

# Use of Nanotechnology in The Development of Herbal Medicines

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**Abstract**—"Nanotechnology" is based on the detection of particles smaller than 100 nm in size. It is due to the engineering and Production of materials at the atomic and molecular levels. The application of nanotechnology to "phytotherapy," or the treatment of various ailments with herbal medicines/drugs, including herbal drug delivery, where present and upcoming nanotechnologies are used. "phytotherapy". The "mesoporous" nanoparticles introduce the gene and activate it in a precise and regulated manner, with no hazardous side effects. The chemotherapeutic effects of biologically synthesised nanoparticles containing plant components are superior against microbial illnesses.

**Index Terms**—plant, treatment, herbal drug, medicine nanotechnology, uses

## I. INTRODUCTION

In nanotechnology, the prefix "nano" refers to a billionth (1 10<sup>-9</sup>). "Nanotechnology" is founded on the recognition that particles smaller than 100 nanometers (nm) in size transmit unique properties and behaviour to nanostructures formed from them. This occurs because particles smaller than the characteristic lengths associated with a specific phenomenon frequently exhibit new chemistry and physics, resulting in new behaviour that is size dependent. On the other hand, "nanotechnology" is a process that develops the ability to manage individual atoms and molecules using a precise set of tools to build and operate proportionately smaller sets so on down to a required scale. Nanoparticles range in size from 1 to 100 nanometers (nm). In nanotechnology, a particle is a small ultrafine particle that works as a single entity in terms of properties and transport. Particles are further classified based on their diameter. Herbs and herbal remedies have been used to treat illnesses since the beginning of time. "Herbal medicines" are natural products isolated from plants. Herbal medicines have been used practically since the origin of human society. Scientists are developing new drugs, which

will be done gradually and in a variety of methods. These drugs, however, have always had their roots in NPs and/or ancient or herbal remedies. Prior to the emergence of high throughput screening for drug discovery, NPs made up 90-95 percent of all drug materials. According to data on the location of new pharmaceuticals from 1981 to 2007, NPs account for roughly half of them. It has been established that NPs are more voluntarily consumed than synthetic medicines. Although it is not believed that herbal treatments can effectively treat ailments, they can help patients manage their diseases better. (1,2,3,4)

## II. TYPES OF NANOPARTICLES

Nanoparticles come in two varieties - inorganic and organic

### A. Inorganic nanoparticles:

Lists the various types of inorganic particles, such as magnetic, metallic, ceramic, and nanoshells, as well as their descriptions, sizes, advantages, and disadvantages.

Inorganic compound	Description	Size in nm
Magnetic	Super paramagnetic iron oxide particles	6-105
Nano cells	Dielectric silica core in thin gold shell	8-280

### B. Organic nanoparticles

Describes and sizes the various organic nanoparticle types, including carbon nanotubes, quantum dots, dendrimers, liposomes, and polymers.

Organic compound	Description	Size in nm
Carbon tubes	Cylindrical sheet	2-160
Lyposomes polymer	Phospholipid colloidal particle	4-90

(5,6,7)

## III. ROLE OF NANOPARTICLES

- To disperse the medication in tiny particles that improve the complete surface area of the medication, allowing for faster clearance from the circulation.
- The drug delivery strategy is quite specialised.
- The medication's ability to cross epithelial and endothelial barriers
- Getting the drug to the right places.
- Using two different strategies in therapeutic medications.
- Benefits of Nanoparticles -
- Because it is smaller than liposomes and microspheres, it may easily pass through the sinusoidal gaps in bone marrow and spleen versus other organ systems with a long circulation period
- Nanoparticles increase the resistance of a medication or protein to enzymatic degradation.
- They represent a significant improvement over current practices. In terms of efficacy and efficiency, oral and intravenous (IV) delivery routes
- It reduces the toxicity of the liver.
- The downsides of nanoparticles are as follows:

#### A. CRUDE DRUG AS NANOPARTICLES

1. artemisia annua

- Significant immunogenicity
- Prolonged and pricey costs
- Potential for poor targeting

#### IV. NANOTIZED HERBAL MEDICINES IN SOME CONDITION

The use of nanotechnology in medicine, specifically drug delivery, is expected to grow substantially. Many chemicals are now being researched for drug delivery and, more especially, cancer therapy. Surprisingly, pharmaceutical sciences are employing nanoparticles to lessen drug toxicity and side effects. Positively, the ability to pass the blood-brain barrier may offer up new avenues for drug delivery into the brain. Furthermore, the micro size permits access into the cell and its numerous cellular compartments, including the nucleus. A wide range of substances are currently being researched for the preparation of nanoparticles for drug delivery, ranging from biological substances such as albumin, gelatin, and phospholipids for liposomes to chemical substances such as various polymers and solid metal containing nanoparticles. (8,9)



## 2. Common name

Sweet wormwood is the popular name for *Artemisia annua*. Sweet sagewort and annual mugwort are other names for it.

*Artemisia annua*, often known as sweet wormwood, is a plant species belonging to the Asteraceae family. It is native to China and has been utilised for generations in traditional Chinese medicine. The plant is now widely distributed around the world and is produced commercially for the extraction of the anti-malaria medication artemisinin from its leaves.

## 3. Family - Asteraceae

## 4. Chemical constituents

Artemisinin is the most pharmacologically active component found in the plant. It is a sesquiterpene lactone. It has long been used as an antimalarial medication.

**Flavonoids:** These are antioxidant-rich chemicals that are responsible for the plant's yellow colour. Quercetin, luteolin, kaempferol, and apigenin are among them.

Coumarins are chemicals present in the plant's leaves and stems that have anticoagulant qualities. Scopolletin and umbelliferone are two examples.

**Essential oils:** These are volatile chemicals that give the plant its scent. Cineole, camphor, and thujone are among them.

**Polysaccharides:** These are complex carbohydrates that have immune-stimulating properties and are found in the leaves and stems of the plant.

**Tannins:** These are polyphenolic compounds that have astringent properties and are found in the leaves and stems of the plant.

## 5. Uses

*Artemisia annua* is the most often used anti-malarial plant. The plant contains artemisinin, a chemical that is effective against the malaria parasite.

**Anti-inflammatory:** *Artemisia annua* possesses anti-inflammatory qualities and may aid in the reduction of inflammation in the body.

**Anti-cancer:** *Artemisia annua* includes chemicals that have been proven to have anti-cancer effects and may aid in the inhibition of cancer cell development and spread.

*Artemisia annua* may assist to enhance digestive health by lowering inflammation and encouraging the growth of beneficial gut bacteria.

**Immune System Support:** *Artemisia annua* may assist to support the immune system by boosting immune cell synthesis and decreasing inflammation.

Anti-viral: *Artemisia annua* has been demonstrated to have anti-viral characteristics, which may aid in the inhibition of virus reproduction.

*Artemisia annua* can protect the skin from UV damage, reduce inflammation, and enhance wound healing. (10,11,12)

*B. murva*



1. Common name

The common name of Murva is Indian Trumpet

2. Biological source

Murva's biological source is the plant *Marsdenia tenacissima*, a flowering plant in the Apocynaceae family. It is also known by a variety of other names, including Murudsheng, Murwa, Murba, and Marorphali. The plant is native to India and is found throughout Asia, including China, Nepal, Bhutan, and Myanmar. The plant's roots contain the majority of the therapeutic compounds and are used in traditional medicine to treat a variety of diseases.

3. Family - Apocynaceae.

4. Biological source

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4. Chemical constituents

Cardiac glycosides: These are a group of compounds that have a steroid nucleus and a sugar moiety. They

are known for their ability to improve heart function and have been used in the treatment of heart failure. Murva contains several cardiac glycosides, including marsdenin, marsdenoside, and tenacigenin.

Triterpenoids: These are a diverse group of compounds that are widely distributed in the plant kingdom. They have a variety of biological activities, including anti-inflammatory, antioxidant, and anticancer activities. Murva contains several triterpenoids, including ursolic acid and oleanolic acid. Triterpenoids: These are a diverse group of compounds that are widely distributed in the plant kingdom. They have a variety of biological activities, including anti-inflammatory, antioxidant, and anticancer activities. Murva contains several triterpenoids, including ursolic acid and oleanolic acid.

Flavonoids are a type of chemical with antioxidant and anti-inflammatory effects. Murva includes flavonoids such as rutin and quercetin.

Alkaloids are a class of chemicals with a nitrogen-containing heterocyclic ring. They have numerous biological actions, including anticancer, analgesic, and antipyretic properties. Murva contains alkaloids such as marsdenin and tenacissin.

Phenolic chemicals are compounds that have a hydroxyl group linked to an aromatic ring. They have anti-inflammatory and antioxidant qualities and have been used to treat a variety of ailments. Murva includes phenolic substances such as gallic acid and ellagic acid.

#### 5. Uses

Murva is often used for respiratory disorders such as cough, asthma, and bronchitis. It has been demonstrated to have bronchodilator and expectorant effects, which can help with breathing.

**Digestive Health:** Murva is also used to treat digestive issues such as constipation, indigestion, and diarrhoea. It can assist to regulate bowel movements and enhance digestion.

**Anti-inflammatory:** Murva includes chemicals that have anti-inflammatory characteristics, which can help to reduce inflammation in the body.

Murva has been demonstrated to strengthen the immune system by promoting the formation of white blood cells.

**Antioxidant:** Murva includes antioxidants, which can help protect the body from oxidative stress and free radical damage.

Murva is used in Ayurvedic medicine to treat a variety of skin disorders, including eczema and psoriasis. It can aid to calm the skin and relieve irritation.

**Anti-cancer:** Murva includes chemicals that have been demonstrated to have anti-cancer characteristics and may aid in the prevention of cancer cell growth and spread. (13,14,15,16)

#### C. Quercetin



#### 1. Common name

Quercetin is a flavonoid component that is abundant in nature and can be found in a variety of fruits, vegetables, and plants. It does not have a distinct common name, however it is commonly known as "quercetin."

2. Family\_ flavonoids

3. Biological source

Quercetin is a flavonoid, a type of polyphenolic substance that is abundant in the plant kingdom and can be found in a variety of fruits, vegetables, and herbs. The following are biological sources of quercetin:

**Onions:** Onions are one of the best sources of quercetin in the diet. The onion's outermost rings have the highest concentration of quercetin.

**Apples:** Quercetin is abundant in apples, particularly in the skin.

**Berries** contain variable quantities of quercetin, including blueberries, cranberries, and blackberries.

**Grapes and red wine** contain quercetin, which is found in grape skins and seeds. **Green leafy vegetables** include quercetin, which can be found in kale, spinach, and broccoli.

Many herbs, including parsley, sage, and thyme, contain quercetin. Quercetin can be isolated from these plants and used as a dietary supplement or a component in a variety of food products.

4. Chemical constituents

Quercetin is a flavonoid found across the plant kingdom that has been demonstrated to have a variety of pharmacological effects. Quercetin's chemical components include:

D. Danshen

Quercetin belongs to the flavonol class, which is a form of flavonoid chemical with a 3-hydroxyflavone backbone. Kaempferol and myricetin are two more flavonols.

**Glycosides:** Quercetin is frequently found in its glycosidic form, where it is linked to a sugar molecule such as glucose or rutinose.

Quercetin can also exist as an aglycone, which is an unbound, free version of the molecule.

Quercetin can be esterified with a variety of phenolic acids, including gallic acid and caffeic acid.

5. Uses

**Immune System Support:** Quercetin has been demonstrated to help the immune system by lowering inflammation and increasing immune cell formation.

**Cardiovascular Health:** Quercetin may benefit cardiovascular health by lowering blood pressure, cholesterol levels, and inflammation.

**Anti-Cancer:** Quercetin has been demonstrated to have anti-cancer characteristics and may aid in the prevention of cancer cell growth and spread.

**Allergy Relief:** Quercetin can help reduce inflammation and decrease the release of histamines, which are responsible for allergic reactions.

**Brain Health:** Quercetin may aid in the improvement of brain function and the prevention of age-related cognitive decline.

**Anti-viral:** Quercetin has been proven to have anti-viral characteristics and may aid in the inhibition of virus replication.

Quercetin has been shown to help protect the skin from UV exposure, reduce inflammation, (17,18,19)



1. Common name

Danshen is also known as Red Sage or *Salvia miltiorrhiza*.

2. Family\_ *lamiaceae*

3. Biological source\_

Danshen is a plant species endemic to China and other regions of East Asia. It is also known as *Salvia miltiorrhiza*. It is a member of the mint family (*Lamiaceae*) and has been utilised for generations in traditional Chinese medicine. (21,22,23,24)

4. Chemical constituents

**Tanshinones:** Tanshinones are a collection of structurally similar chemicals that give danshen its red colour. Tanshinones have been demonstrated to exhibit a variety of pharmacological activity, including antioxidant, anti-inflammatory, and anticancer properties.

**Salvianolic acids** are a class of water-soluble phenolic acids with antioxidant, anti-inflammatory, and cardiovascular protective properties.

**Cryptotanshinone** is a tanshinone chemical that exhibits anti-inflammatory and anticancer properties.

**Danshensu:** This is a water-soluble chemical with antioxidant and anti-inflammatory properties. **Rosmarinic acid** is a phenolic acid that has antioxidant, anti-inflammatory, and neuroprotective

properties. **Lithospermic acid** is a phenolic acid that has antioxidant and anti-inflammatory properties (25,26,27,28)

5. Uses

Danshen is commonly used in the treatment of cardiovascular disease. It can aid in the improvement of blood flow, the reduction of blood pressure, and the prevention of blood clotting. It has also been demonstrated to lower the risk of stroke and other cardiovascular illnesses.

**Anti-inflammatory:** Danshen contains anti-inflammatory chemicals, making it effective in the treatment of inflammatory disorders such as arthritis, asthma, and allergies.

Danshen can aid to improve liver function and protect the liver from toxicity-induced damage.

Danshen has been found to enhance cognitive function, particularly memory and learning.

Danshen can aid with skin health by lowering inflammation and facilitating wound healing.

**Cancer:** Danshen contains chemicals that have been demonstrated to have anti-cancer effects and may aid in the prevention of cancer cell growth and spread (29,30,31)

## V. CONCLUSION

Herbal remedies are rapidly gaining popularity due to their ability to heal virtually all diseases. However, the use of herbal treatments is limited due to a variety of difficulties such as poor solubility, poor bioavailability, limited oral absorption, instability, and unpredictable toxicity. In order to address the challenges raised by herbal drugs, nanotechnology has developed appealing solutions for the pharmaceutical business. The usefulness and significance of using nanocarriers in combination with natural products and herbal remedies is expected to boost the significance of present medicine delivery techniques.

## VI. ACKNOWLEDGEMENT

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