RECENT RESEARCH WORKS ON PHYTOSOMES

In past decades numerous studies are being conducted by scientists on phytosome& natural product and the current research disclosed that the phytosome is a novel process for enhancing the absorption and bioavailability of herbal moieties. The present situation has covered the technique of novel studies (more et al. 2019).

Sharma et al. 2019 the study based on review of. phytosome are superior to the conventional drug delivery system in term of pharmacokinetics and pharmacodynamic properties. Phytosomal delivery of extract of silybin, grape seed, olive oil etc. has been profitable use. Phytosomes have been refined the therapeutic uses like hepatoprotective, cardioprotective, antihypertensive, anti-inflammatory, vein and skin disorder etc. or for preventive of health reasons. In the ever-expanding horizon, phytosome as a modern technology increasing for drug bioavailability as well as efficiency of drug delivery system (Sharma et al. 2019).

Antonella et al. 2018 recently developed, quercetinphytosome and found that they facilitate the attainment of very high plasma levels of quercetin which was up to 20 times more than usually obtained following a dose of quercetin in human volunteers. moreover it did not demonstrate any notable side effects. These results suggest that quercetinphytosome can be safely administered orally and enhance the bioavailability of quercetin, thus facilitating the effective utilization of this natural compound to treat various human diseases (Antonella et al. 2018).

Effionora A & Nadira F. 2018 Reported that Phytosome is a nanovesicle that combines plant extracts and phospholipids to produce more soluble fat complex and provide better absorption. The purpose of this study was to formulate and produce a phytosome-loaded microsphere of green tea leaf extract with good physicochemical properties, so it can improve the stability and delivery of phytosome. Phytosome-loaded maltodextrin and gum arabic microsphere of green tea leaf extract could increase the stability and biovalability of EGCG (Effionora A & Nadira F 2018).

Park et al. 2018 the author investigated the effects of CA phytosome on inflammatory reponses bymacrophages in an atopic dermatitis (AD) mouse model. The effects of CA phytosome on atopic dermatitis were examined by usingphthalic anhydride (PA)-induced AD mouse model and RAW 264. Furthermore, CA phytosome inhibited LPS-induced DNA binding activities of NF-κB, and this was associated with the discontinuation of IkBα degradation and subsequent decreases in the translocation of p65 and p50 into the nucleus and having antinflammatory activity (Park et al. 2018).
Sushila R & Anjoo K, 2017 This study was aimed to investigate the development and optimization of antidiabetic phytosomes using a 3-factor, 3-level box-behnken design (17 batches). Phytosomes were found to have antidiabetic activity comparable to metformin in low dose. HPTLC showed the presence of the phyto-constituent quercetin (Sushila R & Anjoo K 2017).

Rudra SP & Ramakant N, 2015 The aim of this study was to prepare the phytosome of lawsone and evaluate it for its anti-inflammatory activity. *Ex-vivo* permeation study of phytosome gel of lawsone through excised rat skin showed 92.91% of cumulative drug permeation up to 6 h. The anti-inflammatory activity of gel of phytosome of lawsone showed significant anti-inflammatory activity as compared to plant drug gel at 4 h (*P* < 0.001) (Rudra SP & Ramakant N 2015).

Sahu R et al., 2015 The aim of the present investigation was to formulate boswellic acid loaded Phytosome for improved delivery. Phytosomal formulations were developed using different concentration of Cholesterol (1-3%) and ethanol (20-40%) then optimized and characterized its physiochemical properties. Based on minimum particle size and maximum entrapment efficiency E6 (2% of Cholesterol concentration and 40% of ethanol concentration) was selected as optimization Phytosomal formulation. The resulted optimized phytosome formulation has more stability (Sahu et al. 2015).

Dhase et al., 2015 Phytosomes was prepared by solvent evaporation method. Firstly leaves of *A. marmelos* were extracted with pet ether and then with methanol by soxhlet extraction. From above studies we are concluded that phytosomes has better physical characteristics as compared to that of methanolic extract of leaves of *A. marmelos*. Phytosomes has nearly same antioxidant, antiproliferative and anticancer activity as that of methanolic extract of leaves of *A. marmelos* (Dhase et al. 2015).

Shalini et al., 2015 This study was conducted on amethanolic extract of *Terminalia arjuna* bark and its phytosme were formulated to investigate its antiproliferative activity on human breast cancer cell line MCF-7 by MTT assay by comparing activities with quercetin and its phytosme. The IC$_{50}$ values of the extract and its phytosme were 25µg/ml and 15µg/ml respectively which suggests that phytosome exhibited more antiproliferative effect as compared to free drug (Shalini et al. 2015).

Mali et al., 2014 The present study is directed towards the development of stable phytosomes from medicinal plant *Thespesia populnea*. Categorized as remedy for skin ailments, Antioxidant activity and Wound healing activity. The prepared phytosomes were subjected to determination of physical and chemical evaluation and result complies as per standards (Mali et al. 2014).

Keerthi et al., 2014 Objective of the present study was to formulate and evaluate capsules of Ashwagandhaphytosmes. *In vitro* drug release studies revealed that the cumulative % drug release of
capsules of Ashwagandhaphytosomes 76.8%. Antioxidant activity of Ashwagandhaphytosomes was evaluated by reducing power method. The results showed that the Ashwagandhaphytosome complex exhibited more antioxidant activity compared to the Ashwagandha extract. Hence it was concluded that Ashwagandhaphytosomes serve as useful novel drug delivery system and provide more bioavailability than conventional formulations (Keerthi et al. 2014).

**Giorgio et al. 2014** Examined the clinical utility of oral supplementation with combination product comprising an alpha –lipoic acid, curcuminphytosome, and B group vitamins in 180 patients with carpal tunnel syndrome (CST). The treatment was connected with high fulfilment levels and good compliance, signifying the potential clinical helpfulness of this supplementation before and after surgery in CST patients programmed for the surgical decomposer of the medial nerve (Giorgia et al. 2014).

**Mahmoodiet al. 2014** Worked with silybin and its phytosome to study the expression levels of estrogen receptor α (ERα) overexpression in breast cancer, which is responsible for tumor growth enhancement, and is a prognostic and predictive factor. Silybin (silibinin)- (silybummarianum) is a natural polyphenol with high antioxidant and anticancer properties which blocks VEGF, EGFR, COX-2 and TNF. The comparison of silybin and silybin-phophotidylcholine doses had 2.5-3 times more inhibitory effect on cell growth than the same silybin doses in the T47D cell line. The results for 48 hours indicated all doses significantly down regulated ESR (Mahmoodi et al. 2014).

**Sabzichiet al. 2014** explore the previously studied role of Nrf2(Nuclear factor erythroid 2 –related factor 2) in resistance to chemotherapeutic agents in different types of cancer. In the study, M.Sabzichi et al. 2014.Used luteolinphytosome to sensitize cancer cells MDA-MB 231 cells (humanbreast cancer cell lines) to chemotherapeutic agent doxorubicin by downregulating the Nrf2 expression. The probable mechanism of action of luteolin would be such that due to presence of luteolinphytosome the action of detoxifying enzymes and transporter could not act on doxorubicin as a resuls cells become sensitive to the drug(Sabzichi et al. 2014).

**Gianni et al. 2013** Assessed the advantageous possession of green select phytosome, proprietary lecithin formulation of caffeine free green tea cathechin essence in controlled registry study on 50 asymptomatic subject borderline of metabolic syndrome factors and with amplified plasma oxidative stress. Compare to the control (lifestyle and dietary changes alone), green select phytosome was particularly operative for weight/ wiast changes. The outcomes emphasized the significance of addressing multiple factors tangled in the expansion of metabolic disease with apheliotropic agent accomplished by enhancing the valuable
effects of lifestyle and dietary changes and foster the attainment of a globally improved profile (Gianni et.al.2013).

**Surendra et al. 2013** The objective of this review is to focus on the application of phytosome technology along with its preparation, various properties and characterization. This review contains a comparative account of liposomes and phytosomes along with recent advancements in the field of phytosome technology with a special concern to transdermal drug delivery (Surendra et al. 2013).

**Prashad et al. 2012** The study is based on review of Drug delivery system for phytosomes was prepared by complexing polyphenolic phyto-constituents with phospholipid mainly phosphatidylcholine which bind components to each other on a molecular level. Bioavailability is enhanced due to their capacity to cross the lipid rich bio-membranes and to protect the valuable components of the herbal extract from destruction by digestive secretions and gut bacteria. For the future purpose it can used as a targeting drug delivery system as a liver targeting, brain targeting, cardio protective etc. Phytosomes thus prepared were subjected to solubility and drug content evaluation, scanning electron microscopy (Prashad et al.2012).

**Gandhi et al. 2012** The present review represents the recent advances and applications of various standardized herbal extract phytosomes as a tool of drug delivery & enhancement of bioavailability of drug (Gandhi et al 2012).

**Zaveri et al.2012** Have designed the curcumin- phospholipid complex in a molar ratio of (1:2) of curcumin and phospholipid. They varied the formation of the complex by FT-IR Spectroscopy and DSC analysis. They likened the skin permeation of curcumin with complexedcurcumin and orginate that the complexedcurcumin disclosed a 60% greater permeation of curcumin through the rat skin. They stated that the phospholipid complex has supplementary transdermal penetration than pure curcumin (zaveri et.al. 2011).

**Cuomo et al. 2011** Examined the comparative absorption of a standardized curcuminoid mixture and its equivalent lecithin formulation (meriva) in a randomised double bond crossover design in the human study. They informed the enhanced absorption and improved plasma curcuminiod profile of the meriva at a dose comparatively lower than unformulated curcuminiodmixture(Cuomo et al.2011).

**Gupta & Dixit, 2011** Described that the combination of high amount of curcumin in a topical preparation cannot offer improved bioavailability. They formulated complex of curcumin with phophotidylcholine and evaluated them on the basis of TLC,DSC, Melting point and FTIR. They likened the action of vascular system like liposome , noisome, phyto-vesicle. In consequence, they got that the phyto-vesicle are having outstanding antioxidant and anti-aging properties compared with other vesicular system that may be due to
the amphiphilic nature of the complex, which greatly improved the water and lipid miscibility of the curcumin (Gupta et al. 2011).

**Coa et al. 2011** Prepared oxymatrine–phospholipid complex (OMT-PLC) to enhanced the lipid solubility and efficiency of OMT. The main aim of their study was to discover the efficacy of the mixture of a micro emulsion and an OMT-PLC as a topical delivery vehicle for improving the absorption and effectiveness of OMT. They characterized numerous physiochemical properties and in vitro and in vitro permeability through the skin. They resolved that the combination of a micro emulsion and phospholipid complex represent an effective vehicle for topical delivery of OMT (Cao et al. 2011)

**Singh et al. 2011** The study is based on the review of Phytosomes are newly introduced herbal formulations developed to incorporate standardized plant extracts or water soluble phytoconstituents into phospholipids to produce lipid compatible molecular complexes and so vastly improve their absorption and bioavailability. Phytosomes exhibit better pharmacokinetic and pharmacodynamic profile than conventional herbal extracts. It is also often known as herbosomes. This article apart from providing information regarding the advantages and physiochemical properties of phytosomes gives various simple research techniques in the preparation and its optimization (Singh et al. 2011).

**Singh et al. 2011** the study is base Phytosomes as newly introduced herbal formulations developed to incorporate standardized plant extracts or water soluble phytoconstituents into phospholipids to produce lipid compatible molecular complexes and so vastly improve their absorption and bioavailability. Phytosomes exhibit better pharmacokinetic and pharmacodynamic profile than conventional herbal extracts (Singh et al. 2011).

**Forster et al. 2009** Described in their review that the topical delivery of plant derived formulation can be successfully done in cosmetic groundwork by phospholipidcomplexation (Forster et al. 2009).

**Kid et al. 2009** Stated the hydration of the superficial corneous layer is related to the liposomal like properties of phospholipid of the complex. ginkoselectphytosome enjoy a transdermal action which helps the ginseng saponin present in the phospholipid complex to pass though the skin (Kid et al. 2009).

**Yanyu et al. 2006** Formulation the silymarinphytosome and examined its pharmacokinetics in rats. In this study the bioavailability of silybin in rat was enhanced noticeably after oral administration of formulated silybin–phospholipid complex due to an inspiring enhancement of the lipophilic property of silybin–phospholipid complex and enhancement of the biological effect of the silybin (yanyu et al. 2006).

**Moscarella et al. 2006** Investigated in one study of 232 patients with chronic hepatitis (viral ,alcohol or drug induced ) treated with silybinphytosome at a dose of 120 mg either twice daily or trice daily for up to 120
days, liver function return to normal faster in patients taking silybinphytosome related to a group of controls (49 treated with commercially available silymarin, 117 untreated or given placebo) (Moscarella et al. 2006).

Maiti et al. 2005 Established the quercetin–phospholipid complex by easy and reproducible technique and also presented that the preparation expressed improved therapeutic efficiency than the molecules in the rat liver injury made by carbon tetrachloride (Maiti et al. 2005).

D. gallo et al. 2005 Aimed to assess growth inhibitory effect of silipide (silybin complex) against human ovarian cancer (HOC) in vivo. The downregulation and upregulation of vascular endothelial growth factor (VEGF) and angiopoietin-2 respectively indicates the angiogenic activity. HPLC analysis of free silybin levels was found to be 7.0 mg/ml and 183.5ng/g tissue in the plasma and tumor samples, respectively. No significant difference were seen in the human VEGF levels in silybin treated cell and vehicle blank. But a consistent decrease in VEGF concentration was observed in the tumor specimens treated with silipide as good candidate for the management of recurrent ovarian cancer (D. gallo et al. 2003).

Busby et al. 2002 Described that the practice of a silymarinphytosome displayed a better photo-protectant action from ethanol-induced behavioural deficits than uncomplexedsilymarin (Busby et al. 2002).

Grange et al. 1999 conducted a series of an experiment on silymarinphytosome, comprising a standardised extract from the seeds of S.Marianum, administered orally and found that it could protect the fetus from maternally ingested ethanol (Grange et al. 1999).

Bombardelli et al. 1991 described the silymarinphytosomes, in which silymarin (a standardized mixture of flavanolignans extracted from the fruits of S. Marianum) was complexed with phospholipid. Phytosomes displayed much higher specific activity and a longer lasting action than the single components, with respect to percent reduction of oedema, in habitation of myeloperoxidase activity, antioxidant, free radical scavenging property (Bombardelli et al.1991).