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Niosomes: A Camouflaged Carrier for Drug Delivery System

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Abstract: *The formation of vesicles as a tool to improve the drug delivery system. Niosomes are a system aimed at delivering drugs. Niosomes of non-ionic vesicles are highly affected by the hydration of nonionic syntactants, or unmixed cholesterol or other lipids. Niosomes promise a drug delivery and non-ionic vehicle, is less toxic and improves drug treatment index by inhibiting its action to target cells and play a key role in regulating nutrient release. Niosomes are preferred over liposomes because the former exhibit high chemicalstability and economy. The application of vesicular (lipid vesicles and non-ionic surfactantvesicles) systems in cosmetics and for therapeutic purpose may offer several advantages.They improve the therapeutic performance of the drug molecules by delayed clearance from the circulation, protecting the drug from biological environment and restricting effects to target cells. This article focuses on the recent advances in niosomal drug delivery, potential advantages over other delivery systems, formulation methods, methods of characterization and the current research in the field of niosomes.*

Keywords: Niosomes, Proniosomes, Non-ionic surfactant, Cholesterol

I. INTRODUCTION

Niosomes are a common form of drug delivery system and have a multilameller vesicular structure of non-ionic surfactants. Niosomes are widely studied by researchers as one of the tools for liposomes.The composition of niosomes has two types of content namely, 1. Nonionic surfactants and additives. Non-ionic vesicles of lamellar surfactants are composed of a component of nonionic surfactants of alkyl or dialkyl polyglycerol ether class with hydration-containing cholesterol in liquid media. The first report of nonionic surfactant comes from cosmetic use by L, Oreal. Niosomes can incorporate a different type of drug into a multilameller vesicular structure

1.1 Elements of NIOSOMES

Niosomes basically contain the following substances
1. ionic-free surfactants Non-ionic surfactants are a bilayer circle where hydrophobic head facinf aqueous bulk while hydrophobic head aligns with contact with liquid media can reduce
Nonionic surfactants are mainly used to form niosomes
1. Alkyl ether e.g. Surfactant-1 momoalkyl glycerol
2. Alkyl esters e.g. seriton ester
3. Alkyl amides e.g. galactosides and glucosides
4. Cholesterol e.g. steroid
Charged molecules and other burnt molecules are added to niosomes to increase the stability of niosomes in depression.

1.2 Methods of Preparation

Some of the following methods are used to create niosomes

1.3 How to Inject Ether

In this method a solution containing a certain amount of cholesterol and surfactant in ether is added slowly to the already hot aqueous solution of the drug stored at 60 ° C with a prescribed gauze needle. The depletion of ether leads to the formation of unilameller vesicles of surfactants containing drugs. Alternatively, inspired hydrocarbons have been

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used instead of thermolabile drug ether, as they breathe at very low temperatures. The size of the niosomes obtained in this way varies between 50—1000 mm, depending on the structural variability and test conditions.

1.4 Handshake

First cholesterol and surfactant will be dissolved in another natural solution (such as ether, chloroform, benzene etc.). Afterwards, the solvent is heated under reduced pressure in a vacuum evaporator in the lower circular flask and leaving a mixture of stable surfactant and cholesterols in the rear box frames. This layer was then re-infused with a water-repellent solution containing an earthquake-resistant drug that results in inflammation of the active layer. Swollen amphiphiles sooner or later coagulate and form vesicles that hold these drugs. The amount of fluid trapped in the vesicles was once found to be small which means 5-10% .

1.5 Sonication Method

In this way initially the mixture of surfactant-cholesterol dissolves in a strong phase.This is dispersed and investigated for 10 min at 60 ° C, which leads to the formation of multilameller vesicles (MLV). These MLVs are further processed by a byprobe sonicator or bath sonicator, resulting in the conversion of unilameller vesicles.

1.6 Evaporative Stage Phase

In this process a solution of cholesterol and surfactant is prepared by a combination of ether and chloroform (1: 1). In this case, the aqueous solution of the drug is distilled and sonicated at a temperature of 4-5 ° C. The solution is suitable after the infusion of the phosphate buffer saline (PBS) followed by gel formation. Thereafter the temperature rises to 40 ° C and the pressure is reduced to the removal of the solvent. PBS is then reheated and heated in a water bath at 60 ° C for 10 minutes to produce niosomes.

1.7 Transmembrane pH Gradient (Internal Acidic)

Drug Discovery Process (Remote Upload) According to this principle, in the niosome cells there is a lower pH (acidic pH) than that of the outside. A simple synthetic drug crosses the niosome membrane but after entering the niosome it becomes ionized with an acidic medium and is unable to remove the niosome and as a result this method will increase the absorption of these drugs. The acidic pH that is close to the homes of niosomes acts as a barrier to drug resistance.

1.8 Extrusion Method

In this way, a combination of ldl cholesterol and diacetyl phosphate is combined and the solvent changes the use of a rotary vacuum evaporator to leave a thin film. The film is then coated with an aqueous solution and the resulting suspension is removed with a polycarbonate membrane (mean pore size 0.1 mm) and placed in sequence up to eight pieces to obtain the same proportional niosomes.

1.9 Microfluidization Method There are two methods

liquid streams (one containing a drug and a different surfactant) have ultra high velocity interactions, well defined by narrow channels inside the contact chamber in such a way that the electricity supplied by the system resides in the area of the niosomes formations. This is known as immersed jet policy. It results in high uniformity, small size and regeneration in the system of niosomes.

II. TYPES OF NIOSOMES

1. Bola Surfactant Containing Niosomes This type of niosomes are composed of omega-hexadecyl-bis- (1-aza-18 crown 6) (bola surfactant): span-80 / cholesterol in 2: 3: 1 ratio moral

2. Preniosomes This type of sound has a surfactant and carrier. Each dissolved water molecule is covered with a thin film of dry surfactants called preniosomes. Niosomes are identified by adding a liquid phase to T> Tm and short disturbances (Blazek et al., 2001)

T = Temperature

Tm = means the temperature of the switch phase.

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4. Niosomes of Carbopol Gel In this case the niosomes are composed of medicine, nails and cholesterol so the niosomes are then combined with carbopol-934 gel (1% w / w) and contain propylene glycol (10% w / w) and glycerol (30% w / w).

5 . Vesicles in Water and Oil System (v / w / o) A mixture of sorbitol monostearate, cholesterol and solulan C24 (poly-24-oxyethylenecholesteryl ether) in the oil phase at 60 ° C to form more than niosomes to make a Vesicles suspension in the Water and Oil System (v / w / o).

III. A TIME THAT AFFECTS THE NIOSOMES

1. Coatings of the membrane Stability can be increased by the number of additives in the formation of niosomal and surfactant drugs.
2. Hydration temperature niosomal vesicles can be formed by temperature change. The size of the vesicle and shape can change with temperature.
3. The characteristics of Dros niosomes are affected by molecular weight, chemical composition, hydrophilicity, lopophilicity and the hydrophilic lipophilic balance (HLB) value of the drug.
4. The amount and type of person acting on the impact is due to the fact that the surface strength is reduced by the dehydration of the surfactants.
5. Composition of surfactants The geometry of the vesicles formed during niosomal preparation also depends on the critical packaging parameters (CPP). According to CPP the geometry of the vesicles can be predicted.27) CPPcan is calculated using followin.

IV. ADVANTAGES OF NIOSOMES

1. Niosomes are biodegradable, biocompatible to the body.
2. Niosomes can improve oral bioavailability of the drug'
3. Niosomes are easy to handling, storage and transportation.
4. Niosomes show a greater bioavaibility than conventional dosage form.
5. Niosomes have better patient compliance than conventional formulation.
6. Niosomes are osmotically active and stable.
7. The therapeutic performance of drug molecule can be improve by delayed clearance from the circulation, protecting the drug from biological envirement and restricting effects to the targatted cell.

4.1 Characterization of Niosomes

The characterization of niosome is essential for the clinical applications. Characterization parameters have a direct impact on the stability of niosomes and a significant effect on their in vivo performance. Therefore these parameters such as morphology, size, polydispersity index (PI), number of lamellae, zeta potential, encapsulation efficiency, and stability must be evaluated.

4.2 Size and Morphology

Dynamic light scattering (DLS), scanning electron microscopy (SEM) , transmission electron microscopy (TEM), freeze fracture replicationelectron microscopy (FF-TEM), and cryotransmission electron microscopy (cryo-TEM) are the most used methods for the determination of niosome sizes andmorphology. DLS provides simultaneously cumulative information of particle size and valuable information on the homogeneity of the solution. A single sharp peak in the DLS profile implies existence of a single population of scatterers. The PI is helpful in this respect. It less than 0.3 corresponds to a homogenous population for colloidal systems. The microscopic approaches are generally used to characterize the morphology of the niosomes.

4.3 Zeta Potential

Surface zeta potential of niosomes can be determined using zetasizer and DLS instruments.The surface charge of niosome plays an important role in the behavior of niosomes. In general, charged niosomes are more stable against aggregation than uncharged vesicles. Bayindir and Yuksel prepared paclitaxel loaded niosomes and investigated the

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physicochemical properties such as zeta potential of niosomes. They found that negative zeta potential values ranging between −41.7 and −58.4 mV are sufficiently high for electrostatic stabilization of niosomes .

4.4 Bilayer Characterization

Bilayer characteristics of niosomes have an importance on drug entrapment efficiency. The number of lamellae can be determined by AFM, NMR, and small angle X-ray scattering (SAXS) for multilamellar vesicles . Membrane rigidity of niosomal formulations can be measured by means of the mobility of fluorescence probe as a function of temperature. DPH (1,6 diphenyl1,3,5-hexatriene) is most used fluorescent probe and added to niosomal dispersion. DPH normally exists in hydrophobic region in the bilayer membrane. The microviscosity of niosomal membrane is determined by fluorescence polarization. High fluorescence polarization means high microviscosity of the membrane . Moreover, the bilayer thickness can be characterized using the latter method, together with the in situ energy-dispersive X-ray diffraction (EDXD) .

4.5 Entrapment Efficiency

Entrapment efficiency (EE%) is defined as the portion of the applied drug which is entrapped by the niosomes. Unencapsulated free drug can be removed from the niosomal solution using centrifugation, dialysis, or gel chromatography. After this step the loaded drug can be released from niosomes by destruction of Journal of Nanomaterials 5 Hydrophobic drug Hydrophobic drug Hydrophilic drug Hydrophilic drug Targeting ligand Codrug delivery Targeted delivery Niosomes can be destroyed with the addition of 0.1% Triton X-100 or methanol to niosomal suspension. The loaded and free drug concentration can be determined by a spectrophotometer or high-performance liquid chromatography (HPLC) .

4.6 Stability

The stability of niosomes can be evaluated by determining mean vesicle size, size distribution, and entrapment efficiency over several month storage periods at different temperatures. During storage the niosomes are sampled at regular intervals of time and the percentage of drug which is retained into the niosomes is analyzed by UV spectroscopy or HPLC methods.

4.7 In Vitro Release

One often applied method to study in vitro release is based on using of dialysis tubing. A dialysis bag is washed and soaked in distilled water. After 30 mins, the drug loaded niosomal suspension is transferred, into this bag. The bag containing the vesicles is immersed in buffer solution with constant shaking at 25∘ C or 37∘ C. At specific time intervals, samples were removed from the outer buffer (release medium) and replaced with the same volume of fresh buffer. The samples are analyzed for the drug content by an appropriate assay method.

V. APPLICATIONS

5.1 Niosomes as Drug Carriers

Many employees reported modification, comparison and application of niosomes as drug carriers. Niosomes contain anti-cancer drugs, if well designed, expected accumulate inside the tissues in the same way in liposomes. Niosomal insertion for Methotrexate and Doxorubicin increase the drug delivery to the tumor and tumoricidal function of the tree. Doxorubicin niosomes have muramic acid and triglycerol it is not taken very seriously. The triglycerol niosomes accumulated in the tumor and vesicles of muramic acid accumulated in ubende. Those vesicles contain polyoxyethylene the faces were quickly taken boldly again collected on a small scale in captivity. Baillie investigated recurrence 5.6-carboxy-soluble solute retention fluorescence (CF) in niosomes. They see that stable vesicles could not be formed in lack of cholesterol but they were more enters the trapped solute. Physical features of vesicles have been found to exist depending on the production method. Chandraprakash et al reported the formation and pharmacokinetic testing of Methosrexate niosomes in mice carrying the tumor, modified the surface of niosomes by adding polyethylene alkyl ether todouble-layered structure. They compare release pattern and plasma level of Doxorubucin in niosomes and Doxorubucin mixed with empty niosomes and observed a stable and high plasma leveldoxorubicin from niosomes in

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mice. studied the absorption of Ciprofloxacin and Norfloxacin there it is regulated as an encapsulated noisome input properties, reported anti-inflammatory activity of the noisome Diclofenac sodium combined in arthritic mice. It has been found to be niosomal composition prepared using 1: 1 The integration of Between 85 suggested the best consistent work of anti-inflammatory mass those 72 hours after single dose administration, reported multiple estimateswith sodium stibogluconate loaded niosomesfound to be effective compared with parasites in liver, spleen and bone marrow as compared to a simple sodium solution it's good.reported reconstructiontesting of niosomes loaded with Indomethacin and demonstrated the effectiveness of medicinesimultaneous increase in effect on the toxic side reduced compared to free Indomethacin in paw edema carrying rats.prepared for the niosomes ofvincristine sulfate was slightly toxic and improving anticancer activity. is a formulated niosomes of Pentoxifylline and studied vivo bronchodilatory work in guinea pigs. Arrestedefficiency found to give 9.26 ± 1.93%continuous extraction of the drug in a 24-hour period hours.reported oral correction and correction and vascular management Methotrexate niosomes loaded in mice. See saw a significant increase in plasma levels and high intake of Methotrexate in the liver from niosomes compared to free drugs Solution.

5.2 Diagnostic Images with Niosomes

The Niosomal system can be used as a diagnostic tool ambassadors. Combined niosomal formulation for gadobenate dimeglcemine and [N-palmitoylglucosamine (NPG)], PEG 4400, as well as a PEG and NPG show greatly improved tumor identification of The combined paramagnetic agent was tested via MR imaging47.

5.3 Delivery of Ophthalmic Drugs

Bioadhesive niosomal formation prepared acetazolamide from span 60,cholesterol stearylamine or dicetyl phosphate indicates an additional tendency to reduce internal pressure compared to the market
formulation (Dorzolamide) chitosancoated niosomal formulation timolol maleate (0.25%) indicates a significant reduction effect intraocular pressure compared to a a sold make-up with little chance of adverse cardiovascular effects.

5.4 Direction of Bioactive Agents

A. Developing a Reticulo-Endothelial (RES) System

RES cells specifically take on fabrics. The detection of niosomes by cellsand by distributing serum substances known as opsonins, which mark them to be allowed. Local drug collection,however, it was abused in the treatment ofanimal plants known to metastasize to the liver and spleen and parasite attacks liver.

B. For non-RES Organs

It has been suggested that the network company system may not redirect to certain sites in the body through use of antibody50. Immunoglobulins appear to act bind easily to the surface of the lipid, thusoffering simple ways of identifying.Many cells are intrinsicthe ability to see and bind certain objectscarbohydrate breakers and this can be the case exploitation to direct the network system in particularcells.

5.5 Delivery of Peptide Drugs

oral delivery of 9- desglycinamide, 8-arginine vasopressinbinding to niosomes in the in vitro intestinesloop and reported that the stability of the peptide is greatly increased.

5.6 Neoplasia

Doxorubicin, an anthracyclic antibiotic comprehensive plant-specific activity, demonstrates a a non-reversible dependent dose of cardio. Niosomal delivery of this drug to rat transport The S-180 plant extends their life span again decreased rate increase sarcoma. Niosomal capture increases the health of the drug component, increases its distribution and altered its metabolism. Injection methotrexate administration trapped in it niosomes appeared in S-180 mice that received a tumor on complete remodeling of the tumor and more plasma level and slow elimination.

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5.7 Physical use of Niosomes

Niosomes used to study the type of immune response that is irritated byantigens. Brewer and Alexander60 have it niosomes have been reported as a potent adjuvant in terms of dosage of bacterial selection, low toxicity and stability.

5.8 Transfer delivery

Transdermal delivery of drugs by niosomes Slow penetration of drug through skin is the major drawback of transdermal route of delivery. An increase in the penetration rate has been achieved by transdermal delivery of drug incorporated in niosomes. Jayraman et al61 has studied the topical delivery of erythromycin from various formulations including niosomes or hairless mouse. From the studies, and confocal microscopy, it was seen that non-ionic vesicles could be formulated to target pilosebaceous glands.

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