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Review Article

A Systematic Overview on The Emerging Landscape of Herbal Nanomedicines

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ABSTRACT

Herbal nanomedicines represent a transformative advancement in pharmaceutical sciences, integrating traditional herbal therapy with nanotechnology to overcome limitations of conventional formulations. Nanoformulations like liposomes, polymeric nanoparticles, solid lipid nanoparticles, and metallic nanostructures enhance solubility, stability, permeability, and bioavailability of herbal bioactives such as curcumin, quercetin, and resveratrol. Leveraging nanoscale dimensions (1–100 nm), they enable targeted delivery, sustained release, and superior efficacy against cancer, diabetes, inflammation, neurodegenerative disorders, and cardiovascular diseases. This approach amplifies pharmacological activity via improved cellular uptake and reduced first-pass metabolism, while minimizing toxicity, side effects, and dosing frequency to boost patient compliance. Preclinical studies show curcumin-loaded nanoparticles achieving 20-fold higher bioavailability and potent anti-tumor effects in xenograft models. Challenges persist in optimizing scalable methods (e.g., high-pressure homogenization), ensuring reproducibility, standardizing extracts, meeting regulatory standards (FDA/EMA), and evaluating long-term safety including nanotoxicity. Advances in characterization (DLS, TEM, HPLC), smart nanocarriers, and clinical translation promise to unlock herbal nanomedicines as safer, effective, personalized therapies in modern healthcare.

INTRODUCTION

Herbal Nanomedicines offer several key advantages over traditional herbal formulations. They improve solubility and stability of herbal compounds,significantly enhancing their bioavailability and therapeutic efficacy. Nanocarriers used in these formulations, such as nanoparticles, liposomes, and nanoemulsions, allow for targeted drug delivery, prolonged release, and better permeation and retention in tissues [1]. This results in improved pharmacological effects including anti-inflammatory, antioxidant, anticancer, and antidiabetic activities.

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Additionally, herbal nanomedicines reduce toxicity and side effects compared to conventional herbal or synthetic drugs. These benefits also include enhanced patient compliance through reduced dosing frequency

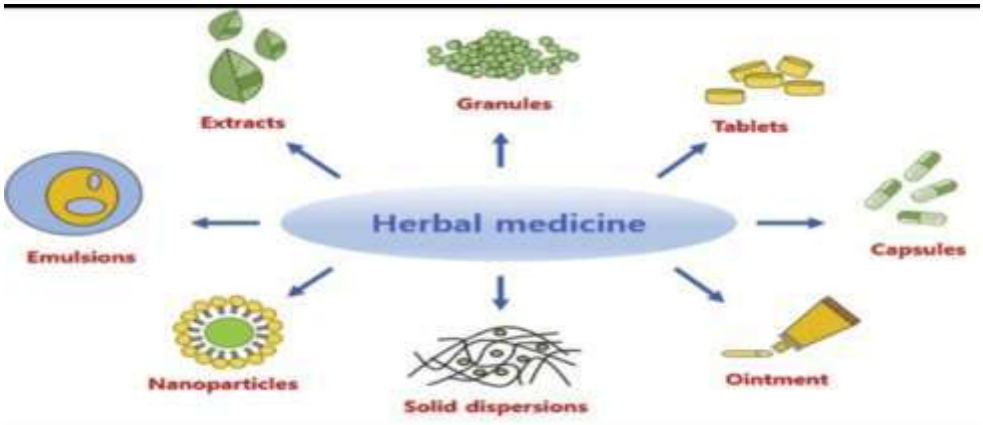


Fig no.01 : Different types of dosage forms prepared from herbal medicines.

However herbal nanomedicines face challenges such as the selection of suitable nanoformulations for specific herbal extracts, reproducibility in preparation methods, and optimization of physiochemical variables such as size of the particle, surface charge, and drug loading. There are also hurdles in crossing biological barriers and ensuring consistent therapeutic outcomes. Regulatory issues and lack of extensive clinical data remain key obstacles for widespread adoption. Overcoming these challenges requires systematic research and strategic development to fully realize the potential of herbal nanomedicines for chronic diseases such as cancer, diabetes, and infections [19].In Summary, herbal nanomedicines represent a promising intersection of traditional herbal therapy and advanced nanotechnology, offering improved

delivery and effectiveness with ongoing work needed to address formulation and regulatory challenges.

NEED FOR NANO TECHNOLOGY IN HERBAL MEDICINES:

Nanotechnology is increasingly needed in herbal medicines to address several inherent limitations of traditional herbal formulation [9]. Key reasons for the need include improving the bioavailability, stability, targeted delivery, and therapeutic efficacy of herbal compounds:

Table no.01 : How Nanotechnology enhances drug delivery efficiency.

How nanotechnology helps	Description
Enhanced Bioavailability	Nanoparticles improve absorption of herbal compounds with poor water solubility, increasing bioavailability and effectiveness.
Targeted Drug Delivery	Nanocarriers can deliver herbal actives specifically to target tissues or cells, reducing adverse effects and optimization of curative effects
Controlled/Sustained Release	Nanotechnology enables controlled release of herbal drugs, simpli dosing frequency and enhancing patient adherence .
Increased Stability and Shelf Life	Nano-encapsulation protects sensitive herbal ingredients from degradation by heat, light, and oxygen, enhancing stability.
Improved Solubility and Synergistic Effects	Nanotech improves solubility of poorly soluble compounds and can enhance antimicrobial and pharmacological activities when combined with nanoparticles.

Modernizing Traditional Medicine	Integration of nanotech modernizes herbal medicine formulations, making them safer, more effective, and allowing for personalized treatments.

This table encapsulates how nanotechnology addresses traditional herbal medicine challenges by improving delivery, stability, and efficacy for better therapeutic outcomes [27].

TYPES OF HERBAL NANO CARRIERS :

Table no.02 : Different types of herbal Nanocarriers with examples.

Nanocarrier type	Key Features	Example Herbal Component
Nanoemulsions	Improves solubility and absorption	Curcumin oil nanoemulsions
Solid Lipid Nanoparticles (SLNs)	Stable, biodegradable	Quercetin-loaded SLNs
Liposomes	Enhances skin penetration and systemic delivery.	Green tea extract liposomes
Phytosomes	Phytochemicals complexed with phospholipids	Silymarin phytosome
Polymeric Nanoparticles	Sustained release, high stability	Neem extract nanoparticles

These nanocarriers help improve solubility, stability, bioavailability, skin penetration, and targeted delivery of herbal bioactives, making them more effective therapeutically.[1,14]. Examples such as curcumin, quercetin, green tea extract, silymarin, and neem have all been successfully formulated into these nanocarrier systems for enhanced medicinal benefits [10].

METHODS OF PREPARATION OF HERBAL NANOMEDICINES :

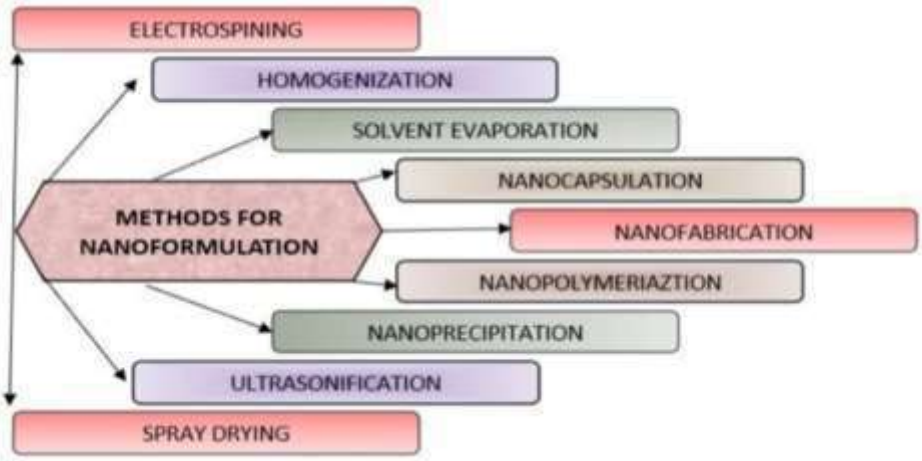


Fig no.02 : Different methods of herbal Nano medicines preparation .

1.ELECTROSPINNING METHOD :

- Prepare polymer solution mixed with herbal extract.
- Load the solution into a syringe connected to a needle.
- Set up electrospinning apparatus: high-voltage power supply, syringe pump, grounded collector.
- Apply voltage to needle to create electric field.

- Polymer solution at needle tip forms Taylor cone under electrostatic force.
- Charged jet ejects from Taylor cone toward collector.
- Jet elongates and solidifies as solvent evaporates, forming nanofibers.
- Nanofibers collected as non-woven mat on collector.
- Nanofibers can be further processed into herbal nanomedicine products.

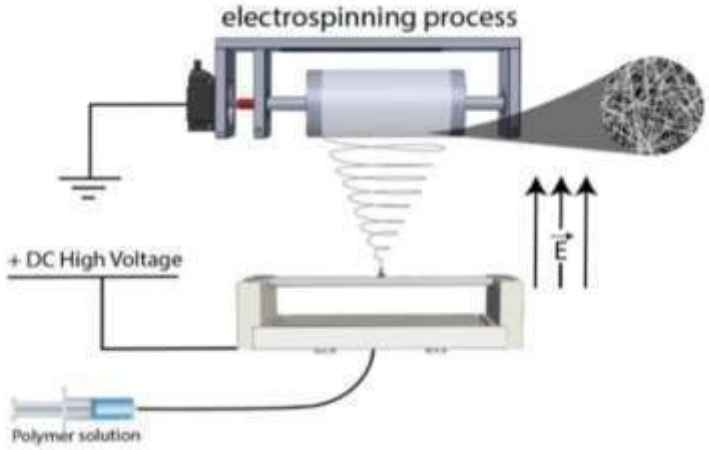


Fig no.03 : Electrospinning process for the preparation of herbal nanomedicines.

2 .SOLVENT EVAPORATION METHOD :

- Dissolve polymer & drug in organic solvent (acetone, chloroform, etc.)
- Emulsify with aqueous phase containing surfactant to form o/w emulsion.
- Evaporate the solvent by heating, reduced pressure, or stirring.
- Nanoparticles form by precipitation; stabilize with surfactants/polymers.
- Collect nanoparticles by centrifugation/filtration [25.]

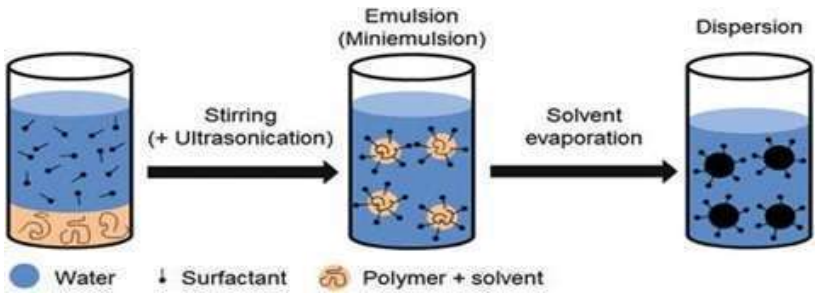
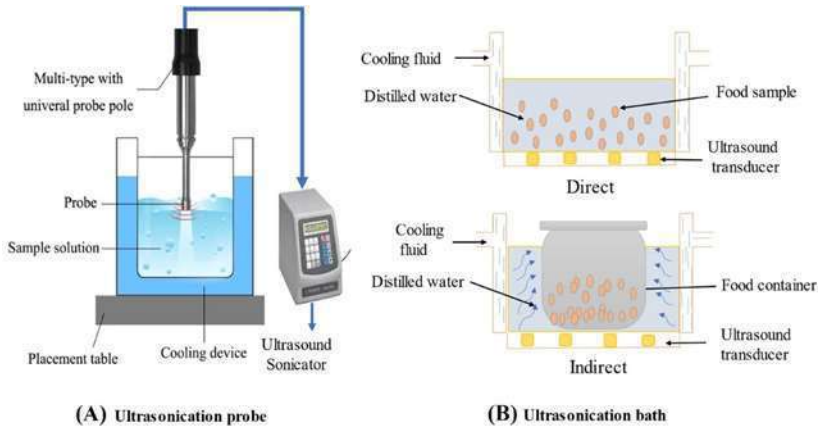


Fig no.04 : Solvent evaporation process for the preparation of herbal nanomedicines

3.ULTRASONICATION METHOD :

- Disperse or dissolve drug in appropriate solvent.
- Apply ultrasonic waves using ultrasonic cleaner/device to reduce particle.
- Form nanoparticles by cavitation and shear forces[11]

- Stabilize and collect nanoparticles.



(A) Ultrasonication probe (B) Ultrasonication bath

Fig no.05 : Ultrasonication process for the preparation of herbal nanomedicines

4. HIGH PRESSURE HOMOGENIZATION METHOD :

- Prepare a coarse emulsion or suspension of drug and polymer/lipid.
- Pass emulsion under high pressure through a homogenizer multiple times.
- Nanoparticles are formed by size reduction and shear forces.
- Stabilize and collect nanoparticles [2] .

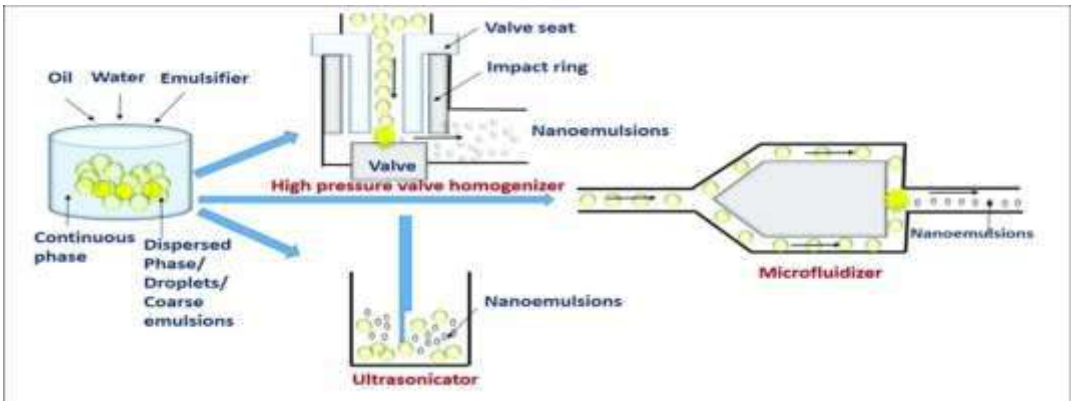


Fig no.06 : High pressure homogenization process for the preparation of herbal nanomedicines

5. THIN FILM HYDRATION METHOD :

- Dissolve lipid or polymer in organic solvent.
- Evaporate solvent to form thin film on container wall.
- Hydrate film with aqueous phase, with or without drug.
- Sonicate or vortex to form vesicles/nanoparticles[11]
- Stabilize and collect nanoparticles.

Fig no.07 : Thin film hydration process for the preparation of herbal nanomedicines.

6. IONIC GELATION METHOD :

- Prepare aqueous polymer solution (e.g., chitosan).
- Add drug or herbal extract to polymer solution.
- Add crosslinking agent or ionic solution to induce gelation.
- Nanoparticles form by ionic crosslinking of polymer chains.
- Stabilize and collect nanoparticles .

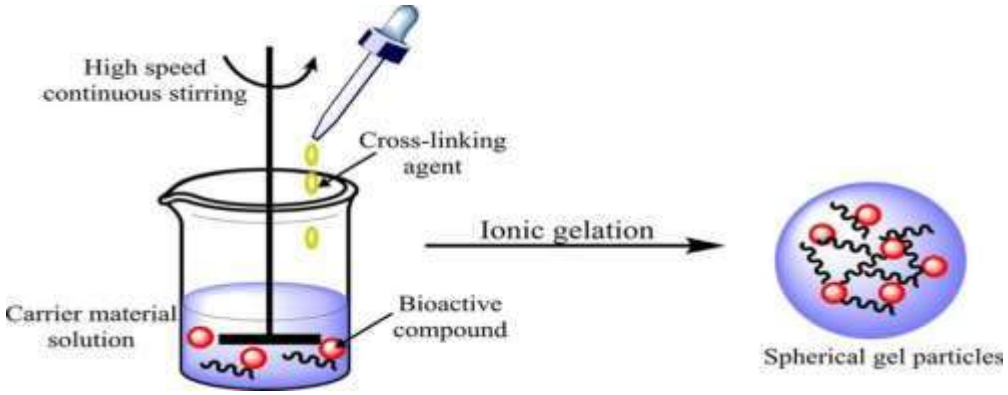


Fig no.08 : Ionic gelation process for the preparation of herbal nanomedicines.

The above matter summarizes the key steps involved in each method for herbal nanomedicine preparation, highlighting the solvent use , particle formation process ,stabilization and collection process[16].

THERAPEUTIC APPLICATIONS :

Table no.03 : Therapeutic interventions of Herbal Nanomedicines .

Disease/ Condition	Herbal Nanomedicine Example	Effect
Cancer	Curcumin nanoparticles	Enhanced anti cancer activity.
Diabetes	Gymnema Sylvestre nanosuspensions	Improved glucose regulation.
Inflammation	Boswellia nanoemulsion	Strong anti-inflammatory effect
Skin Disorders	Aloe vera nanogels	Fast wound healing
Anti-microbial therapy	Neem nano-silver formulations.	Strong antibacterial action.

This table summarizes the improved therapeutic activities observed with these herbal nanomedicines, which leverage nanotechnology to increase bioavailability, targeted delivery, and efficacy in treating these conditions [14,17].

ADVANTAGES OF HERBAL NANOMEDICINES :

The advantages of herbal nanomedicines primarily stem from the integration of nanotechnology into traditional herbal medicine, resulting in various important advantages.

1. Enhanced Bioavailability:

Nanotechnology reduces the particle size of herbal compounds to the nanoscale, improving their absorption and penetration through biological membranes. This is especially beneficial for poorly water-soluble herbs, significantly increasing their therapeutic effectiveness.[9].

2. Targeted Drug Delivery:

Nanoscalecarriers such as nanoparticles, liposomes, dendrimers, and nanoemulsions enable precise delivery of herbal compounds to specific cells or tissues. This focussed approach reduces adverse effects and maximizes therapeutic outcomes, for example in cancer or inflammatory conditions [1].

3. Controlled Release and Stability:

Nanoformulations can protect active herbal compounds from degradation by external influences like light, heat, and oxygen, thereby increasing the stability and shelf life of herbal medicines. They also allow for controlled release of the herbal compounds, enhancing efficacy over time.

4. Improved Solubility:

Nanotechnology enhances the solubility of herbal compounds via nanosuspensions and other formulations, leading to better dissolution in biological fluids and improved therapeutic action [8]

5. Synergistic and Enhanced Properties:

Nanoformulations allow for combining multiple herbal ingredients, potentially yielding synergistic effects that boost overall treatment effectiveness. Nanoparticles can also enhance the antimicrobial, anti-inflammatory, and antioxidant potential of herbal based formulations [19].

6. Reduced Toxicity and Side Effects:

By enabling more precise delivery and targeted action, herbal nanomedicines reduce the required dosage and systemic exposure, which decreases toxicity and adverse effects.

Overall, herbal nanomedicines represent a significant advancement by modernizing herbal therapies to be safer, more bioavailable, more stable, and more effective compared to conventional herbal and synthetic drugs. They also open new avenues for personalized and precision medicine using herbal compounds. However, challenges remain in scalability, regulatory approval, and safety evaluation of these nanoformulations[3].

LIMITATIONS AND CHALLENGES OF HERBAL NANOMEDICINES :

- **Poor Solubility and Bioavailability:** Many herbal medicines suffer from poor aqueous solubility, low oral absorption, and poor bioavailability, which limit their therapeutic effectiveness. Nanoparticles in herbal nanomedicines aim to improve solubility and bioavailability but these issues remain important hurdles [26,19].

- **Stability and Toxicity:** Herbal nanomedicines face challenges such as physical instability and unpredictable toxicity profiles of herbal constituents when formulated at the nanoscale. The toxicity profile of nanoparticles needs thorough characterization to avoid adverse effects [26.]

- **Complex Formulation Development:** The complexity of active constituents in herbal medicines makes developing reproducible novel drug delivery systems difficult. Selection and optimization of the type of nanoformulation, preparation methods, and physicochemical parameters are challenging due to variability in herbal extracts ,[19].

- **Standardization and Reproducibility:** Variability due to geographical, seasonal, and biodiversity factors complicates standardization of herbal nanomedicines. Achieving consistent content and therapeutic efficacy is challenging,[19].

- **Manufacturing and Cost Issues:** Nanoparticle manufacturing involves high costs, platform instability, and technical difficulties such as loading problems and maintaining stability during production ,[6].

- **Regulatory and Safety Concerns:** Satisfying international standards for toxicology, biocompatibility, and environmental safety is critical for herbal nanomedicines. There is a need for systematic toxicological evaluation and regulatory oversight ,[26,19].

- **Pharmacokinetics and Targeted Delivery:** While nanoparticles improve targeting, bio-distribution, and pharmacokinetics, ensuring efficient targeting and avoiding off-target effects or clearance challenges persist ,[26,19].

In summary, herbal nanomedicines hold promise for enhanced therapeutic efficacy and bioavailability over conventional herbal formulations, but face significant challenges in formulation complexity, stability, safety assessment, manufacturing costs, and regulatory approval. Addressing these limitations through advanced research and standardized practices is necessary to fully realize their potential in herbal medicine **.**

FUTURE PROSPECTS OF HERBAL NANOMEDICINES :

The future prospects of herbal nanomedicine are extremely promising, with advances In nanotechnology expected to revolutionize the efficacy, safety, and personalization of herbal-based therapies. Nanotechnology in herbal medicine enables targeted drug delivery, improved bioavailability, enhanced stability, and controlled release, paving the way for more effective and customized treatments for chronic and complex diseases , [9,1].

EMERGING TRENDS AND ENHANCEMENTS

- **Enhanced Bioavailability**

Nanoparticles, nanoemulsions, and nanosuspensions can encapsulate herbal compounds, increasing absorption and allowing poorly soluble ingredients to effectively reach therapeutic levels in the body ,[9].

- **Targeted drug delivery :**

Nanoformulations like liposomes, dendrimers, and solid lipid nanoparticles allow for site-specific administration of herbal extracts. This leads to enhanced efficacy and decreased toxicity, especially important in conditions like cancer and inflammatory diseases ,[9,1].

- **Improved Stability and Shelf Life**

Nanotechnological encapsulation protects volatile or unstable herbal compounds from environmental degradation (light, heat, oxygen), enhancing shelf stability and ensuring consistent potency , [9].

- **Controlled Release and Precision Medicine**

Nanocarriers facilitate gradual, controlled release of herbal medicines, which may reduce dosing frequency and enable sustained therapeutic effects. Innovations also point towards the integration of personalized medicine by tailoring nano-herbal treatments to an individual's genomic characteristics combined with their health history.[9].

- **Synergistic Antimicrobial Properties**

Nanoformulations can enhance or combine antimicrobial activity, such as herbal extracts with silver nanoparticles, providing potent defenses against pathogens ,[9].

OPPORTUNITIES AND EMERGING APPLICATIONS :

- Addressing the limitations of traditional herbal medicines, such as poor solubility, rapid degradation, and low bioavailability, [9].
- Application in a wide range of diseases including cancer, diabetes, and cardiovascular disorders, with potential expansion into diagnostics and theranostics (therapy combined with diagnostic monitoring),[1].
- New possibilities for combination therapies involving multiple herbal and synthetic drugs with integrated imaging for real-time efficacy visualization,[1].

CURRENT OBSTACLES AND PROSPECTIVE PATHS :

- Scientific hurdles include optimization of nanocarrier systems, scaling up production, regulatory approval, and comprehensive toxicological and clinical testing,[9].
- Safety, long-term effects on human health and environmental factors and regulatory transparency remain persistent challenges that need to be resolved as the field continues to advance. [9,1].

The intersection of nanotechnology and herbal medicine has opened groundbreaking avenues for innovative, safe, and effective therapeutics, with continued research likely to expand thesepractical implementations and resolution of existing challenges,

CONCLUSION:

Herbal nanomedicines represent a promising evolution in the delivery and efficacy of plant-based therapies, addressing many limitations of conventional herbal preparations and opening new pathways for scientific investigation and therapeutic use. The use of nanotechnology in herbal medicine enhances bioavailability, stability, and targeted delivery, which can significantly improve therapeutic outcomes compared to traditional formulations

Despite these advances, challenges persist, such as the need for standardized protocols, toxicity assessments, regulatory frameworks, and thorough clinical validations before widespread adoption can be realized. Continued interdisciplinary research is necessary to address existing hurdles, optimize nanoformulations, and ensure safety and efficacy, thereby facilitating the integration of herbal nanomedicines into mainstream healthcare.

ACKNOWLEDGEMENT:

Herbal nanomedicines blend ancient wisdom with nanoscale innovation, and this review article reflects a collaborative journey to illuminate that fusion. Crafting a unique acknowledgement requires originality, drawing from sincere gratitude while avoiding template phrases common in academic papers .

Creative Metaphor : Imagine this manuscript as a nanoemulsion: droplets of insight stabilized by collective support. Deep appreciation goes to the invisible forces—mentors who emulsified ideas, peers who homogenized critiques, and institutions that provided the high-pressure drive for clarity and precision

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- Laboratory allies, enabling solvent evaporation of doubts into stable formulations of knowledge.
- Family anchors, offering the thin-film hydration that sustained long nights of ionic gelation over data.

Final Gratitude: This work emerges from a high-pressure homogenization of efforts, targeting not just publication but real-world impact in herbal therapeutics. Endless thanks to all who turned raw herbal extracts into targeted delivery systems of progress.

REFERENCES

1. Khushi. S. Kathole, Pooja Ramadas Hatwar, Ravindra. L. Bakal, Vaishnavi. G. Karule – Nanotechnology based drug delivery systems and herbal medicine ; Journal of drug delivery and therapeutics(JDDT); March 2025,vol 15,issue 3.
2. Dhananjay. A. Deore, Sushant. M. Ahire, Sunil. K. Mahajan – Herbal medicine meets Nanotechnology : A Transformative Approach ; Asian Journal of Pharmaceutical Research ; 2025,15(3):302-368.
3. Farhang. H. Awlqadr, Kithar Rasheed Majeed, Ammar. B. Altemimi – Nanotechnology : Based Herbal medicine: Preparation, Synthesis and Applications in food and medicine ; Journal of Agriculture and Food Research, March 2025, Vol 19, 101661.
4. P N Karishma, P. Anitha, G Mariyababu, Bhavani Boddeda -Nanotechnology :Enabled Herbal drug delivery: A Paradigm Shift in Phytopharmaceuticals ; Jan-Mar 2025,Vol 17.
5. Pinki, Kajal Choudary, Sanjiv Duggal – A Review of Nano-Herbal Formulations : A Futuristic Approach in Herbal drug delivery; IRJPMS;2025, Vol-8,Issue-3.
6. Prachi. S. Tajne, Pooja. R. Hatwar- Nanotechnology in Herbal Medicine: A Promising Approach for enhanced Drug delivery and Therapeutic Efficacy; JDDT,2025,15(6),268-277.
7. Dr Rupesh Soni, Dr. Shekhar Verma- An overview of Drug Delivery Methods Based on Nanotechnology and Herbal Remedies; IJPHDT, Feb 2025,Vol-2,Issue -2.
8. S. S, Siddheshwar, Dnyanda. H. Kangude, Dnyaneshwar I. B. Kangune- A Review article on Herbal Drug Nanotechnology and Nanomedicine; Asian Pharma; 2024.
9. Diksha Sharma, Lakshay and Kapil Kumar Verma- Observing Nanotechnology in Herbal Medicine; WJBPHS;2024,20(01),176-191.
10. Shery Jacob, Mahesh Attimarad, Anroop. B. Nair- Advances in Nanocarrier Systems for

Overcoming Formulation challenges of Curcumin; Nanomaterials ,2024,Vol-14,672.
11. A. C. Potraje, B. Y. Zade- A Review on Different Preparation Methods used for Development of Curcumin Nanoparticles;IJPRA,2024.
12. Dr. Debajyothi Das, Chandan Das- Herbal Nanoformulations: A Novel Drug Delivery System; IIP Series,2024,Vol-3.
13. Preksha Vinchhi, WongTin Wui, Mayur. M. Patel – Healing with herbs : An Alliance with 'Nano' for Wound Management; Expert opinion on drug delivery,2024,Vol-21,Issue-7.
14. Amir Jalili, Rafieh Bagherifar – Current Advances in Nanotechnology: Mediated Delivery of Herbal and Plant derived Medicines; Adv Pharm Bull,2023,Jul19 ,13(4); 712-722.
15. Pradnya Santosh Jadhav, Pratiksha Santosh Jadhav – Nanoparticles for Herbal Extract; IJPRA, 2022.
16. Domenico Lombardo, Mikhail Akiselev – Methods of Liposomes preparation: Formation and Control Factors of Versatile Nanocarriers for Biomedical and Nanomedicine Application,2022.
17. Mayang Kusuma Devi, MadeJone – Improved Activity of Herbal Medicine through Nanotechnology, Nanomaterials;Nov-18 2022,12(22), 4073.
18. Virendra Kumar, Vandana Garg, Harish Dureja – Nanomedicine: Based Approaches for Delivery of Herbal Compounds ; TMR,2022,7(5).
19. Parusu Kavya Teja – Herbal Nanomedicines : Recent Advancements ,Challenges, Opportunities and Regulatory Overview,2022.
20. Yasmin Abo-Zeid, Rana Diab, Rania Sanad, Wedad Sakran – Recent Advances in Herbal-Based Nanomedicine for Anti -inflammatory purposes, Oct -2021,Vol-5,Issue-4.
21. Md. Noushad Javed, Ekta Singh Dahiya, Faheem Hyder Pottoo – Recent Advancements in Clinical Application of Nanotechnological Approached Targeted Delivery of Herbal Drugs; Nanophytomedicine ,July 2020,pp 151-172.
22. Dina. A. Hafez, Kadria. A. Elkhodairy, Mohamed Teleb & Ahmed O. Elzogh by – Nanomedicine : Based Approaches for improved delivery for Phytotherapeutics for Cancer therapy; Expert Opinion on Drug Delivery,2020,17(3).
23. Sonu Ambwani, Roopali Tandon, Tanuj Kumar Ambwani, Yashpal. S. Malik – Current Knowledge on Nanodelivery Systems and their Beneficial Applications in enhancing The Efficacy of Herbal Drugs;JEBAS,2018,6(1),87-107.
24. Sarangi, Manoj Kumar, Padhi, Sasmita – Novel Herbal Drug Delivery System: An Overview; AM&HS,Jan- Jun 2018,6(1).
25. Ganesh G. Tapadiya – Impact of Nano-technology on Global trade of Herbal drugs : An overview; IJGP,2017,Vol-11,Issue – 3.
26. Krishnasis Chakraborty, Arun Shivakumar, Sundaram Ramachandran – Nano-technology in Herbal Medicines : A Review; International Journal of Herbal Medicines ,2016,4(3),21-27.
27. Sreeraj Gopi, Augustine Amalraj, Sabu Thomas – Introduction of Nanotechnology in Herbal Drugs and Nutraceuticals : A Review,2016,6(2).
28. Manish Mathur and Govind Vyas – Role of Nanoparticles for Production of Smart Herbal Drugs : An Overview; Indian Journal of Natural Products and Resources, Dec -2013,Vol4(4).
29. S. H. Ansari, Farha Islam, Mohd Sameem – Influence of Nanotechnology on Herbal

Drugs: A Review; J Adv Pharm Tech & Res,2012,3(3),142-146.

30. Neeraj Choudary and Bhupinder Singh Sekhon – An Overview of Advances in the Standardization of Herbal Drugs ;J Pharm Educ Res,Dec – 2011,Vol-2,Issue-2.

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