

## NOVEL DRUG DELIVERY SYSTEM FOR HERBAL DRUGS- AND OVERVIEW

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### ABSTRACT

*The basic idea behind is to exploit nanotechnology in drug delivery system where the drug is delivered in nanosized figure via non-toxic vehicles that trap and both hydrophilic and hydrophobic components of drugs are exploited for better results in traditional medicine. Modern pharmaceutical science has developed several novel drug delivery systems like liposomes, phytosomes, micropellets, transfersomes, ethosomes, niosomes, and proniosomes, etc. Mode of drug delivery will affect its efficacy significantly. At a certain concentration, the drugs give the optimum results and below which shows decreased therapeutics or no therapeutic efficacy at all. Drug delivery systems combine pharmaceuticals, chemistry, and molecular biology. The conventional systems of medicines are having good therapeutic effects but their limitations fail to give desired concentration in blood. Thus NDDHS has the advantage to enhance the therapeutics by increases bioavailability, increased stability and many more. Novel drug delivery technique when assimilated in herbal active ingredients decreases the loss of therapeutic dosage via liver metabolism and reduces drug doses by converting the drug into nanosized form, which is more effective even at low doses, transfers drug to site of action with good bioavailability, sustained delivery and increased stability and Enhancement of pharmacological activity. Thus herbs can be used in a more advanced and scientific manner to change them into modern dosage formulations. This present review paper is to pen down the present novel drug herbal formulations with their active ingredients and application of novel drug formulations.*

**Keywords:** liposomes, transfersomes, NDDS, NHDDS.

### 1. INTRODUCTION

As per WHO, Traditional medication is defined as " It is the sum of the knowledge, skill, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness"[1]. Whereas other complementary medicines are defined as "broad set of health care practices that are not part of that country's tradition or conventional medicine and are not fully integrated into the dominant health-care system. They are used interchangeably with traditional medicine in some countries"[2].

There is a potential involvement where traditional medicine, as well as complimentary, can make to health care services and encourages member states to consider it an important part of the health system within the country's health systems, as it was introduced in Beijing's declaration in WHO congress of 2008. A new beginning is happening all over the globe with a comeback of

old traditional therapeutic medicines in India. People are opting for herbal medicines and herbal therapies to treat the various diseased conditions rather than preferring modern medical science. Reason for the popularity of herbal medicines is:

- a) Comparatively safe to use.
- b) Modern medical science is weakening to treat a lot of common health situation
- c) The natural measure proves to be better result-oriented with no side effects than modern drugs and surgery

Current modern medicine suppresses symptoms without treating the cause of disease. Whereas comparatively, traditional medicine uses drugs to treat the underlying cause and provides good results. Mode of drug delivery will affect its efficacy significantly. At a certain concentration, the drugs give the optimum results and below which shows no therapeutic efficacy at all. Studying pharmacokinetics and pharmacodynamics, toxic doses and efficacious drugs are generated. These are called DDS. That combines pharmaceutics, chemistry and molecular biology [3].

From the past golden times to the latest trend of nowadays in medical history, one thing has never changed is the effort of the doctor to provide the best potential medication for their patients for fast and complete recovery from ailments. Moreover, the drug that is being used in any of the particular formulations should be safe, efficacious, acceptable, and the preparations to be more effective. Apart from pharmaceutics, chemistry and molecular biology are interested to exploit drug formulations with the latest technology. Due to this reason, the Drug Delivery System (DDS) is developed by highly incorporating, systems that need the various interdisciplinary approach of various disciplines of chemistry, biology, and engineering to join and develop a well-optimized system [4].

This is now being known by the name of New drug delivery system- also called novel drug delivery system (NDDS) or advanced drug delivery system. It includes formulations, systems, and technologies that improve drug potency for transporting any pharmaceutical compound in the body for desired, safe and sustained therapeutic effects with controlled drug release. Keeping in view the side effects of modern medicines. “Novel drug delivery system (NDDS)” is gaining popularity only from the past few years [5]. Significant attention has been given on NDDS for herbal drugs. Since herbal drugs are gaining more and more acceptability owing to their reduced side effects, human-friendly nature, and meticulous therapeutic behavior to treat a variety of ailments with a wholesome approach. At the same time, the stumbling block in traditionally using herbal extracts is their instability in high pH and liver metabolism that do not allow the drug to give its desired therapeutic effect with the desired concentration in blood. Moreover Traditional herbal drugs are not able to meet desired effects as they are rendered unsuccessful in fulfilling the new traditional demands of controlled drug release and targeted drug delivery, sustained and prolonged drug releases. This hampers their therapeutics response. So, the basic idea behind is to exploit nanotechnology via various drug delivery vehicles that may be either, Phytochemicals of drugs that are exploited for phytosomes in nanosized form. They can be liposomes, nanoparticles, transferosomes, and emulsions. Thus NDDHS has the advantage to

enhance therapeutics. They are essential non-toxic vehicles that trap and both hydrophilic and hydrophobic components [6] of drugs are exploited for better results in traditional medicine.

When the NDDS technique is assimilated in herbal active ingredients that minimize the loss of therapeutic dose via liver metabolism and does not give desired side effects of drug getting accumulated in non-target tissues. It provides ease to administer the drug in children and old age people [7] as it reduces the drug dose, transfers the drug to the site of action with good bioavailability and its hydrophilicity allows them to easily dissolve in gastric fluids and lipophilicity allows them to cross bilipid cell membranes. Polyphenols are Phytochemicals are having good water solubility but are poorly absorbed [8] because of their large size are not able to diffuse enterocytes of cell membranes [9] due to their hydrophilic nature. So NDDS for herbal drugs also helps in a way as it has the advantage to overcome the obstacles in the traditional mode administration and its metabolism. Thus, the novel drug delivery system for herbal medicines is useful in providing the medicament at a particular site of action by minimizing the harmful drug effects with enhancing therapeutic availability.

Since, NDDS is superior to the traditional dosage forms in better bioavailability, reduced toxicity for certain drugs, enhanced pharmacological actions, improved pharmacokinetics, and pharmacodynamics, sustained drug delivery, targeted delivery of drugs to certain organ-specific and protects Physico-chemical properties.

Examples of potential NDDS include anticancer drugs when formulated in liposomes, increase drug availability in tumor areas and prevents the other cells from exposure to anticancerous drugs. Thus prevents its toxic effects. Similarly, phytosomal chemicals are found effective in inefficient drug delivery of herbal extracts of ginseng. When directly bonded phosphatidylcholine to herbal extracts leads to better absorption than traditional drugs. Other formulations as microspheres and nanoparticles have been seen to have good and effective to hold herbal components. This article is compiled to have an outline of various delivery systems to assimilate therapeutic components in different potential formulations in this system.

### **1.1. NOVEL DRUG DELIVERY APPROACHES**

Various drug delivery devices are recently developed that reduces the drug dose with time and thus maintains the optimum dose and reduce the side effects, provides appropriate bioavailability in the area needed. Popularly known drug delivery devices are

- Liposomes
- Microcapsules
- Lipoproteins
- Micelles
- Phytosomes
- Niosomes
- Proniosomes
- Transdermal drug delivery system
- Microspheres

- Trasferosomes
- Micropellets
- Polymeric micelle formulation

Basic modes of drug delivery system involve a) Targeted drug delivery b) Controlled drug delivery [9] and c) sustained drug delivery [4].

**a) Targeted drug delivery** It is a method to where the drug is loaded to the site of action. Two types of targeting are available i) Passive targeting & ii) Active targeting

Active targeting or smart drug delivery technique is a technique where medicine is given to the patient when its concentration is increased in somebody's parts compared to other parts. Nanoparticle delivery system is planned to overcome the drawbacks of the traditional drug delivery method. Specific tissues are targeted by nanoparticle system to spare the healthy tissue interactions. The motive is to increase time duration, localize the drug to a target tissue and only the interaction happens with the diseased tissue and healthy tissue is not at all involved. Drug carriers are received by target cell receptors where the action is needed. Due to which the process is highly precise because the ligand-receptor can be very selective.

Active targeting provides a precise activity to a site of action in the traditional system the drug is delivered across biological membranes wherein targeted drug delivery technique the drug is released in dose forms. Thus, reducing the frequency of drug intake reduced fluctuating levels of drug and more reduction of side effects. Thus, a method that delivers drugs for a long time to a diseased area in the body.

Passive targeting is the name given when the number of drugs is collected in solid tumors due to the increased permeability of healthy tissues. This is achieved by enveloping the nanoparticle with coating. PEG, when added on the surface of the nanoparticle, is made hydrophilic which binds water molecules to oxygen molecules via hydrogen bonding. This makes the substance antiphagocytic, due to which it stays in the blood for a longer period. Thus, nanoparticles between 10 to 100 nm in sizes are found to circulate for a long time in blood.

**b) Controlled drug release** and drug dose reduction with time are again important for the preparation to be successful. NDDS for a particular drug depends on the type of drug to be administered [10]. As sustained-release drugs need to be administered in polymer s formulation. But researchers prefer the Pulsatile release of drugs as it closely resembles the body's production of hormones. This is performed efficiently by using polymers that act in response to particular stimuli that can be temperature, pH, or light [9]. The drugs are released in different ways that involve

- ✓ Adsorbed drugs are desorbed
- ✓ Drugs are diffused via carrier matrix medium
- ✓ Drugs are diffused via carrier wall
- ✓ Drugs are diffused in a combined manner

**c) Sustained Drug Release [9]:** This system is known to exist in the medical literature from the past many decades and used to elucidate the therapeutic dosage such that its emergence in the

systemic circulation is delayed and prolonged. When orally given the plasma profile is delayed in duration and there is always an extreme limit of dose to be administered, a general of 0.5-1.0 gm is the generalized popular dose and the compounds that need large amounts of doses can be used in multiple amounts or they can be formulated in the liquid forms. Again a large amount of drug administration also involves the narrow therapeutic range.

NDDS- enhances bioavailability, solubility, permeability with the reduced dose, side-effects and exhibits similar effects when changed to NDDS compared to conventional. So, there is a huge perspective in herbal drugs for the growth of NDDS.

NHDDS- Herbal drugs can thus be utilized with improved efficacy by incorporating new dosage forms.

Limit of herbal drugs and phytochemicals is the lack of stability in high acidic pH. Pre-systemic metabolism in liver, solubility and absorption problems may cause to reduce the drug levels below therapeutic concentrations. Whereas plant molecules such as glycosides, tannins, flavonoids, etc which are polar in nature and large molecular sizes interfere with passive diffusion and severely limit their ability to cross the bilipid biological membranes because of their poor lipid solubility.

Thus, reduced bioavailability and low therapeutic index of plants make a need for a merging of novel drug technology to plant and reduces presystemic metabolism, drug degradation in GIT and accumulation of the drug in non-target tissues and reduces side-effects also. NHDDS offers new windows for herbal drug delivery at the right time, place and right concentration. Previously herbal medicines were not taken into consideration for novel formulations because of deficient scientific justification and difficulties in medicine processing techniques and their standardization. Modern phytopharmaceutical research includes pharmacokinetics, site of action, and mechanism of action and exact dose calculation of herbal medicines, which make it very easier to be incorporated in NDDS.

### **1.1.1. Liposomes**

Colloidal carriers, of 0.05-5  $\mu\text{m}$  in diameter forms whenever some lipids are hydrated in aqueous media. The spherical colloidal particles that get entrapped in a solvent which pass around, flow into its interior with one or multiple concentric layers. Liposomes are formed of polar lipids that are they have a hydrophilic and lipophilic group on the same molecules. But their formulations are expensive in formation. Moreover, the ingredients are chemically unstable. So, they require special storage and handling because they are tending oxidative degradation [1].

Liposomes based drug delivery system has a high competence to increase the capacity of anti-cancer drugs as they concentrate the drug in tumor cells by decreasing their effect in normal cells [11]. List of some formulations are mention in table 1.

Some of the advantages that allow efficiently use liposomes as the drug delivery system vehicle are: a) increased biocompatibility

b) Easy to prepare

c) Versatile nature allows the loading of hydrophilic and lipophilic compounds of its

| <b>Table 1: List of Herbal Formulations merged in Liposomal Drug Delivery Systems</b> |                             |                                                   |                  |
|---------------------------------------------------------------------------------------|-----------------------------|---------------------------------------------------|------------------|
| <b>Plant constituents</b>                                                             | <b>Therapeutic category</b> | <b>Applications w.r.t liposomal technology</b>    | <b>reference</b> |
| Amelopsin                                                                             | Anticancer                  | Improved therapeutic efficacy                     | 12               |
| Capsaicin                                                                             | Anticancer                  | high entrapment with long systemic residence time | 13               |
| Curcumin and high entrapment                                                          | Anticancer                  | Long systemic residence time                      | 14               |
| Paclitaxel                                                                            | Anticancer                  | Ph sensitivity and improved entrapment efficiency | 15               |
| Usnic acid                                                                            | Antimycobacterial           | Prolong action and solubility enhancement         | 16               |
| Wogonin                                                                               | Anticancer                  | extended duration of action                       | 17               |
| Quercetin                                                                             | Hemoglobin                  | Enhancement of hemoglobin binding                 | 18               |
| Garcilin                                                                              | Lungs                       | Increases efficiency                              | 19               |
| Catechins through                                                                     | Antioxidant and             | Increased permeation through the                  | 20               |

constituents.

|             |                         |                                    |    |
|-------------|-------------------------|------------------------------------|----|
| skin        | chemoprotective         | skin                               |    |
| Breviscapin | Cardiovascular diseases | Sustained delivery of breviscapine | 21 |

### 1.1.2. Phytosomes

Biologically flavonoids are poorly available when taken orally bioavailability of phytosomes is comparatively more than simple herbal extracts due to their increased penetrating power to lipid bilayer to reach the blood. Phospholipids from soy are phosphatidylcholine used to prepare lipid phase phytosomes. Water-soluble phytochemicals (polyphenols) can be changed into lipid-soluble phytosomes. Only a few years back phytosome complexes were found to have bioactive constituents like flavonoids for cosmetic applications, but support for possible delivery of drug has been evidenced for the cardiovascular, anti-inflammatory, anticancerous, hepatoprotective and therapeutic profile is better than their non-formed herbal extracts.

It delivers the herbal drug at a predetermined rate, at the site of action by minimizing the toxic effects and increasing the bioavailability of drugs. Managing of distribution of the drug is attained by incorporating the active ingredient in the carrier system or altering the structure of drugs at the molecular level. Herbal drugs gain popularity in modern medicine Phytosomes is a novel approach to DDS and it is beneficial in delivering the herbal drug at a prearranged rate, delivery of drug at the site of action, Minimizes the toxic effects, enhance in the bioavailability of drugs. Herbal drug are becoming more popular for their applications [22]. It is newly introduced patented technologies to urbanized and incorporate the standardized plant extracts. The phytosomes process produce a small cell because of that the important components of the herbal extract are secluded from damage by digestive secretions and gut bacteria. They are better able to transition from a hydrophilic the environment into the lipid-friendly environment of the enterocyte cell membrane and from there into the cell finally reaching the blood. Phytosomes have improved pharmacokinetic and pharmacological parameter [22]. Phytosomes are having the patent license to develop and accommodate the plant extracts. It accommodates the herbal extracts in a small cell technique which avoids its destruction by secretions of digestive tract and bacteria of the gut wall. Apart from the carrier molecule, it is also having a hepatoprotective action, shows more stable studies to form chemical bonds in between phosphatidylcholine and botanical extracts [23].

### 1.1.3. Nanoparticles

They are delivering vehicles for both hydrophilic and hydrophobic drugs [1]. Particles of the sub-micron size of 10-1000nm nanoparticles lie in controlling particle size. It is biodegradable and surface properties and pharmacologically active agents have released at the site of action inappropriate rate and doses combinations. Recently they are considered as a potential drug delivery devices [24] with active constituents dispersed throughout in nanoparticles in shape of nanospheres [5].

Nanonisation improves formulation stability, Reduces medicinal doses and Improves absorbing capacity. Nanoparticle drug delivery system is given in table 2.

| Table 2: Herbal Nanoparticulate Drug Delivery Systems [5] |                             |                                                                                 |
|-----------------------------------------------------------|-----------------------------|---------------------------------------------------------------------------------|
| Plants/constituents                                       | Therapeutic category        | Applications w.r.t nanotechnology                                               |
| Triptolide nanoparticle                                   | Anti-inflammatory           | Enhances the penetration of drugs through stratum corneum by improved hydration |
| Artemisian nanocapsules release                           | Anticancer                  | Sustained drug release                                                          |
| Taxel nanoparticle                                        | Anticancer                  | Enhances the bioavailability and sustained drug release                         |
| Berberine nanoparticle                                    | Anticancer                  | Sustained drug release                                                          |
| Curcuminoids solid lipid nanoparticles                    | Anticancer and Anti-oxidant | extended-release of the curcuminoids                                            |
| Camptothecin encapsulated nanoparticle                    | Anticancer                  | Prolonged blood circulation and high accumulation in tumors.                    |
| Naringenin nanoparticle                                   | Hepatoprotective            | enhanced the release and improves its solubility.                               |

#### 1.1.4. Niosomes

Vesicles with multi lamellae. They are vesicles formed from alkyl or dialkyl ether class and cholesterol [25]. Polyglycerol non-ionic surfactants. They have the similarity of functions with liposomes [26] but overcome hazards as the purity of phospholipids, cost and stability issues which limit the use of liposomes.

Economical, more stable and ease of storage of non-ionic surfactants has shown the way to the usage of niosomes. they were first acknowledged in the early 70's, in the cosmetic industry. Further work in this area will open new research options as drug carriers. Use of niosomes in liver and spleen ailments (leishmaniasis). Further, it is seen in anti-cancer drugs that will use the structure of tumor tissue. More specifically once co-relation is made in nature of niosome and their biological response [5].

#### 1.1.5. Proniosomes

An improvement in niosomes. Because it is a gel formulation that can be used for application at various sites on hydration with water from the skin and converted into niosomes. They are water-soluble vehicles coated with surfactant on hydration form a niosomal dispersion on slightly mixing with hot water medium. Few formulations are given in table no 3.

**Table 3: Proniosomes in Drug Delivery Systems [5]**

| <b>Plants/constituents</b> | <b>Therapeutic category</b> | <b>Applications w.r.t nanotechnology</b> |
|----------------------------|-----------------------------|------------------------------------------|
| Levonorgestrel             | proniosomes (Gel/patch)     | Contraceptive agent                      |
| Indomethacin               | Proniosomes (oral)          | NSAID                                    |
| Piroxicam                  | Proniosomes (gel/patch)     | NSAID                                    |
| Estradiol                  | Proniosomes (gel/patch)     | Female Hormone                           |
| Tenoxicam                  | Proniosomes (gel)           | NSAID                                    |
| Chlorpheniramine maleate   | Proniosomes (gel/patch)     | antihistamine                            |
| Exemestane                 | Proniosomes (oral)          | anticancer                               |

#### 1.1.6. Transdermal DDS

This drug delivery system (DDS) is better credited for its therapeutic effects in local as well as for systemic delivery of medicaments [27]. They are also acknowledged as an upcoming smart drug delivery devices [28]. TDDS is known for its enhanced bioavailability, controlled release and reduced side effects. Special recently developed transdermal formulations of boswellic acid and curcumin have been developed, where the skin is used as a target for continuous drug administration. This bypasses the hepatic metabolism and even supplies a prolonged drug delivery which can be given any time.

#### 1.1.7. Microspheres

They are discrete spherical particles with sizes from 1-50 microns [12]. They are known to maintain the specificity and desired concentration at the site of interest. Entrapping the drug prolongs its therapeutic duration effect of a drug, reduces the dose and adverse reactions. A steady plasma concentration of microspheres is kept constant [13]. Certain active components of plants have been made into microspheres. They include Rutin, zedoary oil, Quercetin, Cynara Scolymus, etc. Recently immune microspheres and magnetic microspheres are also been reported. Immune microspheres are formed when polymer microspheres adsorb antigen-antibody [14].

#### 1.1.8. Ethosomes

An advanced technology better known as ethosomal patches that are prepared from ethosomes. They are made of soya phosphatidylcholine, ethanol, and water. Present with multilamellae with high capacity to trap lipophilic molecules. Generally, this drug delivery system is used for drugs in very small molecular forms. Examples are peptides & protein vaccines [17]. An important property needed to be a successful transdermal DDS, it should have an efficient penetrating capacity for the skin. Similar to liposomes their Physico-chemical properties provide an

authentic route to ensure penetration to stratum corneum layer of skin and then to blood circulation [18] moreover, for hydrophilic and lipophilic drugs, ethosomes also provides intracellular efficient delivery [19]. Anti-inflammatory drugs“matrine” percutaneous absorption is increased [20]. Similarly, antibacterial peptic penetration to fibrocytes also occurs easily [21]. Review of literature reveals, 3 clinical trials until now have been conducted on the human system with ethosomal drugs. Horwitz et al – performed a double-blind randomized clinical pilot study in 40 individuals for comparing the difference in the efficiency of ethosomal acyclovir development and commercially availability of acyclovir cream (Zovirax) to treat 'herpes labialis'. Ethosomal acyclovir proved to be better than commercial preparation of "Zovirax cream". Improvement in symptoms like crust formation, the disappearance of pain, etc. were seen. Similarly, the efficacy of clindamycin phosphate ethosomal gel and salicylic in acne patients with symptoms like comedones decreased in number, pustules, and several lesions in comparison to placebo. Similarly, ethosomal preparation of PGE<sub>1</sub>. in a clinical study of 12-15 patients was evaluated with erectile dysfunction. After administration symptoms like peak systolic velocity, erection dysfunction were improved with no adverse reactions on the skin were reported [24].

#### 1.1.9. Emulsions

When two immiscible liquids among which one is hydrophilic and the other is lipophilic, one disperses in another making small droplets [15]. It appears translucent. A further emulsion can be classified as ordinary emulsions (0.1-100µm), microemulsions 910-100nm) and submicron emulsions (100-600nm). Here microemulsion is named under nanoemulsion & sub-micron emulsions are named under lipid emulsions. When administered in body emulsions get distributed in targeted areas & offer sustained release for a long time, because when kept in direct touch with body and tissue fluids [16]. Lipophilic drugs are made up of oil/water emulsion or oil/water/oil emulsion. So, when oil droplets are acted by macrophages. Their phagocytic action in the liver and spleen gives a high concentration in them. When the quantity of drugs is also loaded. Similarly, water-soluble drugs are made into water/oil or water /oil/water emulsion system which can be very well administered in lymphatics by intramuscular/subcutaneous injection routes. Now, apart from the sustained and targeted effect the herbal drug when converted into emulsion formulation will also achieve stability from hydrolyzed materials. Thus, improving their permeability power in skin & mucous membrane also. Some drugs with examples of emulsions are camptothecin, brucea javanica oil, coixenolide oil, zedoary oil, etc [16]. Checked the effect of aluminum and protein on human lung adenocarcinoma cell carcinoma cell line A549 and revealed a dose-dependent relationship and they reached a conclusion that aluminum emulsions have a good application as anti-cancer drugs with no marrow suppressions and no damage to the liver as demonstrated by examples in table 4.

**Table 4: Herbal Emulsions as Drug Delivery Systems**

| Plant/constituents    | Application category | Therapeutic w.r.t nanotechnology            |
|-----------------------|----------------------|---------------------------------------------|
| Self-nano emulsifying | Zedoary              | enhanced aqueous dispersibility, stability, |

|                              |                   |                                                                                     |
|------------------------------|-------------------|-------------------------------------------------------------------------------------|
| essential oil                |                   | and oral dispersibility, bioavailability                                            |
| Triptolide microemulsion     | Anti-inflammatory | improve the penetration of drugs through the stratum corneum by increased hydration |
| Docetaxel submicron emulsion | Anticancer        | Improves residence time                                                             |
| Berberine nanoemulsion       | Anticancer        | Improves residence time and absorption time                                         |
| Silybin nanoemulsion         | Hepatoprotective  | Releases formulation                                                                |
| Quercetin microemulsion      | Antioxidant       | increase penetration into stratum corneum and epidermis                             |

#### 1.1.10. Transferosomes

Introduced in 1990, this drug delivery system is of massive importance to overcome problems in the transdermal drug delivery system to transport large molecules and their rate of penetration in the stratum corneum layer of skin [29]. They are elastic vehicles that can easily squeeze through the skin, which are many times smaller than their size [30]. They are specially optimized vehicles that can give a good response to stress by their ability to rapidly transform shapes. This can be practically applied as a drug carrier for small molecules as peptides, proteins, and herbal products. Xiao et al [31] made transferosomes of capsaicin and observed that they were getting locally absorbed better. Examples of certain transferosomes and ethosomes are given in table 5.

| Table 5: Herbal Transferosomes and Ethosomes as Drug Delivery Systems |                      |                                                  |
|-----------------------------------------------------------------------|----------------------|--------------------------------------------------|
| Plant/constituents                                                    | Application category | Therapeutic wrt nanotechnology                   |
| Capsaicin transferosomes                                              | Analgesic            | Increases skin penetration                       |
| Colchicines transferosomes                                            | Analgesic            | Increase skin penetration                        |
| Vincristine transferosomes                                            | Antigout             | Increase skin penetration                        |
| Ammonium Glycyrrhizinate ethosomes                                    | Anti-inflammatory    | Increase of the in-vitro percutaneous permeation |

#### 1.1.11. Mouth Dissolving Tablets

ResQ is a polyherbal medicine highly effective in asthma and other respiratory ailments. This drug was the first drug to be made from ayurvedic medicines. It is very useful and effective. When kept in the mouth it dissolves and is absorbed with saliva. The patient gets relief from respiratory distress in 15 min. this has a similar action as Sorbitrate used in cardiac disease.

**1.1.12. Micropellets**

Here the bulk drug is fine powder and is converted into small free-flowing spherical units. This is a multiparticulate system and better than single unit dosage forms due to its technical and therapeutic advantages [5].

**1.1.13. Polymeric micelle formulation**

Used as a success delivery vehicle for drugs that lack water solubility. Formed from amphiphilic substances. They have typical features as small particle size, shape, stability, improved kinetics of release due to its altered physic-chemical properties.

**CONCLUSION**

When Compared to modern medical science all over the world beneficial effects of herbal medicines are being acknowledged by everyone in the medical and non-medical field for a better and wholesome therapeutic approach for any diseases with few side effects. The ayurvedic drugs are used with enhanced efficacy when incorporated in modern formulations dose. Phytochemicals still need a better approach to use the plant components in an efficient way to avoid repeated administration. This has been possible by NDDS for herbal drugs. This not only reduces the dose but also reduced the repeated administrations. Thus being more comfortable to patients. Thus, ayurvedic medicines are now been focused on NDDS for better scientific advancement. This also helps modern medicines to be helpful to compete for the in-market for conducting clinical researchers, drug standardization, evaluating toxicity and monitoring pharmacodynamics and pharmacokinetics.

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