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The impact of emerging phytosome technology in healthcare management

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Abstract

Phytosomes are advanced technology in the herbal field that enhances the absorptivity of the plant bioactive compounds and vis-a-vis improves the capacity to cross the biological membrane. The phytosomes are basically natural phytophospholipid complexes especially lecithin. Phospholipids have a better solubility and also act as an emulsifier. This technology linked to the conventional herbal delivery systems along with advanced drug delivery systems with the help of an intermolecular bonding. The bonding is between the lipid layers with the single molecule of phytoconstituent. Hence, it improves the efficacy, and better pharmacokinetic profile for the poor absorptivity of the phytoconstituents. This technology helps in fast action of absorption of the conventional herbal extracts and results better therapeutic efficacy with the increased bioavailability. Recently, phytosome technology is the best choice against COVID-19 virus. Not only that, this advanced technology is widely applicable in any type of therapeutic effectiveness and targeted as an effective healthcare management process. Therefore, the phytosomes are the boon in advanced novel drug delivery system in plant science.

1. Introduction

A new drug delivery is an advanced formulation based approach which is developed for safe administration. It is customized technology by which drugs are transported within the body and results optimum therapeutic benefits with minimum or very low adverse effects. This technology is the modernization of an existing drug molecule from a conventional form to a *novel* delivery system. There are many benefits for this technology such as controlling the pharmacokinetics, pharmacodynamics, non-specific toxicity, immunogenicity, biorecognition, increase bioavailability, increase in accumulation of drugs in the targeted delivery zones, and better therapeutic efficacy of drugs in the body. This technology is also referred to drug delivery system which is based on interdisciplinary approaches such as combine polymer science, pharmaceutics, bioconjugate chemistry, and molecular biology. With the mechanism of active and passive targeting, the targeted drugs are release in the site of action and shows effectiveness. For development of effective formulations, controlled drug release and subsequent biodegradation are also important methods in this novel technology. Potential release of the drugs involve various mechanisms such as, desorption of surface-bound/adsorbed drugs, diffusion through the carrier matrix, diffusion through the carrier wall for nanocapsules, carrier matrix erosion, and a combined erosion/diffusion process. There are many novel drug delivery systems available such as niosome, nanogel, liposome, nanoparticle, ethosome, nanocapsules, transdermal system, enteric coated tablets, nanofibres, nano carbontube, mesoporous materials, *etc*.

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Such novel drug delivery system is also applied in to the herbal field. A number of advanced herbal formulations like polymeric nanoparticles, nanocapsules, liposomes, phytosomes, nanoemulsions, microsphere, transferosomes, and ethosomes are used in bioactive compounds and plant extracts (Figure 1). These new formulations are having remarkable advantages over conventional formulations of phytoconstituents and plant extracts (Lu *et al*., 2019). Some important applications are include enhancement of solubility, bioavailability, combating toxicity, strengthening of pharmacological activity, enhancement of stability, improved tissue macrophages distribution, sustained delivery, and protection from physical and chemical degradation (Saraf, 2010).

Of late, phytosome is among them which help to deliver the plant bioactive compounds in the systemic target. Maximum bioactive plants constituents are polar in nature which is freely soluble in water. The most important phytochemicals such as flavonoids, tannins, terpenoids, glycosides are having high molecular sizes that leads to poor absorption. They cannot absorb by passive diffusion, or due to their poor lipid solubility. Therefore, these molecules cannot pass across the lipid-rich biological membranes, that results poor bioavailability (Manach *et al*., 2004). It has been observed that certain nutrients substantially improve the bioavailability of such poorly absorbed bioactive constituents or such plant extracts by enhancing the absorption of the phospholipids. Thus, a novel technology, phytosome has developed to incorporate poor lipid soluble plant constituents and also some standardized plant extracts into phospholipids to produce lipid compatible molecular complexes (Saraf, 2010). This new drug delivery system remarkably improve their absorption and bioavailability in the target sites and provides much better therapeutic efficacy than conventional one. The method of phytosome preparation is based on complexation by phosphatidylcholine with the plant components or with crude plant extracts in a ratio of 1:1 or a 2:1 molecular complex depending on the substance(s) complexed, involving chemical bonds (Figure 2).

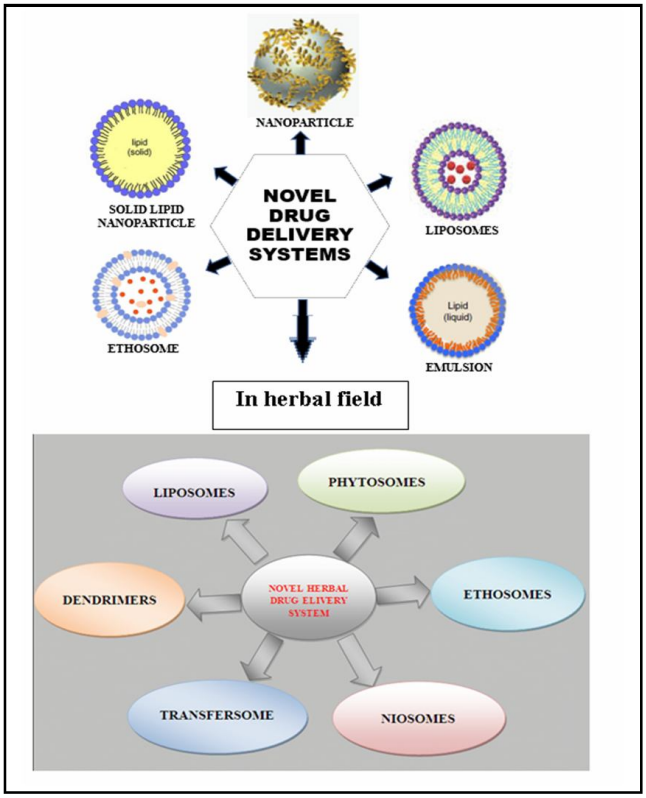

Figure 1: Novel drug delivery system in herbal field.

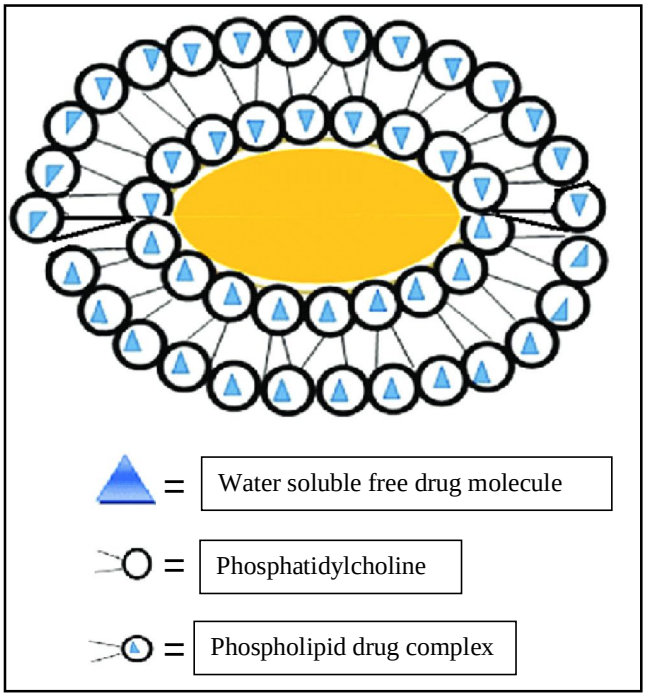

Figure 2: Structure of phytosome.

The phospholipids act as natural digestive aids and as carriers for both fat-miscible and water miscible nutrients in humans. They are miscible both in water and in lipid and even well absorbed orally. Therefore, phytosomes are having more bioavailability with the enhanced capacity to cross the lipoidal biomembrane and finally reaching the systemic circulation. Henceforth, phytosome is an emerging trend in delivery of herbal drugs and shows potential activities in health care management.

2. Materials and Methods

The informations in the review is collected from various latest research papers, bibliographic data base, and information from the various official websites. Databases like PubMed, PubMed Central., Science Direct, SCIELO, DOAJ, Science alert, Semantic scholar and Google scholar were used for the informations. The maximum number of studies related to individual plants are searched and tabulated to contain the latest information in this review. All the figures are self modified and were collected from the various images procured through various websites.

Phytosomes are formed with several methods such as antisolvent precipitation process, rotary evaporation process, solvent ether injection process, and the novel technology (Rathore and Swami, 2015). In particular, the herbal complexes are formed by reaction between equimolar mixture of natural phospholipid and active constituents or herbal extract in aprotic organic solvents (Karimi *et al*., 2015). The synthetic biodegradable high molecular polymer and natural polymer are act as major carrier materials in nanoparticles. Furthermore, phytosomes through novel methods for the phospholipid complexation include gas solvent technique, compressed solvent process and supercritical solvent methods (Khan *et al*., 2013).

3. Phytosome in healthcare management

Phytosomes are commonly known as herbosomes. Usage of phytosome in healthcare management has gained importance from past few decades. They are applied in many therapeutic activities. With the new technology and the higher demand, the phytosomes are applied in various fields like pharmaceuticals, cosmeceuticals and nutraceuticals in preparing different cosmetic and pharmaceutical formulations such as solutions, emulsion, creams, lotions, gels, *etc*., The phytosome process has applied not only with many herbal extracts but also in many isolated bioactive constituents. Some herbal extracts such as *Ginkgo biloba*, grape seed, hawthorn, milk thistle, green tea, ginseng extracts are used in the phytosome form and applied in many therapeutic benefits (Saraf, 2010). The main bioactive components of herbal extracts, namely; flavonoid and terpenoid components are directly bind to phosphatidyl choline and formulated phytosome. Metal phytosome was synthesized by encapsulation of extract of *Calendula officinalis* and showed its antioxidative activity (Demir *et al*., 2014). With the potent polyphenolic nature, silybin phytosome from milk thistle extract was studied for the expression levels of estrogen receptor α (ERα) over expressed in breast cancer, which is responsible for tumor growth enhancement, and is a prognostic and predictive factor (Mahmoodi *et al*., 2014). The rutin phytosome (flavonoid from *Ruta graveolens*), is used as powerful antioxidant agent and also applied to treat capillary fragility, hypertension, ultraviolet radiation induced cutaneous oxidative stress, by better penetrability in to the stratum corneum (Das and Kalita, 2014). *Terminalia arjuna* bark methanol crude extract in phytosome form was investigated for an antiproliferative activity on human breast cancer cell line MCF-7 by MTT assay by comparing its activities with quercetin and its phytosomes (Shalini *et al*., 2015). The sinigrin phytosome complex showed complete recovery of wound than the crude extract and even sinigrin phytosomes also showed enhanced

anticancer activity on the A-375 melanoma cells (Mazumder *et al*., 2016). *Casperome boswellia* phytosome was applied as potent anti-inflammatory agent, Ginkgo select herbosome as cognition enhancer and as antioxidant, hawthorn herbosome for cardiovascular health, sericoside herbosome as antiwrinkle and tonic and 'Meriva', a curcumin herbosome for healthy joints. The antioxidant and free radical scavenging activity of silipide phytosome of *Silybum marianum* showed hepatoprotective activity (Chivte *et al*., 2017). Recently, quercetin (polyphenol) phytosome was studied clinically and used in the treatment of COVID-19 where it increases oral absorption up to 20-fold than normal (Di Pierro *et al*., 2021). Some important herbal formulations as phytosome are listed in Table 1 and few important commercial registered phytosome products are also tabulated in below Table 2.

Table 1: Herbal formulations containing phytosome

Formulation	Active ingredients formulations	Application of phytosomal	Method of preparation	Route of administration	References
Ginkgo biloba phytosomes	Flavonoids	Stabilize the reactive oxygen species	Phospholipids complexation	Subcutaneous	Panda and Naik, 2008
Ginseng phytosome	Ginsenosides	Increase absorption	Phospholipids complexation	Oral	Bhattacharya, 2009
Hawthorn phytosome	Flavonoids	Increase therapeutic efficacy and absorption	Phospholipids complexation	Oral	Bhattacharya, 2009
Quercetin phytosome	Quercetin	Exerted better therapeutic efficacy	Quercetin–phospholipid complexation	Oral	Maiti *et al*., 2005
Curcumin phytosome	Curcumin	Increase antioxidant activity and increase bioavailability	Curcumin–phospholipid complexation	Oral	Feng-Lin *et al*., 2009

Table 2: Commercial registered phytosome products

Biological source	Phytoconstituent complex	Therapeutic indication	Commercial product	Reference
Ammi visnaga	Visnadine	Improve microcirculation	Visnadex™	Singh *et al*., 2011
Centella asiatica	Asiatic acid	Skin disorders, antiulcer, woundhealing, anti-hair loss agent	Centella triterpenoid phytosome™	Singh *et al*., 2011
Cucurbita pepo	Tocopherols, steroids, carotenoids	Anti-inflammatory	Cucurbita phytosome™	Singh *et al*., 2011
Melilotus officinalis	Melilotoside, flavanoids and terpenoids	Anti-inflammatory, in oedema	Lymphaselect™	Pandey, 2010
Curcuma longa	Curcumin	Curcumin phytosome™	Anti-inflammatory, osteoarthritis, anticancer	Farinacci *et al*., 2009
Camellia sinensis	Epigallocatechin, epicatechin-3-O-gallate, epigallo catechin-3-O-gallate, catechin	Green tea phytosome™	Nutraceutical, anticancer, antioxidant, atherosclerosis	Pierro *et al*., 2009
Pinus maritime	Procyanidins	Pycnogenol phytosome™	Anti-inflammatory, antiwrinkle	Mullaicharam *et al*., 2013
Santalum album	Ximenynic acid, ethyl ximenynate	Ximilene and ximenoil phytosome™	Improve microcirculation	Singh *et al*., 2011
Silybium maranium	Silybin, silycristin, isosilbin	Silybin phytosome™	Hepatoprotective, hepatitis	Singh *et al*., 2011
Vitis vinifera	Resveratrol, catachin	Masquiliers phytosome™	Aantioxidant, nutraceutical	Singh *et al*., 2011

4. Conclusion

In recent era, an appreciable attention has been given towards the development of novel drug delivery system for herbal drugs. The novel carriers are ideally fulfil with two prerequisites that it should deliver the drug at a rate directed by the needs of the body for longer period of the treatment and also it should channel the phyto-entity of herbal drug to the site of action. The focus on phytosome in this present review describe the various applications in healthcare management including effective agent as antiviral activity especially combating COVID-19 virus in recent pandemic. The nano sized novel drug delivery systems of herbal drugs especially the phytosome have a potential future in enhancement of the various therapeutic activity and overcoming problems associated with the phytomedicines.

Conflict of interest

The author declares that there are no conflicts of interest relevant to this article.

References

Bhattacharya, S. (2009). Phytosomes: Emerging strategy in delivery of herbal drugs and nutraceuticals. Pharma Times, **41**(3):9-12.

Chivte, P.; Pardhi, V.; Joshi, V. and Ajitha, R.R. (2017). A review on therapeutic applications of phytosomes. Journal of Drug Delivery and Therapeutics, **7**(5):17-21.

Das, M. K. and Kalita, B. (2014). Design and evaluation of phyto phospholipid complexes (Phytosomes) of rutin for transdermal application. J. Appl. Pharm. Sci., **4**(10):51-57.

Demir, B.; Barlas, F.B.; Guler, E.; Gumus, P.Z.; Can, M.; Yavuz, M.; Coskunolbef H. and Timur, S. (2014). Gold nanoparticle loaded phytosomal systems: Synthesis, characterization and *in vitro* investigations. RSC Adv., **4**:34687.

Di Pierro, F.; Derosa, G.; Maffioli, P.; Bertuccioli, A.; Togni, S.; Riva, A.; Allegrini, P.; Khan, A.; Khan, S.; Khan, B.A.; Altaf, N.; Zahid, M.; Ujjan, I.D.; Nigar, R.; Khushk, M.I.; Phulpoto, M.; Lail, A.; Devrajani, B.R. and Ahmed, S. (2021). Possible therapeutic effects of adjuvant quercetin supplementation against early-stage COVID-19 infection: A prospective, randomized, controlled, and open-label study. Int. J. Gen. Med., **14**:2359-2366.

Farinacci, M.; Gaspardo, B.; Colitti, M. and Stefanon, B. (2009). Dietary administration of curcumin modifies transcriptional profile of genes involved in inflammatory cascade in horse leukocytes. J. Ani. Sci., **8**:84-86.

Feng-Lin, Y.; Tzu-Hui, W.; Liang-Tzung, L.; Thau-Ming, C. and Chun-Ching, L. (2009). Preparation of naringenin nanoparticles. Pharm. Res., **26**(4): 893-902.

Karimi, N.; Ghanbarzadeh, B.; Hamishehkar, H.; Pezeshki, A. and Mostafayi, H. (2015). Phytosomes as novel delivery system for nutraceutical materials. Int. J. Curr. Microbio. App. Sci., **4**(6):152-159.

Khan, J.; Alexander, A.; Saraf, A. and Swarnlata, S.S. (2013). Recent advances and future prospects of phytophospholipid complexation technique for improving pharmacokinetic profile of plant actives. J. Controlled Rel., **168**:50-60.

Lu, M.; Qiu, Q.; Luo, X.; Liu, X.; Sun, J.; Wang, C.; Lin, X.; Deng, Y. and Song, Y. (2019). Phytophospholipid complexes (Phytosomes): A novel strategy to improve the bioavailability of active constituents. Asian J. Pharm. Sci., **14**(3):265-269.

Mahmoodi, N.; Motamed, N. and Paylakhi, H.S. (2014). The comparison of the effects of silybin and silybin phosphatidylcholine on viability and ESR expression in human creast cancer T47d cell line. Cell J., **16**(3):299-308.

Maiti, K.; Mukherjee, K.; Gantait, A.; Ahamed, H.N.; Saha, B.P. and Mukherjee. P.K. (2005). Enhanced therapeutic benefit of quercetin-phospholipid complex in carbon tetrachloride induced acute liver injury in rats: A comparative study. Iran J. Pharmacol. Ther., **4**:84-90.

Manach, C.; Scalbert, A.; Morand, C.; Remesy, C. and Jimenez, L. (2004). Polyphenols: Food sources and bioavailability. The American Journal of Clinical Nutrition, **79**(5):727-747.

Mazumder, A.; Dwivedi, A.; Du Preez, J. L. and Du Plessis, J. (2016). *In vitro* wound healing and cytotoxic effects of sinigrinphytosome complex. Int. J. Pharm., **498**:283-293.

Panda, V.S. and Naik, S.R. (2008). Cardioprotective activity of *Ginkgo biloba* phytosomes in isoproterenol-induced myocardial necrosis in rats: A biochemical and histoarchitectural evaluation. Exp. Toxicol. Pathol., **60**:397-404.

Pandey, S. (2010). Phytosomes: Technical revolution in phytomedicine. Inter J. Pharm. Tech. Res., **2**:627-631.

Rathore, P. and Swami, G. (2015). Planterosomes: Potential phytophospholipid carriers for the bioavailability enhancement of herbal extracts. Int. J. Pharm Sci. and Res., **3**(3):737-755.

Saraf, A.S. (2010). Applications of novel drug delivery system for herbal formulations. Fitoterapia. **81**(7):680-689.

Shalini, S.; Kumar, R. R. and Birendra, S. (2015). Antiproliferative effect of phytosome complex of methanolic extact of *Terminalia arjuna* bark on human breast cancer cell lines (MCF-7). Int. J. Drug Dev. Res., **7**(1):173-182.

Singh, A.; Saharan, V.A.; Singh, M. and Bhandari, A. (2011). Phytosomes: Drug delivery system for polyphenolics phytoconstituents. Iranian J. of Pharma. Sci., **7**(4):209-219.

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