International Journal of Innovation Scientific Research and Review
Vol. 08, Issue, 05, pp.9867-9870, May 2026
Available online at http://www.journalijisr.com
SJIF Impact Factor 2025: 7.913

Research Article

ISSN: 2582-6131

PHYTOSOMES AS AN INNOVATIVE DRUG DELIVERY STRATEGY

[1,*] Dr K.S.Srilatha, [2]Dr Bharath C, [3]Dr Venupriya, [4]Susmitha K R, [4]Rajani B K

[1]Professor and HOD Department of Pharmaceutics, Shridevi Institute of Pharmaceutical Sciences Tumkur, Karnataka, India.
[2]Asst professor Department of Pharmacy practice, Shridevi Institute of Pharmaceutical Sciences Tumkur, Karnataka, India.
[3]B.A.M.S M.D (Ayu) Practitioner, Banglore Karanataka, India.
[4]Asst professor Department of Pharmaceutics, Shridevi Institute of Pharmaceutical Sciences Tumkur, Karnataka, India.

Received 03rd March 2026; Accepted 04th April 2026; Published online 30th May 2026

ABSTRACT

Phytosomes represent a groundbreaking advancement in herbal drug delivery systems, offering a novel approach to enhance the bioavailability and efficacy of phytoconstituents. Traditional herbal extracts often face challenges such as poor solubility, limited absorption, and rapid metabolism, which hinder their therapeutic potential. Phytosomes, formed by complexing phytoconstituents with phospholipids, particularly phosphatidylcholine, facilitate improved penetration of active compounds through biological membranes. This innovative delivery strategy not only increases the stability and absorption of plant-based bioactives but also ensures targeted delivery with reduced side effects. The current review discusses the structural characteristics, preparation techniques, and pharmacokinetic advantages of phytosomes, underscoring their potential to revolutionize herbal medicine formulations. Emphasizing recent research and clinical applications, this paper highlights phytosomes as a promising platform for enhancing the therapeutic efficacy and patient compliance of herbal drugs, paving the way for their broader acceptance in modern pharmacotherapy.

Keywords: Molecular Complex, Herbosomes and Amphiphilic.

INTRODUCTION

Phytosomes are an advanced herbal drug delivery system where bioactive plant compounds are bound to phospholipids like soy lecithin, creating a lipid-compatible complex. This process enhances the bioavailability and absorption of water-soluble plant extracts, protecting them from degradation and helping them cross lipid-rich cell membranes more effectively. The technology is used to create a "little cell" structure that improves the pharmacokinetic and pharmacodynamic properties of herbal medicines.

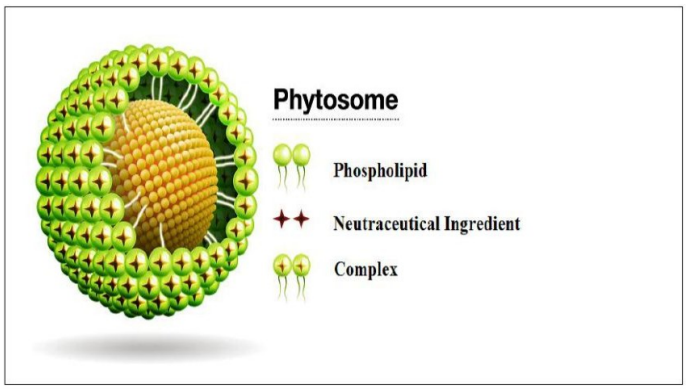

FIGURE NO 1 :Structure of Phytosomes

In herbaceous treatments, novel medication parturition strategies may even improve the effectiveness of specific botanical ingredients and medications while lowering related side effects. The incorporation of a unique drug administration technique in herbal medicines is based on this core concept. Several herbs, notably those with polyphenolic rings in their frames, such as flavonoids, terpenoids, and coumarins, have been shown to have a base oral bioaccumulation. Many active ingredients derived from plants, on the other hand, are poorly absorbed when taken by mouth, limiting their use. These chemicals have a low absorption rate due to two factors. Polyphenols' multi-ring structures are too big for passive diffusion or non-active absorption. Second, the low solubility of these chemicals in water or lipids prevents them from getting through the gastrointestinal cells' outer membrane.

In vitro, active chemicals derived from plants have demonstrated therapeutic effects; however*, in vivo* absorption is frequently negligible. Numerous approaches, including the creation of emulsions, liposomes, and nanoparticles as well as the alteration of chemical structures and distribution as prodrugs, have been put forth to address the problem of inadequate absorption. Phytophospholipid complexes, also known as phytosomes, have emerged as a key technique for boosting the bioavailability of active components.

Phytosomes or phytophospholipid complexes or herbosomes

"Phyto" refers to a plant, whereas "some" refers to something that looks like a cell Herbosome is the other name for it. Phospholipids enclose and bind the physiologically active phytoconstituents of herbal extracts in this innovative medication delivery method. By processing flavonoids, ginseng, plant extracts, etc. phytosome technology improves the bioavailability, lipid solubility, and stability of herbal extract. Phytophospholipid complexes called phytosomes are created by combining phytoconstituents with lipid-compatible phospholipids. Phospholipids, such as soy lecithin components like phosphotidylcholine, phosphotidylethanolamine, and phosphotidylserine, are used in the creation of phytosomes.

Active ingredients are complexed at precise mole ratio with phospholipids (phosphatidylcholine) under certain conditions to produce phytophospholipid complexes. The choline fraction is

***Corresponding Author: Dr K.S.Srilatha,**
1Professor and HOD Department of Pharmaceutics, Shridevi Institute of Pharmaceutical Sciences Tumkur, Karnataka, India.

hygrophilous, and the phosphatidyl fraction is hydrophobic, making phosphatidylcholine a bifunctional molecule. The choline lead about the phosphatidylcholine speck attaches to the photosensitive ingredient in the phytophospholipid complex, while the lipid-soluble section wraps around it. As a result, phytophospholipid complex is produced (Figure 2).

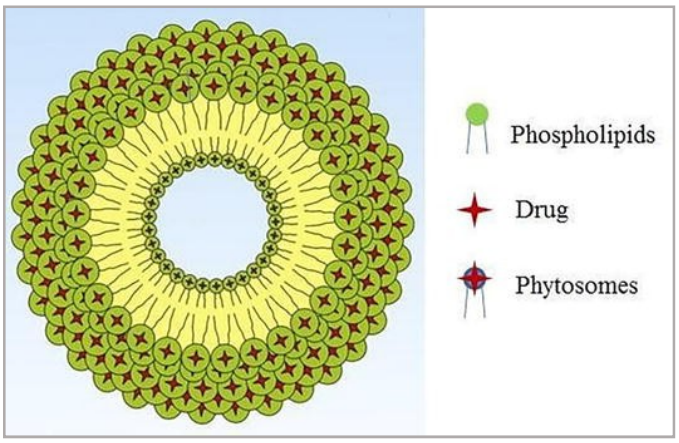

FIGURE NO 2: Structure of phyto some-loaded complex

COMPONENTS OF PHYTOSOMES THERE ARE THREE MAIN COMPONENTS OF PHYTOSOMES :

Phospholipids

Active phyto constituents

Solvents

Phospholipids

Phospholipids are found in both cellular and subcellular membranes. They are found in plants, animals, and humans. Phospholipids are composed of nonpolar acyl chains that are again linked to alcohol and a polar head. Due to variations in alcohols, aliphatic chains, and hydrophilic groups, there are several phospholipids present. Phospholipids such as phosphatidylcholine, cardiolipin, phosphatidylethanolamine, phosphatidylserine, sphingolipids, and phosphatidylinositol are examples of phospholipids that are present in eukaryotic cell membranes. Phospholipids, including natural, synthetic, and hydrogenated phospholipids such soy lecithin components like phosphatidylcholine, are used in a wide variety of compositions. Relying on their backbone, phospholipids are classified as glycerophospholipids or sphingomyelins. Phosphatidylcholine (PC), phosphatidylethanolamine (PE), phosphatidylserine (PS), phosphatidic acid (PA), phosphatidylinositol (PI), and phosphatidylglycerol (PG) are all examples of glycerophospholipids (PG). The main phospholipids utilized to make complexes with a hydrophilic head group and two hydrophobic hydrocarbon chains are PC, PE, and PS. Phospholipid complexes are most often made with phosphatidylcholine, which is the most widespread phospholipid. The amphipathic features of phosphatidylcholine offer it moderate solubility in both water and lipid mediums, which is one of its advantages. Furthermore, because phosphatidylcholine is a necessary component of cell membranes, it has a high level of biocompatibility and is low in toxicity. Hepato-protective properties of phosphatidylcholine molecules have been observed in the remedy of liver-colored illnesses such as “hepatitis, fatty liver, and hepatocirrhosis”.

Active phytoconstituents

A significant amount of the bioactive ingredients in phytomedicines are flavonoids (for example, silymarin is found in milk bramble, anthocyanidins are found in bilberries, and catechins are found in green tea). However, most flavonoids have low absorption. Standardised plant extracts, mostly flavonoids, are used to create phytosomes. "Quercetin, kaempferol, quercretin-3, rhamnoglucoside, quercetin-3-rhamnoside, hyperoside, vitexine, diosmine, 3-rhamnoside, (+) catechin, (-) epicatechin, apigenin-7-glucoside, luteolin, luteolinglucoside, ginkgetin, isogink" are among the flavonoids that are selected from this category.

Solvents

In the preparation of phytosomes, the phospholipids are mixed with inorganic solvents; phytosomes are prepared by a one solvent or mixed solvent system. Though several publications have utilized mixed solvent systems in which the phospholipids are dissolved in a separate solvent than the drug/extract, for example, aprotic solvent—tetrahydrofuran, dichloromethane, diethyl ether and chloroform, protic solvents—ethanol, even though typical preparation procedures use a single solvent. More subsequently, protonic solvents including ethanol and methanol have been used to make phospholipid aggregates.

Characteristics of phytosomes

Chemical properties

A reaction between the polymer (phospholipids) and substrate, usually in ratios of 1:1 and 1:2, or depending on the necessary amount of phospholipids and substrate, produces phytocomplexes. In the polar areas of both phospholipids and substrate molecules, there is proof that hydrogen bonds were formed when the two parties were in contact. It is feasible to use a spectroscopic device to study it. Although phytosomes are connected to the outer surface of phospholipids, they have the ability to change into a section of the molecular film's interior where OH interactions with the flavone moiety's phenol hydroxyls can form. It is feasible to make the phytosomes' NMR more akin to that of the original precursor, as long as the signals from the fatty sequence remain mostly intact. This would show the phytosomes' accessibility by assessing their substance qualities.

Biological properties

With the goal of improving the products' absorption and consumption as well as their cascading effects over the entire range of herbal medications, phytosomes are as sophisticated as the natural world for herbal crops. Instead than using simple botanical herbs, phytosomes can assist increase their bioavailability. It was created as a consequence of research conducted both *in vitro* and *in vivo* to improve the invention of herbs in living things.

Preparation

Three main techniques for synthesizing phytophospholipid complexes

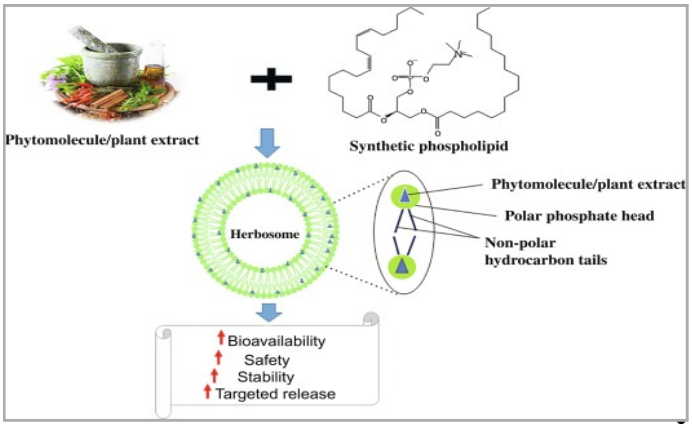

FIGURE NO 3: Steps involved in phytosome preparation

Dissolve the phytoconstituent and phospholipid separately in a suitable organic solvent, usually chloroform or methanol. Mix the two solutions to attain a specific ratio of phytoconstituent to phospholipid. The solvent is then evaporated under reduced pressure using a rotary evaporator. The obtained complex is further dried to ensure complete removal of solvent and then stored.

Anhydrous co-solvent lyophilization:

A specified quantity of medicine, copolymer, and phospholipids can be immersed in a specific solvent in a rotating cylindrical distillation flask, and then agitated for 3 hours at room temperature not exceeding 40°C. Before adding n-hexane and agitating frequently with a mechanical stirring, a thin covering of the specimen can be achieved. The phytosome-loaded aggregate can be collected and incubated at room temperature in an orangish glass container.

Technique of anti-solvent precipitation:

A precise quantity of medication, phospholipids, and polymer can be placed in a spherical bottom flask and refluxed for 2 hours with a specific solvent at a temperature of not more than 60°C. A second solvent (referred to as anti-solvent in various reports) is then added to the solution with stirring to obtain the precipitated phospholipid complex. The precipitate can be filtered and dried to obtain the final product.

Mechanism of phytosomes complex

Phytosomes are often used in the context of improving the solubility and bioavailability of poorly water-soluble phytochemicals or botanical drugs. Phospholipid complexation involves the interaction between the phospholipids and the phytoconstituents.

Interaction with the phospholipid bilayer: The primary structure of phospholipids contains a hydrophilic “head” and two hydrophobic “tails”. This amphiphilic nature allows phospholipids to form bilayers, with the hydrophilic heads facing outward and the hydrophobic tails tucked inside.

Complex formation: The poorly water-soluble phytochemicals, which are usually lipophilic (fat-loving) or hydrophobic, interact with the hydrophobic region of the phospholipid. This interaction leads to the formation of a complex between the phytoconstituent and the phospholipid.

Enhanced solubility: Due to the amphiphilic nature of phospholipids, the complex’s overall solubility in water is enhanced. This is because the outer hydrophilic region of the phospholipid can interact with water, making it easier for the complex to dissolve.

Enhanced permeability: The phytophospholipid complex might alter the permeability of membranes, making it easier for the compound to traverse biological barriers.

Complex formation:

Phytosomes are formed by reacting a standardized herbal extract with phospholipids in a suitable solvent. The process involves forming hydrogen bonds between the polar head of the phospholipid and the polar functional groups of the plant's active compounds.

Lipid-compatible structure:

This creates a lipid-soluble molecular complex that resembles a little cell or liposome. The active compounds become integral parts of the complex, which can easily integrate with cell membranes.

Enhanced absorption:

When taken orally, the lipid-compatible phytosome complex is more readily absorbed in the gastrointestinal tract compared to conventional, water-soluble herbal extracts.

Protection from degradation:

The phytosome structure protects the active compounds from destruction by digestive secretions and gut bacteria.

Advantages of phytosomes
Improved bioavailability:

The primary advantage is enhanced absorption and bioavailability, meaning more of the active compound gets into the bloodstream.

Increased stability:

The phospholipid complex makes the formulation more stable.

Reduced dosage:

Improved bioavailability can lead to a requirement for a lower dose to achieve the desired therapeutic effect.

Versatility:

Phytosomes can be used for both oral and topical applications, improving the percutaneous absorption of active compounds for skin treatments.

Examples of applications

Milk thistle: Used for liver protection.

Ginkgo biloba: Used for various therapeutic purposes.

Grape seed extract: Used for its antioxidant properties.

Green tea extract: Used for various health benefits.

Curcumin: Used for its anti-inflammatory properties.

RECOMMENDATIONS

Clinical Recommendation: Bioavailability Breakthroughs

Phytosomes are highly recommended for delivering **polyphenolic compounds** (like flavonoids and tannins) that are typically poorly absorbed due to their large size and water solubility.

- **Milk Thistle (Silymarin):** Research confirms that the phytosomal version (e.g., Siliphos) is up to **7 times more bioavailable** than standard extracts. It is the gold standard recommendation for chronic liver management.
- **Curcumin:** To overcome the "rapid metabolism" barrier of turmeric, phytosomes are recommended because they protect the molecule from intestinal degradation, allowing it to reach systemic circulation effectively.
- **Quercetin:** Phytosomal quercetin is recommended for its significantly higher plasma concentration, making it a viable adjuvant therapy for respiratory health and immune support.

ACKNOWLEDGMENTS

I would like to express my grateful thanks to our chairman Dr. M.R.Huinayakar for his motivation and support. My deepest gratitude to our director Dr Gopala krishna Shridevi Institute of Pharmaceutical Sciences Tumakuru for Valuable suggestions and guidance Thanks to Dr.TS. Bheemaraju HOD of Psychiatric Nursing for his valuable suggestions guidance inpublishing this manuscript.

CONCULSION

In conclusion, **Phytosomes** have emerged as a transformative bridge between traditional botanical medicine and modern molecular pharmacology. By 2026, they are no longer viewed merely as an "alternative" delivery method but as a **benchmark platform** for the pharmaceutical-grade delivery of natural bioactive compounds.

Final Synthesis: The Impact of Phytosomal Technology

- **The Bioavailability Paradox Resolved:** The "bioavailability gap"—where potent plant extracts perform well in a lab but fail in the human body—is effectively bridged by the chemical bonding of phytoconstituents to phospholipids.
- **Safety Meets Efficacy:** By utilizing **biocompatible** carriers like Phosphatidylcholine, phytosomes offer a dual-action therapeutic effect: the carrier repairs cell membranes while the plant extract treats the disease, resulting in a system with virtually zero toxicity.
- **Paving the Way for Precision Phytotherapy:** The integration of **Quality by Design (QbD)** and **Nanotechnology** allows for standardized, predictable, and reproducible herbal dosing, making these treatments acceptable for integration into mainstream clinical protocols.

REFERENCES

1 **Maliwal, K., Chasta, P., & Ali, M. Z. (2025).** "Review on Phytosomes: A Novel Drug Delivery System." International Journal of Pharmacy and Life Sciences, 16(5), 1-5.
2 **Panchal, A. (2025).** "Phytosomes: A Comprehensive Review on Advances in Herbal Drug Delivery Systems." International Journal of Pharmaceutical Sciences, 3(12), 897-907.
3 **ResearchGate (2024).** "Phytosome: An Emerging Trend for Delivery of Phytopharmaceuticals." Research Journal of Pharmaceutical Dosage Forms and Technology.
4 **M. S. Vrushabh, et al. (2025).** "Phytosomes: Bridging Nature And Nanotechnology For Enhanced Drug Delivery." International Journal of Environmental Sciences, 11(8s), 801-810.
5 **Portela, M., et al. (2025).** "Phytosomes-Based Nanocarriers Enhanced with Seaweed Extracts: Overcoming the Blood–Brain Barrier." MDPI Nanomaterials.
6 **PubMed Central (2025).** "Nano-Phytomedicine: Harnessing Plant-Derived Phytochemicals in Nanocarriers for Targeted Human Health Applications." PMC12348851.
7 **ScienceOpen (2024).** "Unlocking the potential of phytosomes: a review of formulation techniques, evaluation methods, and emerging applications." AMM-2024-0055.
8 **Fitoterapia (Oct 2025).** "Polyphenolic phytosomes for targeted drug delivery." PubMed PMID: 41046876.
9 **Oxford Academic (2023/2024).** "Recent development of novel drug delivery of herbal drugs." RPS Pharmacy and Pharmacology Reports, 2(4).
10 **ResearchGate (July 2025).** "Phytosomes: A novel herbal drug delivery system with emphasis on Camellia sinensis for enhanced topical bioavailability." International Journal of Pharmacy and Pharmaceutical Science.
11 **Asian Journal of Pharmaceutical Research and Development (2025).** "Formulation and Evaluation of Phytosome for the Topical Drug Delivery." AJPRD 13(4):06-15.

****