A Review : Novel Herbal Drug Delivery System

Akanksha Zalke, Sudarshan Gangasagar, Sujit Abhang, Kapil Kadam.

Abstract

Researcher are engaged in to find out new plants metabolite useful for human and animals treatment. They develop new drug from herbal material by study of clinical or preclinical trials Because In-vitro or In-vivo study of drug not able to translated clinical use, Different factors like inefficient systemic delivery, Bioavailability, drug toxicity of promising agent that significantly contribute to this disconnection.

As compared to traditional drug delivery system, over the past decade extraordinary advanced have made successful on the development of Nobel herbal drugs delivery system .The kind of novel herbal formulations such as polymeric nanoparticles, nanocapsules, liposomes, phytosomes, animations, microsphere, transfersomes, and ethosomes has been reported using proactive and plant selections.Different problems of traditional systems of medicine are overcome by Novel herbal drugs delivery system, such as enhancement of solubility, bioavailability, and protection from toxicity, enhancement of pharmacological activity, enhancement of stability, improved tissue macrophages distribution, sustained delivery, and protection from physical and chemical degradation etc.

Novel drug delivery technologies have gained the importance to achieve modified delivery of herbal drugs their by increasing the therapeutic value as well as reducing toxicity. The present reviews gives information regarding various novel techniques used for improving safety and efficacy of phytomedicines and application of novel formulation

Keywords: Herbal, novel drug delivery system.

INTRODUCTION:-

Development of New drug molecule is expensive and time consuming process. Herbal formulations means a dosage form Having of one or more herbs or processed herbs material in predetermined quantity to provide different benifit like nutritional, cosmetic or medicinal. Herbal preparations are obtained by subjecting whole plant or any part of plant for the treatments of any disease or disorder. Formulation of any herbal products by the using distillation, extraction, expression, fractionation, purification, infusion, Digestion, percolation, Maceration process. These include comminuted or powdered herbal substances, tinctures, extracts, essential oils, expressed juices and processed exudates.[1] Essentially, herbal remedies consist of portions of plants or unpurified plant extracts containing several activ pharmaceutical ingradient have pharmacological action and which are often generally believed to work together synergistically.[2]In case of side-effects Of herbal drugs appear to be infrequent and mild.[3] Both safety and efficacy of Any drugs depend on the therapeutic index, as compared to traditional systems of medicine Herbal drugs have more advantages and less side effects.[4] In case of drug delivery and site specificity of Herbal drugs shows lack of results But, by the using

(NDDS) Novel drug delivery system like Microparticles, Nanoparticles, Liposomes, Niosomes, Transdermal drug delivery, Microencapsulation, Dendrimers.[5] By the Incarporating Herbal drugs into above different (NDDS) not only reduce the repeated administration of dose or overcome noncompliance, but also help to increase the therapeutic value by reducing toxicity and increasing the bioavailability of Herbal Drugs.[6] Novel drug delivery system it's new approach for Herbal drugs . It helps to evaluate the existing form of herbal drugs molecule to long acting more effectively control release and good distribution of drug is achieved by incorporating the drug in suitable carrier system.

ADVANTAGES OF NOVEL DRUG DELIVERY SYSTEM :-

- Sustained release of Drug for specific period of time.
- Increase the bioavailability of drug.
- Protection from Drug toxicity.
- Enhancement of pharmacological activity of drug.
- Improve tissue macrophages distribution.
- Site specificity.
- It protects physically and chemical degradation of Drug.[7]

RECENT DEVELOPMENTS IN NOVEL DRUG DELIVERY SYSTEM OF HERBALS:-

1. Liposome
2. Phytosome
3. Neosomes
4. Ethosomes
5. Transfersome
6. Microsphere
7. Microemulsion
8. Nanoparticles [8]

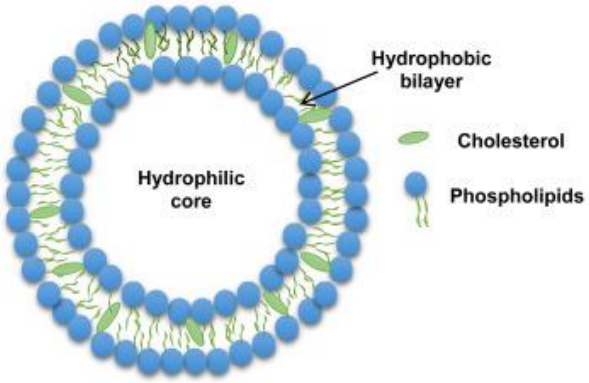
1. Liposomes :-

In 1956 some researchers published first description on swollen phospholipid systems. After few years, a variety of enclosed phospholipid bilayer structures consisting of single bilayers, initially 'bangosomes' and then 'liposomes', was described. Gregoriadis and Perrie have described the concept that liposomes are small artificial vesicles of spherical shape that can be created from cholesterol and natural non-toxic phospholipids which is enclosed drug delivery system. Liposomes can be classified on the basis of size and number of bilayers. They are classified as multilamellar vesicles (MLV), large unilamellar vesicles (LUV) and small unilamellar vesicles (SUV).[9]

Advantages of Liposomes :-

- Liposomes can form complex with both negatively and positively charged molecules.
- Liposomes provide offer a degree of protection to the DNA from degradative processes.

- Liposomes can carry large pieces of DNA, possibly as big as a chromosome.
- Liposomes can be targeted to specific cells or tissues.[10]



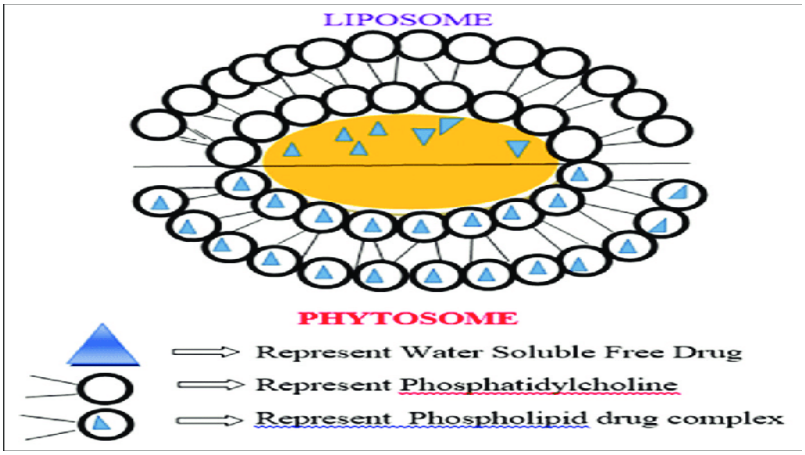
Schematic Representation of Liposome[11]

Method of preperation of liposomes :-

- Thin film hydration method. (Bangham method)
- Reverse-phase evaporation method.
- Solvent injection methods.
- Detergent removal method.
- Dehydration-rehydration method.
- Heating method.
- Ph jumping method.
- Microfluidic channel method.
- Supercritical fluidic method.[12]

2. Phytosome :-

Most of the Active pharmaceutical ingradient of herbal drugs are polar in nature or water soluble in nature due to that problem in absorption, restricts the utilization of these type of compounds which ultimately decreases the bioavailability. For improvement of bioavailability, herbal products must have proper homeostasis between hydrophilic (for absorption into gastrointestinal tract fluid) and lipophilic (to cross lipid bio membrane balance) is important.[13] Phytosome or herbosomes are complex of phospholipids and natural active pharmaceutical ingredients having lipid compatible phospholipid complex, contains herbal extract bounded with phospholipids. It is a vesicular drug delivery system containing phytoconstituents surrounds by lipid. Phytosomes different nature in phytosomes phytoconstituents and phospholipids are present in1:1 or 1:2 ratio whereas in liposomes water soluble constituents is surrounded by several phosphatidyl choline units.[14]



Difference between Phytosomes and Liposomes[15]

Advantages of Phytosomes:-

- It enhance the absorption of lipid insoluble polar phytoconstituents through oral as well as topical way showing improved bioavailability.
- Chemical bonds are formed between phosphatidylcholine molecule and phytoconstituent, therefore the phytosomes prove improved stability outline.
- Additional nutritional profit of phospholipids.
- Considerable drug entrapment.[16]

3. Neosomes :-

The first niosome formulations were developed and patented by L'Oreal in 1975. In the presence of proper mixtures of surfactants and charge inducing agents from the thermodynamically stable vesicles It's a novel drug delivery system, which entrapped the hydrophilic drug in the core cavity and hydrophobic drugs in the non-polar region present within the bilayer hence both hydrophilic and hydrophobic drugs can be incorporated in that.The niosomes are amphiphillic in nature, in which the medication is encapsulated in a vesicle which is made by non-

ionic surfactant are present and hence they are called as niosomes.[17]

Advantages of Neosomes :-

1) less amount of drug need to get proper effect

2)Due to hydrophilic in nature the drug that they entrapped they tend to increase their stability

3) Neosomes enhance drug permeability through topical route

4) vesicles present in the suspension and they are hydrophilic that's why they show high amount of patient acceptance compared to oil based system.[18]

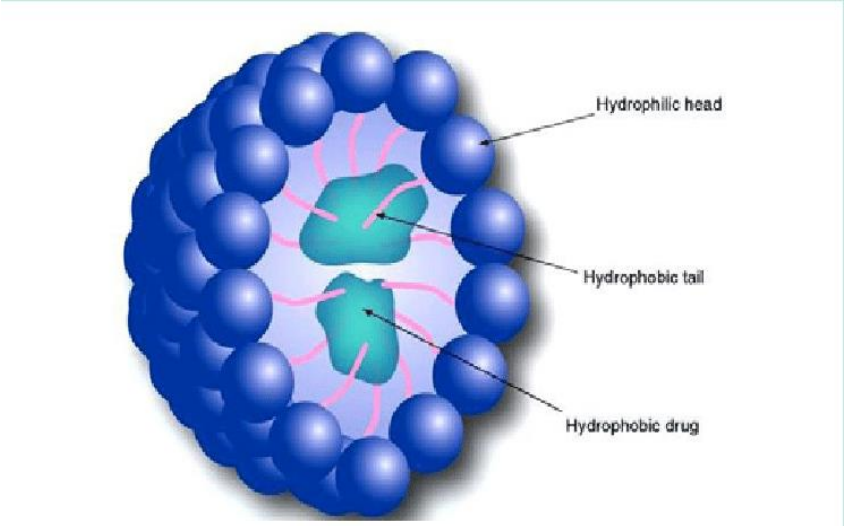


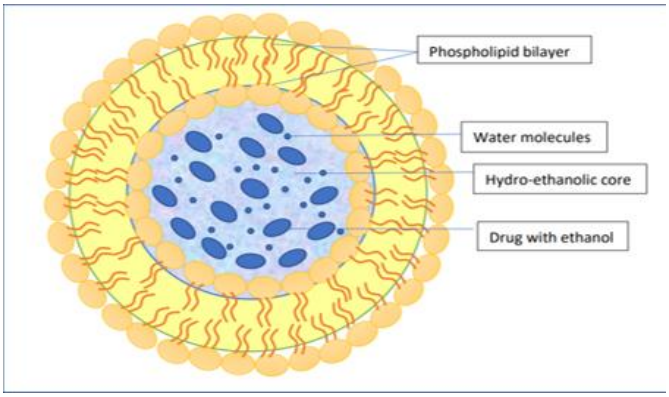
Diagram of Niosome[18]

4. Ethosomes :-

Ethosomes are ethanolic liposomes" it's defined as noninvasive delivery carriers that enable drugs to reach deep into the skin layers and/or the systemic circulation. These are soft, malleable vesicles for enhanced Drug delivery of Activ pharmaceutical ingradient. The vesicles have been well known for their importance in cellular communication and particle transportation for many years. Vesicles also allow to control Drug delivery over the extended period of the. And keep the drug shielded from immune response and other removal system thus it able to release Drug for longer period of time with constant plasma concentration. They are lipid vesicles containing phospholipids, alcohol (ethanol and isopropyl alcohol) in relatively high concentration and water.The size range of ethosomes may vary from 10 nanometers (nm) to microns (μ) ethosomes permeate through the skin layers more rapidly and show significantly higher transdermal drug delivery.[19]

Advantages of Ethosomes :-

1. Delivery of large molecules like (peptides, protein molecules) is possible.
2. It contain non toxic raw material in formulation
3. It enhance Drug delivery through skin (Transdermal Drug delivery)
4. The Ethosomal system is passive, non-invasive and is available for immediate commercialization.[19]



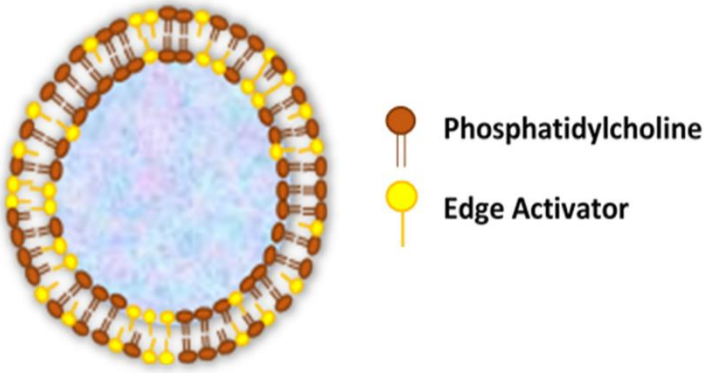
Structure of Ethosomes Depiciting various layer[20]

5. Transfersomes :-

Transfersome consist of atleast one inner aqueous compartment surrounded by lipid bilayer. They are optimized ultradeformable lipid supramolecular aggregates able to penetrate skin, because of incorporation of edge activators like sodium cholate, sodium deoxycholate, span 80,tween 80. They are capable to delivering low as well as high molecular weight of drugs and posses deformability hence they penetrate through the pores present on skin and get into the intact skin. Peptides like insulin, bovine serum albumin, vaccines can be delivered by using Transfersomes.By using these several conventional route disadvantage like first pass metabolism can be overcome.[21]

Advantages of Transfersomes :-

1. Encapsulation of insulin into transfersomes to overcomes the problem of inconvenience of administration by subcutaneous route
2. Transfersomes based corticosteroids are biologically active at dose several times lower than the currently used formulation for the treatment of skin diseases.
3. Transfersomes as drug delivery systems have the potential for providing controlled release of drug like interleukin-2 and interferone-α.
4. Transfersomes of capsaicin has been reported to show better topical absorption as compared to pure capsaicin.[22]



Structure of Transfersomes[23]

6. Microsphers :-

Microsphere are normally free-flowing powders, consisting of biodegradable synthetic polymers or proteins they are spherical particle with size varying from 50nm to 2nm containing a core substance. Thay are also called as microbeads and -beads. In which the Active components is loded by physical entrapment, chemical linkage and surface absorption entrapment largely depends on the method of preparation and nature of the drug or polymer.[24]

Advantages of Microsphers :-

1. Improvement of protein and peptides Drug delivery.
2. Ability to bind and release of high concentration of Drug.
3. First paas effect can be avoided.
4. Can be injected into body by using hypodermic needles.
5. Reduce dose frequency and therapy improved the patients compliance.[24]

7. Microemulsion :-

Microemulsion is dispersion of water, oil, and surfactant that is thermodynamically stable system in which dispersed medium having range 10 to 50 nm.The term of microemulsion is mixture with at least three components; an oily phase, an aqueous phase and a surface active species, that's why it also called surfactants. Depends upon ration between the components very tiny water droplets dispersed in oil phase (w/o micro emulsion) to a oil droplets dispersed in water phase (o/w micro emulsion). The other difference is that the size of droplets in emulsions are in the range of micrometers, while in micro emulsions the size of micelles are in the range of 5-100 nm, depending on the some parameters such as surfactant type and concentration, the extent of dispersed.[25]

Advantages of Microemulsion :-

1. Process avoids use of any hazardous organic solvents for oil extraction; hence it is a relatively „Clean Approach"
2. stable at room temperature
3. Low surfactant need to achieve high efficiency
4. Simultaneous recovery of oil and protein is possible with low initial costs.[26]

8. Nanoparticles:-

It's a fundamental component of Nanotechnology which particle range varying from 1to 100nm made up of from metal, metal oxides, organic matter, carbon etc. Nanoparticles have different dimensions, to shapes and sizes apart from their material.[27] They are designed to improve the pharmacological and therapeutic effects of the drug. They also have a very high surface area and they permit many functional groups to be adhere to them which in turn, can bind to tumor cells. They have proven to be an excellent replacement for radiation and chemotherapy as they can easily assemble in the micro environment of the tumor. A major advantage of nanoparticles which makes them an efficient delivery system is their submicron size which makes extravasations possible and occlusion of terminal blood vessels.[28]

Advantages of Nanoparticle :-

1. Main advantages of nanoparticles to delivery of TB drug tothe lungs with reduced systemic toxicity, aswell as achieving higher drug concentration at the main site of infection.[29]
2. Diagnosis, treatment, and management of cancer.
3. pH-sensitive or temperature sensitive to establish and regulate the drug release.[30]

Conclusion:-

Development of New drug molecule is expensive and time consuming process. Gregoriadis and Perrie have described the concept that liposomes are small artificial vesicles of spherical shape that can be created from cholesterol and natural non-toxic phospholipids which is enclosed drug delivery system. Most of the Active pharmaceutical ingradient of herbal drugs are polar in nature or water soluble in nature due to that problem in absorption, restricts the utilization of these type of compounds which ultimately decreases the bioavailability. It's a novel drug delivery system, which entrapped the hydrophilic drug in the core cavity and hydrophobic drugs in the non-polar region present within the bilayer hence both hydrophilic and hydrophobic drugs can be incorporated in that.The niosomes are amphiphillic in nature, in which the medication is encapsulated in a vesicle which is made by non-. Ethosomes :-. Ethosomes are ethanolic liposomes" it's defined as noninvasive delivery carriers that enable drugs to reach deep into the skin layers and/or the systemic circulation. Delivery of large molecules like (peptides, protein molecules) is possible. Transfersome consist of atleast one inner aqueous compartment surrounded by lipid bilayer. Microsphere are normally free-flowing powders, consisting of biodegradable synthetic polymers or proteins they are spherical particle with size varying from 50nm to 2nm containing a core substance. Ability to bind and release of high concentration of Drug. Microemulsion :-. Microemulsion is dispersion of water, oil, and surfactant that is

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