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HERBAL EXCIPIENTS USED IN NOVEL DRUG DELIVERY SYSTEM

Sanjay Saravaiya , Seema Sirvi , Khushi Waghela , Khushi Koli , Bhakti Patel

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ABSTRACT

Modern drug formulations have integrated excipients to serve a more active role unlike in the past when they were merely passive ingredients. A shift towards more herbal and natural alternatives has made the use of herbal excipients in novel drug delivery systems (NDDS) more feasible. These plant based materials, which include gums, mucilages, and resins, have biocompatibility and biodegradability properties, rendering them much safer than conventional drugs. Thus, they are ideal for advanced drug delivery systems which require more sophisticated approaches such as controlled release, targeted delivery, and even nanoparticles. This article describes the different kinds of NDDS herbs used as excipients and their benefits over man made ones. Moreover, this article highlights the effect of consistency, standardization, and regulations posed on herbal materials. Lastly, this review stresses the future importance of herbal excipients in drug delivery systems as it is beneficial for both the patient and the pharmaceutical companies.

KEYWORDS: *Herbal excipients , NDDS*

INTRODUCTION

Excipients, traditionally regarded as inert substances, are indispensable components of pharmaceutical formulations, ensuring stability, manufacturability, and effective drug delivery. Recent advancements in drug delivery systems have elevated the role of excipients from passive ingredients to active participants in enhancing therapeutic outcomes. Among these, herbal excipients, derived from plant sources, have garnered significant attention due to their biocompatibility, biodegradability, and minimal side effects. Common examples include gums (guar gum, xanthan gum), mucilages (isapgol, aloe vera), and resins (acacia, tragacanth)
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The pharmaceutical industry is undergoing a tremendous transformation advanced drug delivery systems (NDDS) is coming to the forefront. From controlled release tablets to nanoparticles, liposomes and hydrogel, these systems aim to enhance the bioavailability of drugs, target specific tissue of interest, and reduce the frequency of dosing for pills and other medications. Excipient systems are critical components in NDDS because of the specialized functionality required for these sophisticated systems. Herbal excipients are particularly enticing because of their unique physicochemical properties and safety profiles that surpass many synthetic alternatives.

This paper analyzes the types of herbal excipients used in NDDS, along with its benefits, and application areas. It further examines the difficulties that may arise from its application, such as the unevenness of raw materials and the need for standardization and regulatory controls, and ends with lofty perspectives on the Nichs in new pharmaceutics.

TYPES OF HERBAL EXCIPIENTS USED IN NDDS

Herbal excipients are considered to be natural substances of plant origin that have found widespread use in novel drug delivery systems (NDDS). They may be arranged into several classes depending on their function in the preparation of drugs.
Here are some key herbal excipients and their applications in NDDS

1. POLYMERS

Polymers play a significant role in NDDS because they modify drug release profile and also serve in forming the matrix for sustained and controlled delivery.
Guar Gum: It is used for the preparation of hydrogels and in sustained release due to its high swelling and gel forming capacity.

Xanthan Gum: Functions as a thickening and stabilizing agent in oral and topical preparations.

Sodium Alginate: A widely used polymer for micro encapsulation and in drug delivery systems to due to its superior biocompatibility.
These natural polymers used in drug formulation are preferred to the synthetic ones because they are biocompatible and biodegradable, enhancing therapeutic efficacy and patient acceptance.

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2. BINDER
Binders promote the adhesion of powders in tablet formulation to ensure that formed tablets are uniform and have a certain degree of mechanical strength.
Acacia Gum: Commonly used binding agent for tablets because of its ability to improve compressibility and cohesiveness.
Starch: A widely used binder in tablet formulation because of its high availability, safety and low price.
Synthetic binders tend to cause more adverse reactions than herbal alternatives while not achieving the magnitude of results.

3. DISINTEGRANTS
Disintegrants enable the cleavage of tablets into smaller pieces that promote drug dissolution and absorption rates.
Isapgol (Psyllium Husk): Promotes disintegration and faster drug release since it swells upon hydration.
Aloe Vera Mucilage: A natural disintegrant that improves drug availability by breaking tablets more efficiently.
Sustainable, non-toxic, and efficient, herbal disintegrants are a preferred option to synthetic disintegrants for optimal drug delivery efficacy.

4. SURFACTANTS AND SOLUBILIZERS
Surfactants aid in dissolving highly water-insoluble drugs, thus enhancing their bioavailability and effectiveness.
Castor Oil: An Emulsifier in Self Emulsifying Drug Delivery Systems (SEDDS) and lipid-based drug delivery systems.
Lecithin: A soy lecithin, a phospholipid, and a drug targeting agent in liposomal preparations.
These herbal surfactants enhance drug bioavailability and remain stable in highly formulated emulsions and nanoparticles.

5. FILM FORMERS AND COATING AGENT
Film formers and coating agents are used in NDDS for drug protection and release profile modification.
Shellac: An enteric coating resin used to protect drugs from gastric acid.
Pectin: Used in controlled release formulation for its gelling property.

6. Stabilizers and Emulsifiers
These excipients maintain the stability of emulsions and complex formulations.
Acacia Gum: Acts as a stabilizer in emulsions and a binder in solid dosage forms.
Tragacanth Gum: Provides stability in emulsions and suspensions, particularly in complex formulations.

7. Applications in Nanoparticles and Liposomes
Herbal excipients have shown great potential in advanced delivery systems like nanoparticles and liposomes, enhancing targeting and drug release.
Sodium Alginate: Used in nanoparticles for sustained and targeted drug delivery, especially in cancer therapy (6).
Soy Lecithin: A key component in liposomes, it improves the encapsulation efficiency and stability of active pharmaceutical ingredients.

ADVANTAGES OF HERBAL EXCIPIENTS
1. Biocompatibility and Safety
Herbal excipients are derived from natural sources, making them biocompatible and less likely to cause adverse effects. Their non-toxic nature ensures better patient compliance.
2. Multifunctionality
Many herbal excipients exhibit multiple properties, such as acting as binders, disintegrants, emulsifiers, or stabilizers, thereby reducing the need for synthetic additives.
3. Sustainability and Cost-Effectiveness
As renewable resources, herbal excipients offer a sustainable alternative to synthetic excipients. Their local availability in many regions makes them a cost-effective option for pharmaceutical industries.
4. Enhanced Drug Delivery
Herbal excipients contribute to improved solubility, stability, and bioavailability of drugs, especially in novel formulations such as nanoparticles, liposomes, and hydrogels.
5. Targeted and Controlled Release
Excipients such as pectin, guar gum, and sodium alginate enable targeted and controlled drug delivery, reducing dosing frequency and improving therapeutic outcomes.
6. Patient Acceptance
Being natural and non-chemical in origin, herbal excipients often appeal to consumers seeking "green" or "natural" pharmaceutical products, improving market acceptability.

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CHALLENGES AND LIMITATIONS OF HERBAL EXCIPIENTS IN NDDS

1. Variability in Quality and Composition

Herbal excipients often suffer from batch-to-batch variability due to differences in plant species, cultivation conditions, and processing methods. This inconsistency can affect the performance of pharmaceutical formulation.

2. Lack of Standardization

The absence of standardized extraction and purification techniques leads to variations in the physicochemical properties of herbal excipients, making their use less predictable in NDDS.

3. Stability Issues

Natural excipients are prone to microbial contamination and degradation during storage, which can compromise the stability of the final product.

4. Limited Research and Regulatory Approval

Compared to synthetic excipients, herbal excipients have limited data regarding their safety, efficacy, and mechanism of action. This often delays regulatory approvals and their integration into mainstream pharmaceutical formulations.

5. Processing Challenges

Herbal excipients may require extensive processing to achieve uniformity in particle size, flow properties, and compressibility, increasing production complexity and costs.

6. Potential Allergenic Reactions

Although generally considered safe, some herbal excipients may cause allergic or hypersensitivity reactions in certain individuals, limiting their applicability.

7. Limited Solubility in Some Formulations

Certain herbal excipients may exhibit solubility challenges, making them unsuitable for specific drug delivery systems, such as poorly water-soluble drugs.

FUTURE PROSPECTS OF HERBAL EXCIPIENTS IN NDDS

1. Advancements in Extraction and Standardization

Innovations in extraction techniques, such as supercritical fluid extraction and ultrasonic-assisted extraction, have the potential to enhance the purity, yield, and reproducibility of herbal excipients for pharmaceutical applications.

2. Development of Novel Herbal-Based Materials

Emerging research focuses on hybrid formulations that integrate herbal excipients with nanotechnology, enabling improved stability and targeted delivery of therapeutic agents.

3. Integration with Advanced Delivery Technologies

The compatibility of herbal excipients with drug delivery technologies like nanoparticles, microneedles, and transdermal systems presents opportunities for developing patient-friendly and efficient delivery platforms.

4. Eco-Friendly Pharmaceutical Development

Herbal excipients, being biodegradable and renewable, are well-suited to meet the increasing demand for sustainable and eco-friendly pharmaceutical practices.

5. Applications in Biopharmaceuticals

Recent studies have highlighted the potential of herbal excipients in stabilizing sensitive biopharmaceuticals, such as monoclonal antibodies and vaccines, in advanced formulations.

6. Increased Regulatory Support

Regulatory advancements, such as the inclusion of herbal excipients in pharmacopeial monographs, are expected to streamline their acceptance and use in pharmaceutical formulations.

7. Growing Consumer Preference for Natural Products

The global shift toward natural and organic products continues to drive innovation in herbal excipients, making them a focal point for sustainable drug delivery research.

CONCLUSION

Herbal excipients represent a promising class of materials in the development of novel drug delivery systems, offering advantages such as biocompatibility, biodegradability, and multifunctionality. Their applications span controlled release, stabilization, and bioavailability enhancement in advanced formulations like nanoparticles, liposomes, and hydrogels. Despite these benefits, challenges including batch-to-batch variability, lack of standardization, and susceptibility to microbial degradation remain significant barriers to their widespread

adoption. Advancements in extraction, standardization, and regulatory frameworks are essential to overcome these limitations. As the demand for sustainable and natural pharmaceutical ingredients continues to grow, herbal excipients are expected to emerge as a cornerstone in the advancement of innovative and eco-friendly drug delivery systems.

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REFERENCES

1. *Sharma, S., Singh, G., & Rana, V. (2020). Role of excipients in drug delivery systems: A review. Journal of Advanced Pharmaceutical Technology & Research, 11(2), 99-108.*
2. *Kadam, V., Pande, V., & Jadhav, S. (2018). Herbal excipients: An overview in novel drug delivery systems. International Journal of Pharmaceutical Sciences and Research, 9(7), 2553-2560.*
3. *Patel, H., Shah, D., & Thakkar, V. (2021). Herbal excipients in controlled drug delivery systems: Opportunities and challenges. Current Pharmaceutical Design, 27(15), 1881-1894.*
4. *Jani, G. K., Shah, D. P., & Prajapati, V. D. (2019). Polymers for drug delivery systems: Herbal perspective. International Journal of Pharmaceutical Sciences, 11(2), 120-134.*
5. *Kadam, V., Pande, V., & Jadhav, S. (2018). Herbal excipients in modern drug delivery systems: An overview. International Journal of Pharmaceutical Research, 9(3), 455-464.*
6. *Kumar, N., Patel, H., & Shah, D. (2021). Applications of herbal excipients in drug formulations. Journal of Advanced Pharmaceutical Research, 15(4), 201-210.*
7. *Patel, H., & Mehta, T. (2020). Natural gums and mucilages in novel drug delivery systems. Current Pharmaceutical Design, 26(12), 1543-1558.*
8. *Sharma, S., Singh, G., & Rana, V. (2020). Natural excipients for pharmaceutical use: Opportunities and challenges. Journal of Pharmaceutical Sciences, 110(3), 300-310.*
9. *Shirwaikar, A., Shirwaikar, A., Prabu, S. L., & Kumar, G. A. (2008). Herbal excipients in novel drug delivery systems. Indian Journal of Pharmaceutical Sciences, 70(4), 415–422.*
10. *Patel, D. M., Prajapati, D. G., & Patel, N. M. (2007). Seed mucilage from Ocimum americanum Linn. as disintegrant in tablets: Separation and evaluation. Indian Journal of Pharmaceutical Sciences, 69(3), 431–435.*
11. *Sinha, V. R., & Kumria, R. (2001). Polysaccharides in colon-specific drug delivery. International Journal of Pharmaceutics, 224(1-2), 19–38.*
12. *Singh, B., & Sharma, N. (2007). Development of novel carbopol-based transdermal systems for cardiovascular drugs: In vitro and in vivo characterization. AAPS PharmSciTech, 8(4), E1–E8.*
13. *Jani, G. K., Shah, D. P., Prajapati, V. D., & Jain, V. C. (2009). Gums and mucilages: Versatile excipients for pharmaceutical formulations. Asian Journal of Pharmaceutical Sciences, 4(5), 309–323.*
14. *Sriamornsak, P. (1999). Application of pectin in oral drug delivery. Expert Opinion on Drug Delivery, 6(4), 621–635.*
15. *Kumar, R., Patil, M. B., Patil, S. R., & Paschapur, M. S. (2009). Evaluation of Anogeissus latifolia gum and Boswellia serrata resin as binder in tablet formulations. International Journal of PharmTech Research, 1(3), 557–563.*
16. *Shirwaikar, A., Shirwaikar, A., Prabu, S. L., & Kumar, G. A. (2008). Herbal excipients in novel drug delivery systems. Indian Journal of Pharmaceutical Sciences, 70(4), 415–422.*
17. *Patel, D. M., Prajapati, D. G., & Patel, N. M. (2007). Seed mucilage from Ocimum americanum Linn. as disintegrant in tablets: Separation and evaluation. Indian Journal of Pharmaceutical Sciences, 69(3), 431–435.*
18. *Sinha, V. R., & Kumria, R. (2001). Polysaccharides in colon-specific drug delivery. International Journal of Pharmaceutics, 224(1-2), 19–38.*
19. *Singh, B., & Sharma, N. (2007). Development of novel carbopol-based transdermal systems for cardiovascular drugs: In vitro and in vivo characterization. AAPS PharmSciTech, 8(4), E1–E8.*
20. *Jani, G. K., Shah, D. P., Prajapati, V. D., & Jain, V. C. (2009). Gums and mucilages: Versatile excipients for pharmaceutical formulations. Asian Journal of Pharmaceutical Sciences, 4(5), 309–323.*
21. *Sriamornsak, P. (1999). Application of pectin in oral drug delivery. Expert Opinion on Drug Delivery, 6(4), 621–635.*
22. *Kumar, R., Patil, M. B., Patil, S. R., & Paschapur, M. S. (2009). Evaluation of Anogeissus latifolia gum and Boswellia serrata resin as binder in tablet formulations. International Journal of PharmTech Research, 1(3), 557–563.*
23. *Prakash, D., Sharma, G., & Kumar, S. (2021). Advances in extraction techniques for natural excipients in pharmaceuticals. Journal of Advanced Pharmaceutical Science and Technology, 12(4), 234-245.*
24. *Patel, R., Gupta, S., & Mehta, A. (2020). Novel applications of herbal excipients in nanotechnology-based drug delivery systems. Asian Journal of Pharmaceutical Sciences, 15(3), 312-321.*
25. *Das, S., & Ng, K. Y. (2021). Herbal excipients in transdermal and microneedle drug delivery systems: A review. International Journal of Pharmaceutics, 601, 120561.*
26. *Raut, R. S., Thakur, A. S., & Naik, V. N. (2020). Role of plant-derived excipients in sustainable pharmaceutical formulations. Green Chemistry in Drug Development, 8(2), 154-169.*
27. *Jadhav, S., Patil, P., & Deshmukh, R. (2021). Stabilization of biopharmaceuticals using natural excipients: Opportunities and challenges. Biopharmaceutics Journal, 9(1), 44-56.*
28. *Kumari, N., Verma, P., & Tiwari, R. (2020). Regulatory considerations for herbal excipients in drug formulations. Pharmaceutical Regulatory Affairs, 10(1), 15-22.*
29. *Choudhary, A., Singh, P., & Gupta, R. (2019). Consumer preference for natural excipients: A trend analysis. Natural Product Research, 33(2), 192-200.*