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Striking the Bustle of Herbal Remedies from Side to Side Nanotechnology

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Abstract

Phytochemicals, also known as secondary metabolites, are plant-produced substances that have been shown to have a wide range of biological activities, providing a scientific basis for the use of herbs in traditional medicine. Furthermore, the use of herbs is thought to be safer and less expensive than synthetic medicine. Herbal medicines, on the other hand, have drawbacks such as low solubility, stability, and bioavailability. Some of them can degrade physically and chemically, reducing their pharmacological activity. Nanotechnology-based herbal drug formulations have attracted attention in recent decades due to their increased activity and potential for overcoming the problems associated with herbal medicine. Approaches that use biocompatible, biodegradable nanotechnology-based delivery systems based on lipids, polymers, or Nano emulsions can improve the solubility, stability, bioavailability, and pharmacological activity of herbals. The purpose of this review article is to provide an overview of the most recent advances in the development of nanotechnology-based herbal drug formulations for increased activity, as well as a summary of the challenges that these herbal medicine delivery systems face.

Keywords: Phytochemical • Herbal medicine • Nanotechnology • Bioactivity

Introduction

Plants have been used for medicinal purposes for thousands of years, both directly and through extraction. Plants are a source of various phytochemicals that have been used for human health because of their low side effects, low cost, and widespread acceptance. Plants produce phytochemicals (also known as secondary metabolites), which are important in traditional medicine. Secondary metabolites have been shown to have a variety of biological activities, establishing a scientific foundation for the use of herbs in traditional medicine. They exhibit pharmacological effects that could be used to treat bacterial and fungal infections, as well as chronic degenerative diseases like diabetes and cancer.

Herbal medicines are becoming increasingly popular around the world and have the potential to provide treatment, maintain and improve health, as well as prevent and treat a variety of diseases because they are considered safer than modern conventional medicines and are less expensive. However, most of these biologically active phytochemical constituents have limitations; specifically, their absorption and distribution are low, and phytochemical target specificity is generally low, resulting in low bioavailability and decreased biological activity. Furthermore, large doses of these phytochemical compounds are required to produce activity, and some of these phytochemical compounds are sensitive to acidic conditions and have low stability phytochemical compounds. These constraints impede their clinical application [1].

Literature Review

Nanotechnology-based delivery systems act as drug carriers, overcoming the various limitations that herbal medicines face, such as increasing phytochemical bioavailability and bioactivity. The application of nanotechnology to phytochemical constituents may be a promising innovative technology that increases the phytotherapy efficiency of herbal medicines. Several researchers are working to create an efficient and safe drug delivery system. Recent advancements in nanotechnology have rekindled interest in herbal medicinal formulations. Phytosomes and solid lipid nanoparticles are two delivery system approaches [2].

The particle diameter of the nanoscale system is 0.1 m, also known as a submicrometer. This provides several advantages in terms of various aspects, such as administration route and increased therapeutic effects, making this nanotechnology more developed and widely studied by researchers. Many studies have combined herbal medicine and nanotechnology because nano-sized systems have the potential to increase activity, reduce dosages, and reduce side effects. Herbal medicines that use nanotechnology-based delivery systems have enormous potential and unique properties, such as the ability to transform less soluble, poorly absorbed, unstable substances into promising drugs. As a result, nanotechnology-based delivery systems are a promising prospect for increasing herbal activity and overcoming the challenges associated with herbal medicine.

Discussion

Sinigrin is a type of glucosinolate that is found in the Brassicaceae family. Mazumder et al. formulated sinigrin into a phytosome delivery system with the goal of increasing bioavailability and overcoming the problem of sinigrin solubility, which was then evaluated through its activity. Sinigrin is known to have wound-healing properties. Mazumder et al. compared the wound-healing activity of sinigrin to that of the phytosome-sinigrin complex in a study. When compared to pure sinigrin, sinigrin-phytosome demonstrated a significant wound-healing effect. The phytosome-sinigrin complex healed 100% of the wounds after 42 hours, whereas pure sinigrin only healed 71%. This demonstrates that sinigrin-phytosome promotes wound healing [3].

Ginkgo biloba extract has been reported to have several activities, including radical scavenging, autooxidation, antitumor, and central nervous system protection. However, for oral administration of GbE, low bioavailability (10%) and a short half-life have caused bioavailability issues. The use of delivery systems, such as niosomes, increases drug diffusion through biological membranes and protects against enzymatic degradation, resulting

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in increased drug bioavailability. Jin et al. successfully encapsulated GbE in a niosome delivery system. Drug entrapment efficiency for GbE niosomes at 4 °C and 25 °C after three months of storage has good stability, according to stability studies [4].

Curcumin has been shown to have biological activity against a variety of diseases, including neurological disorders, inflammatory diseases, diabetes, and various cancers. Curcumin has been shown in recent studies to inhibit metastatic tumour spread in a pancreatic cancer xenograft model. Curcumin, on the other hand, has limitations in terms of water solubility, stability, and bioavailability. The development of a nano delivery system is one strategy for increasing curcumin bioavailability and activity. As a result, Arya et al. researched curcumin-loaded chitosan/PEG-blended nanoparticles as an ideal delivery system. In comparison to free curcumin, the formulation demonstrated strong cytotoxicity, enhanced antimigratory and antiinvasive properties, and induced apoptosis in metastatic pancreatic cancer [5].

Nanotechnology-based delivery systems for active herbal ingredients provide numerous benefits, including increased solubility, bioavailability, pharmacological activity, stability (of active ingredients), protection (from chemical and physical degradation), and a lower dose requirement. It is impossible to deny the potential of developing herbal medicine as a promising alternative medicine. However, nanotechnology-based formulations face their own set of challenges, such as high production costs, difficulty scaling up the process, and a lack of data on the safety and toxicity of nanotechnology-based herbal formulations; thus, the potential hazards associated with nanotechnology-based drug delivery systems must be considered. Another challenge for nanoparticles is the nanoparticles' own stability [6].

Conclusion

The use of nanotechnology-based delivery systems for phytochemical constituents is important in public health around the world. Herbal medicines are becoming more popular around the world, but their limitations as medicines include low solubility, bioavailability, and pharmacological activity, as well as being physically and chemically unstable and easily degraded. As a result, developing herbal medicines with nanotechnology-based delivery systems could be a viable option for increasing their pharmacological activity. However, the development of these nanotechnology-based delivery systems must be reviewed further, particularly in terms of safety and toxicity profiles, in order to ensure their safety and effectiveness in curing various types of diseases.

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Conflict of Interest

There is no conflict of interest by author.

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