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PHYTOSOMES AND LIPOSOMES: DELIVERING ENCAPSULATED DRUGS IN STYLISH MANNER

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ABSTRACT

Liposomes are acceptable and superior carriers and have ability to encapsulate hydrophilic and lipophilic drugs and protect them from degradation. Liposomes are microparticulate lipoidal vesicles which are under extensive investigation as drug carriers for improving the delivery of therapeutic agents. Due to new developments in liposome technology. Phytosomes are produced by a process whereby the standardized plant extract or its constituents are bound to phospholipids, mainly phosphatidylcholine producing a lipid compatible molecular complex. Phytosome exhibit better pharmacokinetic and pharmacodynamic profile than conventional herbal extracts. The present review represents the recent advances and applications of various standardized herbal extract phytosomes as a tool of drug delivery.

INTRODUCTION

Lipids are amphiphilic molecules, where one part of the molecule is water-loving(hydrophilic and the other water-hating (hydrophobic). When lipids are placed in contact with water, the unfavorable interactions of the hydrophobic segments of the molecule with the solvent result in the self assembly of lipids, often in the form of liposomes. Liposomes consist of an aqueou core surrounded by a lipid bilayer, much like a membrane, separating the inner aqueous corefrom the bulk outside. They were first discovered by Bangham and his co-workers in 1961 and described as swollen phospholipid systems In the following years, a variety of enclosedphospholipid bilayer structures were defined which were initially called bangosomes and then liposomes, which was derived by the combination of two Greek words, "lipos" meaning fat and "soma" meaning body.

Liposomes have been used to improve the therapeutic index of new or established drugs by modifying drug absorption, reducing metabolism, prolonging biological half-life or reducing toxicity. Drug distribution is then controlled primarily by properties of the carrier and nolonger by physico-chemical characteristics of the drug substance only.

Lipids forming liposomes may be natural or synthetic, and liposome constituents are not exclusive of lipids, new generation liposomes can also be formed from polymers (sometimes referred to as polymersomes). Whether composed of natural or synthetic lipids or polymers, liposomes are biocompatible and biodegradable which make them suitable for biomedical research. The unique feature of liposomes is their ability to compartmentalize and solubilise both hydrophilic and hydrophobic materials by nature. This unique feature, coupled with biocompatibility and biodegradability make liposomes very attractive as drug delivery vehicles. Hydrophobic drugs place themselves inside the bilayer of the liposome and hydrophilic drugs are entrapped within the aqueous core or at the bilayer interface. Liposomal formulations enhance the therapeutic efficiency of drugs in preclinical models and in humans compared to conventional formulations due to the alteration of biodistribution. Liposome binding drugs, into or onto their membranes, are expected to be transported without rapid degradation and minimum side effects to the recipient because generally liposomes are composed of biodegradable,

biologically inert and non-immunogenic lipids. Moreover, they produce no pyrogenic or antigenic reactions and possess limited toxicity [3-5]. Consequently, all these properties as well

as the ease of surface modification to bear the targetable properties make liposomes more attractive candidates for use as drug-delivery vehicles than other drug carrying systems such as nanoparticles [6, 7] and microemulsions [8, 9]. In the 1970s [1,
10-13], liposomes were introduced as drug delivery vehicles but the initial clinical results were not satisfactory due to their colloidal and biological instability.

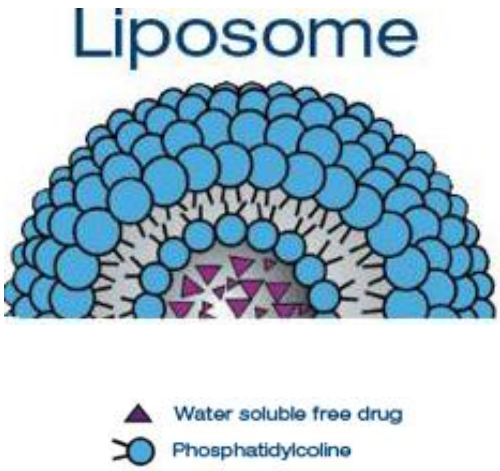


Figure no. 1

Advantage of liposome

1. Non ionic
2. Can carry both water and lipid soluble drugs
3. Biodegradable drugs can be stabilized from oxidation
4. Improve protein stabilization
5. Controlled hydration
6. Provide sustained release
7. Targeted drug delivery o r site specific drug delivery
8. Stabilization of entrapped drug from hostile environment
9. Alter pharmacokinetics and pharmacodynamics of drugs
10. Can be administered through various route

Disadvantages of liposome

1. Less stability
2. Low solubility
3. Short half life
4. Phospholipids undergoes oxidation,hydrolysis
5. Leakage and fusion
6. High production cost
7. Quick uptake by cells of R.E.S
8. Allergic reactions may occur to liposomal constituents
9. Problem to targeting to various tissue due to their large sizes

Therapeutic applications of liposomes

1) Liposome as drug/protein delivery vehicle:
2) Controlled and sustained drug release in situ
3) Enchaned drug solubilization
4) Altered pharmacokinetic and biodistribution
5) Enzyme replacement therapy and lysosomal disorders
6) Liposome in antimicrobial, antifungal and antiviral therapy:
7) Liposomal drugs
8) Liposomal biological response modifier
9) Liposomes in tumour therapy:
10) Crrrier of small cytotoxic molecule
11) Vehicle for macromolecule as cytokines or genes
12) Liposome in gene therapy:
13) Gene and antisence therapy
14) Genetic (DNA) vaccination
15) Liposome in immunology:
    - ✓ Immunoadjuvant
    - ✓ Immunomodulator

- ✓ Immunodiagnosis

16) Liposome as artificial blood surrogates

17) Lipososmes as radiopharmaceutical and radiodiagnostic carrier

18) Liposomes in cosmetics and dermatology

19) Liposomes in enzyme immobilization and bioreactor technology

PHYTOSOMES

INTRODUCTION

Preparations of plants or parts of them were widely used in popular medicine since ancient times and till today the use of phytomedicines is widespread in most of the world's population. During the last century chemical and pharmacological studies have been performed on a lot of plant extracts in order to know their chemical composition and confirm the indications of traditional medicine. It has often been observed that the separation and purification of the various components of an extract may lead to a partial loss of specific activity for the purified component. Phytosome is a patented technology developed by a leading manufacturer of drugs and nutraceuticals, to incorporate standardized plant extracts or water soluble phytoconstituents into phospholipids to produce lipid compatible molecular complexes, called as phytosomes and so vastly improve their absorption and bioavailability**[2]**. The Phytosomes process produces a little cell because of that the valuable components of the herbal extract are protected from destruction by digestive secretions and gut bacteria. Phytosomes are better able to transition from a hydrophilic environment into the lipid-friendly environment of the enterocyte cell membrane and from there into the cell finally reaching the blood**[3]**. Phytosomes have improved pharmacokinetic and pharmacological parameter which in result can advantageously be used in the treatment of the acute and chronic liver disease of toxic metabolic or infective origin or of degenerative nature. It can also be used in anti-inflammatory activity as well as in pharmaceutical and cosmetic compositions

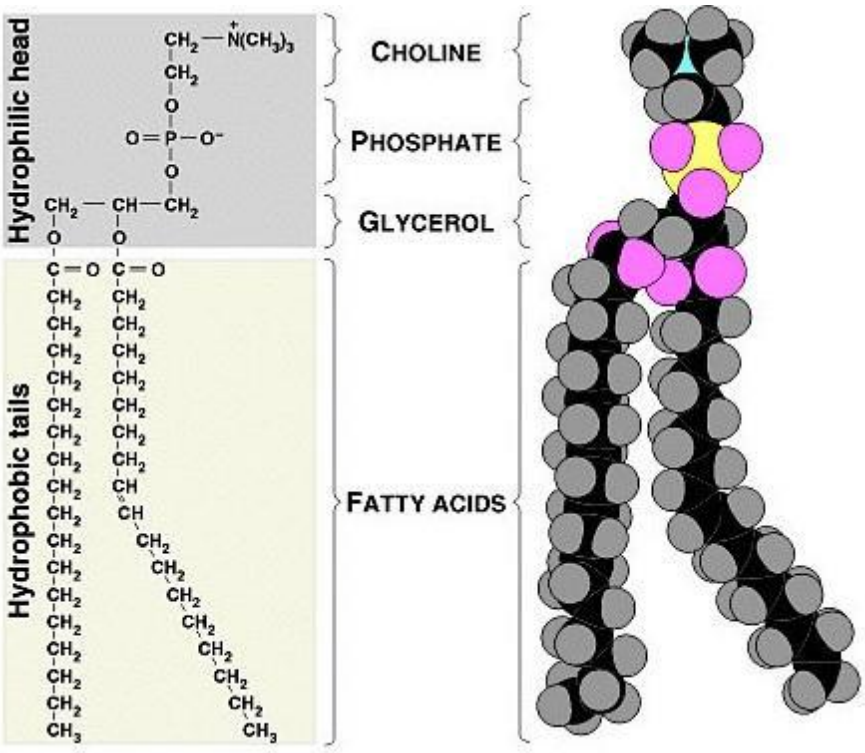


Figure no.2 :Structure of phosphatidylcholine

Figure no.3

Advantages of phytosomes :

The phytosome technology has revolutionized the nutraceutical industry by serving the following benefits,

1. Phosphatidylcholine, one of the components of phytosome, has a dual function that it acts a carrier as well as has a health benefit such hepatoprotective effect.
2. The composition of phytosome is safe and the components are approved for pharmaceutical use.
3. The absorption and bioavailability of water soluble phytoconstituents is increased. This results in better therapeutic effects.
4. Because the bioavailability of phytoconstituents is increased, therefore, the dosage required to produce desirable effect is reduced.
5. The phytosomes have a better stability than liposomes. This is because the former consists of chemical bonds while as it is absent in the later.
6. Phospholipids add to the nutritional value of the plant extract.
7. High market demand for products.
8. The process of manufacturing phytosomes is relatively simple.
9. Phytosomes have the ability to permeate through skin with quite ease and thus enhances their effectiveness.
10. The water soluble phytoconstituents are enveloped by phospholipid which prevents them from destruction by digestive enzymes and gut bacteria. It helps in proper drug delivery to targeted tissue.
11. Phosphatidylcholine nourishes skin besides acting as a carrier because it is part of cell membrane.
12. They can be used for systematic targeting as phytosomes are able to transit from hydrophilic environment into lipophilic environment of enterocyte cell and from there into cell.

Disadvantage

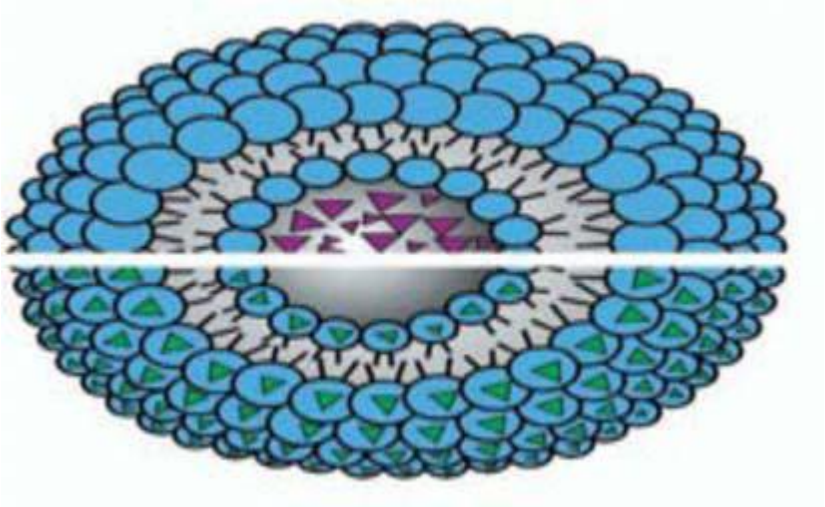
1. Phytoconstituent is rapidly eliminated from phytosome
2. The dose requirement is reduced due to improved absorption of the main constituent. They can also be given in smaller quantities to achieve the desired results.

Applications

1. Specific targeting, molecular shielding
2. Poor adjuvant active
3. Ligand mediated drug delivery
4. Drug targeting
5. Parenteral delivery of poorly water soluble drugs
6. Targeted delivery to tumour cell
7. Targeting of macromolecular drugs
8. Cell specific gene transfer
9. High capacity oxygen carrying system
10. Photodynamic therapy
11. Better catalytic activity turnover than non associated enzymes
12. Multiple compartment of phytosomes give better protection to the interior content of serum

DIFFERENCE BETWEEN PHYTOSOMES AND LIPOSOMES (9)

Sr. No	PHYTOSOME	LIPOSOME
1	Phytosome is a unit of a molecules bounded together	Liposome is an aggregate of many phospholipid molecules that can enclose other phytoactive molecules but without specifically bonding to them.
2	Phytosome process the phosphatidylcholine and the plant components actually form a 1:1 or a 2:1 molecular complex depending on the substances (s) complexed. Involving chemical bonds. So they better absorbed and shown better bioavailability.	In liposome no chemical bond is formed. The phosphtidylcholine molecules surround the water soluble substance. There may be hundereds or even thousands of phosphtidylcholine molecules surrounding the water soluble compound.
3	Phytosome complex can somewhat be compared to an integral part of the lipid membrane. Where the polar functionalities of the lipophilic guest interact via hydrogen bonds with the polar head of a phospholipids (i.e. phosphate and ammonium groups). Forming a unique pattern which can be characterized by spectroscopy.	In liposomes. The active principles are dissolved in the central part of the cavity. With no possibility of molecular interaction between the surrounding lipid and hydrophilic substance.
4	Phytosomes act with the solvent having a reduced dielectric constant such as Acetone, Dioxane, Metyhlenechloride	Liposomal drug complex is formed in the presence of the water or buffer solution.



PHYTOSOME

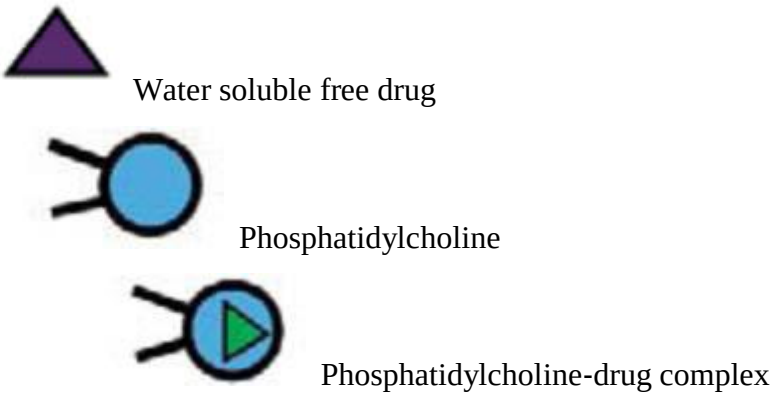


Figure no. 4

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