GLOBAL ACADEMIC RESEARCH INSTITUTE

COLOMBO, SRI LANKA

GARI International Journal of Multidisciplinary Research

ISSN 2659-2193

Volume: 03 | Issue: 04

On 31st December 2017

http://www.research.lk

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GARI Publisher | Herbal Medicines | Volume: 03 | Issue: 04

Article ID: IN/GARI/02ICATMMP/2017/103 | Pages: 72-81 (09)

ISSN 2659-2193 | Edit: GARI Editorial Team

Received: 27.08.2017 | Publish: 31.12.2017

PHYTOSOMES AS NOVEL BIOMEDICINE – A REVIEW

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ABSTRACT

*In recent days, most of the prevailing diseases and nutritional disorders are treated with herbal medicines. Several plant extracts and phytoconstituents, despite having excellent bioactivity in vitro demonstrate less or no in vivo actions due to their poor lipid solubility or improper molecular size or both, resulting in poor absorption and bioavailability. Phytosome is a novel emerging technique which contains phytoconstituents of herbal extract surrounds and bound by lipid. Phytosomes are often known as herbosomes. The term- "phyto" means plant while "some" means cell-like. Phytosomes are little cell like structure. Phytosome is composed of phospholipids, mainly phosphatidylcholine, producing a lipid compatible molecular complex with other constituents. Most of bioactive constituents of phytomedicine are water soluble compounds like flavonoids. Because of water solubility and lipophilic outer layer, phytosome shows better absorption, hence produces better bioavailability than the conventional herbal extracts. Development of phytosomes is at the budding stages in India and abroad. It has a lot of potential in the field of medicine, pharmaceuticals and cosmetics. The current review highlights key findings of recent research work conducted on phytosomes which can give the new directions and advancements to herbal dosage forms and the technical aspects of phyto-phospholipid formulations to face the future challenge.**Keywords: Herbal extracts, Phosphatidylcholine, Phytosomes, Bioavailability.*

INTRODUCTION

In the recent days, most of the prevailing diseases and nutritional disorders are treated with herbal medicines. The effectiveness of any herbal medication is dependent on the delivery of effective level of the therapeutically active compound. But a severe limitation exists in their bioavailability when administered orally or by topical applications. Phytosomes are recently introduced advanced microsphere or cell forms of herbal products that are better absorbed, and produce better pharmacokinetic and pharmacodynamic profile than conventional herbal extracts. These are also known as herbosomes [1]. The term "Phyto" means plant while "some" means cell-like. The phytosome structures contain the active ingredients of the standardized plant extract or its constituents bound to phospholipids, mainly phosphatidylcholine producing a lipid

compatible molecular complex [2]. Phospholipids are complex molecules that are used in all known life forms to make cell membranes. They are cell membrane building blocks, making up the matrix into which fit a large variety of proteins that are enzymes, transport proteins, receptors, and other biological energy converters. In humans and other higher animals the phospholipids are also employed as natural digestive aids and as carriers for both fat-miscible and water miscible nutrients[3].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 [4]. The present review represents the recent advances and applications of various standardized herbal extract phytosomes as a tool of drug delivery.

PHYTOSOME TECHNOLOGY

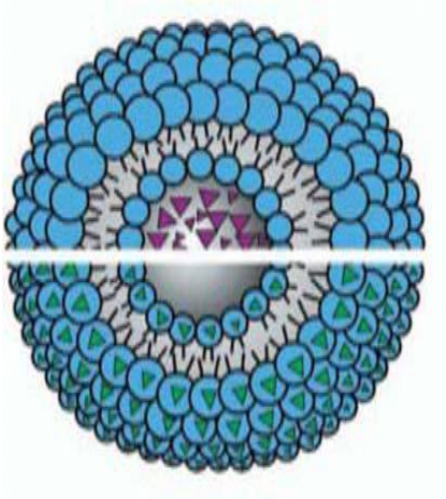
The falconoid and terpenoid constituents of plant extracts lend themselves quite well for the direct binding to phosphatidylcholine. Phytosomes results from the reaction of a stoichiometric amount of the phospholipid (phosphatidylcholine) with the standardized extract or polyphenolic constituents (like simple flavanoids) in a non polar solvent [5]. Phosphatidylcholine is a bifunctional compound, the phosphatidyl moiety being lipophilic and the choline moiety being hydrophilic in nature. Specifically the choline head of the phosphatidylcholine molecule binds to these compounds while the lipid soluble phosphatidyl portion comprising the body and tail which then envelopes the choline bound material. Hence, the

phytoconstituents produce a lipid compatible molecular complex with phospholipids, also called as phyto-phospholipid complex.

Molecules are anchored through chemical bonds to the polar choline head of the phospholipids, as can be demonstrated by specific spectroscopic techniques. [6-8] Precise chemical analysis indicates the unit phytosome is usually a flavanoid molecule linked with at least one phosphatidylcholine molecule. The result is a little micro sphere or cell is produced. The phytosome technology produces a little cell, whereby the plant extract or its active constituent is protected from destruction by gastric secretions and gut bacteria owing to the gastro protective property of phosphatidylcholine [9].

DIFFERENCE BETWEEN PHYTOSOME AND LIPOSOME

The fundamental difference between liposomes and phytosomes is that in liposomes the active principle is dissolved in the medium contained in the cavity or in the layers of the membrane, whereas in the phytosome it is an integral part of the membrane, being the molecules anchored through chemical bonds to the polar head of the phospholipid (Fig 1). Liposomes are used primarily in cosmetics to deliver water-soluble substances to the skin. A liposome is formed by mixing a water-soluble substance with phosphatidylcholine. No chemical bond is formed; the phosphatidylcholine molecules surround the water-soluble substance. There may be hundreds or even thousands of phosphatidylcholine molecules surrounding the water-soluble compound. In contrast, with the Phytosome process the phosphatidylcholine and the individual plant components actually from a 1:1 or a 2:1 complex depending on the substance. This difference results in Phytosomes being much better absorbed that liposomes. Phytosomes are superior to liposomes in skin care products [10, 11].



PHYTOSOME

Water soluble free drug

Phosphatidylcholine

Phosphatidylcholine-drug complex

Fig 1: *Major difference between liposome and phytosome. The molecular organization of the liposome (upper segment) versus many individual phytosomes (lower segment).*

ADVANTAGES OF PHYTOSOME TECHNOLOGY:

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

benefits [12-15].

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.

The composition of phytosome is safe and the components are approved for pharmaceutical use.

The absorption and bioavailability of water soluble phytoconstituents is increased. This

results in better therapeutic effects.

Because the bioavailability of phytoconstituents is increased, therefore, the

dosage required to produce desirable effect is reduced.

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.

Phospholipids add to the nutritional value of the plant extract.

High market demand for products.

The process of manufacturing phytosomes is relatively simple.

Phytosomes have the ability to permeate through skin with quite ease and thus

enhances their effectiveness.

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.

Phosphatidylcholine nourishes skin besides acting as a carrier because it is part of cell

membrane.

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.

Table 1

Commercially available phytosome products **[16-20]**

S.No.	Phytosome product	Phytoconstituent complexed with	Dose	Indications

		phosphatidylcholine		
1.	Silybin Phytosome™	Silybin from *Silybum marianum*.	120 mg	Hepatoprotective, antioxidant for liver and skin.
2.	Hawthorn Phytosome™	Flavonoids from *Crataegus* sp.	100 mg	Nutraceutical. Best choice in heart disease or high blood pressure.
3.	Ginseng Phytosome ™	37.5 % ginsenosides from immunomodulator *Panax ginseng*	150 mg	Nutraceutical, Immunomodulator
4.	Green Tea Phytosome™	Epigallocatechin from *Thea sinensis*	50 to 100 mg	Nutraceutical, Systemic antioxidant. Best choice for protection against cancer and damage to cholesterol.
5.	Ginkgo Biloba Phytosome™	24 % Ginkgoflavonglycosides from *Ginkgo biloba*	120 mg	Protects brain and vascular lining; Anti-skin ageing agent. Best choice for most people over the age of 50.
6.	Grape Seed Phytosome™	Procyanidins from *Vitis vinifera*	50-100 mg	Nutraceutical, systemic antioxidant. Best choice for most people under age of fifty. Also specific for the eyes, lungs, diabetes, varicose veins, and protects against heart disease.
7.	Bilberry Phytosomes	Extract of *Bilberry* which provides anthocyanosides	_	Improve capillary tone, reduce abnormal Blood vessel permeability and are potent antioxidants.
8.	Super Milk	Silybin from	150 mg	Antioxidant for liver and skin

	thistle Extract™	*Silymarin* Food Product		
9.	Centella Phytosome	Terpenes	-	Used to treat Vein and Skin disorders
10.	Palmetto berries Phytosomes	Fatty acids, alcohols and sterols	-	Used for the treatment of Non-cancerous Prostate Enlargement.
11.	Olive oil Phytosomes	Polyphenols from *Olea europaea* oil	-	Inhibit oxidation of LDL cholesterol, and also have anti-inflammatory activity.
12.	Echinacea Phytosome	Echinacosides from *Echinacea angustifolia*	-	Nutraceutical, Immunomodulator
13.	Visnadine Phytosome	Visnadine from *Ammi visnaga*	-	Circulation Improver

CONCLUSION

Phytosomes forms a bridge between the convectional delivery system and novel delivery

system. Phytosomes are advanced form of herbal extract that are better absorbed which results

better than conventional herbal extract. Phytosomes have improved pharmacokinetic and pharmacological parameter, which in result can advantageously be used in various diseases. The nutraceutical products based on phytosome technology become present at the site of action of

liver, kidney, brain, heart) at similar or less dose as compared to conventional plant extract[21,22].Phytosomes have improved pharmacokinetic and pharmacological parameter, which in result can advantageously be used in treatment of acute liver diseases,either metabolic or infective origin. Absorption of phytosome in gastro-intestinal tract is appreciably greater resulting in increased plasma level than the individual component. Hence, the therapeutic action becomes enhanced, more detectable and prolonged[23]. Several excellent phytoconstituents have been successfully delivered in this way

exhibiting remarkable therapeutic efficacy in animal as well as in human models. Thorough study of literature reveals that several plant extracts (crude, partially purified or fractionated) are reported to possess different significant pharmacological or health promoting properties. These extracts can be standardized accordingly and may be formulated as phytosomes for systematic investigation for any improved potential to be used rationally. In this way after screening and selection of potential extracts or constituents from plants, phytosomes can be developed for different therapeutic purposes like cardiovascular, anti-inflammatory, immunomodulator, anticancer, antidiabetic, etc., or for prophylactic and health purposes as nutraceuticals, in due course[24]. Phytosomes have wide scope in cosmetology and many areas of them are to be revealed in future in the prospect of pharmaceutical application.

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