



# Current Progress in Novel Drug Delivery System for Delivery Herbal Drugs: A Review

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## Abstract

Due to their aesthetic value, increased patient compliance, and prominent health benefits, herbal medicines have recently attracted the attention of people and researchers around the world. Treatment outcomes Compared to traditional formulations, novel drug delivery systems for the delivery of herbal medications have a number of advantages. It include improving solubility, bioavailability, and protection from toxicity, among other things. By combining the herbal medications into proper dose forms, a more ethical course of treatment can be followed with increased efficacy. By creating inventive drug delivery systems for certain medications, this can be accomplished. These systems include microspheres, phytosomes, nanocapsules, polymeric nanoparticles, and animations. The current article summarises the state of novel herbal formulation development, their type of active ingredients, biological activity, and novel herbal formulation applications.

## Keywords

Novel Drug Delivery; Herbal drug; Nanoparticles; Liposome; Phytosome

## I. Introduction

Due to their attractiveness, increased patient compliance, and pronounced therapeutic effects, herbal medicines have drawn attention from all over the world. Information on such plants' ethnobotanical uses and their cultural applications is helpful in theTo advance the health care system, traditional medical practises must be preserved, as well as biodiversity [1-2]. These plant species, numbering in the thousands, are widespread throughout the globe. medication contained

inpreservation of the traditional medical model, biodiversity, Withaniasomnifera, Aloe vera, Azadirachtaindica, MurrayaKoenigii, Carica papaya, and Allium sativum, among others [3–17]. Compared to traditional formulations, novel drug delivery systems for herbal medicines have a number of advantages [18]. The patient receives the ideal dosage of the drug in question, administered in such a way that it precisely reaches the site of action and has therapeutic effects [19]. SomeDrugs have a range of optimal doses where the greatest benefit is obtained; quantities outside or inside of this range can be harmful or have no therapeutic effect at all.

## Conventional dosage form

Various drug delivery and drug targeting systems are now being developed to reduce drug degradation and loss, eliminate unwanted side effects, and increase drug bioavailability and the percentage of the medication accumulated in the necessary zone. Development A new method of drug delivery is called a novel drug delivery system. It makes the drug's effects last longer and be more potent. This gets around the drawbacks of earlier medication administration techniques [20]. disadvantages of traditional dosing formats. The following restrictions apply to conventional dose forms [21]. Poor patient compliance increases the likelihood that a medication with a short half-life that requires frequent administration will be missed. Unavoidable drug concentration changes can result in under- or overmedication. It is possible to obtain a conventional peak- trough plasma concentration time profile, This make achieving the steady-state condition challenging. A medicine with a low



therapeutic index is highly susceptible to the effects of drug level changes.

Time an overdose occurs.

### Novel drug delivery system

In innovative drug delivery technology, the drug is either incorporated into a carrier system or has its molecular structure altered to govern the dispersion of the drug. The following benefits can be seen in novel medication delivery methods [22].

- Increasing solubility
- An improvement in bioavailability.
- Defense against toxicity.
- Boosting pharmacological activity.
- An increase in steadiness.
- More evenly distributed tissue macrophages.
- Consistent delivery.
- Defense against chemical and physical deterioration

### Herbal drugs

An herbal formulation is a dosage form that contains one or more herbs or processed herbs in specific amounts to provide specific nutritional, cosmetic, and/or other benefits intended for use to diagnose, treat, or mitigate diseases of altering the physiology or anatomy of humans or animals is also possible. Herbal preparations are made by putting whole, cut, or fragmented plants through processes like extraction, distillation, expression, fractionation, purification, concentration, or fermentation. Comminuted or powdered herbal compounds, tinctures, extracts, essential oils, expressed juices, and processed exudates are some of these [23–24].

### Advantages of herbal drugs

The following benefits apply to herbal medications [25–27].

### Low risk of side effects

Most herbal medications are well tolerated by the patient, have fewer side effects and unintended consequences than traditional medications, and may be safer to use.

### Effectiveness

Long-standing health issues that don't respond well to conventional medicine are better treated with herbal medications. The use of herbs and complementary therapies to treat arthritis is one instance. a popular prescription medication called Vioxx is used to treat an increased risk of cardiovascular problems, arthritis, was recalled. On

the other hand, arthritic herbal therapies have less adverse effects. These treatments involve dietary adjustments like introducing simple herbs, avoiding vegetables from the nightshade family, and consuming less white sugar.

### Lower cost

Herbal medicines cost substantially less than prescription drugs. The price of prescription medications is significantly increased by research, testing, and marketing. Compared to drugs, herbs are typically more affordable.

### Widespread availability

Herbs are available over-the-counter. At home, you can grow simple herbs like chamomile and peppermint.

### Limitation of herbal drugs

The following restrictions apply to herbal medications [28–33].

### Not suitable for many diseases

Herbal or alternative remedies are far less effective at treating unexpected, serious illnesses and accidents. A traditional doctor employing up-to-date diagnostic procedures, surgery, and medications would be able to heal appendicitis or a heart attack more successfully than a herbalist could treat major injuries like a broken leg. He also wouldn't be able to treat heart attacks or appendicitis as successfully as a conventional physician using up-to-date diagnostic tools, procedures, and medications.

### Lack of dosage instruction

Risk factors for self-treatment with herbal medicines might be numerous. Additionally, improper dosage direction can result in overdose.

### Poison risk associated with wild herbs

Poisoning can result by using the wrong plant part or from using herbal medications without correctly identifying the plant.

### Lack of regulation

Since there are no tight regulations for herbal items, customers may purchase subpar herbs. Herbal items' quality can differ between batches, brands, or producers. The correct dosage of an herb may become much more challenging to prescribe as a result. All Herbal medications are not always safe; some could be lethal or trigger allergic reactions.

### Novel drug delivery system (ndds)

The use of herbal medicines to treat a variety of diseases with less hazardous side effects



and better therapeutic results is growing in popularity in the modern world. For herbal medications, there is a high likelihood that several components will be destroyed in the stomach pH is very acidic. Before they enter the bloodstream, other substances might be metabolised by the liver. As a result, the actual dosage of the medication might not get into the blood. The blood must contain the drug at a minimum level, which is There won't be any therapeutic effect if the dose falls below the "minimum effective level" [34].

### Ndds for delivery of herbal drugs

The herbal medicine is given to the patient using an antiquated, traditional drug delivery system, which reduces the drug's effectiveness. Additionally, for a very long time, the development of novel formulations of herbal medicines was not considered. due to a lack of scientific support and processing challenges, like standardization, extraction, and identification of specific drug components in complex polyherbal systems [35]. Modern phytopharmaceutical research can address issues with pharmacokinetics, site of action, mechanism of action, necessary precise dose, and more [36].

### Types of novel herbal drugs delivery system

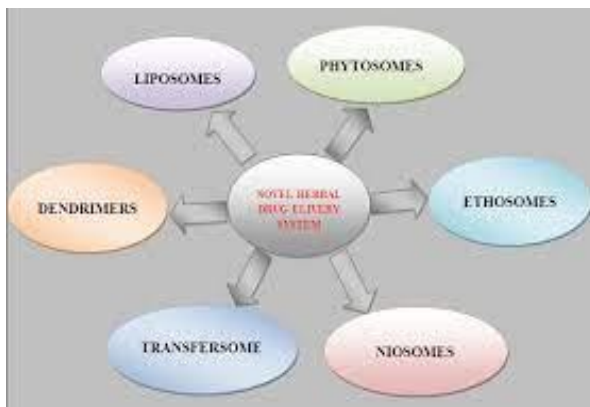


Fig 1.1 Novel Drug Delivery System Of Herbal Drugs[36]

Different methods for delivering novel herbal drugs include different formulations like liposomes, phytosomes, pharmacosomes, niosomes, nanoparticles, microspheres, transfersomes, and ethosomes as well as transdermal drug delivery. Below is a discussion of the system and proniosomes, etc.

### Liposomes Characteristic

A portion of the solvent is encapsulated in spherical liposomes, which allow the solvent to easily diffuse or float into their core. These are colloidal or microparticulate carriers with diameters typically ranging from 0.05 to 5.0  $\mu\text{m}$  that develop on their own. Hydration of lipids occurs in aqueous media. They may have one, a few, or numerous cone-shaped membranes [37]. Polar lipids, the building blocks of liposomes, are characterised by having both a lipophilic and a hydrophilic group on the same molecule. The high biocompatibility, among other benefits, of using liposomes is the simplicity of preparation, (iii) chemical adaptability that permits the loading of hydrophilic, amphiphilic, and lipophilic compounds, and (iv) the straightforward modification of their pharmacokinetic properties by altering the chemical composition of the participant components [38]. A membranous lipid bilayer made primarily of phospholipids, either natural or synthetic, surrounds an aqueous volume inside liposomes, which are concentric bilayered vesicles. From two Greek words, "Lipos" and "soma," comes the name "liposome," meaning body, with "Soma" denoting fat. Depending on the size, a liposome can be formed as a unilamellar or multilamellar structure, and its name refers not to its size, but to phospholipids as structural building blocks. Unlike a liposome, water is a lipophobic substance, but it doesn't mean it always contains it. Vesicles formed of a lipid bilayer make up liposomes, which are manufactured. Liposomes may be utilised to give medication for cancer and other disorders, and is filled with medication. Liposomes and biological membranes can be damaged during preparation, such as via sonication. When some lipids are hydrated in aqueous solution, liposomes, which are microscopic or colloidal carriers and typically range in size from 0.05 to 5.0  $\mu\text{m}$ , spontaneously develop. An aqueous volume is contained within one or more bilayers of material that is largely biocompatible and biodegradable by liposomes. Lipids, either organic or synthetic. It is possible to encapsulate drugs in liposomes at the bilayer interface, in the phospholipid bilayer, or in the entrapped aqueous volume. the bilayer interface, etc.

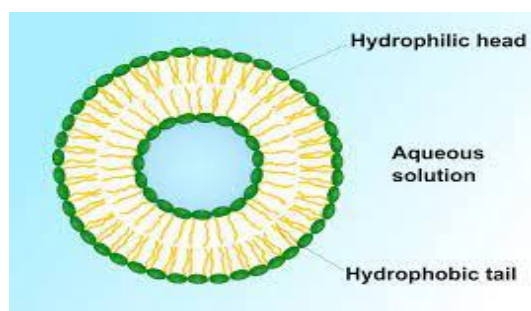


Fig 1.2 Structure Of Liposomes

#### Method of preparation

- There are four fundamental steps in all liposome preparation techniques:
- Dehydration of lipids using an organic solvent.
- The lipid's dispersion in aqueous media
- Purifying the final liposome;
- Testing the outcome.

#### Advantages of liposomes formation

- Drugs that are hydrophilic and hydrophobic can be administered.
- Liposome herbal treatment serves as a medium delivering both macromolecules like genes and tiny cytotoxic chemicals.
- The formulation may be released in a controlled and sustained manner.

#### Phytosomes

##### Characteristic

The majority of phytomedicines' bioactive components are flavonoids, which have a low oral bioavailability. compounds from plants that are soluble in water

(mostly polyphenoles) can be transformed into phytosomes, which are lipid-compatible molecular assemblies. Due to their improved ability to pass through lipid-rich biomembranes and eventually reach the blood, phytosomes are more accessible than basic plant extracts [39].

#### Method of preparation

In a round bottom flask (RBF), phosphatidylcholine and cholesterol were accurately weighed and then dissolved in 10 ml of chloroform and sonicated for 10 min using a bath sonicator. Rotary evaporators (45–50°C) are used to remove organic solvents. The mixture of phospholipids was created as a thin film after the solvent had been completely removed. thin layer of phospholipids mixture was created out of solvent. This film was hydrated with a methanolic plant extract in a rotary evaporator for one hour at 37–40°C. Following hydration, a lipid and plant extract mixture was

sonicated for 20 minutes. min. with cold bath present for heat dissipation. Phytosomes were then prepared, placed in amber-colored bottles, and kept in the freezer (2–8 oC) until needed [40].

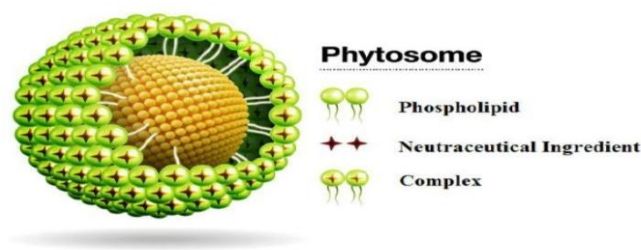


Fig.1.3 Phytosomes

#### Advantages of phytosomes

phytosomes have the following advantages[41],

- Increased bioavailability, better lipid-insoluble polar phytoconstituent absorption, and significant drug entrapment, which is advantageous.
- Considerable drug entrapment that is advantageous.
- Because of increased absorption, reduce the dose.
- As a hepatopoietic substance, phosphatidylcholine exhibits synergistic effects.

#### Nanoparticles

##### Characteristic

Both hydrophilic and hydrophobic medicines can be delivered effectively using nanoparticles. The size range of nanoparticles, which are submicron-sized particles, is 10 to 1000 nm. Designing nanoparticles as a delivery mechanism was the main objective. are to regulate drug release, surface characteristics, and particle size in order to accomplish the drug's site-specific effect at the therapeutically ideal rate and dosage schedule. Biodegradable polymeric nanoparticles have received a lot of attention recently as potential medication delivery systems. [42]

#### Method of preparation

- Solvent evaporation
- Nanoprecipitation,
- Emulsification/solvent diffusion,
- Salting out,
- Dialysis,
- Supercritical fluid technology (SCF) [43].



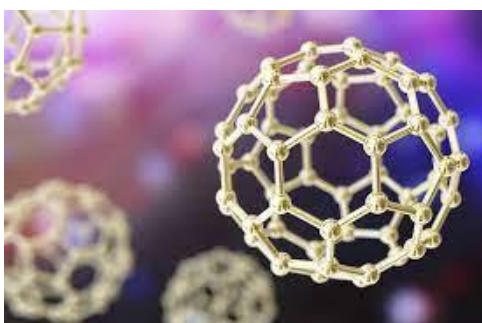


Fig.1.4 Nanoparticles

### Advantages of herbal nano particles delivery system

The herbal composition is delivered directly to the site of action via a nanoparticulate method. Drugs can be encapsulated into nanoparticles to increase their solubility and drug pharmacokinetics. Nanoparticles can also penetrate a variety of formulations, help medications cross biological barriers, and boost their bioavailability. It can deliver the medication straight to the area where it will work without harming the ecosystem [44].

### Niosomes

Niosomes are multilamellar vesicles made of cholesterol and non-ionic surfactants from the class of alkyl or dialkyl polyglycerol ethers. Previous research conducted in collaboration with L'Oreal has demonstrated that niosomes generally exhibit drug-like characteristics. Liposomal-like carriers [45] In that they provide some advantages over liposomes, niosomes are distinct from liposomes. Problems with liposomes include their high cost and the chemical instability of its constituent parts, such as phospholipids. Natural phospholipid purity varies, they need specific treatment and storage, and they are subject to oxidative deterioration. None of these issues exist with niosomes [46].

### Proniosomes

are generated when a nonionic surfactant, cholesterol, and a charge-inducing substance are mixed together and then hydrated in aqueous fluids. Niosomes can accommodate medicinal molecules with a wide range of solubilities since its infrastructure is made up of both hydrophobic and hydrophilic moieties. The use of niosomes in several pharmaceutical applications has been studied. Important benefits of employing niosomes in these therapeutic applications include their capacity to decrease systemic toxicity by encapsulating Slow

medication release reduces elimination of such therapy drugs from the body. The proniosome gel system is an improvement over niosome and can be used in a variety of ways to deliver actives to the desired place. The pheniosomal gels are compounds that transform into niosomes when in contact with skin moisture. Proniosomes are water-soluble carrier particles coated with surfactant that, upon brief agitation in hot aqueous media, can hydrate to form a niosomal dispersion right before use [46].

### Advantages of proniosomes

- More stable during storage and sterilization.
- Easy to transfer and distribution.

### Transdermal delivery system

There is growing interest in using the skin to provide medications for both systemic drug delivery as well as local therapeutic effects on sick skin (topical delivery). Nevertheless, they lacked such anticipated success with other medications. However, transdermal drugs have enormous potential as smart drug delivery systems in the future [47]. Controlled drug delivery, improved bioavailability, fewer side effects, and simple application are benefits of transdermal delivery systems. Boswellic acid and curcumin have been combined in a transdermal formulation for ongoing medication the executive [48].

### Microspheres

#### Characteristics

The average particle size of microspheres, which are discrete spherical particles, ranges between 1 and 50 microns. It is believed and recognised that microparticulate drug delivery methods are a reliable option for precisely delivering the drug to the target site, to maintain the without adverse consequences, the desired concentration is achieved at the target spot. A helpful technique that increases patient compliance and considerably lengthens the duration of a drug's impact is micro encapsulation [49].

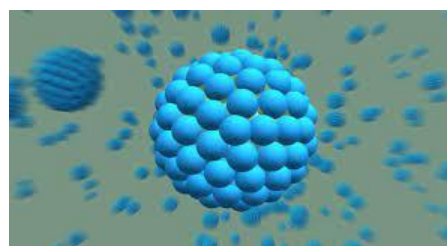


Fig.1.5 Structure Of Microspheres



### Methods of preparation

- Spray Drying
- Solvent Evaporation
- Single emulsion technique
- Double emulsion technique
- Phase separation coacervation technique.
- Spray drying and spray congealing
- Solvent extraction
- Quasi emulsion solvent diffusion [50].

### Ethosome characteristics

The ethosomal patch, which contains medication in ethosomes, was created thanks to recent advances in patch technology. Soya phosphatidylcholine, ethanol, and water are the components of ethosomal systems. They could develop with a high entrapment capacity for molecules with different lipophilicity levels, multilamellar vesicles are multilayered structures. Additionally studied are the transferosomes and elastic vesicles used as drug carriers for a range of small molecules, peptides, proteins and vaccines [51].

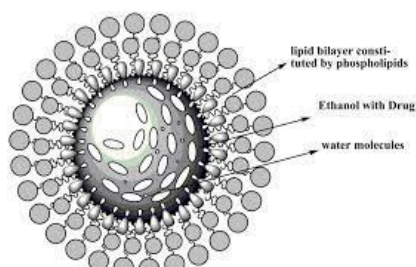


Fig.1.6 Ethosomes

### Method of preparation [52]

- Hot Method
- Cold Method
- Conventional mechanical dispersion technique

### Advantages of ethosomal drug delivery

- Drug transdermal absorption via the skin may be improved.
- A variety of drug classes in large quantities can be given.

Improved results are obtained when the ethosomal medication is administered in semisolid form. Compliance by the patient [53].

### Analysis of NDSS systems of herbal drugs

Routine quality control approaches are used to examine NDSS systems that comprise isolated

phytoconstituent extracts, portions, or the entire medication. High performance thin layer chromatography and high performance liquid chromatography are among the quality control methods. Gas chromatography, liquid chromatography, UV spectrophotometry, and other techniques [54–70]

## II. Conclusion

The herbal medications can be included in NDSS, allowing us to deliver the right dosage to the target site. The NDSS for herbal medications will therefore be a new application in the traditional herbal compositions, saving the preparation period and will also improve patient compliance.

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