
NANOTECHNOLOGY IN HERBAL DRUGS: A COMPREHENSIVE REVIEW

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Abstract

Nanotechnology is an opportunity in all scientific and technical fields for fresh perspectives. Among these applications, the fast growing fields of nano research are herbal drugs and nutraceuticals. Using bioactive plant extracts and food materials, a number of new herbal formulations and nutraceuticals such as polymeric nanoparticles, nano capsules, nano emulsions, transferosomes and ethosomes have been recorded. New herbal drugs and nutraceuticals are reported to have significant advantages over traditional plant active ingredients and extract formulations that include solubility improvement, bioavailability, stability expansion, sustained delivery, and improved distribution of tissue macrophages, toxicity safety, pharmacological activity improvement, and physical and chemical degradation protection. An overview of the introduction of nanotechnology in the field of herbal drugs and nutraceuticals is given in this study.

Keywords: Applications, Field, Herbal, Nanotechnology, Nano.

I. INTRODUCTION

Since ancient times, phytomedicines have been a vital source of medications, their use has been increased rather than the other medicines due to their medicinal activity and fewer side effects. The popularity of herbal drugs is the subject of both developing and developed countries, primarily due to their natural origin and low side effects. Strong support for the development of revolutionary novel herbal drugs has been provided by fast-growing nanotechnologies[1].



Figure 1: Illustrates the methods of preparation of nanotechnology in herbal drugs and nutraceuticals[2].

Nutraceuticals are foods and food components that, beyond basic nutrition, have health benefits, but many nutraceuticals show poor bioavailability. Nanotechnology applications have been given the opportunity to address the difficulties and technological obstacles associated with the solubility, bioavailability, durability and food delivery of bio-actives. The rapid advancement of nutraceutical nanotechnology is strongly committed to providing new and efficient functional foods as a way of preventing and even curing some non-communicable diseases[3]. Numerous studies have already been published in the field of nanotechnology for the delivery of herbal drugs and nutraceuticals in various types of preparatory methods of nano materials Figure 1. The present analysis focuses on the incorporation of nanotechnology for nanomedicine and functional foods into herbal medicines and nutraceuticals. It also demonstrates major and rapid advancements in biomedical technology and food technology[4].

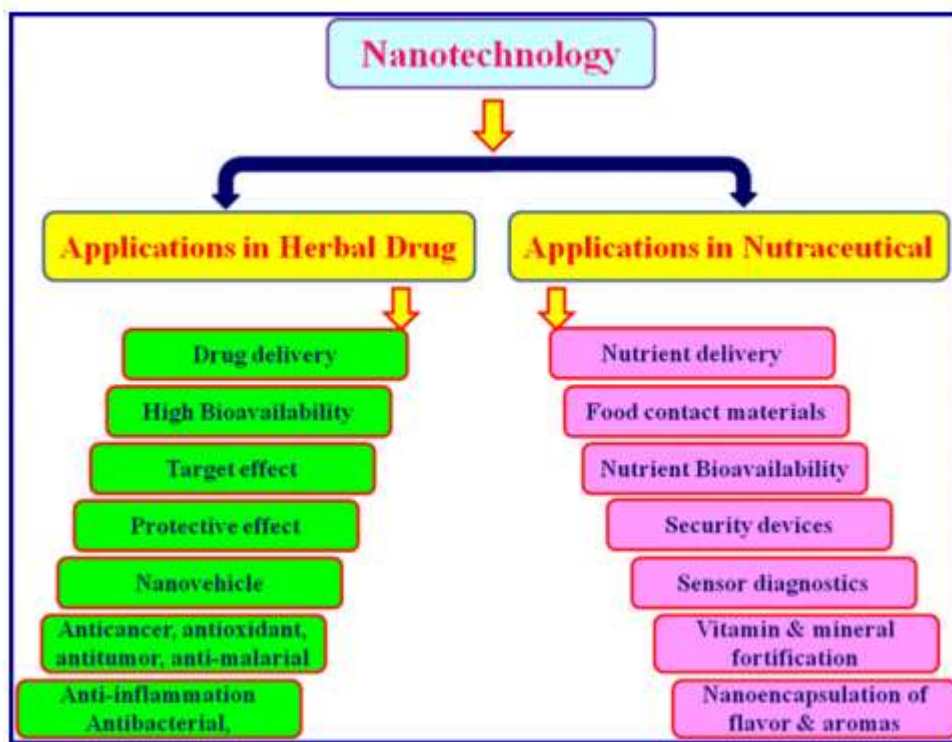


Figure 2: Illustrates the applications of nanotechnology formulated herbal drugs and nutraceuticals[5].

II. DISCUSSION

Figure 1 illustrates the methods of preparation of nanotechnology in herbal drugs and nutraceuticals. Figure 2 illustrates the applications of nanotechnology formulated herbal drugs and nutraceuticals. Nanotechnology can be used to boost the delivery of herbal drugs that are poorly water soluble, targeted delivery in a cell or tissue, cross-tight epithelial and endothelial barriers, release of large herbal molecules, co-delivery of two or more drugs, and observation of drug delivery sites by integrating imaging modalities of herbal drugs[6]. The applications of formulated herbal drugs in nanotechnology are schematically depicted in Figure 2.

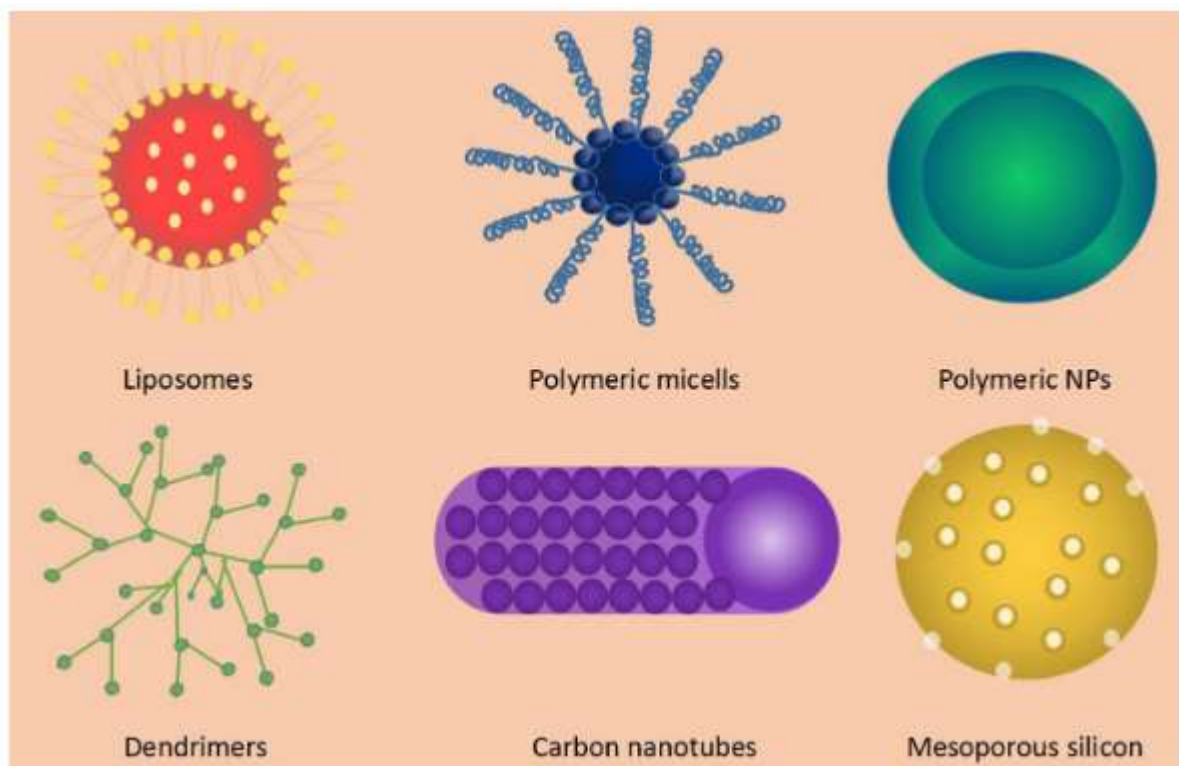


Figure 3: Illustrates the Common types of nano-drug carriers[7].

Table 1: Category and features of nano-drug carriers[8].

Category	Structure	Drug loading	Advantages	Limitations
Liposomes	Lipid bilayer	Physical encapsulation/Chemical connection	Great biocompatibility, none immunogenicity	Low stability, easy leakage of hydrophilic drug
Polymeric nanoparticles	Nanospheres/ Nanocapsules/ Polymer-based nanoparticles with lipophilic core		Good stability, low leakage of drugs	Intravenous toxicity
Polymeric micelles	Core/shell architecture formed by self-assembly		Easily prepare, increase stability of hydrophobic drug	Low stability, depolymerization after dilution
Metal nanomaterials	Nanoparticles, nanorods, nanocapsules, nanocuboid, and nanowire		Antibacterial properties, magneto-optical response characteristics	Toxicity, hard to degrade
Inorganic non-metallic nanomaterials	The same size with a adjustable pore size		Stable size, large surface area and pore volume, high drug loading	Extremely slow biodegradation rate

The activity of herbal medicines depends on the overall role of a variety of active components, as synergistic action is given by all the constituents and the therapeutic value is thus enhanced. An important function is played by each active constituent and they are all connected to each other. However, most herbal medicines have insoluble characteristics, leading to lower bioavailability

and increased systemic clearance requiring repeated or higher dose administration, rendering the medication a poor candidate for therapeutic usage. Herbal remedies and natural products have been used since ancient times to treat diseases[9]. The herbal treatments have thousands of constituents that all function simultaneously against the diseases, unlike the commonly used allopathic system. In order to improve patient compliance and prevent repeated administration, phytotherapeutics need a scientific method to deliver the components in a continuous manner[10]. By developing novel drug delivery systems (NDDSs) for herbal constituents, this can be done. In order to resolve non-compliance, NDDSs not only minimize repetitive administration, but also help improve the therapeutic benefit by minimizing toxicity and increasing bioavailability, and so on. Figure 3 Illustrates the Common types of nano-drug carriers. Table 1 Category and features of nano-drug carriers.

III. CONCLUSION

Overall, this analysis shows that nanotechnology has great potential for the delivery of herbal drugs and nutraceuticals, and that its use for successful disease prevention and health promotion is important and to be expected in light of extensive health problems. While nanotechnology offers promising approaches to the delivery of herbal drugs and nutraceutical applications, more groundbreaking research is required to resolve the nano material cost-effective and long-term protection. The area of applied science and technology is nanotechnology, which aims to create devices and dosage forms in the range of 1 to 100 nm. The applications of nanotechnology have recently been referred to as nanomedicine for the treatment, diagnosis, monitoring and control of biological systems. Safe materials, including synthetic biodegradable polymers, lipids, and polysaccharides, have been made from nanocarriers.

IV. REFERENCES

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