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NIOSOMES REVIEW ARTICLE

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ABSTRACT
Niosomes are crucial for the delivery of drugs. It was made up of a vesicle of non-ionic surfactant. which are made by hydrating a combination of non-ionic surfactant and cholesterol. By increasing the length of their residence period and decreasing their removal, Niosomes increase the bioavailability of drugs. Medication is delivered by encapsulating pills in a form known as Niosomes. Topically, such as in Niosomes, may function as a dermal depot for local solubilization matrix. For the purpose of controlling the systemic absorption of drugs; as membrane rate-limiting barriers or as penetration enhancers for the prolonged release of active compounds.

KEYWORDS: Niosomes, method of preparation routes, Factor,evaluation parameters.

INTRODUCTION

Nonionic surfactants, which are composed of sugar-, polyoxyethylene-, polyglycerol-, and crown ether-based surfactants, can be employed as possible drug delivery systems. Membrane additives, such as cholesterol or its derivatives, are occasionally combined with nonionic surfactants to form Niosomes bilayer membrane.[4] Because their likelihood of causing irritation is lower—cationic > anionic > nonionic—nonionic surfactants are more desirable.[6]

This is capable of containing both hydrophilic and hydrophobic medications. These nanoparticles, referred to as vesicular delivery systems, work as Niosomes to enhance the therapeutic efficacy of drugs by altering their surface and limiting their effects to certain cells, which lowers the drug's clearance. Because of their distinct benefits, vesicular nanocarriers called Niosomes have drawn a lot of interest as possible drug delivery methods during the past 30 years. Their amphiphiles molecules are arranged in lamellar (bilayer) structures, which are encircled by an aqueous compartment.[1] The oral bioavailability of drugs can be increased via Niosomes. Because of the functional groups on their hydrophilic heads, surface modification is quite easy.Three groups can be distinguished among Niosomes. These consist of three types of vesicles: small (SUV, size = 0.025-0.05 µm), multilamellar (MLV, size = 0.05 µm), and large (LUV, size =0.10µm).

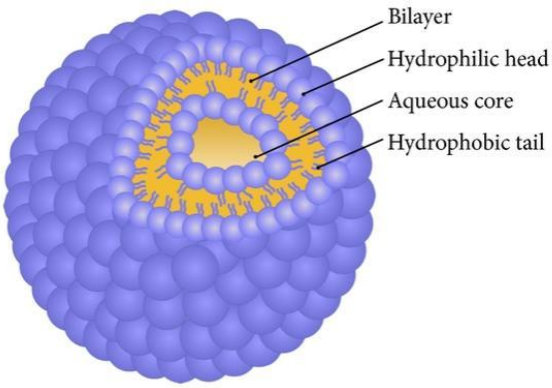
MERITS

-Niosomes are used for parenteral, oral, and topical routes.
-No special conditions are needed for handling and storing surfactants; - Controlled and targeted drug delivery.
-Stable and osmotically active.
-Increased dermal penetration and oral bioavailability; - Improved therapeutic performance of drug.
-Due to their Due to their water base, Niosomes exhibit superior patent compliance compared to greasy dosage forms.

DEMERITS

-May show signs of drug fusion, leaching, or hydrolysis, which would shorten its shelf life.
-The drug loading capacity is insufficient
-Specialized equipment is needed for manufacturing
-The drug leaks when entrapped
-The formulation takes a long time
-Aggregation is costly, and so on.

STRUCTURE OF NIOSOMES



COMPOSITION OF NIOSOMES

• Using cholesterol or its derivatives,

• Non-i onic surfactants, and occasionally ionic amphiphiles are the two main ingredients in the Niosomes manufacturing process.

First, Cholesterol
second, Non-ionic surfactants.

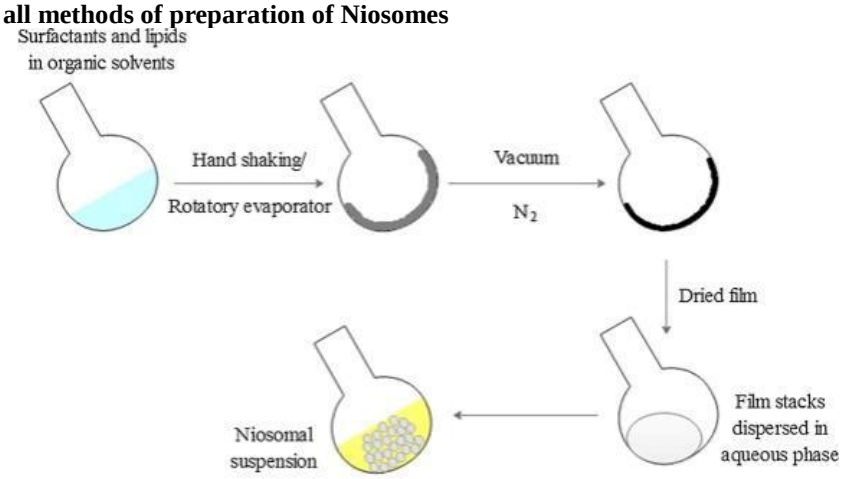
1. The cholesterol

• The preparations of Niosomes are stiffened and properly shaped by the application of cholesterol.

2. Non-ionic surfactants

Surfactants are essential for the synthesis of Niosomes. When making Niosomes, the following non-ionic surfactants are typically utilised. For instance, Tweens (tween 20, 40, 60, 80), Spans (span 60, 40, 20, 85, 80), and Brijs (brij 30, 35, 52, 58, 72, 76). The hydrophilic head and the hydrophobic tail of the non-ionic surfactants are present. The three different types of Niosomes are: multilamellar vesicles (MLV, size=>0.05 µm), small unilamellar vesicles (SUV, size=0.025-0.05 µm), and large unilamellar vesicles (LUV, size=>0.10 µm).

Common stages of all methods of preparation of Niosomes



In an organic solvent, cholesterol and non-ionic surfactant dissolve. Drying on a rotating evaporated surface at 40°C to 60°C and 60 RPM is the solution for organics. Phosphate buffer and thin film dispersion were used to create the hydration. A suspension of Niosomes forms.

• The Bubble Method
Niosomes are made using the bubble process without the use of organic solvents. After combining the surfactants and additives in an aqueous phase, like PBS, the mixture is moved to a flask with three necks and a round bottom.

• Ether for injection method
The ether injection method basically involves slowly injecting Niosomal components in diethyl ether into a heated aqueous phase that is kept at 60°C using a 14-gauge needle at a rate of about 0.25 ml/min. The creation of bigger unilamellar vesicles is likely due to the sluggish vaporisation of the solvent, which creates an ether gradient that extends towards the aqueous–non-aqueous boundary.The bilayer structure might have formed because of the former. This method's drawbacks include the fact that a tiny amount of ether is usually present in the vesicle suspension and is challenging to eliminate.[15]

• Sonication Method
One common method for creating Niosome vesicles is sonication. The medication, cholesterol, and surfactants are taken out of a 10-ml glass vial and combined with buffer. Subsequently, the mixture is subjected to a titanium probe sonication for approximately three minutes in order to generate Niosomes. The final product has tiny, unilamellar vesicles in it. The most common application of this method is in the creation of tiny vesicles. The two types of sonicators utilised in the sonication process are probe and bath types. Depending on the situation, either type can be employed.[11]

• Multiple Membrane Extrusion Method
Evaporation is used to create a thin film from a mixture of surfactant, cholesterol, and diacetyl phosphate in chloroform. Aqueous drug solution is used to hydrate the film, and the resulting suspension is then extruded through a sequence of polycarbonate membranes that can accommodate up to eight passageways. This is an effective way to manage noisy sizes.[15]

• Reversed-Phase Evaporation
In order to obtain a water phase with an emulsified medicine, the surfactants are dissolved in a mixture of ether and chloroform and then added. After homogenising the mixture, the organic phase is removed by evaporating it. Prior to hydrating to create spherical stable uniform vesicles, the lipid or surfactant forms a gel.[8]

ADVANCES IN NIOSOMAL DELIVERY

It was looked at using glucose-targeted Niosomes to transfer vasoactive intestinal peptide (VIP) to the brain. Mice received intravenous injections of glucose-bearing Niosomes loaded with VIP/125I-VIP. The measurement of 125I-labeled VIP's radioactivity by γ-counting was used to quantify the brain uptake following intravenous delivery of the drug in solution, encapsulated in glucose-bearing Niosomes, or in control Niosomes. The brain distribution of intact VIP following the injection of glucose-bearing Niosomes revealed that radioactivity was more evenly distributed throughout the entire brain following the delivery of control vesicles41, but it was preferentially found in the anterior and posterior regions of the brain. Using ultra critical carbon dioxide, polyoxyethylene monostearyl ether Niosomes were made and characterized.[9]

APPLICATIONS OF NIOSOMES

It is used as Drug Targeting.[1]
► It is used as Anti- Neoplastic Treatment i.e. Cancer Disease.eg.Methotrexate
►It is used as Leishmaniasis i.e. Dermal and Mucocutaneous infections e.g. Sodium stibogluconate.
► It is used act as Delivery of Peptide Drugs.
► It is used in Studying Immune Response.
►Niosomes as Carriers for Hemoglobin.
► Transdermal Drug Delivery Systems Utilizing Niosomes. Eg. Erythromycine is used in Ophthalmic drug delivery. Eg. Cyclopentolate.

DRUGS AND ROUTES OF ADMINISTRATION USED IN NIOSOMES

1. Intravenous Route
Eg. Ipromide, Vincristine, Indomethacin, Colchicines, Rifampicin, Transferrin, Zidovudine, Cisplantin, amarogentin, Daunorubicin, Amphotericin **B.**

2. Transdermal Route
Eg. Flurbiprofen, Piroxicam, Levonorgestrol, Nimeluside, Estradiol, Ketoconazole, Enoxacin, DNA loaded noisome, Cyclosporine, Erythromycin, a interferon.

3. Oral Route
Eg. Vaccine, Polysaccharide Coated noisome, Cipro floxacin, Insulin.

4. Oncology Route
Eg. Methotrexate, Doxorubicin, adriamycin.

5. Ocular Route
Eg. Timolol, cyclopentolate.

6. Nasal Route
Eg. Sumatriptan, Influenza.

7. Immunological Adjuvant
Eg. Bovine serum albumin, Hemoglobin.

8. For treatment of Leishmaniasis
Eg. Stilbogluconat.

FACTORS AFFECTING THE FORMATION OF NIOSOMES

1. Nature of surfactant
Non-ionic surfactants of the ester type are less harmful and less stable than those of the ether type. The surfactant's HLB value is more crucial for the formation

of Niosomes. The crucial packing parameter of the surfactant determines the geometry of the vesicles that are generated.

It is computed using the equation that follows
CPP is equal to v/Ic times a0. In which the critical packing parameter (CPP) Volume of hydrophobic groups = Vlc = Critical length of the hydrophobic group a0 = Hydrophilic head group area The stability of the Niosome suspension is reduced when the hydrophilic chain of the surfactant lengthens, lowering the phase transition temperature and increasing the leakage of low molecular weight medication from the aqueous compartment. As the surfactant's hydrophobic chain length increases, It raises the transition temperature, reduces low molecular weight drug leakage from the aqueous compartment, and increases drug encapsulation, all of which contribute to the stability of the Niosome suspension.[13]

2. Nature of encapsulated drug
The drug's physicochemical characteristics affect the stiffness and charge of the Niosome bilayer. Compared to hydrophilic medicines, hydrophobic medications leak from the bilayer less frequently. Drugs that are hydrophobic have better transdermal penetration and formulation stability. However, hydrophilic medicines are more likely to leak from the bilayer, which reduces the preparation's stability. The Niosomes effectively encapsulate amphiphilic medicines.[13]

3. Cholesterol contents
The HLB values of the surfactant d"term'ne the cholesterol concentration. The range of the surfactant/lipid ratio is 10-30 mM, or 1-2.5% w/w. It might have an impact on the structure and physical characteristics of Niosomes. A suitable amount of cholesterol raises the efficiency of trapping and the hydrodynamic diameter. Because high cholesterol increases the stiffness of the bilayer, it slows down the pace at which medicines release.[13]

4. Temperature of hydration
It ought t' be higher than the system's gel to liquid phase transition temperature. It might have an impact on Niosome size and shape.[13]

EVOLUTION PARAMETERS AND METHODS

Evaluation Parameters	Method
Morphology	SEM, TEM, freeze fracture technique
Size distribution, polydispersity index	Dynamic light scattering particle size analyzer
Viscosity	Ostwald viscometer
Membrane thickness	X-ray scattering analysis
Thermal analysis	DSC
Turbidity	UV-visible diode array spectrophotometer
Entrapment efficacy.	Centrifugation, dialysis,gel chromatographye
Invitro release study	Dialysis membrane
Permeation study	Franz diffusion cell.

CONCLUSION
The idea of encapsulating the medication within Niosomes to improve delivery of the medication to the right tissue location. They resemble liposomes in structure, hence they can be thought of as an alternative to liposomes in vesicular systems. Because of their affordability, durability, and other advantages over liposomes, Niosomes are considered superior options for drug administration. Niosomes can be used for targeted, ocular, topical, parentral, and other types of drug delivery.

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