



Herbal Liposomes: Natural Network for Targeted Drug Delivery System

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Herbal medicines have tremendous therapeutic potential that can be explored across various effective drug delivery systems. Decoctions, herbal teas, tinctures, glyceritum, oxymel, and use much soap, herbal tablets, herbal capsules, and herbal cream, herbal books, and prepared the confection of the most commonly available forms of dosage. The less use of herbal formulations in recent decades due to their lack of standardization. It is possible to use plant extract and isolated constituents to overcome this problem. But these phytoconstituents are suffering from drawbacks, mostly due to problems with stability and low lipid solubility. Novel drug delivery such as liposomes plays an important role in problem solving. Infact, compliance with the patient also improves. The review article discusses the recent status of new herbal liposomal formulations and describes the different ways in which these formulations are prepared.

Keywords: Herbal liposomes; targeted drug delivery; preparation.

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1. INTRODUCTION

India officially recognised alternative health programs have a long, safe, and reliable use of many herbal medicines [1]. Millions of Indians often use herbal medicines as herbs, home remedies, natural foods and medicines as self-medicinal products or as non-allopathic products [2,3]. Herbal medicines are thought to be as ancient as human beings. Plant or plant preparations have been commonly used in medicine since ancient times. Up to now, phytomedicines have been commonly used in most of the world's population [4]. Herbal medicines are believed to be as old as human beings. Since ancient times plants materials have also been widely used in medicine. Phytomedicines have also been widely used in most of the world's population thus far [5]. Moreover, Advancement in the Ayurvedic herbal medicine has been revolutionized from the showing of phytochemicals and pharmacological activities to elucidating their mechanisms of action and sites of action [6,7]. Some drawbacks of herbal medicines and phytochemicals, such as highly acidic pH instability, problems with solubility and absorption, can lead to medication levels below plasma therapy concentration, resulting in little or no therapeutic effects [8]. Incorporating novel drug delivery new technologies into active plant substances minimizes presystemic metabolism, drug degradation in the gastrointestinal tract, distribution / accumulation of drugs in nontargeted tissues and organs, thereby reducing side effects and increasing therapeutic effectiveness and eventually patient compliance [9]. In this situation we need a capable drug delivery system by using various biomaterials such as biodegradable nanomaterial [10]. Therefore liposomes considered as a novel targeted drug delivery system tool. Liposomes can be prepared according to different methods. They may vary in their dimensions, composition (different phospholipids and cholesterol contents), charge (resulting from the charges of the composing phospholipids), and structure (multilamellar liposomes consisting of several concentric bilayers, separated by aqueous compartments or unilamellar liposomes, consisting of only one phospholipid bilayer surrounding one aqueous compartment) [11].

1.1 Novel Drug Delivery System

1.1.1 Liposomes

The integration of the drug into the carrier network takes place in novel drug delivery technology or alters the drug structure at the molecular level to achieve distribution efficiency. New ideas for monitoring pharmacodynamics, pharmacokinetics, immunogenicity, non-specific toxicity, drug biorecognition and efficacy have been developed. Such new approaches, also known as targeted drug delivery are based on an interdisciplinary approach integrating science of polymers, bioconjugate, chemistry pharmaceutical and molecular biology. The novel drug delivery system is built to distribute drugs continuously over a longer duration of circulation, at a consistent and reproducible rate. Potential benefits of this concept include prevention of drug-related side effects due to controlled blood levels rather than fluctuating blood levels, improved patient compliance due to decreased dosage frequency and reduced total medication dosage [12]. Bangham first described liposomes during the study of cell membranes in 1965 [13]. He found the liposomes to be vesicles structures composed of hydrated bilayers that develop spontaneously as water disperses phospholipids [14,15]. More studies have been carried out on liposomes and their use in various fields, such as medicine and science [16]. The term liposome derives from two Greek words: "Lipos" means fat and "Soma" means body [17]. A liposome is a vesicle made out of the same material of a cell membrane. Usually these consist of phospholipids, which are molecules that consist of a tail and a head portion [18]. The head is hydrophilic, while the tail consisting of a long hydrocarbon chain is hydrophobic. Phospholipids are typically found in bilayer form. The main reason it has for advancing work into liposomes is largely because liposomes can simulate biological cells. This also ensures that liposomes are extremely biocompatible, making them an ideal candidate for a drug delivery system, with uses ranging from enzymes, antibacterials, antiviral drugs, antiparasite drugs, fungicides, transdermal carriers, vaccine diagnostic tools and adjuvants. Antitumor and antifungal agents in liposome form are commercially available today [19]. Its amphipathic nature is a typical feature of bilayer-forming lipids. A collection of polar heads attached covalently to one or two hydrophobic hydrocarbon tails. Once such lipids, e.g. phosphatidyl glycerol, phosphatidyline or phosphatidyl ethanolamine, are exposed to an

aqueous environment, interactions among themselves (hydrophilic interaction between the polar head groups and van der Waals interactions between hydrocarbon chains and hydrogen bonding with to water molecules) lead to condition formation of closed bilayers. The size of the liposomes can differ, ranging from smallest vesicles (20 nm in diameter) to visible liposomes under an optical microscope (diameter equal to or greater than 1 μm or greater than the size of living cells) [20]. A drug encapsulated by liposomes achieves a long-lasting therapeutic standard as medication must first be released from liposomes before metabolism and excretion [21]. Liposomal products have also been extensively employed mostly in past decade to improve drug delivery efficiency across multiple routes of administration. The major benefits of topical liposomal drug formulations are accrued by their demonstrated ability: (i) Reduced adverse effects and incompatibilities arising from exceptionally high systemic absorption of medications (ii) Boost substantially the accumulation of drugs also at site of administration as a result of the high substantive rates of biological membranes liposomes (iii) The number of hydrophobic and hydrophilic drugs could be readily integrated. Liposomes are often biodegradable, non-toxic and are designed for large-scale preparations. In addition, they also provide selective passive targeting of tumor tissues, increased efficacy and therapeutic index, increased stability through encapsulation, reduced toxicity of encapsulants, improved pharmacokinetic effects, and site specificity. Ligand coupling to achieve the flexibility of active targeting. Structural liposomes consist primarily of two components: Phospholipids and cholesterol [22]. Liposomes can also be divided into two categories: (1) Multilamellar vesicles (MLV) and (2) unilamellar vesicles. Unilamellar vesicles can also be classified into two categories: (1) Large unilamellar vesicles and (2) small unilamellar vesicles. The vesicle has one single phospholipid bilayer sphere in unilamellar liposomes that surrounds the aqueous solution. Vesicles have an onion-structure in multilamellar liposomes. Classically, several monolayer vesicles of smaller size can develop within other vesicles to form a multilayer structure of concentrated phospholipid spheres separated by a layer of water [23].

1.1.2 Methods of liposome preparation

For liposome preparation, the following methods are used:

1. Passive loading techniques
2. Active loading technique.

Passive loading techniques include three different methods:

- A) Mechanical dispersion method
- B) Solvent dispersion method
- C) Detergent removal method

A) Mechanical dispersion methods are the following types:

- Lipid film hydration by hand shaking, non-hand shaking or freeze drying
- Micro-emulsification
- Sonication
- French pressure cell
- Membrane extrusion
- Dried reconstituted vesicles
- Freeze thawed liposomes

B) Solvent dispersion methods are following types:

- Ethanol injection
- Ether injection
- Double emulsion vesicles
- Reverse phase vesicles
- Stable plurilamellar vesicles

C) Detergent removal methods are following types:

- Detergent(cholate, alkylglycoside, Triton X-100) removal from mixed micelles by
- Dialysis
- Column chromatography
- Dilution
- Reconstituted Sendai virus enveloped vesicles

1.1.2.1 Quercetin liposomes

Quercetin is well known as an effective antioxidant which protects against damage from free radicals or reactive oxidative species (ROS) associated with oxidative stress. In particular, the antioxidant quercetin activity may be attributable to the ability of catalase to protect cells from oxidative stress and damage by scavenging H_2O_2 . The capacity of quercetin as an anticancer agent. When used in combination, quercetin appears to increase the cytotoxicity of cisplatin to ovarian cancer in the various murine models of cancer. Low dissolution in gastrointestinal fluids leads to slow

gastrointestinal absorption of quercetin due to its poor aqueous solubility, which results in low bioavailability. Its solubility needs to be enhanced and different methods have been used to achieve this, including the development of more water-soluble quercetin compounds, the use of liposomes in formulating approaches. Quercetin liposomes were developed taking advantage of the ability of quercetin to bind copper. Quercetin powder was applied directly to preformed liposomes cholesterol (CHOL) and (2-distearoyl-sn-glycero-3-phosphocholine (DSPC) containing copper [24]. Another approach used to prepare quercetin-loaded liposomes is the thin film hydration process. Phospholipids, cholesterol, and quercetin were dissolved in 25 ml of chloroform-methanol mixture (4:1) at a constant molar ratio. In the rotary evaporator, the mixture is evaporated to remove traces of solvent and form thin film. At room temperature, hydrate the film with phosphate buffer (pH 7.4) for 1 hour. The dispersion of the vesicles was then homogenized by means of a sonicator probe. Optimized liposomal formulations were explored using surface-response methodology (RSM) [25].

1.1.2.2 Curcumin liposomes

Curcumin is one of the most widely studied bioflavonoids today and many studies have confirmed its antioxidant, anti-inflammatory, anti-cancer, chemoprotective and gastroprotective properties [26]. Curcumin is a natural compound with many antitumor properties and specificity of the tumor cells, but it is poor in bioavailability and water solubility. Liposomes increase the therapeutic index of curcumin by shielding the drug from enzymatic degradation, and surface modulation helps polyethylene glycol (PEG) to circulate long-term. Curcumin has such a range of anti-cancer effects including tumor blocking, tumor growth avoidance, and invasion and metastasis inhibition [27]. Curcumin liposomes prepared using hydration method of thin film and using dilution method of polyol. In thin film, lipid hydration method was dissolved in chloroform, placed in round bottom flask then dried under reduced pressure in rotary evaporator to form thin lipid film on the flask's inner surface. The phospholipid film was kept in PBS buffer (pH 7.4), sonicated for 30 minutes at 4°C and rehydrated afterwards. Liposomes under UV lamp is sterilized for 2h [28]. Method for diluting polyol without residual organic solvents. Curcumin liposomes have a molar ratio of 9:1 and consist of phosphatidylcholine (PC) hydrogenated and cholesterol (CH). The polyol

solvents used are propylene glycol (PG), polyethylene glycol 400 and glycerine (PEG-400). Extrusion was applied following suspension [29].

1.1.2.3 Paclitaxel liposomes

Some of the most promising paclitaxel anticancer drugs particularly effective in treating breast and ovarian cancer suffer from problems such as low water solubility and low bioavailability. Products currently available in non-aqueous vehicles containing Cremophor EL® (polyethoxylated castor oil) can produce allergic reactions as well as precipitation when administered intravenously in an aqueous diluent. The lack of any effective vehicle delivery restricts and delays the widespread clinical use of this drug. It is therefore strongly recommended to develop alternative formulation of paclitaxel with strong aqueous solubility and reduced side effects [30]. Paclitaxel loaded liposomes have been developed with the objective of enhancing the cancer treatment effects. The encapsulating Paclitaxel liposomes were prepared in 20 percent ethanol using a thin film hydration process using PTX-saturated 20 percent ethanol, bovine serum albumin (BSA) solution and bovine serum albumin (BSA) solution, and the amount of PTX loading in the liposome [31].

1.1.2.4 Colchicine liposomes

Colchicine, an alkaloid present in the plants *Colchicum autumnale* and *Gloriosa* extracts Superb, is effective in treating acute gout and dermatological disorders such as leukocytoclastic vasculitis, psoriasis, and the syndrome of sweets. Oral colchicine administration also has dose-dependent side effects, suggesting the need to develop alternative dosage form which topically delivers colchicine to the affected joints. The vesicular systems were widely used for the delivery of transdermal and dermal drugs. The vesicular system is heavily dependent on its physico-chemical properties. Deformable vesicles such as elastic liposomes have become more effective in improving the transport of drugs. The elastic liposomal formulation of Colchicine was prepared using traditional rotary method of sonication by evaporation $40 \pm 1.0^\circ\text{C}$. At room temperature, the obtained vesicles were swollen for 2 hours to obtain large multilamellar vesicles (LMLV). LMLVs have been sonicated at 4°C and 40 W for 20 minutes to prepare smaller vesicles. The

sonicated vesicles is extruded by a sandwich of polycarbonate membranes 100 and 200 nm [32].

1.1.2.5 Silymarin liposomes

A hepatoprotective agent, Silymarin has poor bioavailability for oral use. The new form of dosage drug doesn't affect the liver and inflammatory cells directly. To develop a lecithin-based silymarin carrier system by incorporating a phytosome-liposome approach to enhance oral bioavailability and target specificity to improve liver hepatoprotection. The liposome for silymarin was prepared using film hydration method. It is focused on the fact that phytosomal silymarin is more stable in the gastric environment to improve silymarin bioavailability while liposomal silymarin has the highest capacity to be captured and modulated by macrophages, Kupffer cells, and infiltrated WBC viz., neutrophils, monocytes, etc. This process makes it possible to target silymarin-targeted inflammation in the formulation. Liposomes are prepared by the film hydration method. Put 10 mg of silymarin (S), different amounts of soybean phosphatidylcholine and cholesterol into round bottom flask and dissolve them in a chloroform methanol mixture (1:9). At 40°C the solvent was then evaporated to form a thin film on a rotary evaporator under vacuum. Dry in a vacuum desiccator overnight, eliminated traces of solvent from the film. The film was prepared in phosphate buffered saline (PBS, pH 7.4) containing different quantities of cryoprotectants (mannitol and sucrose) at 100 RPM for 1 hour at 50°C hydrated to prepare the liposomal suspension. After 5 cycles the liposome vesicle size decreased at 20,000 psi under high pressure homogenization. The liposomes had been placed in a deep refrigerator at 80°C overnight. The frozen liposomes were lyophilised at low pressure and placed in the airtight container at 4°C [33].

1.1.3 Liposomal neem gel

In order to improve its effectiveness, different synthetic drugs and herbal drugs are incorporated into liposomes. The incorporation of herbal extracts into liposomes can eliminate the side effects associated with synthetic lipids. *Azadirachta indica* leaves have strong antibacterial activity which confirms the great potential of bioactive neem compounds. *Azadirachta indica* aqueous extract and alcoholic extract, alcoholic leaf extract, have been found to be more aggressive against the bacterial species. This extract has been integrated into the

liposomes to boost its skin delivery function. Methanolic Neem Extract (MeNE) was introduced by hydration of thin film into the liposomes. A lipid layer was prepared by dissolving in the chloroform-methanol mixture (2:1 v / v) accurately weighed amounts of Methanolic Neem Extract (MeNE), soya lecithin and cholesterol in the round bottom flask containing glass beads. Rotary evaporation at 45-50°C, under reduced pressure, eliminated the solvent mixture from the lipid process to produce the thin layer of lipids on the flask wall and bead surface. The dried lipid film was hydrated in phosphate buffer pH (6.5) at a temperature of 60 ± 2°C. The dispersion was left to stand at the room temperature for 2-3 hours to completely swell the lipid membrane and obtain a vesicle suspension [34].

1.1.3.1 Capsaicin liposomes

Capsaicin is natural compound and has poor bioavailability for oral use. For enhanced oral bioavailability, capsaicin, an important medication for treatment of the neuropathic pain, can be encapsulated into liposome. Another promising method in development of liposome formulations may be the excellent in vitro-in vivo correlation (IVIVC) of capsaicin-loaded liposomes, which has the additional benefit of reducing animal testing. Thin film hydration process used to formulate liposomes. Capsaicin, soybean lecithin with a phosphatidylcholine was dissolved in a single-neck flask in 20 ml of absolute ethanol and subjected to ultrasound until the solution was clear and transparent. The solution was evaporated using rotary evaporator to eliminate ethanol before adding cholesterol (0.2 g), sodium cholate (0.8 g) and isopropyl myristate (0.8 g), and dissolving further in 20 ml ethanol. The evaporation process was repeated again to remove residual solvent, leaving a film-like complex at the bottom of the flask. Double distilled water hydrated the dried lipid film to create a final solution with different concentrations (2, 8, 15 mg-mL⁻¹, called F1, F2 and F3 formulation, respectively).

The different preparations were stored at a 4°C before further investigations into the efficiency of encapsulation, the stability test and the effect of different capsaicin concentrations on liposomal systems [35].

1.1.3.2 Baicalein liposomes

Baicalein exhibited suppression against nitric oxide / prostaglandin E2 production and cancer

cell proliferation [36]. Because of its low oral bioavailability it is inconvenient and troublesome to use BAI. To enhance its bioavailability grow nano liposomes containing flavonoids (BAI-LP). Baicalein-loaded nanoliposomes (BAI-LP) were prepared by hydration of thin films. The lipid phase was prepared in a 25ml recovery flask by dissolving correctly weighted amounts of soybean phosphatidylcholine (SPC), cholesterol and baicalein in 6ml dichloromethane-methanol (2:1, V / V) mixture. The mixture was withdrawn at 40°C by rotary evaporation, creating a thin layer of lipids on the eggplant-shaped bottle wall. The thin film was then purged for 5 minutes with nitrogen. The lipids film was hydrated at 60°C in an eggplant-shaped bottle with 10ml of ultrapure water, accompanied by 15–30 minutes of sonication. Samples were filtered using 450 nm and 220 nm membrane filters to obtain yellowish Baicalein-loaded nanoliposomes (BAI-LP) [37].

1.1.3.3 Brucine liposomes

Brucine itself is known for relieving arthritic and chronic pain as an analgesic and anti-inflammatory treatment. The major pharmacodynamic activities include pain relief, swelling reduction, and circulation enhancement. Because of its high occurrence of side effects, including violent seizures and even lethal poisoning, the possible use of brucine is extremely limited. Therefore, it is essential to find a suitable formulation also for therapeutic application of this molecule to minimize its harmful side effects while preserving or possibly improving its efficacy. Develop brucine liposome to reduce side effects. Modified ethanol-dripping method was used in brucine liposome preparation. A lipid ethanol solution (lecithin: cholesterol = 6:1, w / w), sodium deoxycholate, tween-80 and brucine (16:4:4:1, w / w) was discharged into mannitol solution (5.3 mg / ml). In the final suspension the ethanolic-lipid liquid ratio to the aqueous phase was 1:9 (v / v). Then the suspension was sonicated for 20 min with an ice water-bath and 72 h freeze-dried. The dry powder may be rehydrated 3 min before application [38].

1.1.3.4 Asparagus racemosus liposomes

Antiulcer, antioxidant, immunomodulatory, antidiabetic, antidiarrheal, phytoestrogenic, antiaging and adaptive properties have been recorded for the pharmacological activity of *Asparagus racemosus* root extract (AR). *Asparagus* root has moisturizing, cooling, anxiety, constipation, galactose regulation,

aphrodisiac, diuretic, rejuvenating, digestive, stomachic and antiseptic properties, so it can be used as a digestive asparagus root. The *Asparagus racemosus* root has many beneficial effects recommended for treating nervous disorders, dyspepsia, vomiting, tumors and inflammation. Preparation of thin film hydration (TF) for *Asparagus racemosus* root extract liposomes, reverse phase evaporation (REV), and polyol dilution (PD) methods with different lipid extract ratios. In a 250 ml round bottom flask, thin film hydration (TF)-total lipid mixture (100 mg) with a PC to CHOL molar ratio of 7:3 has been dissolved in 20 ml chloroform. The solvent was eliminated from the lipid process under reduced pressure, by rotating at 35°C until a dry film was deposited on the flask wall. The dry thin film was hydrated with an aqueous solution containing various weight ratios of *Asparagus racemosus* to total lipid at 0:5, 1:5, 2:5 and 3:5 in a 20 ml isotonic phosphate buffer pH 7.0 above phase transition temperature to obtain a homogeneous white liposome suspension. The suspension was left for further 2 hours at the room temperature to achieve full swelling of a lipid membrane. Use ultracentrifugation at 4°C for 1 h, the untrapped *Asparagus racemosus* was isolated. Liposomes with isotonic phosphate buffer pH 7.0 were washed several times until the concentration of *Asparagus racemosus* in the supernatant was < 1.0 percent. Before usage, the filtered liposomes were moved to a container and placed at 4°C. Reverse-phase evaporation (REV) method- The total lipid mixture (100 mg) with a PC-to-CHOL molar ratio of 7:3 was dissolved in 60 ml dichloromethane in a round bottom flask, after which the aqueous phase containing different weight ratios of *Asparagus racemosus* to total lipid (0:5, 1:5, 2:5 and 3:5 in 20 ml isotonic phosphate buffer, pH 7.0) was injected into the lipid solution by means of a 22 gauge hypodermic needle with a 5 ml syringing needle. With a glass stopper, the flask was immediately sealed and placed in an ultrasonic bath. At 7° C the mixture was sonicated. For 10 minutes the water-in - oil emulsion (w/o) is formed. The emulsion was then transferred to a rotary evaporator and, under reduced pressure at 35°C, the solvent was slowly evaporated until a viscous gel was formed. Finally the initiation of the evaporation culminated in a homogenous aqueous dispersion. Liposomal dispersions were subsequently subjected to complete removal of the remaining organic solvent traces in a rotary evaporator at 35 to 37°C for approximately 30 minutes. Finally, the obtained liposome dispersion was purified by ultracentrifugation in

Table 1. Liposomal formulations

Formulations	Active ingredients	Biological activity	Method of preparation	Reference No
Quercetin loaded liposomes	Quercetin	Wound healing	Thin film hydration	[25]
Curcumin liposomes	Curcumin	Anticancer	Thin film hydration	[27]
Curcumin liposomes	Curcumin	Anti-inflammatory	Thin film hydration	[28]
Curcumin loaded thiolated polymer coated liposomes	Curcumin	Aphthous ulcer	Thin film hydration	[29]
Paclitaxel liposomes	Paclitaxel	Anticancer	Thin film hydration	[30]
Colchicine liposomes	Colchicine	Anti-gout	Rotaryevaporation sonication method	[32]
Silymarin liposomes	Silymarin	Hepatoprotective activity	Reverse evaporation technique	[33]
Liposomal neem gel	Methanolic neem extract	Antimicrobial	Thin film hydration	[34]
Capsaicin liposomes	Capsaicin	Anti-inflammatory	Thin film hydration	[35]
Baicalein liposomes	Baicalein	Antitumor	Thin film hydration	[37]
Brucine liposomes	Brucine	Anti-inflammatory	Modified ethanol dripping method	[38]
Rutin liposomes	Rutin	Antioxidant activity	Film dispersion Method	[40]
Guggul liposomes	Guggul	Anti-inflammatory	Sonication method	[41]
Rutin trihydrate Liposomes	Rutin	Topical administration as antioxidant	Thin film hydration method	[42]
Doxorubicin PEG liposomes	Doxorubicin	Anti-cancer	Evaporation method	[43]
Herbal liposome	Ketoconazole	Seborrheic Dermatitis	Thin film hydration	[44]
QUE/RES-loaded elastic liposomes	Quercetin	Anti-cancer	Thin lipid film method	[45]
EGCG Quercetin hybrid liposomes	Quercetin	Antioxidant activity	Thin film hydration	[46]
Paclitaxel liposomes	Paclitaxel	Anti-proliferative	Thin film hydration	[47]
Paclitaxel-loaded stealth liposomes	Paclitaxel	Anti-cancer	thin film hydration technique	[48]
<i>Asparagus racemosus</i> liposomes	<i>Asparagus racemosus</i>	Anti-inflammatory	Thin-film hydration, reverse-phase evaporation and polyol dilution	[49]
Cosmeceutical liposomes	avobenzone and arbutin	Cosmetic Purpose	Thin film hydration and reverse-phase evaporation	[50]
PEGylated Liposomes	Meloxicam	Anti-cancer	Thin film hydration	[51]
Arbutin Liposomes	Arbutin	Skin-whitening activity	Film dispersion method	[52]
Vitamin loaded topical liposomal	Vitamine E	Anti-oxidant	Film dispersion method	[53]

the same way as the TF method, and stored at 4°C until further use. Polyol dilution (PD) method-Concentrate the total lipid mixture (100 mg) with PC to 50°C, and dissolve CHOL with a molar ratio of 7:3 in 4 ml of propylene glycol. Preheat aqueous phase to 50°C with various weight ratios of AR to total lipids (0:5, 1:5, 2:5 and 3:5) in 16 ml of isotonic phosphate buffer (pH 7.0) Then slowly infused. Lipid solution, and mix for 45 minutes. The resulting liposome dispersion was purified by ultracentrifugation in a manner similar to that previously described by the TF method and stored at 4°C until needed [39].

1.1.3.5 Rutin liposomes

Rutin (quercetin-3-O-rutinoside) is a natural glycoside to the flavonoid. This exhibits essential scavenging properties both in vitro and in vivo on oxygen radicals. It also exhibits several other significant pharmacological properties, including antiviral, vasoprotective, and anti-inflammatory. Rutin shows low water solubility, which leads to poor efficacy or bioavailability in oral absorption. Therefore, the development of novel rutin delivery systems to improve the therapeutic effectiveness of rutin is of considerable interest. Developing rutin liposome to improve therapeutic efficacy of the rutin. Nanoparticles of rutin-loaded liposome were prepared using film dispersion method. The delivery systems were prepared in ethanol media (10 ml), containing 0.15:5:1 rutin-PC-CH under 40° C rotary evaporator and 1 h 60 r / min. In a rotary evaporator at 40°C for 30 min, thin lipid film products were low hydrated using phosphate buffer (15 mL, pH 6.8, and containing Tween 80) at low speed. The mixtures were sonicated for 10 min and then filtered through a microporous filter membrane of 0.22µm and matured at 4°C overnight [40].

1.1.3.6 Guggul liposomes

The antiinflammatory effects were identified using a gum resin, i.e. guggul, obtained from *Commiphora Mukul*. The preparation of guggul-liposomes was accomplished by the use of different cholesterol and guggul lipid concentrations with phenyl butazone by sonication method. Guggule lipid is accurately weighed and dissolves on agitator at 700 rpm in 10 milliliters of distilled water until full dissolution, another mixture of phenylbutazone and cholesterol in ethanol was prepared until thin layer formation. Both the mixtures were diversified by 5 percent PVA solution up to 20 ml

and attuned volume. The mixture was sonicated (3 cycles for 5 min) to form fine guggul-liposomal vesicles [41].

Herbal liposomes are mostly studies as compared synthetic drugs the details are depicted in Table 1 with their method of preparation, active ingredients and biological activity.

2. CONCLUSION

As per the example discussed we have concluded an application of new drug delivery systems to phytoconstituents that result in increased bioavailability, increased solubility and permeability, dose reduction and consequently side effects. With the development of standardization, extraction, identification techniques, scientists can now focus their research on the creation of herbal medicines that can suit the targeted delivery, substantially reduced doses and side effect properties of the conventional medicine method.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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