

Emerging Trends in Herbal Drug Delivery: Innovations and Applications

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INTRODUCTION & AIM

Herbal medicines have gained global significance due to their therapeutic benefits, minimal side effects, and traditional use in systems like Ayurveda and Siddha. With nearly 80% of the world's population relying on herbal remedies—especially in developing countries—their role in healthcare continues to grow. However, conventional dosage forms often suffer from poor bioavailability, non-specific distribution, and inconsistent drug release, limiting their effectiveness.

To overcome these challenges, novel herbal drug delivery systems (NDDS) have been developed. These systems enhance solubility, stability, targeted delivery, and therapeutic efficacy while minimizing toxicity and dosing frequency.

This study aims to explore the role of novel herbal drug delivery systems in improving the bioavailability, efficacy, and safety of herbal medicines through advanced carrier-based technologies and site-specific delivery mechanisms.

METHOD

Liposomes – Phospholipid vesicles that encapsulate herbal drugs for improved solubility and controlled release.

Phytosomes – Complexes of herbal extracts with phospholipids to enhance absorption and bioavailability.

Nanoparticles – Nano-sized carriers offering better stability, permeability, and site-specific delivery.

Nanoemulsions – Stable emulsified systems that enhance solubility and skin penetration.

Ethosomes – Ethanol-rich vesicles enabling efficient transdermal delivery of herbal actives.

Invasomes – Modified liposomes containing ethanol and terpenes, designed for deeper skin penetration.

Microspheres – Small spherical particles used for sustained and controlled herbal drug release.

Niosomes – Non-ionic surfactant vesicles offering good stability and enhanced bioavailability.

Proniosomes – Dry formulations that form niosomes upon hydration, improving shelf stability.

Liquid Crystals – Mesophase systems enabling controlled release and enhanced drug loading.

Dendrimers – Highly branched structures for targeted delivery and reduced toxicity.

Transferosomes – Ultra-flexible vesicles capable of deep tissue penetration for transdermal delivery.

RESULTS & DISCUSSION

Recent developments in herbal medicine formulation have demonstrated that incorporating herbal drugs into novel drug delivery systems significantly enhances their therapeutic potential. Various studies and experimental formulations have shown improved solubility, stability, and bioavailability of herbal compounds when delivered through advanced systems such as liposomes, phytosomes, nanoparticles, nanoemulsions, ethosomes, invasomes and transferosomes.

These innovations are widely applied in areas like cancer therapy, skincare, respiratory treatment, and chronic disease management. They enable controlled and sustained drug release, enhance skin and organ penetration, and reduce dosing frequency and side effects, making herbal treatments more efficient, patient-friendly, and suitable for modern healthcare use.

The findings also highlight that novel herbal drug delivery systems bridge the gap between traditional herbal practices and modern pharmaceutical requirements. By addressing long-standing issues such as inconsistent dosing, poor pharmacokinetics, and lack of standardization, these advanced formulations represent a significant advancement in the therapeutic application of herbal medicines.

Overall, the integration of herbal drugs into modern delivery technologies holds promise for safer, more effective, and scientifically validated herbal treatments, supporting their wider acceptance in mainstream healthcare.

CONCLUSION

The development of novel herbal drug delivery systems enhances the precision, effectiveness, and consistency of herbal medicine. Advanced systems like nanoparticles, liposomes, and invasomes improve bioavailability, stability, and dosage accuracy, addressing traditional limitations and boosting therapeutic efficacy.

FUTURE WORK / REFERENCES

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