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Review Article

Review on Phytosomes

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ABSTRACT

Phytosomes are advanced drug delivery system design to improve bioavailability and therapeutic efficacy of phytoconstituents. Many herbal bioactives and despite possessing remarkable pharmacological activities, suffer from poor solubility, instability and limited absorption. Phytosomes are complexes form between natural active phytomolecules and phospholipid which enhances lipophilicity membrane permeability, systemic availability. This review summarizes the concept, preparation technique, characterization, advantages, application and recent trend in phytosome technology.[1] Nowadays, medicinal herbs and their phytochemicals have emerged as a great therapeutic option for many disorders. However, poor bioavailability and selectivity might limit their clinical application. Therefore, bioavailability is considered a notable challenge to improve bio-efficacy in transporting dietary phytochemicals. Different methods have been proposed for generating effective carrier systems to enhance the bioavailability of phytochemicals. Among them, nano-vesicles have been introduced as promising candidates for the delivery of insoluble phytochemicals. Due to the easy preparation of the bilayer vesicles and their adaptability, they have been widely used and approved by the scientific literature. The first part of the review is focused on introducing phytosome technology as well as its applications, with emphasis on principles of formulations and characterization. The second part provides a wide overview of biological activities of commercial and non-commercial phytosomes, divided by systems and related pathologies. [2]

INTRODUCTION

The poor oral bioavailability of polyphenolic compound can be enhanced through incorporation

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of them into phospholipids based self-assembled delivery system popularly known as 'Phytosomes'.

Phytosomes a term derived by word "Phyto" means Plant & Somes means "resemble or cell like structure". Phytosomes means herbal drug loaded in vesicles, which is available in Nano particles. Phytosomes provides an envelope like coating around the active constituents of herbal extract remain safe & degradation.

The process of creating phytosomes enhances the number of herbal compounds by facilitating better absorption, raising bioavailability, and encouraging medication transport to the tissues. They offer local application at the location of necessity. Topical cosmetic pharmaceutical hybrids designed to improve appearance by adding extra health-related properties to the ingredients are known as functional cosmetics. The correct and economical use of herbal remedies is achieved through the dual uses of phytosomes as a topical medicinal agent and cosmetics with enhanced efficiency and safety. A number of chief constituents of herbal medicine are easily soluble in water (glycoside, flavonoid); however, these constituents are bounded in their potency because they may be partially soluble or hydrophobic in nature, so when applied topically shows less therapeutic efficacy. Numerous efforts have been put forward to enhance the bioavailability of such drug by formulating them to target drug delivery system such as phytosomes and liposomes are good options The use of these techniques in formulation development process may lead to good bioavailability of herbal drugs as compare to conventional herbal extracts.[3]

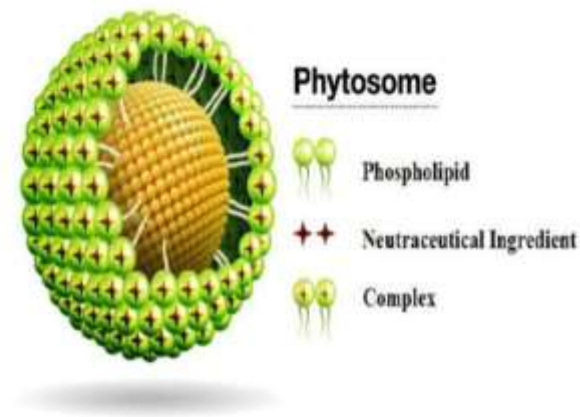

Fig. No. 1: Phytosomes

Phospholipid is the main ingredients in all this are phospholipid with which comprises a glycerol unit joined by a Phosphate group. In phytosome preparation the main phospholipid used as (phytosome) phosphatidylcholine having a great role in biological membrane & also act as hepatoprotective.

Phospholipids have the characteristics of excellent biocompatibility and a especial amphiphilicity. These unique properties make phospholipids most appropriate to be employed as important pharmaceutical excipients and they have a very wide range of applications in drug delivery systems. The aim of this review is to summarize phospholipids and some of their related applications in drug delivery systems, and highlight the relationship between the properties and applications, and the effect of the species of phospholipids on the efficiency of drug delivery.

Phospholipids are unique and versatile molecules. They are of natural occurrence and the main components in cellular membranes. Arranged as a lipid bilayer, phospholipids play a significant role in the structure and functionality of biological membranes. They are amphiphilic and consist of a hydrophilic headgroup and a lipophilic/ hydrophobic tail.[4]

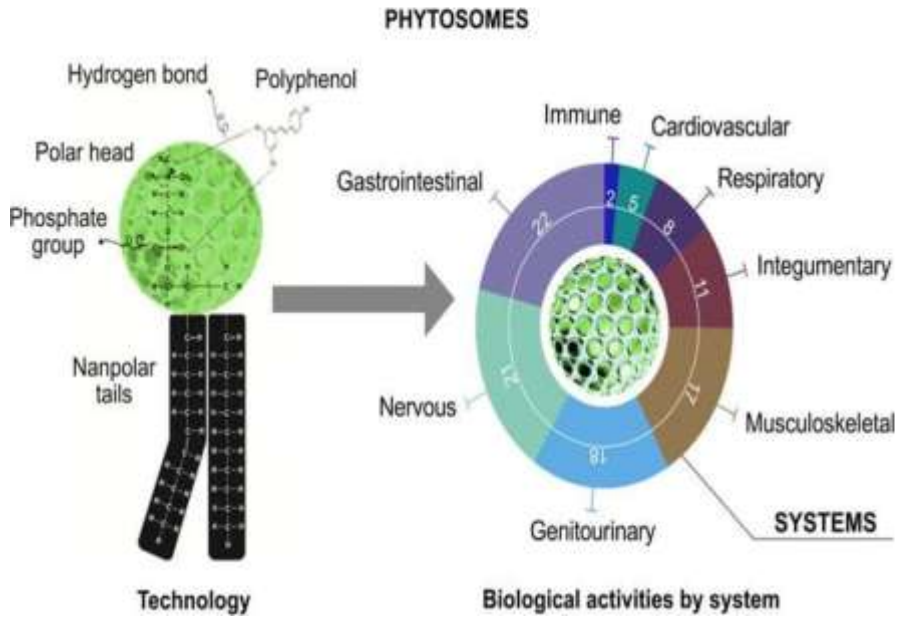

Fig. No. 02:Phospholipids

Phytosome Characterization

Nanomaterial measurement approaches are a rapidly growing field, involving effective methods for physical and chemical characterization. Phytosomes have received tremendous attention for phytochemical delivery as a fast-growing class of nanovesicles. Several techniques were employed to characterize phytosomes size, elemental composition, morphology, and a wide range of other physical characteristics. There are physical properties, which can be investigated by more than one technique. Different limitations and strengths affect the choice of the most appropriate method, while a combinational methodology for characterization is often required. Also, some statistical studies are needed for better application in real world. The main characteristics of phytosomes are (1) size and shape; (2) surface charge; (3) chemical composition; (4) lamellarity and stability; (5) encapsulation efficiency and (6) release behavior. The goal of this chapter is to provide a thorough summary and a systematic overview of all analytical instruments used to characterize phytosomes, including the latest papers.

1. Average Size and Shape

The evaluation of size and morphology is a critical phytosome analysis and provides valuable insight into the quality and different forms of a sample. Different techniques such as DLS, microscopic observation (TEM, SEM, optical, atomic force, fluorescence, etc.), and flow and size-exclusion chromatography can be used for phytosome size characterization. Electron microscopy is broadly used for phytosome visualization, and Cryo-TEM and Freeze-fracture-TEM are the most used. Cryo-TEM could show phytosomes directly in the frozen state to prevent phytosomal disruption. Freeze-fracture-TEM provides the details on liposomal size and morphology without any structural distortion. Methods of microscopy are generally of high resolution and rapid productivity, but the sample preparation is complicated and time-consuming; also, some problems such as shrinking or shape distortion can be generated in sample preparation. The measurement of phytosome size distribution and polydispersity gives data on their physical stability, which can be evaluated by DLS. DLS is easy, precise, accurate, very fast and can therefore be used for regular size distribution measurements of phytosomes. The biggest benefit of DLS is that the assessment could be carried out in the sample's natural environment. The disadvantage of this approach is that the heterogeneous emulations could result in false data.

2. Surface Charge

Zeta potential (complete charge generated by medium) defines the charge of phytosomes in emulsions. Zeta potential may be negative, positive, or neutral depending on the composition of the phytosome. Zeta potential could reflect the stability of phytosomes in a medium; in fact, charged particles repel each other enough to maintain stability. Phytosome emulsion with a zeta potential greater than or less than 30 mV is known to be stable. The electrostatic properties of phytosomes can be measured using Doppler velocimetry, zeta sizer, master size, microelectrophoresis, pH-sensitive fluorophores, high-performance capillary electrophoresis, and DLS instruments. Laser Doppler velocimetry is the method for measuring the velocity or linear or vibrational motion of phytosome emulsions using the Doppler Effect in a laser beam. In light-scattering methods, an electrical field is applied to the cell that causes phytosome movement within the cell. The results of the size were obtained from these movements of particles.

3. Chemical Composition

Assessment of the chemical composition and interaction between vesicle components and phytochemicals is usually studied by NMR, FTIR, and mass spectrometry. Besides, phospholipid quantification in phytosomes can be done by reaction with an appropriate reagent, followed by a spectrophotometric quantification. Due to high signal-to-noise, sensitivity, and selectivity, mass spectrometry is one of the most credible techniques for determining the phytochemical composition of plant extracts and phospholipids. Many authors have also applied FTIR techniques to determine the interaction between phytochemicals and vesicle components. For example, de Azambuja Borges et al evaluated the interaction between soy isoflavone genistein and asolectin-loaded liposomes by HATR-FTIR, high-field 31P NMR, and low-field 1H NMR methods. The findings showed that isoflavone reduces the phosphate group's degree of hydration and mobility. In another study, Mazumder et al confirmed that DSC and FTIR can prove the formation of the sinigrin–phytosome complex. Chen et al also prepared curcumin-liposomes, and TGA and FTIR showed a successful presence of SA and PSA in liposomal lipid bilayers and covalent bonding between SA carboxyl group and WGA amine group.

4. Lamellarity and Stability

The word "lamellarity" represents the number of phytosomal lipid bilayers. The most used methods for the determination of lamellarity are electron microscopy methods, 31P nuclear magnetic resonance, and small-angle X-ray scattering. 31P NMR is one of the most precise and simple methods for determining the lamellarity. The weakness of this approach is that it is sensitive to experimental conditions, such as the concentration of the reagent, vesicle type, and concentration of the buffer. Other recently applied visualization methods are negative staining electron microscopy, freeze-fracture, and cryo-microscopy. In order to evaluate the architecture of the vesicle membrane, Nele et al recently merged cryogenic transmission electron microscopy and small-angle neutron dispersion and offered insights into the impact of the formulation method and lipid composition on the development of liposomes with a defined membrane structure.

Phytosomal stability is another important factor in the successful design of a successful carrier. Studies of stability are performed to explore the phytochemical changes of phytosomes during storage and general circulation. Stability can be assessed over several months by determining mean vesicle size, zeta potential, size distribution, and trap efficiency. Cheng et al assessed the thermal and photochemical stability of rhamnolipids (RL) modified curcumin liposomes and results showed improved stability of the loaded liposomes at different pH, ionic, and heat conditions.

5. **Encapsulation Efficiency and Release Behavior**

Encapsulation efficiency (EE percent) describes the amount of phytochemical that is embedded in the phytosome. EE percent can be described as equation 1:

$$EE\% = \frac{IP - EP}{IP} \times 100$$

where EE% is the efficiency of encapsulation, EP is encapsulated phytochemical and IP is the initial content of phytochemicals.

The process of encapsulation efficiency determination begins with the removal of free unencapsulated phytochemicals from the phytosome emulsion by the Sephadex gel column, ultracentrifugation, or dialysis method (defined cut-off) for several hours against buffer solution. Step 2 in EE estimation is the ruination of the phytosome bilayer (with Triton X-100, acetonitrile, methanol, and ethanol) and the quantification of the released active agent by different methods, such as enzymatic assays, gel electrophoresis, fluorescence spectroscopy, and field flow fractionation chromatographic methods, such as HPLC, UPLC, or LC-MS.

Drug release behavior of vesicle carriers has been the subject of extensive research over the past few years, since the release profile obtained in vitro may provide an indicator of the efficiency of the carrier in vivo. Membrane diffusion strategies (dialysis, micro-dialysis, fractional dialysis, and reverse dialysis), sample and separate strategy, in situ process, and continuous flow are traditional approaches that are most widely used to determine the release rate of active agents. Phytochemical release can be spectrophotometrically determined.[9,10,13]

Properties Of Phytosomes:

- Phytosomes are increases the absorption through the formation of micelles.
- Upon being exposed to wate phytosomes acquire the shape of aggregating structures.
- They can become an essential component of the membrane by allowing for the active principle associated with the phospholipid polar head. For example: in catechindistearoyal phospholipid complex, H-bonds are formed.
- These are advanced herbal products that work better in terms of absorption, application, and outcomes than conventional botanical herbal extracts. Surveys on the pharmacokinetics furthermore pharmacodynamics of phytosomes in both human and animal subjects have demonstrated that phytosomes have a higher bioavailability than simple botanical derivatives.
- They are easily soluble in non-polar solvents, have a definite melting point, and are only slightly soluble in lipids.

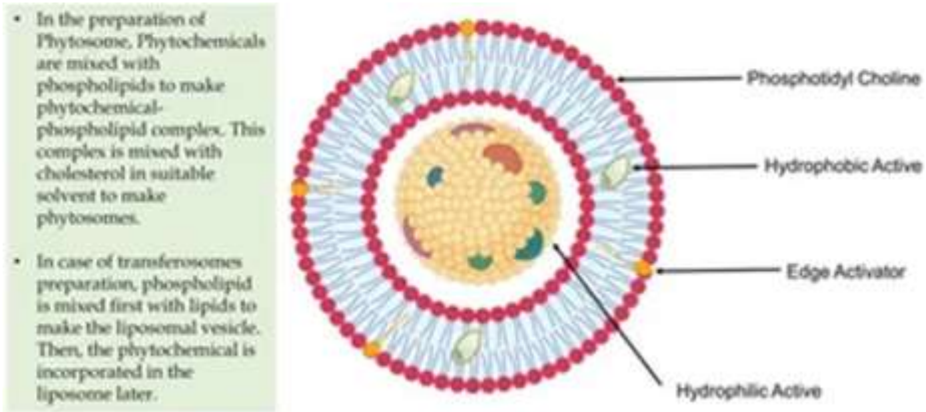

Fig No. 3 :Structure of Phytosomes

Advantages of Phytosomes:

- **Improved absorption:** Plant extracts or bioactive components have dramatically increased bioavailability because of their complexation with phospholipids and better intestinal absorption
- **Cosmetic use:** The components of phytosomes are all permitted for use as pharmaceutical and cosmetic aids and the formulation of phytosomes is safe. They can also be utilized to improve the drug's penetration into the skin for transdermal and dermal delivery [30]. They have better skin penetration and a high lipid profile, making them suitable for widespread application in cosmetics. Functional cosmetics based on phytosomal compositions are possible.
- **Protective in nature:** Because phytosomes can easily make liver-protecting flavonoids accessible they have been employed to administer them. Additionally, because phosphatidylcholine is also hepatoprotective, it works in concert with other substances to protect the liver.
- **Cost-effective:** When it is utilized to protect the skin against external or internal risks of every day and stressful environmental situation, this method offers cost-effective phytoconstituent delivery and synergistic advantages.
- **As a carrier:** Phytosome technology involves phosphatidylcholine, a crucial component of the cell membrane that serves as a transit and nurtures the skin.
- **Improve the entrapment efficacy:** Drug entrapment is not a concern at the time on preparation of the phytosome. Additionally, the entrapment efficiency is great and more over predetermined as the drug itself produces vesicles after conjugating with lipid.
- **Improved Bioavailability:** Phytosomes enhance the absorption of herbal compounds, particularly fat-insoluble ones, by making them more lipid-compatible.
- **Enhanced Absorption & Penetration:** The lipid layer formed by the phospholipids facilitates better absorption through the gastrointestinal tract and enables effective skin penetration for topical treatments.
- **Increased Efficacy:** Due to improved absorption and bioavailability, the overall efficacy of the herbal constituents is increased.
- **Lower Dosage Requirement:** The higher efficacy means a smaller dose of the phytosome formulation is needed to achieve the desired therapeutic effect.
- **Better Stability:** The chemical connection formed between the phytoconstituent and the

phospholipid makes the phytosome formulation more stable.

- **Biocompatibility:** Phytosomes are biocompatible, as phospholipids are natural components of cell membranes.
- **Synergistic Effects:** Phosphatidylcholine, a common component of phytosomes, can offer additional health benefits, such as hepatoprotective effects, leading to synergistic outcomes.
- **Controlled Release:** Phytosomal formulations can help control the release kinetics of the active ingredients.
- **Versatile Applications:** Phytosomes can be used in various therapeutic areas, including anti-inflammatory, antioxidant, and anticancer treatments.
- **Improved Formulation:** The formulation process for phytosomes is relatively simple and efficient.
- They increase bioavailability due to phospholipid complex, thus improve therapeutic effect.
- They are required in fewer doses due to high bioavailability.
- They improve gastrointestinal absorption.
- They show high stability.
- They are preferred over liposomes in cosmetics because of their strong lipophilicity, which results in great penetrability.
- Their clinical benefits are higher.
- Additionally, phytosomes work better in skin care products than liposomes.
- There is no difficulty in drug snare while formulating Phytsomes.
- Due to the drug's conjugation with lipids to produce vesicles, entrapment efficiency is high and almost entirely predefined. It is evident that the medication's bioavailability has improved.
- The dose required has been reduced due to the principal ingredient's maximum absorption. [8,11]

Disadvantages of Phytosomes:

- Stability Problem.
- Phytoconstituents from phytosome are rapidly eliminated.
- When administered orally and tropically they limit their bioavailability**.**
- Rapid elimination of phytoconstituents of phytosome may diminish the target drug
- concentration and indicate the unstable nature of these phytosomes, which is a major drawback.

Method of Preparation:

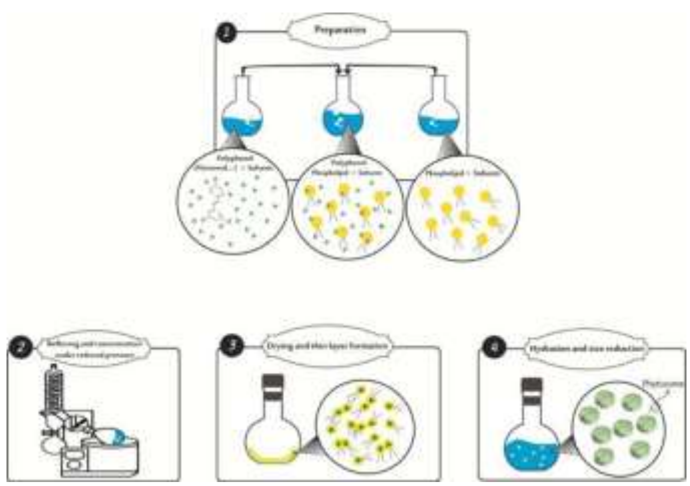

Fig no. 4 :Method of preparation

1. Using precise weighing, 10 millilitres of chloroform are mixed with cholesterol and phosphatidylcholine in a round-bottom flask.
2. The flask is then sonicated for 10 minutes in a bath sonicator.
3. A rotating evaporator is used to extract the organic solvent at 45–50°C.
4. A thin layer of phospholipid mixture is created when the solvent is completely removed, and it is hydrated with the plant's methanolic
5. extract in a rotary evaporator (at 37–40°C for an hour).
6. The mixture of plant extract and lipid is hydrated, and then it is sonicated for 20 minutes in an ice bath to dissipate heat.
7. After harvesting, the phytosomes are placed in an amber-colored bottle and kept in the freezer between 2 and 8°C

When polyphenolic phytoconstituent is complexed with a phospholipid it creates phytosome. The observed mass ratios range from 1:1.5- 1:4, depending on the product. Depending on the protocol used, alternative phytosome preparation techniques and the resultant complex may be used. As a result, three distinct complexes of silybin-phospholipid have been revealed and the phospholipid complex of curcumin formed in an aprotic solvent shows notable differences from the one prepared in protic solvent. Two of them-Silipid, pharmaceutical grade phytosome that undergone detailed characterization and siliphos were made in aprotic solvents, whereas a third silybinphospholipid complex was made in protic solvents. As it is seen for Ginkgo biloba extracts, where the regular phosphatidyl-choline complex is going by the name Ginkgoselect Phytosome and the Phytosome extract using phosphatidylserine, this complex is known as Virtiva. Different phospholipids provide distinct complexes.

Commercially Used Phytosomes:

1. Bilberry (melrtoselect) phytosome Anthocyanosides from Vaccinium myritillus Antioxidant, improvement of capillary tone.
2. Centella phytosome Terpenes obtained from Centellaasitica Brain tonic, vain, and skin disorder.
3. Cucurbita phytosome TM Tocopherols, steroids, carotenoids from Cucurbita pepo Anti-inflammatory, benign prostatic hyperplasia.
4. Curcumin (meri noselect) Polyphenols contained in Curcuma longa Enhancing plasma and oral bioavailability of curcuminoids as a cancer chemo preventive drug.
5. Echinacea phytosome Echinacosides derived from Echinacea augustifolia Nutraceutical, immunomodulator.
6. Ginkgo biloba dimeric flavonoids phytosome Dimeric flavonoids extracted from Ginkgo biloba leaf Lipolytic and vasokinetic agent.
7. Ginkgo biloba terpenes phytosomes Ginkgolides and bilobalide deriving out of Ginkgo biloba leaf Soothing agent.
8. Ginkgo phytosome TM Ginkgo flavonoids from Ginkgo biloba Protects the brain and vascular linings, and acts as an anti-skin aging agent.
9. Ginkgoselect The ginkgo flavonoglycosides contained in Ginkgo biloba Protection against brain and vascular lining.
10. Ginseng phytosomeTM Ginsenosides deriving out of Panax ginseng Nutraceutical, immunomodulator.
11. Glycyrrhiza 18-beta glycyrrhetinic acid Anti-inflammatory activity.
12. Glycyrrhiza phyto-some Glycyrrhetinic acid deriving out of Glycyrrhiza glabra Anti-inflammatory, soothing.

13. Grape seed leucoselect) Procyanidins from Vitis vinifera Antioxidant and anticancer activity.
14. Grape seed phytosomeTM Procyanidins got from Vitis vinifera Nutraceutical, systemic antioxidant, cardioprotective.[15]

Application:

1. Clinical Applications of Phytosomes, The Role of Phytosomes in the Nervous System:

(A) The Phytosomes in Cognitive Impairment and Neuronal Damage Numerous investigations assess the phytosome's bioavailability in relation to comparable unformulated products using animal models, with an emphasis on the active components' tissue distribution. The phytosome formulation had the best performance as an MAO inhibitor and radical scavenger using an in vitro transwell model of the blood-brain barrier, making it a good model to boost the extract's antidepressant-like effects.

(B) The Phytosomes in Migraine Phytosomes in Migraine Disorders the same research team examined the effectiveness of administering 60 mg of Ginkgo biloba terpenes phytosome, 11 mg of coenzyme, and 8.7 mg of vitamin B2 twice a day to fifty individuals suffering from migraine with aura in two different trials.

1. **The Phytosomes in the Gastrointestinal System:**

(A) The Phytosomes and Gut Microbiota Lecithin-curcuminoid formulation and unformulated curcuminoids are two different curcumin-based products whose effects on human colonic metabolism were studied in a recent study. Following the fermentation of both extracts in an in vitro fecal model, curcuminoid content was measured, potential curcuminoid breakdown was evaluated, and the primary metabolites involved in the fermentation of human feces were identified using mass spectrometry. The outcomes shown that curcuminoid catabolites were more frequently observed following the fermentation of curcuminoids prepared with lecithin.

(B) The Phytosomes against Bowel Inflammation The 43 patients voluntarily selected to either receive one 250 mg tablet daily or no supplements for a period of four weeks. The supplementation group saw reduced levels of rectal involvement, anaemia, malaise, watery stools, blood in stools, cramps and diffuse intestinal pain, as well as a decrease in white blood cell count. Additionally, there was less of a need for additional medications and medical testing.

2. **The Phytosomes Effect in the Genitourinary System:**

(A) The Phytosomes and Breast Cancer In the first research, as part of a 4-week treatment regimen before to surgery, 12 patients with early-stage breast cancer received 44.9 mg of epigallocatechin-3-gallate. The treatment plan included taking 300 mg of a commercial lecithin formulation with green tea catechins every day. The Phytosomes Role in Prostate Disease. The effects of phytosomes loaded with silibinin on prostate cancer were assessed in three different investigations. In the first in vivo investigation, male TRAMP mice with a palpable prostate tumors were fed a meal containing 0.5% or 1% w/w phytosomes. Following 11 weeks, the diet reduced the prostate's weight and tumors by up to 60% in a dose-dependent manner. A pair of clinical trials were carried out to assess the effects on human subjects. Thirteen patients with prostate cancer participated in the first pharmacokinetic Phase I research. The daily oral dosage of phytosome was raised from 2.5 g to 20 g.

3. **The Phytosomes Effect in Female Reproductive System:**

The effects of a 2 g (4 × 500 mg daily) curcumin phytosome supplement were assessed over the course of two weeks in six endometrial cancer patients who were not receiving concomitant cancer treatments. Supplementation resulted in a decrease in leukocyte MHC expression, monocyte counts, and CD8 + T cell ICOS protein levels. There were no other significant changes observed in inflammatory indicators, such as the range of immune cell types, T cell activity, or levels of the protein cyclooxygenase-2 (COX2).

4. **The Phytosomes in Urinary Tract Dysfunctions:**

The biological effects of phytosomes on the urinary system were assessed in two clinical trials. In the first trial, urine was evaluated for its capacity to prevent the growth of Candida albicans after 13 healthy subjects were given cranberry extract phytosome or the corresponding standardised extract to drink. For a week, the subjects took two cranberry phytosome or cranberry extract capsules daily, and their poop was measured at various intervals.

5. **The Phytosomes as Modulators of the Immune System**

An in vivo investigation that used 50 mg/kg of Wistar rats for seven days prevented liver damage and inflammation brought on by paracetamol.

In a different study, grape seed extract—which contains a high concentration of epigallocatechin 3-O-gallate was evaluated for its immunomodulatory qualities in its phytosomal form. An evaluation of serum cytokines demonstrated that a one-month treatment of elderly individuals with grape seed phytosomes (300 mg/die) affected their immunological response. Specifically, the treatment increased the synthesis of INFγ and IL-2, suggesting a possible role in the Th1/Th2 balance. The Phytosomes Effect in Wound Healing.

A. Mazumder et al. examined Sinigrin's capacity to heal wounds in HaCaT cells both as a phytosome complex and as an isolated substance in 2016. Sinigrin is a well-known glucosinolate present in plants in the Brassicaceae family.61 Only 65.63% of the wound could be healed by the ethanolic extract alone; in contrast, the phytosomes showed around 90.40% recovery. As was previously mentioned, the Demir et al. 2014 study showed that the created vesicles also showed improved wound. In comparison to sinigrin alone, a complex comprising sinigrin and phytosome showed positive benefits on wound healing in HaCaT cells. The Phytosomes Role in the Respiratory System Diseases.

(A) The Phytosomes in Asthma and Bronchitis The usual treatment for those with mild to severe persistent asthma is a combination of beta agonists and corticosteroids, which was utilized in multicentre research with thirty-two asthmatic volunteers. The 500 mg of Boswellia serrata that the patients were randomly assigned to receive.
(B) The Phytosomes Role in Lung Cancer Using the mammary gland tumor cell line (ENU1564), the anticancer effects of curcumin with phosphatidylcholine injected into the mammary fat of athymic nude mice were assessed. We used free curcumin to assess the phytosome's effects. The curcumin phytosome significantly decreased lung

metastases and the production of MMP-9, a protein associated to tumor invasion and metastasis, including breast cancer, while having no effect on the tumor's size. This was related to the results of the same study on how grape seed phytosomes affected lung cancer cells' in vitro activities. Both Ki-67 and the grading of bronchial histology showed a significant reduction after therapy in bronchial samples.

6. **Phytosomes Role in Hepato Protective:**

It has been discovered that Ginkgo biloba leaf extracts (family: Ginkgoaceae) exhibit strong CNS, antioxidant, hepatoprotective, anti-diabetic, and cardio protective properties. The results of the investigation showed that 200mg/kg of G. biloba phytosomes considerably reduced the cardiac necrosis caused by isoproterenol. The cardio protective properties of phytosomes were further validated by histopathological study of the myocardium. Its reduction in myocardial necrosis (as seen by lower AST, LDH, and CPK release as well as histoarchitectural changes) and increase in endogenous antioxidants are responsible for its cardio protective impact. Andrographolide (AN), which is derived from Andrographis paniculata Linn, has been traditionally used to treat a variety of conditions, such as fever, inflammation, tonsillitis, pharyngitis, laryngitis, pneumonia, tuberculosis, pyelonephritis, and hepatic impairment. When compared to its phytosome dose, the drugs equimolar dose exhibits lower absorption and higher serum levels of SGOT and SGPT, suggesting its hepatoprotective properties.

7. **The Phytosome Role in Enhancing Bioavailability**

Anti-inflammatory, anti-tumor, anti-nociceptive, antiobesity, and thermoregulatory activities are only a few of its many pharmacological properties. Evodiamine is a quinoline alkaloid found in Evodia rutaecarpa. Evodiamine exhibits potential as an anti-tumor agent since it slows proliferation, causes apoptosis, and decreases invasion and metastasis in a variety of tumor cells. Evodiamine phytosomes were found to have improved absorption, a longer half-life, a greater in vitro dissolution rate, and a higher bioavailability. An extended duration of action and increased bioavailability were noted as a consequence of the drug's protracted release from the phytosome. [12-15]

SOME PATENTED TECHNOLOGY OF PHYTOSOME

There is numerous works has been done for commercialization of Phytosome, out of them few patents technology is representing in along with their patent title, description of innovation and patent number.

FUTURE PERSPECTIVE OF “SOMES” WITH THEIR APPLICATION

“Somes” are having a wide area of thrust, not only phytosome is having its property but there are some other “Somes” preparation also suggest

their clinical efficacy which is represented in Vesicular drug delivery system and its application.

CONCLUSION

Herbal products always have great concern of denaturation and bioavailability. There is so many novel approaches are available in the form NDDS. Despite these approaches liposomes and phytosomes are most suitable novel approaches for herbal drugs to overcome this kind of problems. These delivery systems have improved the pharmacotherapeutics and pharmacokinetics of herbal drugs.

Phytosomal delivery systems effectively address the pharmacokinetic challenges of herbal products, offering improved bioavailability, stability, and therapeutic outcomes. This kind of delivery systems is also utilized in the field of nutraceuticals and cosmeceuticals for improving therapeutic effect and permeability in the skin. The formation of phytosomes is simple and reproducible a part of those phospholipids.

REFERENCES

1. Shakeri F, Sahebkar A. Phytosome: a review of the formulation, preparation, and therapeutic applications. Pharmacological Research. 2016; 105:37–50. https://doi.org/10.1016/j.phrs.2016.01.008
2. Semalty A, Semalty M, Rawat M S M, Singh D. Phytosomes in herbal drug delivery. Indian Drugs. 2006;43(12):937–944.
3. Mukherjee P K, et al. Phytosomes: a novel drug delivery system for herbal extracts. Indian Journal of Pharmaceutical Sciences. 2009;71(4):349–358. https://doi.org/10.4103/0250-474X.57282
4. Pu Y, Zhang X, Zhang Q, et al. 20(S)-Protopanaxadiol phospholipid complex: process optimization, characterization, and in vitro dissolution. Molecules. 2016;21(10):1396. https://doi.org/10.3390/molecules21101396
5. Tripathy S, Patel D K, Barob L, et al. A review on phytosomes, their characterization, advancement and potential for transdermal application. J Drug Deliv Ther. 2013;3(3):147–152. https://doi.org/10.22270/jddt.v3i3.508
6. Bhattacharya S. Phytosomes: the new technology for enhancement of bioavailability of botanicals and nutraceuticals. Int J Health Res. 2009;2(3):225–232.
7. Joshi A T, Vangara S, Vetsa V. Amphiphilic drug delivery system – Phytosomes. Res Rev J Pharmacogn Phytochem. 2017;9(2):45–52.
8. Gandhi A, et al. Recent trends of phytosomes for delivering herbal extracts with improved bioavailability. J Pharmacogn Phytochem. 2012;4(1):6–12.
9. Liu S, Tan Q Y, Wang H, Liao H, Zhang J Q. Preparation, characterization and in vitro anti-tumor activities of evodiamine phospholipid complex. Chin Pharm J. 2012; 7:11.
10. Yu F, Li Y, Chen Q, et al. Monodisperse microparticles loaded with the self-assembled berberine-phospholipid complex-based phytosomes for improving oral bioavailability. Eur J Pharm Biopharm. 2016; 103:136–148. https://doi.org/10.1016/j.ejpb.2016.03.019
11. Alhazmi H A, et al. Advances in phytosome technology for improving the bioavailability of phytochemicals. Front Pharmacol. 2023; 14:1123412. https://doi.org/10.3389/fphar.2023.1123412
12. Hussain S, et al. Recent developments in phytosome formulations for enhanced bioavailability of herbal compounds. Drug Deliv Transl Res. 2022; 12:2633–2649. https://doi.org/10.1007/s13346-022-01167-7
13. Thakur V, et al. Phytosome-based delivery systems for herbal bioactives: A review on recent research and future perspectives. J Pharm Invest. 2021;51(6):677–696. https://doi.org/10.1007/s40005-021-00551-3
14. Zhang X, et al. Nanocarrier-based phytosomes for improved therapeutic efficacy of phytoconstituents. Int J Nanomedicine. 2020; 15:5377–5392. https://doi.org/10.2147/IJN.S258527
15. Ternullo S, et al. Phytosome-enhanced delivery systems in dermal and transdermal applications. Pharmaceutics. 2023;15(4):1128.

https://doi.org/10.3390/pharmaceutics15041128

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