

## Editorial

# Herbal Medicines Synchronized with the Advancement of Nanotechnology

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## EDITORIAL

In this editorial our aim is to present a “snapshot” of state-of-the-art of nanophytomedicines and introduction of nanotechnology in the field of herbal drugs.

Medicinal plants and natural products have been the most productive and renewable sources for the development of drugs [1]. The use of herbal medicines to treat diseases, named phytotherapy, is a modality of complementary and alternative medicine (CAM), or traditional medicine. Its popularity is maintained not only in developing countries but also in Western countries [2].

The multiple bioactive components in natural products and phytoconstituents are the reason for a large line of applications of herbal medicines for the treatment of different ailments. Among of all different kinds of compounds in medicinal plants, four major biochemical classes are alkaloids, glycosides, polyphenols, and terpenes. With the advent of synthetic chemistry, all drugs were obtained from natural sources, and mostly from plants. Nowadays, about 25% of the drugs being derived from plants and are attributed as the basis of modern pharmaceutical science [2]. Many drugs such as digoxin, quinine, morphine, atropine, aspirin, bromelain, salbutamol, colchicines had been extracted from the plants. They have potential health effect in different treatment areas including of anti-cancer and anti-inflammation. Most of the plants and formulations (e.g., colchicine, curcumin, triphala, pomegranate, guggalosterone, sariva, etc.) have explored the potential to cure cancer and inflammation [3].

Interest in the use of traditional medicine has been growing globally. Expected annual market growth for production of medicinal food and drugs from botanical sources is about 6–8% [4]. The global market for herbal of the total health care delivered in china and US is approximately accounted for 40% and 42% respectively. Herbal medicines are commonly regulated as dietary supplements in the United States, but as medicines in China [2].

In accordance to WHO report, traditional medicine accounts for around 40% of all health care delivered. In the year of 2000, only 25 countries reported having a national policy for traditional medicine, even though regulation or registration procedures for herbal products exist in nearly 70 countries. As an example, in

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the United States from 1999 to 2012, just two botanical drug candidates had sufficient evidence of medicinal value to be approved by the FDA.

Medicinal plants are now getting more attention than ever. In spite of being useful and having health benefit, herbal medicines have some dark aspects that limit efficiency and application of the active ingredients. These phytoconstituents generally have poor water solubility, low permeability, poor pharmacokinetic parameters, systemic clearance, potential toxicity and chemical instability. Therefore, low bioavailability has plagued their clinical use. These features limit the therapeutic efficacy of herbal medicines and it is difficult for the traditional formulations of herbal medicines to achieve the optimal efficacy within the therapeutic doses. So designing novel formulations by multidisciplinary approaches has become necessary to enhance the therapeutic efficacy of herbal medicines.

Today, many traditional practices have been maintained but also modified as time passes and technology progresses. In this approach nanotechnology plays a great role in modern and advanced application of medicinal plants. Nanotechnology platforms are widely being used to formulate delivery systems for nutraceuticals and bioactive compounds. The size-defining characteristic of nanoparticles and nanomaterials is the subject of debate, and varies in the scale of at least 100 to 300 nanometers (nm). Nanomaterials up to approximately 300 nm in size can be taken up by individual cells. Nanophytomedicines have remarkable advantages over conventional formulations. They have a potential for enhancing the pharmacological activity and overcoming problems associated with herbal medicines, so, biodistribution may be controlled and side effects minimized at the very least.

A variety of nano herbal formulations have been commercially exploited. The nanocarriers have been made of synthetic biodegradable polymers, metal and inorganic materials, biopolymers or lipids [5]. Nanostructured carriers such as nanocapsules, nanoemulsions, nanosuspension, solid dispersions, liposomes and micelles have been investigated for their potential to deliver phyto-formulation drugs in the oral, dermal, topical, injection or inhalation route. It has been reported nanonization of herbal drugs like nanocurcumin, nanovincristine, podophylotoxin, taxol and etc [6]. Nanodelivery technologies

are also currently in use for sustained or enhanced delivery of phyto-derived bioactive compounds in drugs and cosmeceutical products [7,8].

Herbal nanoparticles create potentially attention grabbing results for the treatment of critical diseases and future prospects of nanophytomedicines have been fascinated further research groups. Not only novel improvements of nanophytoconstituents, but also their potential translation into commercial products, are highlighted more than ever, which focus on the areas of drugs, functional foods and supplements. It is anticipated that the effectiveness of the herbal remedies being synchronized with the nanotechnology will elevated the significance of existing drug delivery systems. Now, the development of nanophytomedicine in a number of organizations is being performed at basic and clinical trial levels.

New insights and developments tend to be accompanied by new challenges. The use of nanoparticles has raised safety concerns. Therefore, a new term of “nanotoxicology” has emerged in recent years. The transport, metabolism, excretion, and immune response mechanisms of nanoparticles may differ significantly from those of traditional forms. A growing number of online resources of databases, web portals and gateways play role for linking and sharing information pertaining to the occupational health and safety aspects of nanomaterials, and up-to-date information relevant for scientists working in the area of nanotoxicology. They are not necessarily dedicated to nanophytomedicines. These findings and Managing risk including human and environmental health and safety have significant implications for the emerging fields of green nanotechnology.

Regulatory bodies such as the Food and Drug Administration in the U.S. or the Health and Consumer Protection Directorate of the European Commission have started dealing with the potential risks posed by nanoparticles. Heretofore, either engineered nanoparticles or the products and materials that contain them need to receive special regulation regarding production, handling or labeling, integrated more than before.

These are the imperative steps which must be undertaken before nanoformulation of herbal medicine or its modified version can be released commercially.

At the moment, the question of whether or not nanotechnology is beneficial or harmful to human health remains unresolved. This answer is multilateral and depends on age, health status, and even the presence or absence of specific gut microflora. Clarity on this issue is needed because global consumption of nanomedicines is rapidly increasing. At present, on the basis of few data on the safety and toxicological evaluation for nanomaterials and nanomedicines, scientists must accept that it is still very early in the declaring of appropriateness of different kinds of nanoparticles for living cells.

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