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A REVIEW ON THE PREPARATION AND DEVELOPMENT OF NOVEL DRUG DELIVERY SYSTEM: NIOSOMES

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ABSTRACT

Niosomes represent a promising drug delivery module. They present a structure similar to liposome and hence they can represent alternative vesicular systems with respect to liposomes, due to the niosome ability to encapsulate different type of drugs within their multi environmental structure. Niosomes are thoughts to be better candidate's drug delivery as compared to liposomes due to various factors like cost, stability etc. Various type of drug deliveries can be possible using niosomes like targeting, ophthalmic, topical, parentral, etc.

KEYWORD: Niosomes, Liposome, Targeting, Ophthalmic, Topical, Parentral.

INTRODUCTION

There are currently no drug delivery systems available to reach this location Specific delivery with controlled release kinetics of drugs predictable way. In 1909 Paul Ehrlich Developing targeted administration when you were thinking about drugs A delivery mechanism that directly targets diseased cells. Since then, many carriers have been used to transport pharmaceuticals.

Target organs/tissues containing immunoglobulin, serum proteins, synthetic polymers, liposomes, microspheres, Red blood cells, niosomes, etc. Among various carriers, liposomes

and niosomes are well documented drug delivery. drug targeting can be defined as the ability to prescribe therapeutic drugs Specific to the desired site of action with little or no interaction in non-target tissues. niosomes or nonionic surfactant vesicles is a microscopically small layered structure formed by a mixture of nonionic surfactants of the alkyl or dialkyl polyglycerol ether class, Cholesterol by subsequent hydration in aqueous media Of Niosomes, vesicle-forming amphiphiles, are non-ionic Surfactants such as Span - 60, which are usually stabilized Added cholesterol and a small amount of anionic surfactant such as dicetyl phosphate. Schematic diagram of medicine Targeting by antibody-mediated binding to niosomes is shown in FIG 1.[1,2]

Advantages of niosomes

- Applications of vesicles (lipid vesicles and nonionic surfactants) vesicles) systems for cosmetic and therapeutic purposes It has some advantages: - Vesicle suspension is aqueous vehicle.[3,4]
- This results in higher patient compliance compared to oil-based formulations. ▪ Since it has an infrastructure consisting of hydrophilic, amphipathic, and lipophilic units, it can handle drug molecules with a wide range of solubilities.
- Vesicle formulation properties are variable and controllable. Vesicle properties can be controlled by altering vesicle composition, size, layering, tap amount, surface charge, and concentration. ·
- Vesicles act as depots and release active substances in a controlled manner. Other benefits of niosomes include:
- They are osmotically active and stable, increasing the stability of encapsulated drugs.
- No special conditions are required for handling and storing surfactants.
- Improves oral bioavailability of poorly absorbed drugs and enhances skin penetration of drugs.
- They can be delivered orally, parenterally, or topically to the site of action.

METHODS

Ether injection method

This method provides a means to prepare niosomes by slowly introducing a solution of surfactant dissolved in diethyl ether into warm water maintained at 60 °C. A surfactant blend in ether is injected into the aqueous solution of the material through a 14-gauge needle.

Evaporation of the ether forms unilamellar vesicles. Vesicle diameters range from 50 to 1000 nm, depending on the conditions used.[5]

Hand shaking method (Thin film hydration technique)

A mixture of vesicle-forming components, such as surfactants and cholesterol, is dissolved in a volatile organic solvent (diethyl ether, chloroform, or methanol) in a round-bottomed flask. Using a rotary evaporator to remove the organic solvent at room temperature (20° C.) deposits a thin layer of solid mixture on the walls of the flask. Dried surfactant films can be rehydrated in the aqueous phase at 0-60°C with gentle agitation. This process forms the typical multilayered niosomal lipid film on the wall of a rotary flash evaporator. The drug-containing aqueous phase was added slowly with intermittent shaking of the flask at room temperature, followed by sonication.[5]

Sonication

A typical method for preparing vesicles is sonication of the solution, as described by Cable. In this method, aliquots of drugs in buffer are added Surfactant/cholesterol mixture in a 10 ml glass vial. The mixture is probed at 60 °C for 3 min using an ultrasonicator with a titanium probe to obtain niosomes.[5]

Micro fluidization

Microfluidization is a recent technique used to generate unilamellar vesicles with a defined size distribution. This method is based on the submerged His jet principle, in which two ultrafast fluidizing streams interact in well-defined microchannels within the jet. Interaction chamber Collisions of thin liquid layers along a common front are arranged such that the energy supplied to the system remains in the region of niosome formation. As a result, niosomes formed are more uniform, smaller in size, and more reproducible.[5]

Multiple membrane extrusion method

A mixture of surfactant, cholesterol and dicetyl phosphate in chloroform is thinned by evaporation. The film is hydrated with an aqueous drug solution and the resulting suspension is extruded through a series of polycarbonate membranes for up to 8 passes. This is an excellent way to control niosome size.[5]

Reverse Phase Evaporation Technique (REV)

cholesterol and Surfactants (1: 1) Dissolve in a mixture of ether and chloroform. The drug-containing aqueous phase is added and the resulting two phases are sonicated at 4-5°C. The formed transparent gel is further sonicated after adding a small amount of phosphate-buffered saline (PBS). The organic phase is removed at 40° C. under low pressure. The resulting viscous niosome suspension is diluted with PBS and heated in a 60°C water bath for 10 minutes to obtain niosomes. Raja Naresh et al. report the preparation of diclofenac sodium niosomes using Tween 85 in this manner.[6]

Physical properties of niosomes

Particle size

The particle size of niosomes was measured with dynamic light Scattering (DLS) instrument (NICOMP 380 ZLS, particle size measurement Systems, Santa Barbara, Calif.). The dispersion is about 100 times in Dulbecco's PBS. time dependent correlation The function of scattered light intensity is Scattering angle 90°, wavelength 535 nm.[7]

Morphology

The niosome dispersion was flash frozen in liquid propane using a cryopreparator (Leica EM CPC, Leica AG, Vienna, Austria). Frozen samples were broken in a freezing replica maker (FR-7000A, Hitachi Science Co., Ltd., Tokyo, Japan) at -150 °C. The fracture surface was replicated by evaporating platinum at a 45° angle followed by carbon deposition to strengthen the replica. After washing with acetone and water, it was placed on a 150 mesh copper grid. Vesicles were observed under transmission Electron microscope (JEM-1200EX, JEOL).[7]

Evaluation

Entrapment efficiency

After preparation of the niosome dispersion, the unentrapped drug is separated B. By dialysis, centrifugation and gel filtration. medicine remains Niosome entrapment is determined by complete rupture of the vesicle Use 50% n-propanol or 0.1% Triton X-100 and analytical results Use the following formula and resolve with the appropriate test procedure.[8,9]

Particle size analysis

Particle size analysis was performed by scanning electron microscopy (SEM) Using a JEOL JSM-T330A scanning microscope brass bar. Or The stitches were briefly dried and gold plated at once ion sputtering. The image of the niosome is stubs and counts. about 30

niosomes in diameter Measured from photomicrographs of each batch. finally average Average diameter was considered.[8,10]

In-vitro release study

Human cadaver skin (HCS) was obtained from the ventral portion of the forearm of a 35-year-old male cadaver and stored at 4 °C. The HCS film was spread out and punched out to an area of about 3 cm 2. Excess fat is removed and with Daw's Derma Tone he trims to 500µm thickness. These discs were he hydrated with PBS pH 7.4 for 24 hours before use. HCS was allowed to adhere to Khesary cells (KC filled with 100 ml of PBS) and 10 mg of niosome suspension was added to it. Finally, the cells were bathed in the receptor compartment. Or When the skin surface was just flush with the surface of the permeate solution (PBS) maintained at 37°C ± 0.50°C and magnetically stirred at 50 rpm, an aliquot was removed for each sampling and added to the same volume. Replaced with a new buffer spot. Analyzed by UV spectrophotometry at 294 nm.[11,12]

Stability study

All niosome formulations were subjected to stability testing by storage in a constant temperature oven at 4, 25, and 37 °C for 3 months. After 1 month, the drug content of all formulations was checked as previously described with efficiency parameters included. Additionally, in vitro release studies of selected formulations were performed.[13]

Applications

Therapeutic application

There are few niosome preparations on the market. However, some of the experimentally evaluated uses of niosome formulations have been confirmed in the literature listed below.[14-18]

Anti-cancer drug

Daunorubicin HCl

niosome daunorubicin hydrochloride compared to free drugs. Niosome preparations were able to destroy daltons Free drug persisted for about 6 ays, the process was incomplete, but ascites lymphoma cells in the peritoneum ithin 3 days of treatment. Hematological studies also showed that the Niosomal formulation was superior to free drug treatment. I'm here. Improved median survival time was achieved with his Niosomal formulation, finally confirming the overall efficacy of the Niosomal formulation.

Doxorubicin

Rogerson et al. We studied the distribution of niosomal doxorubicin prepared from C16 monoalkylglycerol ethers with or without cholesterol. Niosomal formulations showed increased levels of doxorubicin in tumor cells, serum, and lung, but not liver and spleen. Cholesterol-free niosomes loaded with doxorubicin slowed tumor growth and extended lifespan in tumor-bearing mice. The cardiotoxic effects of doxorubicin are

Reduced by niosome formulation. Niosome formulations alter the general metabolic pathway of doxorubicin.

Methotrexate

In their research article, the niosome formulation of methotrexate is cited as having a higher AUC compared to intravenously or orally administered methotrexate solutions. The tumoricidal activity of methotrexate formulated with niosomes was Higher than pure chemical.

Bleomycin

A niosome formulation of bleomycin containing 47.5% cholesterol results in higher drug levels in the liver, spleen, and tumors of tumor-bearing mice compared to the planned drug solution. There is no significant difference in lung drug concentrations with niosome formulations compared to planned drug solutions.10 In addition, niosome formulations result in less drug accumulation in the intestine and kidney.

Vincristine

A niosome formulation of vincristine shows a higher tumoricidal efficacy compared to the pure drug formulation. Also, the niosome formulation of carboplatin showed higher tumoricidal efficacy and lower myelotoxicity in S-180 lung carcinoma-bearing mice compared to the proposed drug solution.

Anti-infective agents

Sodium stibogluconate is the drug of choice for the treatment of visceral leishmaniasis, a protozoan infection of the reticuloendothelial system. Niosome or liposomal formulations of sodium stibogluconate have higher antimony levels in the liver compared to free drug solutions. Antimony levels are the same in both layers. H. niosomes and liposomes. The

niosome formulation of rifampicin exhibits superior antituberculous activity compared to the intact drug.

Anti-inflammatory agents

A niosome formulation of diclofenac sodium with 70% cholesterol shows a stronger anti-inflammatory effect compared to the free drug. Niosomal formulations of nimesulide and flurbiprofen also show higher anti-inflammatory activity compared to the free drugs.

Diagnostic imaging with niosomes

The Niosomal system can be used as a diagnostic tool. Conjugated niosome formulations of [Npalmitoyl glucosamine (NPG)], PEG 4400, and gadobenate dimegsemin containing both PEG and NPG significantly improved the tumor targeting of encapsulated paramagnetic drugs as assessed by MR imaging. is showing.

Transdermal drug delivery

Although the transdermal route of drug delivery has advantages such as avoidance of the first-pass effect, it has the significant drawback of slow drug penetration through the skin. Various approaches have been taken to overcome slow adoption rates, One of his approaches to this is niosome formulations. Arsala et al. We investigated proniosome formulations of ketorolac prepared from Span 60 for transdermal delivery and showed higher ketorolac flux through the skin than proniosomes prepared from Tween20. The literature also describes that the bioavailability and therapeutic efficacy of drugs such as diclofenac, flurbiprofen and nimesulide are increased by niosome formulations.

Ophthalmic drug delivery

Achieve excellent drug bioavailability from ophthalmic dosage forms such as eye drops, suspensions, and ointments due to tear production, corneal epithelial impermeability, unproductive absorption, and transient residence time is difficult to do. However, it has been proposed to use various vesicular systems such as niosomes, liposomes, etc. at the experimental level to achieve good drug bioavailability. Bioadhesive-coated niosome formulations of Span 60, cholesterol stearylamine, or acetazolamide made from dicetyl phosphate show a greater tendency to lower intraocular pressure compared to the commercial formulation (dorzolamide). Chitosan-coated niosome preparation Timolol In contrast, maleic acid (0.25%) is more effective in lowering intraocular pressure Switch to over-the-counter formulations with less potential for cardiovascular side effects.

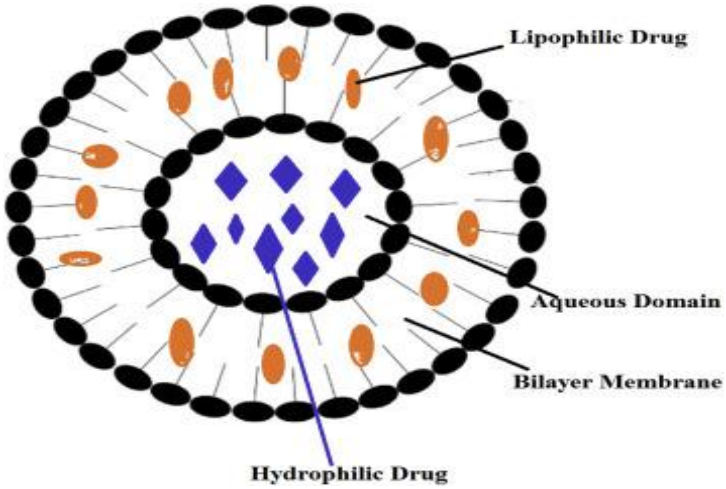

Fig. 1: Niosome structure.

CONCLUSION

The concept of incorporating the drug into liposomes or niosomes for a better targeting of the drug at appropriate tissue destination is widely accepted by researchers and academicians. Niosomes represent a promising drug delivery module. They presents a structure similar to liposome and hence they can represent alternative vesicular systems with respect to liposomes, due to the niosome ability to encapsulate different type of drugs within their multienvironmental structure. Niosomes are thoughts to be better candidate's drug delivery as compared to liposomes due to various factors like cost, stability etc. Various type of drug deliveries can be possible using niosomes like targeting, ophthalmic, topical, parentral, etc.

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