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## AN UPDATED REVIEW ON NOVEL HERBAL DRUG DELIVERY SYSTEM

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### Abstract

A unique drug delivery system is an innovative approach to medication delivery that solves the shortcomings of standard drug delivery systems. Using proactive and plant choices, innovative herbal formulations such as polymeric nanoparticles, nanocapsules, liposomes, phytosomes, microspheres, transfersomes, and ethosomes have been developed. The innovative formulations are claimed as having significant advantages over standard formulations of plant actives and extracts, including increased solubility, bioavailability, and toxicity protection, increased pharmacological activity, increased stability, and enhanced tissue macrophages. By combining herbal treatments into modern dose forms, they can be administered in a more upright manner with increased efficacy. This is possible by developing novel drug delivery mechanisms for natural components.

### Information-

The future of medicine is anchored in the past, before chemists set out to create synthetic silver bullets for all ills, and before pharmaceutical companies hitched our collective health to what has become a multibillion-dollar wagon for them. Historically, practically all medications were derived from plants, with the plant serving as man's sole chemist for centuries. Herbs are making a comeback; a herbal "renaissance" is taking place around the world, and more and more people are turning to herbal remedies to cure a variety of problems instead of conventional medication. The popularity of herbal treatments can be attributed to three factors:

1. There is rising worry over medicine and surgery reliance and safety.
2. Many of the most common health disorders are not properly treated by modern medicine.

3. Many natural measures are being proved to offer greater results than medicines or surgery without the adverse effects.

Revolutionary drug delivery system is a novel technique to medication delivery that addresses the constraints of the standard drug delivery systems. Modern medicine cures a particular ailment by targeting exactly the diseased zone inside a patient's body and conveying the medicament to that location. Drug delivery system is the process by which an optimum amount of the concerned drug is supplied to the patient in such a way that it reaches exactly the 'site of action' and starts working.

### Keywords:

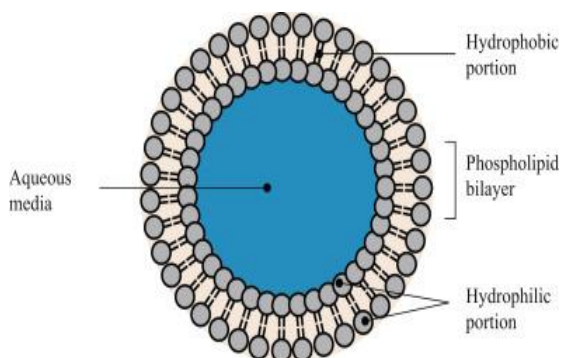
Herbal medicines, herbs, novel drug delivery system, phytopharmaceuticals

- Different types of Novel herbal formulation-

1. Liposome
2. Phytosomes
3. Neosome
4. Ethosomes
5. Transferosomes
6. Microsphere
7. Microemulsion
8. Nanotechnology

### 1. Liposomes

Liposomes, sphere-shaped vesicles comprised of one or more phospholipid bilayers, were initially reported in the mid-60s. Today, they are a very useful reproduction, reagent, and tool in several scientific disciplines, including mathematics and theoretical physics, biophysics, chemistry, colloid science, biochemistry, and biology. Since then, liposomes have made their way to the market. Among several talented novel drug delivery technologies, liposomes characterise



an advanced technology to deliver active molecules to the site of action, and at present, several formulations are in clinical use.

Liposomes are small artificial vesicles of spherical shape that can be made from cholesterol and natural non-toxic phospholipids. Due to their size and hydrophobic and hydrophilic character (besides biocompatibility), liposomes are potential methods for drug delivery. [1]

- Physical properties for liposomes [2]

1. Physical stability can be maintained by avoiding the excess unsaturation in the phospholipids while they are subjected to simple peroxidation and by preserving the pH conditions.
2. It is important for the stabilisation and preservation of the bioactive molecule at the heart of the liposome.
3. morphology and size distribution of the vesicles are significant characteristics for measuring the physical stability.

- Chemical properties of liposomes [3]

Phospholipids are chemically unsaturated fatty acids, prone to oxidation and hydrolysis, which may alter the stability of the drug product.

pH, ionic strength, solvent system, and buffered species also play a major role in maintaining a liposomal formulation.

- Method of preparation of liposomes [4-5]

All the methods of preparing the liposomes involve four basic stages:

1. Drying down lipids from organic solvent.
2. Dispersing the lipid in aqueous media.
3. Purifying the resultant liposome.
4. Analyzing the final product.

### **Method of liposome preparation and drug loading[**

The following methods are used for the preparation of liposome:

1. Passive loading techniques
2. Active loading technique.

Passive loading techniques include three different methods:

1. Mechanical dispersion method.
2. Solvent dispersion method.
3. Detergent removal method (removal of non-encapsulated material)

## Mechanical dispersion method

The following are types of mechanical dispersion methods:

1. Sonication.
2. French pressure cell: extrusion
3. Freeze-thawed liposomes.
4. Lipid film hydration by hand shaking, non-hand. shaking or freeze drying.
5. Micro-emulsification.
6. Membrane extrusion.
7. Dried reconstituted vesicles.

- Advantages of liposomes [6]

There are many drugs in the market, which have good therapeutics activities. Drugs encapsulated in liposomes can be used regularly, as its pharmacokinetics and pharmacodynamics can be controlled. Some of

the advantages of the liposome are as follows.

1. Provides selective passive targeting to tumor tissues
2. Increased efficacy and therapeutic index.
3. Increased stability via encapsulation.
4. Reduction in toxicity of the encapsulated agents.
5. Site avoidance effect.
6. Improved pharmacokinetic effects.

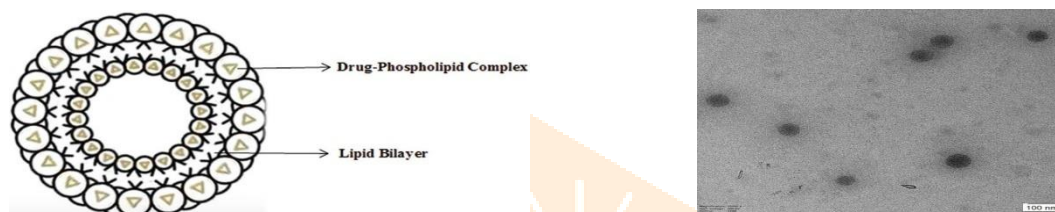
- Disadvantages of liposomes [7]

1. Lipid based drug delivery system are expensive to produce, hence the production cost is high.
2. The cost is high because of high costs associated with the raw materials used in lipid excipients as well as expensive equipment needed to increase manufacturing.

## Application of liposomes [8]

1. Applications of liposomes in medicine and pharmacology can be divided into diagnostic and therapeutic applications of liposomes containing various markers or drugs, and their use as a tool, a model, or reagent in the basic studies of cell interactions, recognition processes and mode of action.
2. In several cases, the toxicity can be reduced, or the efficacy can be enhanced by the use of a suitable drug carrier which alters the temporal and spatial delivery of the drug.
3. Advances in liposome design are leading to new applications for the delivery of new biotechnology products, for example antisense oligonucleotides, cloned genes, and recombinant proteins.

## **2. Phytosomes**



The term “phyto” means plant while “some” means cell-like. Phytosome is novel emerging technique applied to phyto-pharmaceutical which contains phytoconstituents to herbal extract surrounds and bound by lipids. Phytosome shows better absorption, hence produces better bioavailability than the conventional herbal extracts. Most of the bioactive constituents of phytomedicines are flavonoids, which are poorly bioavailable when taken orally. Water-soluble phytoconstituent molecules (mainly polyphenols) can be converted into lipid-compatible molecular complexes, which are called phytosomes.[9]

- Physiochemical properties of Phytosomes [10]

1. Physiochemical properties of phytosome are responsible for their stability as well as the therapeutic effect.

2. It confirms the stability of phytosome in GIT, which cause the greater absorption and bioavailability of the product. Some of the important physiochemical properties are given

1. **Vesicle stability**-The structure and size of vesicles are very important because it determines the stability of vesicle.

2. **Drug content** -High performance liquid chromatography technique is used for the quantitative determination of drug.

- Method of preparation for Phytosomes[11]

Normally phytosomes can be prepared by the solvent evaporation method. For the preparation of Phytosomes the phytoconstituents like bioflavonoids, flavolignan and polyphenolic compounds reacting drop by drop by the solution of natural or synthetic phospholipids like Phosphatidylcholines(PC) with vigorous stirring.

Phytosomes of ginsenoside, and kushenin are prepared in this manner.

Phytosomes which are prepared by the nonsolvent, freeze drying, spray drying or vacuum drying are called the prepared complex phytosome.

- Advantages of Phytosomes [11]

1. Improve the absorption of lipid insoluble polar phytoconstituents, enhance the bioavailability.
2. Appreciable drug entrapment which becomes very beneficial.
3. Reduce the dose due to increased absorption.
4. Effective in cosmetic.

- Disadvantage of Phytosomes

- Phytoconstituents is rapidly eliminated from Phytosomes.

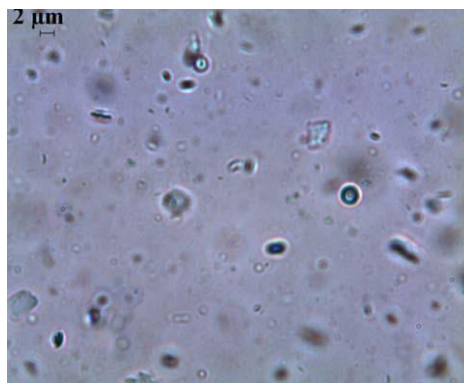
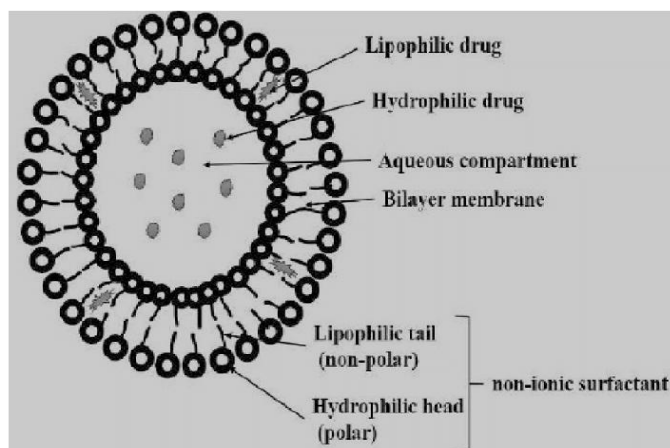
Application of phytosome [12]

1. Enhance bioavailability

Evodiamine, a quinoline alkaloid, (*Evodia rutaecarpa*) possesses a variety of pharmacological qualities, including as anti-tumor, anti-inflammatory, anti-nociceptive, anti-obesity, and thermoregulatory actions. Evodiamine has anti-tumor potential in a wide variety of cancer cells by decreasing proliferation, inducing apoptosis and lowering invasion and metastasis. Phytosomes of Evodiamine revealed to have quicker in vitro dissolution rate, greater absorption, longer action duration and higher bioavailability.

2. Antioxidants properties reactive oxygen species.
3. Cancer treatment
4. Wound healing

### 3.Neosome



Niosomes are multilamellar vesicles generated from nonionic surfactants of the alkyl or dialkylpolyglycerol ether family with cholesterol. Niosomes are unique from liposomes in that they give numerous benefits over liposomes. Liposomes confront challenges such as they are pricey, their ingredients such as phospholipids are chemically unstable owing of their potential to oxidative degradation, they demand specific memory and handling, and purity of natural phospholipids may variable. Niosomes do nothave any of these issues. [13]

- Method of preparation for Neosome [14-15]

#### 1.Ether injection method- [14]

In this method slow injection of surfactant: cholesterol. IN this we make the solution of surfactant dissolve in diethyl ether water maintain at 60 degrees Celsius. Mixture of ether (20ml) is injected through 14-guage needle into aqueous solution of material. Then using rotary evaporator, ether solution is evaporated and formation of single layered vesicles after the evaporation of organic solvent.

#### 2.Hand shaking method

In this we mix all the mixing ingredient such as surfactant, cholesterol and charge inducer and dissolved in volatile solvent (chloroform, diethyl ether or methanol) in RBF. Now organic solvent is removed under a vacuum at room temperature 20 degree Celsius using rotary evaporator and formation of thin layer of solid mixture on the wall of flask. Then we rehydrated the film with aqueous phase at 0-60 degree Celsius with gentle agitation and formation of niosomes.

#### 4.Sonication method-

In this method an aliquot mixture of drug solution in the buffer surfactant and cholesterol in 10 ml glass vial. Sonicated with titanium probe sonicator at 60 degrees Celsius for 3 minutes and formation of niosomes.

- Advantages of Neosome[16]

1.Niosomes increase the bioavailability of drug by shielding/ protect the drug from acidic and enzymatic degradation in GIT due to this it increases/ improves the bioavailability of drug.

2.Niosomes structure are hydrophilic, lipophilic, and amphiphilic in nature due this we incorporate variety of drug moieties and used for many drugs.

3.Niosomes are osmotically active and stable in nature.

4. Skin permeation is also be increased using niosomes.

5. The therapeutic efficiency of drug molecules is improved by slow down the clearance from the circulation.

- Disadvantage of Neosome

1.Aggregation of drug molecules.

2. Physical instability.

3. Entrapped drug can leak.

4. Hydrolysis can decrease the shelf life of encapsulated drug.

5. Time consuming.

#### Application of Niosomes[17]

1. Niosomes as a carrier to haemoglobin

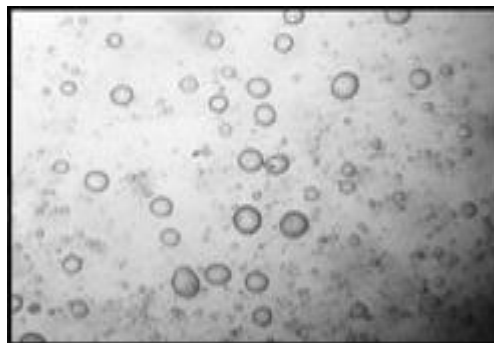
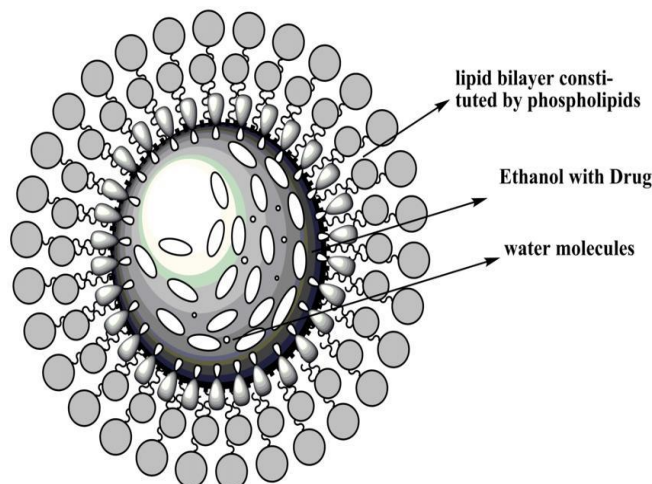
Neosome suspension has a visible spectrum which is superimposable onto that of free haemoglobin hence it may be exploited as a carrier for haemoglobin. Vesicles are also permeable to oxygen and haemoglobin dissociation curve may be altered closely to non-encapsulated haemoglobin.

2. Delivery of peptide drug

Neosome encapsulated oral delivery of 9-desglycinamide, 8- arginine vasopressin was examined in an in-vitro intestinal loop model and revealed that stability of peptide elevated dramatically.



## 4.Ethosomes



- Newer developments in the patch technology have led to the introduction of ethosomal patch, which includes of medicine in ethosomes. Ethosomal systems are made up of soybean phosphatidylcholine, ethanol and water. They may form multilamellar vesicles and have a high entrapment capacity for particles of different lipophilicities. The elastic vesicles and transfersomes have also been exploited as pharmaceutical carriers for a variety of tiny chemicals, peptides, proteins, and vaccines. Ethosome has a high deformability and trapping efficiency and may pierce through the skin totally and boost medicine delivery via the skin. Likened to other liposomes, the physical and chemical properties of ethosomes make the legal passage of the drug through the stratum corneum into a deeper skin layer efficiently or even into the blood circulation. [18]
- **Method of preparation [19]**

### 1. Cold method

At room temperature, with vigorous shaking, the ethanol is dissolved in the phospholipids, medicine, and other lipid components. The jar is then heated to 30 °C. This is widely used and is referred to as the “cold approach. In another beaker, water is heated to 30 °C before being introduced and continuously swirled into the initial mixture. Vesicles start to emerge after 5 min of churning. It's important to keep produced vesicles cold.

### 2. Hot method

The hot procedure entails combining the medication with ethanol and propylene glycol. At 40 °C, phospholipid dispersion in water is created. This dispersion is combined with a previously produced mixture. Size reduction is next accomplished by sonication or extrusion after this final combination is heated to 30 °C.

- **Advantages of Ethosome [20]**

1. Delivery of large molecules (peptides, protein molecules) is possible.
2. It contains non-toxic raw material in formulation.
3. Enhanced permeation of drug through skin for transdermal drug delivery.

4. Ethosomal drug delivery system can be applied widely in Pharmaceutical, Veterinary, Cosmetic fields.
5. High patient compliance: The ethosomal drug is administered in semisolid form (gel or cream) hence producing high patient compliance.
6. Simple method for drug delivery for comparison of Iontophoresis and Phonophoresis and other complicated methods
7. The Ethosomal system is passive, non-invasive and is available for immediate.

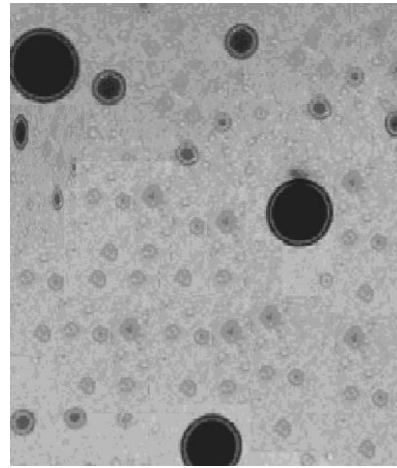
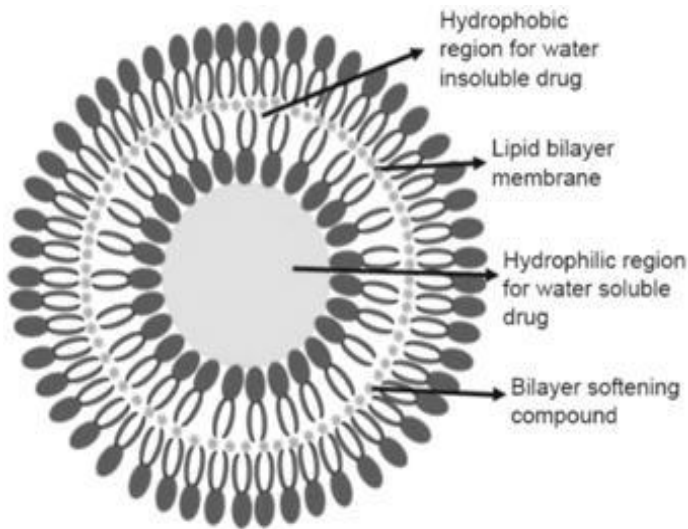
- **Disadvantage of Ethosome [21]**

1. They require high blood levels. It is limited only to potent molecules, those requiring a daily dose of 10mg or less.
2. It is not a means to achieve rapid bolus type drug input, rather it usually designed to offer slow, sustained drug delivery.
3. Adequate solubility of the drug in both lipophilic and aqueous environments to reach dermal microcirculation and gain access to the systemic circulation.
4. It may not be economical.
5. Poor yield.
6. Skin irritation or dermatitis due to excipients and enhancers of drug delivery systems.

### **Application of Ethosome**

1. Ethosomes have been shown in numerous trials to be an effective treatment for viral and microbial skin infections. Animal models of deep skin infections were used to create and test the efficacy of the bacitracin and erythromycin ethosomal systems
2. When tested in vivo on rabbits, ethosomal patches in treating androgen insufficiency in males and menopausal symptoms in women have sufficiently demonstrated better results.
3. Research suggests that ethosomes may have analgesic, antipyretic, and efficacious effects against erectile dysfunction.
4. Research has also indicated that ethosomes might be utilised to topically transport DNA molecules for skin cells to express certain genes.

## 5. Transferosomes



Transferosomes is a carrying body for customised transdermal medicine delivery mechanism. This are special types of liposomes, comprised of phosphatidylcholine and an edge activator. This approach also takes use of phospholipids vesicles as transdermal medicine carrier. It reaches the stratum corneum by either intracellular pathway or the transcellular route through the establishment of “osmotic gradient”. Advantages of Transferosomes are vast variety of solubilities, better penetration, biocompatible and biodegradable etc. Advantages of Transferosomes are oxidative degradation, expensive, etc. The transferosomes were formulated using the conventional rotary evaporation sonication procedure. It includes phospholipids, surfactant and the drug were manufactured. Evaluation properties of transferosomes are as Vesicle size distribution and zeta potential, Vesicle form, No. of vesicles per cubic millimetre, Entrapment efficiency, Drug content, Turbidity measurement, Degree of deformability or permeability measurement, Penetration ability, Occlusion impact, Surface charge and charge density, In-vitro drug release, in-vitro Skin permeation Studies, Physical stability.

- **Method of preparation for Transferosomes [22]**

**A.Thin film hydration technique is employed for the preparation of transferosomes which comprised of three steps [10]**

1. A thin film is prepared from the mixture of vesicles forming ingredients that is phospholipids and surfactant by dissolving in volatile organic solvent (chloroform methanol). Organic solvent is then evaporated above the lipid transition temperature (room temp. for pure PC vesicles, or 50°C for dipalmitoyl phosphatidyl choline) using rotary evaporator. Final traces of solvent were removed under vacuum for overnight.
2. A prepared thin film is hydrated with buffer (pH 6.5) by rotation at 60 rpm for 1 hr at the corresponding temperature. The resulting vesicles were swollen for 2 hr at room temperature.
3. To prepare small vesicles, resulting vesicles were sonicated at room temperature or 50°C for 30 min. using a bath sonicator or probe sonicated at 4°C for 30 min. The sonicated vesicles were homogenized by manual extrusion 10 times through a sandwich of 200 and 100 nm polycarbonate membranes.

**B.Modified hand shaking, lipid film hydration technique is also founded for the preparation of transferosomes which comprised following steps [10]**

1. Drug, lecithin (PC) and edge activator were dissolved in ethanol: chloroform (1:1) mixture. Organic solvent was removed by evaporation while hand shaking above lipid transition temperature (43°C). A thin lipid film was formed inside the flask wall with rotation. The thin film was kept overnight for complete evaporation of solvent.
2. The film was then hydrated with phosphate buffer (pH 7.4) with gentle shaking for 15 minute at corresponding temperature. The transferosome suspension further hydrated up to 1 hour at 2-8°C.

**Advantages of Transferosomes [23]**

- 1.Transferosomes carriers are made of hydrophilic and hydrophobic moieties, which result in generating a unique drug carrier system that can transport therapeutic drugs with wide range of solubility.
- 2.High vesicle deformability enables the transfer of medications over the skin without any discernible loss in intact vesicles and can be employed for both topical, as well as systemic, therapies.
- 3.Transferosomes carriers are exceedingly adaptable and efficient in tolerating a range of agents practically irrespective of their size, structure, molecular weight, or polarity.
- 4.Transferosomes can be employed for the transport of numerous active chemicals, including proteins and peptides, insulin, corticosteroids, interferons, anaesthetics, NSAIDs, anticancer medicines and herbal medications.

5. Avoiding the first-pass metabolism, which is a key problem in oral medication delivery, and result in optimal bioavailability of the drug.

6. Minimize the unwanted side effects of the medicine, as well as shield the drug from metabolic degradation; additionally, the value of short half-life pharmaceuticals.

- **Disadvantage of Transferosomes[24]**

1. Transferosomes are chemically unstable because of their vulnerability to oxidative degradation.

2. Purity of natural phospholipids is another feature militating the usage of transferosomes as drug delivery vehicles.

3. Transferosomes formulations are costly.

### **Application of Transferosomes**

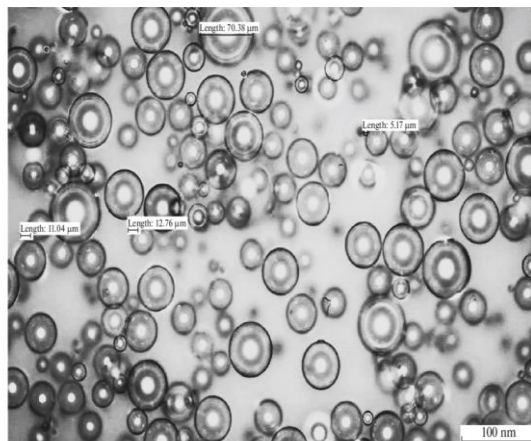
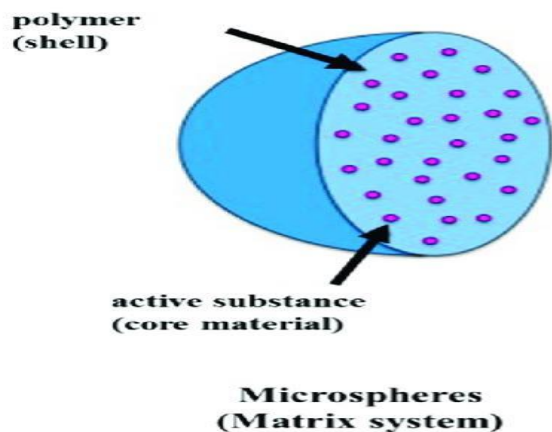
1. Transferosomes provide the possibility for the controlled release of the given drug and boosting the stability of labile medicines due to the addition of phospholipids.

2. Large molecular weight compounds may be easily transferred over the skin with the assistance of transferosomes. For example, insulin.

3. Transferosomes have been widely exploited as a carrier for the transport of proteins and peptides. Proteins and peptide.

### **6. Microsphere[25]**

Microspheres are discrete spherical particles ranging in average particle size from 1 to 50  $\mu$ . Microparticulate drug delivery methods are examined and took on as a dependable one to rescue the medication to the target location with specificity, to assert the required concentration at the situation of interest without unwanted consequences. Microencapsulation is a beneficial approach which increases the duration of medicinal impact greatly and enhances patient compliance. Finally, the complete dose and minimal adverse responses may be smoothed down as a stable plasma concentration is retained. So far, a variety of active compounds of plants, such as rutin, camptothecin, zedoary oil, tetrandrine, quercetine, and Cynara scolymus extract, has been made into microspheres.

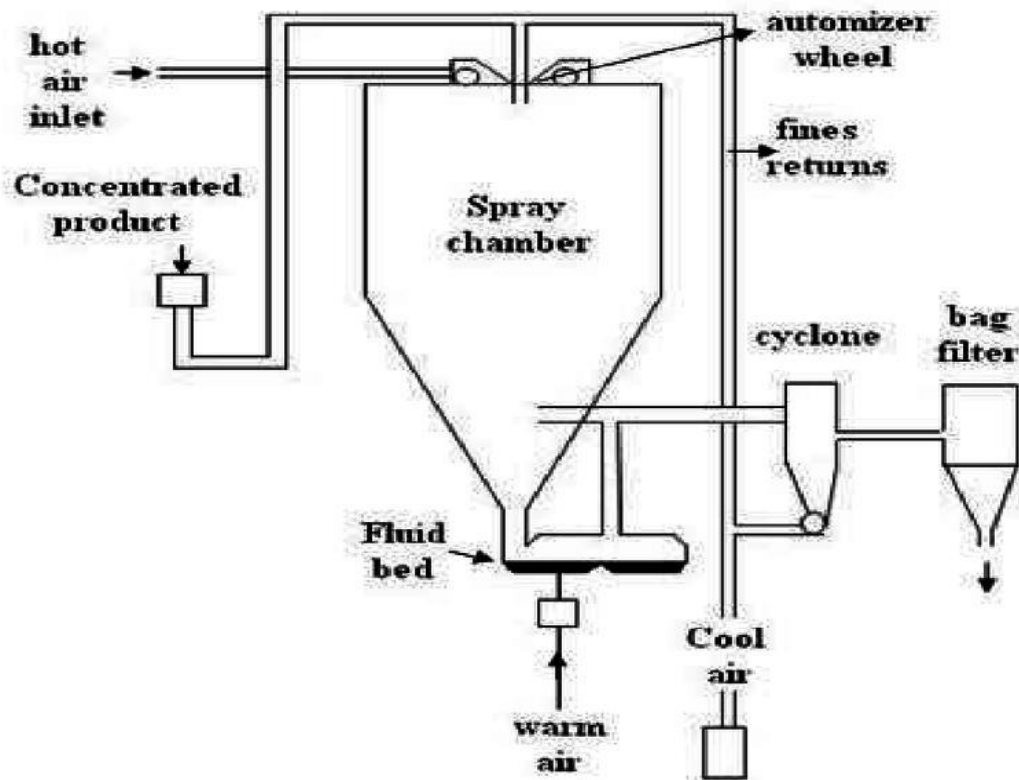


In addition, publications of immunological microsphere and magnetic microsphere are also typical in recent years. Immunological microsphere contains the immune competence because of the antibody, and antigen was coated or adsorbed on the polymer microspheres. Some of the herbal Microspheres produced as medicine delivery devices.

- **Method of preparation for Microsphere [26]**

- **Spray Drying**

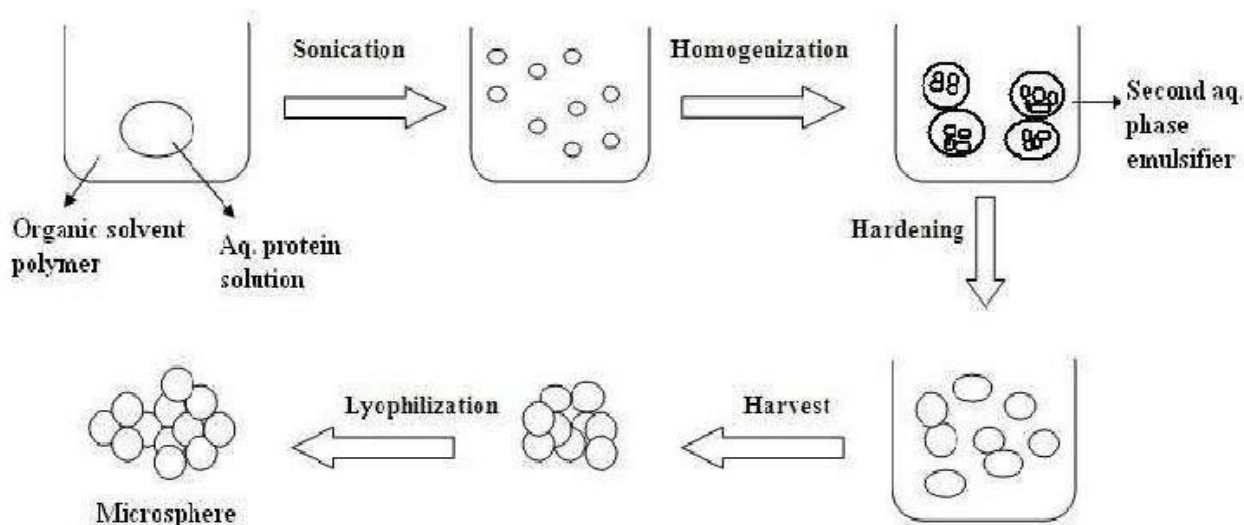
In Spray Drying the polymer is first dissolved in a sufficiently volatile organic solvent such as dichloromethane, Acetone, etc. The drug in the solid form is then disseminated in the polymer solution under high-speed homogenization. This dispersion is subsequently atomized in a jet of hot air. The atomization leads to the generation of the tiny droplets or the fine mist from which the solvent evaporates quickly leading the formation of the microspheres in a size range 1-100μm. Micro particles are separated from the hot air by means of the cyclone separator while the trace of solvent is removed by vacuum drying. One of the key advantages of technique is practicality of operation under aseptic settings this process is rapid and this leads to the production of porous micro particles displayed in figure.



### Solvent evaporation

The processes are carried out in a liquid manufacturing vehicle. The microcapsule coating is dispersed in a volatile solvent which is immiscible with the liquid manufacturing vehicle phase. A core material to be microencapsulated is dissolved or dispersed in the coating polymer solution. The core materials may be either water soluble or water in soluble materials. Solvent evaporation involves the formation of an emulsion between polymer solution and an immiscible continuous phase whether aqueous (o/w) or non-aqueous. The comparison of mucoadhesive microspheres of hyaluronic acid, Chitosan glutamate and a combination of the two prepared by solvent evaporation with microcapsules of hyaluronic acid and gelating prepared by complex coacervation were made

1. Wet Inversion Technique
2. Hot Melt Microencapsulation
3. Single emulsion technique
4. Double emulsion technique
5. Polymerization technique
6. Normal polymerization



- **Advantages of Microsphere [27]**

1. Microspheres provide constant and prolonged therapeutic effect.
2. Reduces the dosing frequency and thereby improve the patient compliance.
3. They could be injected into the body due to the spherical shape and smaller size.
4. Better drug utilization will improve the bioavailability and reduce the incidence or intensity of adverse effects.
5. Microsphere morphology allows a controllable variability in degradation and drug release.

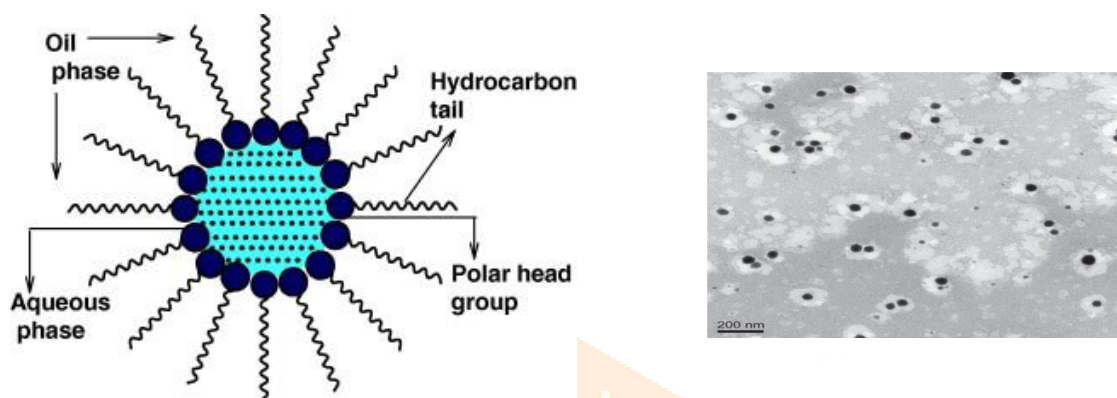
- **Disadvantage of Microsphere [27]**

1. The modified release from the formulations.
2. The release rate of the controlled release dosage form may vary from a variety of factors like food and the rate of transit through gut.
3. Differences in the release rate from one dose to another.
4. Controlled release formulations generally contain a higher drug load and thus any loss of integrity of the release characteristics of the dosage form may lead to potential toxicity.
5. Dosage forms of this kind should not be crushed or chewed.



## 7. Microemulsion[28]

Microemulsions are simple carrier systems because of their thermodynamic stability and simple technology related to the ease of their preparation. Microemulsion is a system of water, oil, and amphiphilic compounds (surfactant and cosurfactant), which is a transparent, single, optically isotropic, and thermodynamically stable liquid. Microemulsions are isotropic and transparent systems, thermodynamically stable, and are comprised of oil, water, and a surfactant, mostly in association with



a cosurfactant. The droplet size may vary from 10 to 200 nm. Broadly, they are classified into 3 types: O/W microemulsion, W/O microemulsion, and a bicontinuous microemulsion with high solubilizing power. The mechanism of action of microemulsion on skin penetration is unique, since they tend to react with lipids on the skin, because of which the intercellular space is changed and hence the drug is transported. Microemulsions are promising tools as delivery systems, allowing both types of drug release, controlled as well as sustained, for various routes of administration. Microemulsions have various distinguishing features as a delivery system, with the main features of being less toxic, facilitating enhanced absorption of drugs, and regulating the drug release rates.

### Methods of preparation for Microemulsions

#### 1 Phase titration method

Microemulsions are prepared by spontaneous emulsification method which is illustrated with help of phase diagrams. Phase diagram construction is a practical approach to study complex series of interaction which occurs when different components are mixed. The aspect of the phase diagram is phase equilibrium and demarcation of phase boundaries. Most often pseudo-ternary phase diagrams are constructed to figure out microemulsion zone as a quaternary phase diagram is time consuming and difficult to interpret.

## 2 Phase inversion method

Phase inversion of Microemulsions happens upon addition of excess of dispersed phase. Phase inversion leads to radical physical changes as change in particle size that alters drug release. During cooling, this system crosses the point of zero spontaneous curvature and minimal surface tension, prompting the formation of finely dispersed oil droplets. Microemulsions can be prepared by controlled addition of lower alkanols (butanol, pentanol and hexanol) to milky emulsions to produce transparent solutions comprising dispersions of either o/w or w/o or colloidal dispersions.

- **Advantages of Microemulsion[29]**

1. Microemulsions have a broad spectrum of applications in drug targeting and controlled drug release.
2. They have unique distinguishing features like enhanced bioavailability, due to their ability to solubilize lipophilic drugs.
3. Microemulsions can carry water-soluble drugs into aqueous phase, and hence demonstrate the ability to carry both lipophilic as well as hydrophilic drugs.
4. Microemulsions have a wide range of applicability, as they can be delivered by all major routes of drug delivery.
5. Ease of application makes them far better dosage forms than others.
6. They provide protection from hydrolysis and oxidation.
7. They facilitate increased patient compliance.
8. Increases bioavailability.
9. Increase rate of absorption

- **Disadvantage of Micro emulsion[30]**

1. Use of a large concentration of surfactant and co-surfactant necessary for stabilizing Nano droplets.
2. Limited solubilizing capacity for high-melting substances.
3. The surfactant must be nontoxic for using pharmaceutical applications.
4. Micro emulsion stability is influenced by environmental parameters such as temperature and ph. These parameters change upon micro emulsion delivery to patients.
5. For unique dosage preparation in gelatine capsules, it may produce softening or hardening effect on capsules shell, so for long time storage is undesirable.

## **Applications of Microemulsion**

1. Microemulsion formulations are typically favourable above the standard oral formulations for oral administration.

2. They offer improved absorption, enhanced clinical potency, and reduced medication toxicity. Hence, microemulsion have been shown to be excellent delivery carriers of medications such as hormones, steroids, antibiotics

3. The oral route is the principal route for medication administration in many illnesses.

## **8. Nanotechnology[31]**

Nanotechnology is a discipline of applied science and technology which attempts to build devices and dosage forms in the range of 1 to 100 nm. The uses of nanotechnology for therapy, diagnosis, monitoring, and control of biological systems have recently been referred to as nanomedicine. The nanocarriers have been built of harmless materials, including synthetic biodegradable polymers, lipids, and polysaccharides. The efficacy of herbal medicines depends on overall function of a range of active components, since all the ingredients produce synergistic action and so boost the therapeutic value. Each active ingredient serves a crucial role and they are all connected to each other. In phyto-formulation research, developing Nano dosage forms (Polymeric Nanoparticles [Nanospheres and Nanocapsules], Liposomes, Proliposomes, Solid Lipid Nanoparticles [SLNs], Nanoemulsion, etc.) has large number of advantages for herbal drugs, including enhancement of solubility and bioavailability, protection from toxicity, enhancement of pharmacological activity, enhancement of stability, improving tissue macrophages distribution, sustained delivery, protection from physical and chemical degradation, etc. Thus, the Nano-sized drug delivery systems of herbal pharmaceuticals have a significant future for increasing the activity and addressing issues connected with plant medicines. [16]

- **Methods of preparation for Nanotechnology [32]**

**High-pressure homogenization method**

In this process, the lipid is driven with high pressure (100 to 2 000 bar) via a very high shear stress, which results in disruption of particles down to the submicrometer or nanometre range. High-pressure homogenization method is a very dependable and powerful technology for the large-scale manufacture of nanostructured lipid carriers, lipid drug conjugate, SLNs, and parenteral emulsions.

**Co-precipitation method**

This approach is a variation of the complicated coacervation method for the creation of nanoscale core-shell particles. This approach has been found to offer high dispersion stability to weakly water-soluble medicines.

**Salting-out method**

This approach is based on the observation that the solubility of a non-electrolyte in water is diminished upon addition of an electrolyte.

**Nanoprecipitation method or solvent displacement method**

This approach is based on the interfacial deposition of a polymer following displacement of a semipolar solvent miscible with water from a lipophilic solution, resulting in a decrease in the interfacial tension between the two phases, increasing the surface area with the formation of small droplets of organic solvent even without any mechanical stirring.

- **Advantages of Nanotechnology**

- 1.Improve the capacity to deliver medications that are poorly water soluble.
- 2.Provide site-specific targeting to limit medication buildup within healthy tissue.
- 3.Help keep the medicine in the body long enough for successful therapy.
- 4.The prolongation of medication bioactivity by protection against the biological environment.
- 5.Allow for the transfer of medicines past epithelial and endothelial barriers.
- 6.Combine therapeutic and diagnostic modalities into one agent.

- **Disadvantage of Nanotechnology**

i. Nanotechnology has elevated the level of living but at the same time, it has increased pollution which includes air pollution. The contamination created by nanotechnology is known as nano pollution. This form of pollution is particularly harmful for living beings.

ii. Nanoparticles can cause lung harm. Inhaled particulate matter may get deposited throughout the human respiratory system and then in the lungs.

iii. The features of nanoparticles that are significant for health consequences include size, chemical composition, and form.

## **Summary**

Novel drug delivery methods not only decrease the repetitive administration to overcome non-compliance, but also aid to boost the therapeutic value by lowering toxicity and enhancing bioavailability and so on. The diminished efficacy of herbal treatments is related to the conventional and out of date way of administration to patients. To reduce these difficulties many innovative drug delivery systems (NDDS) such as phytosomes, ethosomes, transfersomes, herbal transdermal patches, nanoparticles and biphasic emulsions are utilised presently. Novel way of administering herbal therapeutics would boost the efficacy and safety of herbal medicines together with the increased stability of the medicinal product. These procedures allow increased patient compliance, prolonged release and focused action of plant actives and extract.

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