

A Comprehensive Survey on Novel Methods in Herbal Drug Delivery Systems

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ABSTRACT: *Phytomedicines have been used by humans worldwide since ancient times. However, such medicines suffer from some drawbacks, such as toxicity, problems of stability, low bioavailability and compliance with patients. Different novel drug delivery systems (NDDS) such as phytosomes, ethosomes, transfersomes, herbal transdermal patches, nanoparticles and biphasic emulsions are used today to reduce these problems. Using these advanced techniques, it is possible to protect against toxicity, improve safety, improve the bioavailability of herbal formulations, and protect against physical and chemical degradation. Increased patient compliance, continuous release and selective action of plant actives and extracts are provided by these techniques. This review offers details on different novel approaches used to enhance the safety and efficacy of phytomedicines, the type of active ingredients, the biological activity and the application of novel formulations. The oldest form of health care known to mankind is herbal drugs. Herbal medicines have been described by the World Health Organization (WHO) as finished, labelled medicinal products containing active ingredients, aerial or underground sections of a plant or other material or combination of plants. The WHO estimates that 80% of the world's population uses herbal medicine for primary health care at present.*

KEYWORDS: *Drug, Health, Herbal, Plants, Medicines.*

INTRODUCTION

Herbal preparation is obtained through the treatment of whole plants, fragmented or cut plants and parts of plants, such as extraction, distillation, expression, fractionation, cleaning, concentration or fermentation. Herbal drugs have certain advantages over conventional medicines, such as reduced risk of side effects, widespread availability, low cost and long-lasting efficacy for lifestyle diseases[1].

Table 1: Illustrates the Herbal Phytosome Formulations[2].

Biological Source	Category	Application	Use	Active ingredients
Silibium marianum	Flavonoids	Increase in absorption upto 4.6 folds	Hepatoprotective, Antioxidant.	Silybin
Vitis vinifera	Proanthocya-ndinis	Increase in antioxidant property	Antioxidant, Anticancer.	Catechin, epicatechin
Curcuma longa	Polyphenols	Increase in bioavailability	Antioxidant, Antiinflammatory, Anticancer	diferuloylmethane curcumin, demethoxycurcumin and bisdemethoxy-curcumin
Thea sinensis	Polyphenols, Flavon-3-ol	Increase in bioavailability of epigallocatechingallate	Anti-cancer, Antioxidant, Cardiovascular, neuroprotective	epigallocatechin-3-gallate, epigallocatechin, epicatechin-3-gallate, epicatechin
Panax ginseng	Saponin glycosides	Inhibits lipid peroxidation	Immunomodulator	Ginseng
Ginko biloba	Terpenoids	Improve its bioavailability	Incerebral insufficiency	Ginkgoflavoneglucoside Ginkgolides and Bilobalide, Ginkgoic acids

There is also growing proof that many existing drug treatments actually block symptoms and neglect the processes of the underlying disease. In comparison, the cause of many diseases tends to be resolved by many natural products and show superior clinical outcomes. Therefore, the development of a novel drug delivery system for herbal drugs has received considerable attention. Novel carriers should preferably meet two requirements; first, they should distribute the medication over the treatment duration at a pace dictated by the body's needs. Second, it can guide the herbal drug's active entity to the site of operation. In order to resolve non-compliance, the introduction of herbal products into new drug delivery systems not only eliminates repetitive administration, but also helps to improve therapeutic value by decreasing toxicity and increasing bioavailability[3].

Novel drug delivery aims to either sustain drug activity at a predetermined pace or to reduce adverse side effects by maintaining a reasonably constant effective drug level throughout the body. For the delivery of herbal actives/extracts, various drug delivery technologies such as phytosomes, ethosomes, transfersomes, nanoparticle, herbal transdermal patches, micro and nanoemulsion have been developed, which are gaining more attention for better therapeutic response[4].

Table 2: Illustrates the Herbal Ethosome Formulations[5].

Biological Source	Category	Application	Use	Active Ingredients
<i>Glycyrrhiza glabra</i>	Triterpenoid saponins glycosides	Improved Anti-inflammatory activity and sustained release action	Treatment of dermatitis, eczema and Psoriasis	Ammonium glycyrrhizinate
<i>Cannabis sativa</i>	Resins	Improved patient compliance and increased skin permeation	Treatment of Rheumatoid arthritis	Tetrahydrocannabi-diol (THC)
<i>Tripterygium wilfordii</i>	Diterpene oxide	Increase in percutaneous permeability	Anti-inflammatory, Anti-tumour	Triptolide
<i>Sophora alopecuerides</i>	Quinazoline alkaloids	Increase in permeability	Anticancer, Antiendotoxic	Matrine, oxymatrine, sophoridine, sophocarpine (Alkaloidal extract)
<i>Curcuma longa</i>	Resins	Improved bioavailability	Anti-inflammatory	Curcumin

Table 3: Illustrates Herbal Transfersomes Formulation[6].

Biological source	Category	Application	Use	Active Ingredients
<i>Capsicum annum</i>	Resins	Increase skin penetration	Treatment of Rheumatism	Capsaicin
<i>Curcuma longa</i>	Resins	Increase skin permeability	Anti-inflammatory	Curcumin
<i>Catharanthus roseus</i>	Indole alkaloids	Increase in permeability	Anticancer	Vincristine
<i>Colchicum autumnale</i>	Amino alkaloids	Reduction in GIT side effects	Treatment of Gout	Colchicine

Drug transdermal administration is normally limited by the skin's barrier function. One of the most controversial strategies for transdermal delivery of active substances is vesicular systems. Ethosomes are fascinating and sophisticated vesicular structures that have emerged in recent years in the field of pharmaceutical technology and drug delivery. Due to its high deformability, this

carrier presents interesting features correlated with its capacity to penetrate intact through the human skin. The physicochemical characteristics of ethosomes have been shown to enable this vesicular carrier to transport active substances more effectively than conventional liposomes into the deeper layers of the skin through the stratum corneum. Ethosomes capture drug molecules with different hydrophilic, lipophilic, or amphiphilic physicochemical characteristics.

DISCUSSION

Table 4: Illustrates Herbal Nanoparticle Drug Delivery System.

Biological Source	Category	Application	Use	Active Ingredient
<i>Cuscuta chinensis</i>	Flavonolignans	Improve water solubility	Antitumour, Immunostimulatory Antihepatotoxic	Ethanollic extracts
<i>Glycyrrhiza glabra</i>	Saponin glycosides	Improve the bioavailability	Anti-inflammatory, Anti-hepatotoxic, Antiviral	Glycyrrhizic acid
<i>Tripterygium wilfordii</i>	Diterpene oxide	Increase in solubility, Decrease in toxicity	Anti-inflammatory, Antitumour	Triptolide
<i>Ginkgo biloba</i>	flavonoids	Improved cerebral blood flow	Brain function activation	Extracts of Ginkobiloba
Naringenin	Flavonoids	Increase in solubility	Hepatoprotective	-
<i>Artemisia annua</i>	Alkaloid	Increase in therapeutic index	Anticancer	Paclitaxel
<i>Berberis vulgaris</i>	Isoquinoline alkaloid	Sustained drug release	Anticancer	Berberine
<i>Camptotheca acuminata</i>	Quinoline alkaloid	Increase in solubility	Increase in bioavailability, Antitumour	Hydroxy Camptothecin
<i>Stephaniate trandria</i>	Bisbenzylisoquino- line alkaloid	Sustained release action	Anti-inflammatory, Antiplatelet aggregation, Ca ²⁺ channel block, immunosuppressive	Tetrandrine

Table 5: Illustrates Herbal Nanoemulsion Formulations[7].

Biological source	Category	Application	Uses	Active ingredients
<i>Silimum marianum</i>	flavonolignans	Increase in solubility and therapeutic activity	Hepato-protective	Silymarin
<i>Berberis vulgaris</i>	Isoquinoline alkaloids	Improve residence time and absorption	Anticancer	Berberine
<i>Sophora alopencerides</i>	Alkaloids	Increase in percutaneous permeability	Anti-bacterial, Anti- inflammatory, Anti-virus	Matrine
<i>Curcuma zedoaria</i>	Resins	Improved aqueous dispersibility, stability and oral bioavailability	Hepato-protection anticancer and anti-bacterial	β-elemene
Ubiquinone	Benzoquinone	Enhancement in solubility, bioavailability	Antioxidant	-
<i>Colchicum autumnale</i>	Indole alkaloid	Improved oral bioavailability	Treatment of gout	Colchicine
<i>Genista tinctoria</i>	Isoflavones	Improved skin permeation	Anticancer	genistein

It has been found that by adding transdermal drug patches, medications of herbal origin can be used with improved efficacy[8]. Even herbal penetration enhancers such as some terpenes are found to have sufficient potential to replace conventionally available penetration enhancers such as DMSO (Dimethyl Sulfoxide), which has several disadvantages. Herbal Transdermal patches are

medicated adhesive pads designed to release active ingredients at a constant rate over a period of several hours or days after skin application. To control the rate at which the drug contained within the patch can pass through the skin and into the blood stream, the skin uses a special membrane[9].

CONCLUSION

Herbal medicines are being thoroughly studied to integrate them into novel drug delivery systems. Increased bioavailability, reduced toxicity, sustained release action, safety from GI degradation that cannot be accomplished via traditional drug delivery system due to large molecular size, low solubility, degradation of herbal medicines in GI media will lead to the application of these novel techniques to natural medicines. When integrated into novel methods, constituents such as flavonoids, tannins, terpenoids demonstrated increased bioactivity and targeted action at a low therapeutic dosage. The use of herbal medicines in novel delivery methods is therefore also implemented on an industrial scale.

REFERENCES

- [1] Ajazuddin and S. Saraf, "Applications of novel drug delivery system for herbal formulations," *Fitoterapia*. 2010, doi: 10.1016/j.fitote.2010.05.001.
- [2] K. Kesarwani and R. Gupta, "Bioavailability enhancers of herbal origin: An overview," *Asian Pacific Journal of Tropical Biomedicine*, 2013, doi: 10.1016/S2221-1691(13)60060-X.
- [3] *Drug Delivery Nanoparticles Formulation and Characterization*. 2016.
- [4] A. Goyal, S. Kumar, M. Nagpal, I. Singh, and S. Arora, "Potential of novel drug delivery systems for herbal drugs," *Indian Journal of Pharmaceutical Education and Research*. 2011.
- [5] A. Shirwaikar, A. Shirwaikar, S. Prabhu, and G. Kumar, "Herbal excipients in novel drug delivery systems," *Indian Journal of Pharmaceutical Sciences*. 2008, doi: 10.4103/0250-474X.44587.
- [6] A. Alexander, Ajazuddin, R. J. Patel, S. Saraf, and S. Saraf, "Recent expansion of pharmaceutical nanotechnologies and targeting strategies in the field of phytopharmaceuticals for the delivery of herbal extracts and bioactives," *Journal of Controlled Release*. 2016, doi: 10.1016/j.jconrel.2016.09.017.
- [7] P. Kothamasu, H. Kanumur, N. Ravur, C. Maddu, R. Parasuramrajam, and S. Thangavel, "Nanocapsules: The weapons for novel drug delivery systems," *BioImpacts*, 2012, doi: 10.5681/bi.2012.011.
- [8] E. N. Kumar and E. S. Kumar, "A Simple and Robust EVH Algorithm for Modern Mobile Heterogeneous Networks- A MATLAB Approach," 2013.
- [9] S. Kumar, A. Gupta, and A. Arya, *Triple Frequency S-Shaped Circularly Polarized Microstrip Antenna with Small Frequency-Ratio*. International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)ISSN(Online): 2320-9801, 2016.