory agents in the gastrointestinal and respiratory system. These substances of nature were also used as binders, to suspend and provide protection to the substances used in earlier pharmaceuticals thus indicating their extensive applicability in drug preparations and therapy. Natural

polymers have again attracted scientific and industrial interest in recent years as some increasingly question the toxicity, environmental persistence and regulatory issues surrounding synthetic polymers. (Yang Y, Sun X, *et al*., 2024) The resins, gums, and mucilages have been of relevance due to their eco-compatible, bio-compatible, and economical properties with various pharmaceutical applications which include; controlled drug delivery, tissue engineering and nanocarrier systems. (Matini *A et al.*, 2025) Functional versatility these further improvements in polymer characterization, modification methods, and quality standardization have made them applicable to the modern dosage form and biomedical technologies.

Objectives and Scope of the Review

The current review will give an overall description of resin, gum, and mucilages with a specific focus on their natural sources, physicochemical properties, and pharmaceutical importance. (Parvin N *et al*., 2025 & Muthoni A *et al*., 2025) It discusses their conventional and modern uses, functionality mechanisms as excipients, and use in advanced systems of drug delivery. Also, issues of variability, standardization, and regulatory acceptance are discussed, and future opportunities of research and industrial application of these natural polymers in sustainable pharmaceutical development are outlined.

Colon-Targeted Delivery and Transdermal Films

Colonic microflora can easily degrade natural polysaccharide through enzyme action and this is what makes them an attractive delivery system of drugs to the colon. (Nining N *et al.,* 2025) These polymers are not completely degraded in the upper gastrointestinal tract and liberate drugs selectively in the colon. Mucilages and gums have been used as film forming and rate regulating agents in transdermal drug delivery and have been found to enhance flexibility, adhesiveness and prolonged drug permeation through the skin. (Abdi G *et al.,* 2024 & Tahmouzi S, *et al*., 2023)

Use in Cosmetics and Nutraceuticals

In addition to pharmaceuticals, resins, gums, and mucilages are of great importance to the cosmetic and nutraceutical formulations because of their safety profile and their multifunctional work. Their use in these areas has also been inspired by the demand among consumers on natural and sustainable ingredients. (Naini MA *et al.,* 2023)

Emulsifiers and Stabilizers

Gums have been utilized in cosmetic and nutraceutical products and serve as natural stabilizers and emulsifiers in reducing interfacial tension to avoid phase separation. (Rodríguez-González F *et al.,* 2021)They enhance textures, mouthfeel and product consistency and can be used in creams, lotions, syrups, and functional beverages because of their viscosity improving properties. (Ammon HPT. *et al*, 2002 & Bahú JO, *et al* 2021)

Skin-Soothing and Protective Agents

Mucilages and some resins have relaxing, humidifying and protective properties on the skin and mucous membranes. (Banaś K *et al*., 2021 & Corazza E, *et al*., 2022) They have film forming and water retention properties that assist them in keeping the skin hydrated, less irritated, and enhance barrier activity. These properties facilitate their extensive application in dermatological preparations, herbal cosmetics and nutraceutural products directed to the area of gastrointestinal and skin health. (Gara-Ali M *et al* 2025)

Comparisons with Synthetic Polymers

In comparison to synthetic polymers, natural polymers tend to be more biocompatible, less toxic and more widely accepted by patients. (Kaspute G *et al*., 2025) Although synthetic materials can be considered more mechanically strong and dependable, they tend to provoke the questions connected with the safety, accumulation, and preservation of the materials during the long-term period. (Vidić M *et al.* 2025) Although variability and standardization are difficult to overcome, natural polymers are a safer and more sustainable option, especially in oral, topical, and controlled drug delivery

Table 1: Classification of Natural Polymers (Resins, Gums, and Mucilage)

Polymer Type	Source	Properties	Applications
Resins	Plants (e.g., Boswellia, Commiphora)	Hydrophobic, insoluble in water	Anti-inflammatory, wound healing, cosmetics
Gums	Trees, shrubs, seeds (e.g., Acacia)	Hydrophilic, water-soluble, thickening	Excipients, emulsifiers, stabilizers in pharma
Mucilages	Seeds, leaves, roots (e.g., Plantago ovata, Aloe)	Gel-forming, high water-binding capacity	Gastroprotective, demulcent, topical formulations

Table 2: Therapeutic Properties of Resins, Gums, and Mucilages

Therapeutic Property	Polymer Type	Bioactive Components	Common Uses
Anti-inflammatory	Boswellia, Gum Guggul	Boswellic acids, Gum guggulsterone	Arthritis, inflammatory bowel disease, joint pain
Antimicrobial	Resins, Gums	Phenolics, terpenoids, essential oils	Skin infections, oral health, preservatives
Antioxidant	Gums, Mucilages	Polyphenols, flavonoids	Scavenging free radicals, protection against oxidative stress
Gastroprotective	Mucilages (e.g., Aloe, Hibiscus)	Polysaccharides, mucilage components	Soothing action in gastritis, ulcers
Immunomodulatory	Boswellia, Aloe	Triterpenes, polysaccharides	Immune support, wound healing

Table 3: Applications of Natural Polymers in Pharmaceutical, Food, and Cosmetic Industries

Industry	Application	Polymer Types Used	Key Benefits
Pharmaceutical	Excipients in tablets, controlled-release systems	Gums, Mucilages, Resins	Biocompatibility, controlled release
Food Industry	Emulsifiers, stabilizers, thickeners	Guar gum, Acacia gum, Mucilage from Aloe	Texture enhancement, stability, longer shelf life
Cosmetics	Moisturizers, skin care products	Mucilages, Resins, Gums	Hydration, skin-soothing, anti-aging

Figure:1 Physicochemical and Pharmacognostic Properties

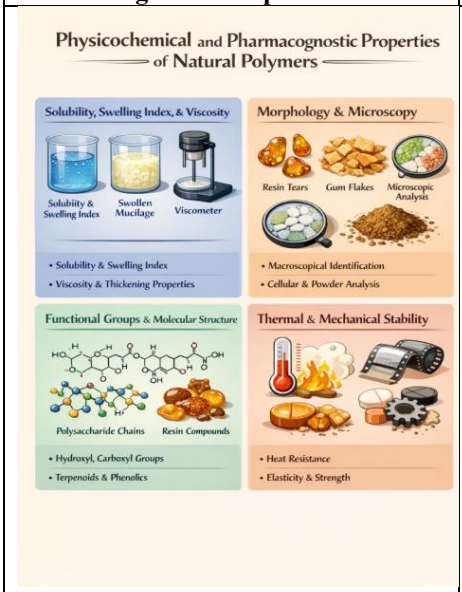

Figure:2 Extraction and Purification Techniques

Figure:3 Pharmaceutical Applications

Marker-Based Identification

The Marker-based identification has become an important method of authentication and quality control of natural polymers. (Dresler S *et al*., 2025 & Rocha MEB, *et al.,* 2024) These indicators are commonly particular chemical compounds or phytochemical constituents which are used as a marker of the appropriate species or type of plant

Challenges in Standardizing Natural Mixtures

There are a number of difficulties associated with standardising natural mixtures such as resins, gum and mucilages because of the variation present in their chemical makeup. (Kellersztein I *et al.,* 2024 & Lhotská I, *et al*., 2024) The quality and properties of these materials may be affected by various factors which may

include geographical location, harvest time, plant species and the extraction method.

Industrial and Commercial Perspectives

There have been impressive growth of natural polymers like resins, gums, and mucilages in the various industries including food, pharmaceutical and cosmetic industries. (Yang Z *et al*., 2025 & Antunes EC *et al.,* 2024) The polymers are used as emulsifiers, stabilizers, and thickening agents in the food sector to enhance the texture, viscosity, and shelf life of different products in the food industry a few examples are sauces, dressings, and soft drinks.

Innovations in Gum and Mucilage-Based Biomaterials

Natural polymers are becoming more capable of use in industry with the latest advancements in the field of gum and mucilage-based biomaterials. (Zheng R, *et al.*, 2024) The research is aimed at the modification and the enhancement of the properties of these polymers to enhance their functionality and increase their scope of applications.

CONCLUSION

Resins, gums, and mucilages are the natural polymers that have been widely used as therapy and have a tremendous pharmaceutical potential. The diversity of their application in the modern drug preparations, their biocompatibility, their biodegradability as well as their sustainability render them viable alternatives to synthetic polymers in pharmaceutical, food and cosmetic industries. The natural ingredients are very diverse in functionality including, but not limited to: excipients in controlled release formulation, binders, disintegrants and suspending agents, therapeutic properties, such as: anti-inflammatory, anti-microbial and anti-oxidant effects. However, challenges that involve irregularities in natural sources, the need in the standardization that is regular, and the complications of ensuring the quality consistency are present. The future of these polymers is being developed in the direction of structural modification, modelling polymer behavior using AI, and regenerative medicine and 3D printing. Due to further research and innovation, resins, gums, and mucilages will still play an even bigger role in the design of targeted drug delivery systems, personalized medicine and sustainable and greener pharmaceutical functions.

REFERENCES

Abdi G, Tariq M, Uthappa UT, Patil N, Raj NS, Jain M, et al. Tragacanth gum-based hydrogels for drug delivery and tissue engineering applications. *Frontiers in Materials*, 11, 2024.

Abd-Rabou AA, Edris AE. Frankincense essential oil nanoemulsion specifically induces lung cancer apoptosis and inhibits survival pathways. *Cancer Nanotechnology*, 13, 2022.

Ammon HPT. Boswellic acids (components of frankincense) as the active principle in treatment of chronic inflammatory diseases. *Wiener Medizinische Wochenschrift*, 152, 2002, 373-378.

Antunes EC, Cintra B, Temmink H, Schuur B, Bredel M. Fractionation of extracellular polymeric substances by aqueous three-phase partitioning systems. *Industrial and Engineering Chemistry Research*, 63, 2024, 10748-10760.

Bahú JO, De Andrade LRM, De Melo Barbosa R, Crivellin S, Da Silva AP, Souza SDA, et al. Plant polysaccharides in engineered pharmaceutical gels. *Bioengineering*, 9, 2022, 376.

Banaś K, Harasym J. Natural gums as oleogelators. *International Journal of Molecular Sciences*, 22, 2021, 12977.

Chrzanowska E, Denisow B, Ekiert H, Pietrzyk Ł. Metabolites obtained from *Boraginaceae* plants as potential cosmetic ingredients: A review. *Molecules*, 29, 2024, 5088.

Corazza E, Di Cagno MP, Bauer-Brandl A, Abruzzo A, Cerchiara T, Bigucci F, et al. Drug delivery to the brain: In situ gelling formulation enhances carbamazepine diffusion through nasal mucosa models with mucin. *European Journal of Pharmaceutical Sciences*, 179, 2022, 106294.

De Medeiros VPB, De Oliveira KAR, Queiroga TS, De Souza EL. Development and application of mucilage and bioactive compounds from *Cactaceae* to formulate novel and sustainable edible films and coatings to preserve fruits and vegetables: A review. *Foods*, 13, 2024, 3613.

Dresler S, Baczewska I, Mykhailenko O, Zidorn C, Sowa I, Wójciak M, et al. Extraction of lichen bioactive compounds using volatile natural deep eutectic solvents and comparative analytical approaches. *Scientific Reports*, 15, 2025.

Fernández-Martínez MC, Jiménez-Martínez C, Jaime-Fonseca MR, Alamilla-Beltrán L. Extraction of purple prickly pear (*Opuntia ficus-indica*) mucilage by microfiltration, composition, and physicochemical characteristics. *Polymers*, 16, 2024, 3383.

Gara-Ali M, Ben-Miled H, Mourali D, Zouaoui E, Ouada HB, Ben-Mahrez K, et al. Physicochemical characterization of sulfated polysaccharides from the thermophilic cyanobacterium *Leptolyngbya* sp. CIN61 and their antimicrobial and anti-proliferative activities. *Chemistry and Biodiversity*, 22, 2025.

Kaspute G, Ivaskiene T, Ramanavicius A, Ramanavicius S, Prentice U. Terpenes and essential oils in pharmaceutics: Applications as therapeutic agents and penetration enhancers with advanced delivery systems for improved stability and bioavailability. *Pharmaceutics*, 17, 2025, 793.

Kellersztein I, Tish D, Pederson J, Bechthold M, Daraio C. Multifunctional biocomposite materials from *Chlorella vulgaris* microalgae. *Advanced Materials*, 37, 2024.

Lhotská I, Kholová A, Švec F, Šatínský D. Nanofibers prepared from synthetic polymers and biopolymers as advanced extraction materials for sample preparation prior to liquid chromatography. *TrAC Trends in Analytical Chemistry*, 180, 2024, 117912.

Martinotti S, Bonsignore G, Ranzato E. Propolis: A natural substance with multifaceted properties and activities. *International Journal of Molecular Sciences*, 26, 2025, 1519.

Matini A, Naghib SM. Microwave-assisted natural gums for drug delivery systems: Recent progresses and advances over emerging biopolymers and technologies. *Current Medicinal Chemistry*, 32, 2025, 2547-2571.

Muthoni A, Anyango A, Wanjala HV. Mucilage-based nanocarriers for targeted cancer therapy—design, functionalization, and therapeutic potential. *Drug Development and Industrial Pharmacy*, 51, 2025, 1439-1461.

Naini MA, Zargari-Samadnejad A, Mehrvarz S, Tanideh R, Ghorbani M, Dehghanian A, et al. Anti-inflammatory, antioxidant, and healing-promoting effects of *Aloe vera* extract in experimental colitis in rats. *Evidence-Based Complementary and Alternative Medicine*, 2021, 2021, 1-12.

Nining N, Wardhana YW, Rusdiana T, Hariyanti H. Deep eutectic solvents in polymeric drug carriers: Insights into release behavior and functional integration. *ChemistryOpen*, 14, 2025.

Parvin N, Aslam M, Joo SW, Mandal TK. Nano-phytomedicine: Harnessing plant-derived phytochemicals in nanocarriers for targeted human health applications. *Molecules*, 30, 2025, 3177.

Rocha MEB, Kakuda L, Souto EB, Oliveira WP. Extraction and characterization of *Plantago major* L. mucilage as a potential natural alternative over synthetic polymers for pharmaceutical formulations. *Sustainable Chemistry and Pharmacy*, 42, 2024, 101764.

Rodríguez-González F, Pérez-González J, Marín-Santibáñez BM, Muñoz-López CN, Vargas-Solano SV. Influence of age on molecular characteristics and rheological behavior of nopal mucilage. *Food Science and Nutrition*, 9, 2021, 6776-6785.

Shiam MAH, Ahmad I, Haque SS, Islam MS. A review of plant-derived gums and mucilages: Structural chemistry, film forming properties and application. *Journal of Plastic Film and Sheeting*, 41, 2025, 195-237.

Tahmouzi S, Meftahizadeh H, Eyshi S, Mahmoudzadeh A, Alizadeh B, Mollakhalili-Meybodi N, et al. Application of guar (*Cyamopsis tetragonoloba* L.) gum in food technologies: A review of properties and mechanisms of action. *Food Science and Nutrition*, 11, 2023, 4869-4897.

Van Rooyen B, De Wit M, Osthoff G, Van Niekerk J. Cactus pear mucilage (*Opuntia* spp.) as a novel functional biopolymer: Mucilage extraction, rheology and biofilm development. *Polymers*, 16, 2024, 1993.

Vidić M, Grujić-Letić N, Gligorić E, Teofilović B. Towards a green and sustainable valorization of *Salix amplexicaulis*: Integrating natural deep eutectic solvents and microwave-assisted extraction for enhanced recovery of phenolic compounds. *Sustainability*, 17, 2025, 6347.

Yang Y, Sun X, Peng C, Wei J, Yang X. The genus *Commiphora*: An overview of its traditional uses, phytochemistry, pharmacology, and quality control. *Pharmaceuticals*, 17, 2024, 1524.

Yang Z, Wang J, Wang H, Xie H, Zhang Y, Wang M. Simultaneous extraction and purification of polysaccharides and proteins from *Pleurotus ostreatus* using an aqueous two-phase system. *Journal of Food Science*, 90, 2025.

Zheng R, Xu S, Zhong S, Tong X, Yu X, Zhao Y, et al. Enhancing ion selectivity of nanofiltration membranes via heterogeneous charge distribution. *Environmental Science and Technology*, 58, 2024, 22818-22828.