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HERBAL NANO TECHNOLOGY

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Abstract

Since ancient times, potential of plants in research and medicine have found pronounced applications, due to better therapeutic value. To meet the mounting demands for commercial nano particles, novel eco-friendly methods of synthesis has led to a remarkable progress via unfolding a green synthesis protocol towards metallic nano particles synthesis Herbal medicines have been widely used around the world since ancient times. The advancement of phyto chemical and phytopharmacological sciences has enabled elucidation of the composition and biological activities of several medicinal plant products. The effectiveness of many species of medicinal plants depends on the supply of active compounds. Most of the biologically active constituents of extracts, such as flavonoids, tannins, and terpenoids, are highly soluble in water, but have low absorption, because they are unable to cross the lipid membranes of the cells, have excessively high molecular size, or are poorly absorbed, resulting in loss of bio availability and efficacy. Some extracts are not used clinically because of these obstacles. It has been widely proposed to combine herbal medicine with nanotechnology, because nanostructured systems might be able to potentiate the action of plant extracts, reducing the required dose and side effects, and improving activity. Treatment of chronic diseases like cancer using targeted drug delivery nano particles is the latest achievement. By analysing the relationship between nanotechnology and biological medicine, the application of Nano technological methods for bioavailability enhancement of herbal drugs can be brought about. "Bhasma", a natural product, is a metallo-medicine in powder form of Nano to submicron size.

Keywords: Green synthesis, Nanoparticles, Herbal medicine, Bioavailability, Phytochemicals

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high and new technology in the present era, and it greatly promotes the development of biological medicine and bio availability enhancement of herbal drugs [2].

Introduction

The term "nanotechnology" was derived by Greek word "nano s", meaning "dwarf". The nano device and nano strategy are one billionth of a meter or 10^{-9} m. The nanotechnology involves the clumps of atoms, molecules and molecular fragments into the extremely small particles between 1 and 100 nm, and puts forward to the interactions of molecular level matters and engineered material characteristically [1].

Nanotechnology is an advanced scientific technique in the 21st century. By analyzing the relationship between nanotechnology and biological medicine, the application of nano technological methods for bio availability enhancement of herbal drugs can be brought about. It is indicated that nanotechnology is one of the fastest developmental, the most potential and the far-reaching

History and development

Since ancient days, natural products, including plants, have been the basis of treatment of human diseases. The basis of concept of modern medicine development remains rooted in traditional medicine and therapies. In different parts of the world like ancient China, Egypt, Africa, America, and India, plants had been used for medicinal purposes long before recorded history [3]. For a long time, herbal medicines were not considered for development as novel formulations owing to lack of scientific justification and processing difficulties, such as standardization, extraction, and identification of individual drug components in complex poly herbal systems [4].

Need for novel drug delivery system nano-carriers for herbal remedies

Before reaching to the blood, many constituents of the herbal drugs will be smashed in the highly acidic pH of the

stomach and other constituents might be metabolized by the liver. Nano carriers applying to herbal remedies will carry optimum amount of the drug to their site of action bypassing all the barriers such as acidic pH of stomach, liver metabolism and increase the prolonged circulation of the drug into the blood due to their small size [5].

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Advantages of herbal nano particle delivery system: They appear to be able to deliver high concentrations of drugs to disease sites because of their unique size and high loading capacities.

• Decrease in the side effects.

Decrease in the dose of the drug Formulation [6].

Requirements for nano carriers for herbal remedies: Before reaching of drugs to the plasma, many constituents of the herbal drugs get denatured in the highly acidic medium of the gastric juice and other constituents might be metabolized by the liver. As the result optimum amount of the herbal drugs may not reach the blood. Patient's refusal due to large doses and less usefulness with the current formulations. Numerous other side effects are linked with presently marketed formulations [7]

❖ Types of nano particles

❖ Polymeric nanoparticles

Refer to colloidal systems with particle size starting from 10 to 1000 nm.

Nanoparticles have several advantages including solubility enhancement, bioavailability enhancement, efficacy enhancement, dose reduction improved absorption of herbal medicines [8-10] Liu et al. developed triptolide-loaded poly (DL-lactic acid) nanoparticles. to beat the issues of poor solubility and toxicity of triptolide, nanoparticles were developed with bio compatible and biodegradable polymers, poly (DL-lactic acid) [8]

❖ Synthesis of Nanoparticles:

Nano particles are generally characterized by their size, morphology and surface charge, using advanced microscopic techniques such as scanning electron microscopy (SEM), transmission electron microscopy (TEM) and atomic force microscopy (AFM) [9], developed triptolide-loaded poly (DL-lactic acid) nanoparticles. To beat the issues of poor solubility and toxicity of triptolide, nanoparticles were developed with bio compatible and biodegradable polymers, poly (DL-lactic acid) [8].

Synthesis of Nanoparticles

Nano particles are generally characterized by their size, morphology and surface charge, using advanced microscopic techniques such as scanning electron microscopy (SEM), transmission electron microscopy (TEM) and atomic force microscopy (AFM) [9]

❖ Micro emulsion:

Micro emulsions are clear, thermo dynamically stable isotropic liquid mixtures of oil, water and surfactant, frequently in combination with a co surfactant. The term (ME) can be define as a fluid system obtained by titration, composed of a simple emulsion along a medium chain alcohol, like pentanol or hexanol; initially semi-transparent, and titrated until clear. [10]

Nano crystals: A nano crystal is a material particle having at least one dimension smaller than 100 nano metres, based on quantum dots (a nanoparticle) and composed of atoms in either a single- or poly-crystalline arrangement. The size of nanocrystals distinguishes them from larger crystals. [11]

❖ **Stratagies of nano technology:** Because of the following advantages nano-sized delivery system was preferred:

Their unique size and high loading capacities as they look as if to be gifted to deliver high concentrations of drugs to disease sites. 1 Assigning quicker dissolution in the blood, nanoparticles deliver the drug in the smaller size that upsurges the whole superficial area of the drugs. They lower the chances of side effects.

They decreases the dose amount of the drug formulation. [12]

❖ NOVEL DRUG DELIVERY SYSTEM FOR HERBAL REMEDIES:

A need of the hour NDDS is designed to overcome the drawbacks of the traditional herbal drug system due to its wide applications to mankind.

Introduction to herbs

Herbs are plants with savory or aromatic properties that are used for flavoring and garnishing food, for medicinal purposes, or for fragrances; excluding vegetables and other plants consumed for macro nutrients. Culinary use typically distinguishes herbs from spices. Herbs generally refers to the leafy green or flowering parts of a plant (either fresh or dried), while spices are usually dried and produced from other parts of the plant, including seeds, bark, roots and fruits [13].

Herbal teas

Some herbs can be infused in boiling water to make herbal teas (also termed tisanes). Typically the dried leaves, flowers or seeds are used, or fresh herbs are used [14].

Medicinal plant

Some plants contain phyto chemicals that have effects on the body. There may be some effects when consumed in the small levels that typify culinary "spicing", and some herbs are toxic in larger quantities. Herbs such as river mint, wattle and eucalyptus were used for coughs, diarrhea, fever and headaches [15].

Herbal cosmetic: Originally there was always doubt in ancient societies, especially in the sceptical medium of western traditions, as to the efficacy of herbal medicines. The use of herbal cosmetics dates back to around six centuries ago in the European and Western countries. Mixtures and pastes were often concocted to whiten the face [16].

❖ Development of Herbal Medicine

Medicinal plants, also called medicinal herbs, have been discovered and used in traditional medicine practices since prehistoric times. Plants synthesize hundreds of chemical compounds for functions including defence against insects, fungi, diseases, and herbivorous mammals.

Strategies of nano technology

Because of the following advantages nano-sized delivery system was preferred:

Their unique size and high loading capacities as they look as if to be gifted to deliver high concentrations of drugs to disease sites [1]. Assigning quicker dissolution in the blood, nanoparticles deliver the drug in the smaller size that upsurges the whole superficial area of the drugs. Biological activity have been identified. However, since a single plant contains widely diverse phyto chemicals, the effects of using a whole plant as medicine are uncertain. Further, the phyto chemical content and pharmacological actions, if any, of many plants having medicinal potential remain unassessed by rigorous scientific research to define efficacy and safety. [17]. NDSSs are reduce the repeated administration to overcome non-compliance, And also help to increase the therapeutic value by reducing toxicity and increasing the bio availability. A NDSS in the traditional medicine system is essential to conflict more chronic diseases like asthma, diabetes, cancer, and other Disease. (18) The Chinese pharmacopoeia, the Shennong Ben Cao Jing records plant medicines such as chaulmoogra for leprosy, ephedra, and This was expanded in the Tang Dynasty Yaoling Lun [18]. The Chinese pharmacopoeia, the Shennong Ben Cao Jing records plant medicines such as chaulmoogra for leprosy, ephedra, and this was expanded in the Tang Dynasty Yaoling Lun [18]. In the fourth century BC, Aristotle's pupil Theophrastus wrote the first systematic botany text, Historia plantarum (19)

Introduction of Drug delivery: Refers to approaches, formulations, technologies, and systems for transporting a pharmaceutical compound in the body some time based on nano particles needed to safely achieve its desired therapeutic effect. It may involve scientific site-targeting within the body, or it might involve facilitating systemic pharmacokinetics; in any case, it is typically concerned with both quantity and duration of drug presence

[20]. Drug delivery is a concept heavily integrated with dosage form and route of administration, the latter sometimes even being considered part of the definition. Drug delivery technologies modify drug release profile, absorption, distribution and elimination for the benefit of

improving product efficacy and safety, as well as patient convenience and compliance [21].

❖ NANOTIZED HERBAL DRUG SOME CONDITIONS / DISEASES

The use of nanotechnology in medicine and more specifically drug delivery is set to spread rapidly. Presently, many substances are under investigation for drug delivery and more specifically for cancer therapy. Interestingly, pharmaceutical sciences are using nanoparticles to reduce toxicity and side effects of drugs [22].

In Ayurveda, seven metals, viz., gold, silver, copper, iron, lead, tin and zinc are used therapeutically. These metals are passed through many process and finally transformed into therapeutic form for various diseases. "Bhasma" are the metal based medicine prepared from metals after many systematic processes to raw metal into therapeutic form. The particle size of "Swarna Bhasma" (gold ash, a therapeutic form of gold metal of nano size particles when evaluated through various tools and techniques) is about 56 nm [23].

In Africa, *Artemisia annua* plants are used as "phytotherapy" to treat malaria. The yield of artemisinin in wild population of *A. annua* plant is low (0.01-0.8%). So, there is a considerable limitation to commercialization of this herbal drug. The semi synthetic production of artemisinin from its precursor artemisinic acid has been documented. Artemisinic acid is present in 10-fold excess in the plants. Hence, the semi-synthetic artemisinin yield is considerably higher than the isolation of artemisinin from plants [24].

Highly stable micelles with the size of 10-40 nm can be prepared from poly (ethylene glycol)/phosphatidyl ethanolamine (PEGPE) conjugates. These micelles easily solubilize and firmly retain substantial quantities of various poorly soluble anticancer drugs (m-porphyrin, tamoxifen, taxol). The micelles with encapsulated drugs have the size and size distribution very close to that of original 'empty' micelles. Stable drug-loaded polymeric micelles may represent a convenient drug delivery system into tumours utilizing the enhanced permeability and retention effect [25].

❖ Future Prospective

The research has been going on herbal treatment and natural products all over the globe. The formulations of herbal remedies in the drug delivery system in a number of institutes and research centers are being carried out at fundamentals and clinical trial levels. The only necessity is to build up the better schemes for the proper delivery of such drugs at the sites of action and in the whole body in the doses which will not compromise with the present treatment. Something that would not only heal the patients from side effects like toxicity and hypersensitive reactions but also will intensify the patient's vigor internally is very much beneficial [26].

Conclusion

Recently, pharmaceutical scientists have shifted their focus to designing a drug delivery system for herbal medicines using a scientific approach. *Cuscuta chinensis* Lam. is a parasitic plant in the family Convolvulaceae. It is native to China and was first described in 1786. This species is used medicinally in Nepal. *Cuscuta chinensis* is a commonly used traditional Chinese medicine synonym is *Grammica Chinensis* provide to nourish the liver and kidney

Author Contributions

All authors are contributed equally

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